Preface

This thesis is a part of my master's degree in financial economics at the Norwegian University of Science and Technology.

Writing this thesis has been a challenging and instructive process, and at times, quite frustrating.

I would like to thank my supervisor, Xunhua Su for giving me help and guidance along the way. Also, I would like to thank my family for moral support.

Some of the data used in this thesis is collected from the regional database of Norwegian Social Science Data Services (NSD). NSD is not responsible for the analysis of the data, nor for the interpretations of the results.

Any errors are my own.

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Abstract

During the past decades, many developed countries including Norway have experienced a remarkable rise in both house prices and immigration inflows. Extant studies have aimed to shed light on how immigration inflows affect housing prices. Given the large weight that housing consumption has on the household budget, the immigration's impact on housing prices could be an important matter (Sá, 2011). This thesis studies the short term and long term effect of immigration on house prices in Norway's largest cities from 1986 to 2012. I find that immigration has had a significantly positive effect on house prices. An immigration inflow equal to 1% of a city's total population is coincident with an increase in housing prices of about 2,9%. These results are consistent with the findings of previous studies. My findings indicate that on average, immigration contributes to nearly one fifth of the total increase of housing prices in Norway. I did not find evidence that the short term effect of immigration on house prices has been greater than the long term effect, although economic theory suggests that the short term effect should be greater than the long term effect since in the long run the supply of housing will adapt to the demand.

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1 Introduction

During the past decade the immigration to Norway has experienced a steady increase. At the same time, house prices have increased dramatically. The same pattern is found in many other countries, and many international studies have aimed to determine how immigration inflows affect housing prices.

The topic for this thesis is immigration and housing prices in Norway. The question I want to answer is: *Does immigration affect the housing prices in Norwegian cities?* Based on annual data for Norway's four largest cities, I will study both the short term and the long term effects of immigration on housing prices.

From 2002 to 2012, the Norwegian population increased by 10%. Immigration was the main source of this population growth (62%). One important explanation of the increased immigration inflows is the extension of the EU in 2004 and 2007 (Hagelund, Nordbø, & Wulfsberg, 2011). This made it easier for the citizens of the new EU- countries to immigrate to Norway. Due to a prosperous economy, with an increased demand for labor combined with high wages, Norway has attracted many work related immigrants from these new EU- countries, particularly from Poland and the Baltic countries. The share of immigrants of the Norwegian population has increased steadily during the past 20 years: In 1986 3% of the population was immigrants. This share had increased to 5% in 2000 and to 11% in 2010.

Sá (2011) points out that given the large weight housing consumption has on the household budget, the immigration's impact on housing prices is an important matter. Hagelund et al. (2011) note that

to the extent that immigration is an important determinant of housing prices, the uncertainty of future immigration inflows can lead to increased instability in the housing market. They explain this by: "Periods with high immigration and high house price inflation may cause high expectations of continued price inflation, which will lead to a high growth in housing construction" (p. 22). If the future immigration inflows are lower than expected, this may cause a drop in the housing prices due to excess supply. This is exactly what happened in Spain in the years after the financial crisis in 2008. During the decade prior to the financial crisis Spain experienced a large immigration inflow combined with a large increase in the housing prices. During the same period the country's residential activity grew rapidly. In the years after 2008, Spain's housing market experienced a large recession (Gonzalez & Ortega, 2013).

The thesis follows the dominant methodology in the literature. The relationship between immigration inflows and housing prices is estimated by OLS regressions. I will use a model where the independent variable is the change in housing prices, and the main independent variable is the immigrant inflow relative to the total population. In addition, the model includes control variables which controls for other factors that might influence the housing prices, for instance the change in unemployment rate and the general state of the economy. The analysis is conducted on a sample of annual data for Norway's four largest cities for the period 1986 to 2012.

The first part of the analysis estimates the short term effect of immigration on housing prices. This is conducted by estimating how the annual inflow of immigrants influences the annual change in housing prices. The next stage of the analysis investigates immigration's long term effect on housing prices. This is done by estimating a model where the price change refers to the change over a decade and the immigrant inflow refers to the inflow of immigrants over a decade. Finally, the analysis is rounded off with a comparison of the estimated short term and long term effect.

The rest of the thesis is organized as follows: Section 2 reviews previous research relevant for the subject matter. Section 3 presents economic theory for housing prices and the empirical methodology used in the analysis. Section 4 describes the data and sample in the empirical tests. The empirical results are reported in section 5. Section 6 concludes.

2 Literature Review

The housing market is a rather popular area of research, and a lot of studies have been conducted over the past 25 years trying to explain the dynamics of the real estate market. However, the issue of the immigration's impact on house prices is a rather new area of research. The main body of literature I've identified on this topic is from the last decade.

The topic is also related to the wage literature. Economists trying to find the local impact of immigration have earlier focused on immigration's impact on local wages.

Several international studies have found that immigration has had a positive effect on house prices. Saiz (2006), Degen and Fischer (2009), and Gonzalez and Ortega (2013) found a positive relationship between immigration and house prices in the US, Switzerland and Spain, respectively. Akbari and Aydede (2012) found only a small positive effect of immigration on house prices in Canada. Sá (2011), on the other hand, found that immigration have had a negative effect on house prices in the UK. Similarly, Stillman and Maré (2008) found weak results that the inflow of immigrants is associated with lower house prices in New Zealand. Nordbø (2013) is the only study I've found using Norwegian data. The study found no clear evidence that immigration causes rising house prices.

Saiz (2006) studies the local impact of immigration on rents and housing prices in American cities. In this study he focuses on the link between the immigrants' effect on local wages and the development in rents and housing prices. He argues that it is not obvious that we should see a local correlation between immigration and changes in house prices. Immigration may cause a decrease in the local wages due to increased competition in the labor market. This may lead to the outmigration of some natives. If the native outflow is exactly offset by the immigrant inflow, there will not be a

change in the local demand for housing, and the housing prices will not increase. Correspondingly, a housing demand shock due to immigration will push up the costs of housing, and may cause a decreased demand of housing from natives. Thus, the housing prices will not increase as much as the initial demand shock would imply. In what degree immigration causes house prices to rise, depends on the natives' sensitivity to housing costs, and in what way immigration affects the locals' wages. The less sensitive locals are to housing costs, and the less negative the locals' wages are affected, the more will the housing prices increase. Sá (2011) also uses this argument in her study of the impact of immigration on the British housing market. She argues that even if the immigration is completely offset by native out- migration, and hence the local population would remain constant, the local housing demand may be affected. The change in the composition of the local population may lead to a change in local income. This would affect housing demand and house prices through an income effect. While Saiz finds that immigration has a positive effect on housing prices, Sá finds that the effect is negative. Saiz concludes that the rents increase in the short run, and that the housing value catches up. An annual inflow of immigrants equal to 1% of the city's initial population is associated with a 1% increase in rents, and an increase in housing prices of 2,9 % to 3,4% . Sá concludes that an immigration inflow of 1% of a city's initial population leads to a 1,6 % decrease in the housing prices. She explains her results by the local population's wage distribution. She found that cities with high immigration tend to be at the bottom of the wage distribution. One explanation of this is that immigration has a negative effect on the wages of natives at the lower end of the wage distribution. Another explanation is that the natives who leave the city tend to be at the higher end of the wage distribution. This generates a negative income effect on housing demand, and pushes down house prices in cities with high shares of immigrants.

Gonzalez and Ortega (2013) investigate immigration's effect on housing prices in Spain in the first decade of the 21st century. During the 10 years prior to the financial crisis in 2008 the foreign- born share of the country's working- age population increased from 2% to 16%. At the same time, the housing prices increased by 175%. In the years after 2008, Spain's housing market experienced a large recession. The estimation of the immigration's effect on housing prices only obtain statistically significant results when the sample is restricted to the years prior to the housing bust. The paper concludes that immigration had a large impact on the housing market. An immigration inflow equal to 1% of an area's initial population is associated with an increase in prices of about 1%. This captures nearly one quarter of the total price inflation.

Degen and Fisher (2009) study the effect of immigration on house prices in Swiss districts. They argue that many previous studies of immigration's effect on housing prices have focused on times and areas with high immigration and high inflation of housing prices. Their paper's objective is to show that the relationship between house prices and immigration also is applicable for scenarios with low house price inflation and modest immigration inflows. The study concludes that an immigration inflow equal to 1% of an area's initial population is associated with an increase in prices for single- family homes of about 2,7%. This captures nearly two-thirds of the total price inflation. If we compare the findings in this paper with the findings of Gonzalez and Ortega (2013), we see that the effect of immigration on house prices in a situation of modest price inflation and immigration actually is greater than in a situation where both price inflation and immigration is high.

Akbari and Aydede (2012) examine immigration's impact on house prices in Canada. In their study, they separate the effect of recent immigrants (immigrants who immigrated during the past five years) and the effect of immigrants who came to the country more than 10 years ago. They find that recent immigrants have no impact on housing prices, while the effect of more established immigrants is positive, but small. Like Saiz (2006) and Sá (2011), they point out that one possible explanation of this muted effect is the out-migration of natives from areas where new immigrants settle. They also suggest that the inflow of new immigrants in an area could increase housing supply if housing developers expect higher demand. This will reduce the upward pressure on prices that follows a demand shock.

Stillman and Maré (2008) analyze the influence of immigration on house prices in New Zealand. In addition to looking at the effect of the inflow of foreign immigrants, they also pay attention to the relationship between the return of New Zealanders previously living abroad and the house prices. They find a negative relationship between the immigration of foreign borns and house prices, but the statistical significance of the estimates are low, so their confined conclusion is that they cannot find evidence of a positive relationship between these two factors. On the other hand, they find a strong positive relationship between inflows of returning New Zealanders and the appreciation of local housing prices. An inflow of returning New Zealanders equal to 1% of an area's initial population is associated with an increase in prices of 6% to 9%. However, these results are not robust across different time periods. The authors argue that this might imply that population growth

is not the dominant determinant of house price changes, and that there might be omitted factors from the analysis. They suggest that the lack of positive relationship between immigration and house prices might be related to the findings by Maré and Stillman (2007, referred to by Stillman and Maré, 2008, p. 28) that immigrant inflows to New Zealand also have small impacts on the labor market, indicating that the labor market spillovers are weaker in New Zealand than in other countries.

Nordbø (2013) investigates whether immigration have an impact on the Norwegian housing prices. When he only controls for the change in unemployment rate and the change in the native population in addition to fixed effects for time, he finds that an increase in an area's initial population of 1 percentage point is associated with an increase in housing prices of 2,6 % to 3,3%. Further, he splits the new immigrants into two groups, Europeans and non- Europeans, and finds an even stronger effect of European immigrants, while non- Europeans are not statistical significant. He argues that one reason for this result could be that European immigrants to a greater extent than other immigrants state employment as their cause to immigrate, and thus choose to move to areas where the economic prospects are good. However, when he also controls for the change in income per capita, the magnitude of the effect of immigrants on housing prices is reduced, and is partly insignificant. This indicates that the immigration's impact on house prices is overstated when the development in income is omitted. The study finally concludes that there is no evidence that immigration has pushed up the housing prices in Norway.

All of the studies discussed above follow a similar methodic pattern, and they are all based on the baseline model of Saiz (2006):

$$\Delta ln\left(p_{it}\right) = \beta\left(\frac{\Delta I_{it-1}}{POP_{it-2}}\right) + \alpha \mathrm{X}_i + \prod u_{it-1} + \mu \Delta \mathrm{Z}_{it-1} + \Lambda_t + \varepsilon_{it} \qquad (2.1)$$

(Saiz, 2006, relation (I))

Firstly, they all use the change in average housing prices in the different areas as the dependent variable ($\Delta \ln (p_{it})$). By estimating the dependent variable in first- difference, they eliminate time-invariant, area- specific factors that affect immigration and the level of house prices (Sá, 2011). For most of the studies the change refers to the annual change in house prices, and thus the estimations

should be interpreted as short run effects. However, Akbari and Aydede (2012) and Stillman and Maré (2008) use census data which aren't updated yearly. In these studies, the change is referring to the change in house prices from one census to the next. In both these cases one census period is five years. The results of these studies should be interpreted as long run effects. Sá (2011) points out that this might explain why these two studies could only find small effects of immigration; "Because housing supply is likely to be more elastic in the long-run, it is not surprising that immigration would have a smaller impact on house prices and rents between Census dates than between consecutive years" (p. 3). All the studies except for Degen and Fischer (2009) use the logarithmic form of the house prices. This is done to reduce the positive skew of the data.

Secondly, all the studies use the same main independent variable; the change in number of immigrants in one period over the total population in the previous period ($\frac{\Delta I_{it-1}}{POP_{it-2}}$). Most of the studies define "immigrant" as any foreign- born individual residing in the area of interest. However, in Degen and Fischer (2009), "immigrant" is defined as foreign nationals instead of foreign- borns. They argue that this may be the source of a potential measurement problem in their analysis, since the immigration stock will vary with factors that are not related to immigration. Gonzalez and Ortega (2013) and Stillman and Maré (2008) use the change of foreign- born relative to the working age population and to the population aged 18 and over, respectively, instead of the change of foreign- born relative to the total population. Their objective for this is that the demand for housing is mainly associated with persons of working age/ persons aged 18 and over.

When it comes to the control variables in the different works' estimated models, there are some differences. All studies control for the level of employment in some way (u_{it-1}). While Akbari and Aydede (2012), Degen and Fischer (2009), Nordbø (2013) and Saiz (2006) use the lagged change in the unemployment rate, Gonzalez and Ortega (2013) and Sá (2011) use the current change in the employment to population ratio. Stillman and Maré (2008) control for changes in various characteristics of the local population. Employment status is one of these characteristics. Some of the studies controls for the change in local income (Z_{it-1}), either with a lagged effect (Nordbø, 2013; Saiz, 2006) or a current effect (Akbari & Aydede, 2012; Stillman & Maré, 2008). Degen and Fischer (2009) point out that the omission of household income from their full sample estimation is an empirical shortcoming of their baseline equation. Due to data availability, they were only able to

estimate a restricted sample with household income. However, they find that the omitted variable bias linked to income does not influence their empirical results. In Saiz' model, X_i represents a vector of initial city attributes such as crime, weather and the population's level of education. Degen and Fischer (2009) have a similar vector to capture regional specific characteristics. Others use area dummies to capture different trends in house prices at the local level (Akbari & Aydede, 2012; Nordbø, 2013; Sá, 2011). All studies include year dummies (Λ_t) to control for national trends in inflation and other economic factors.

Thirdly, all the studies discussed above use the same econometric methods when estimating the models. First they estimate the model with OLS. However, the results from the OLS estimation might be biased due to possible endogeneity of the main independent variable. "Immigration flows are likely to be correlated with other factors that cause house prices to increase, but that were not adequately controlled for in the study" (Hodgson & Poot, 2010, p. 24). The direction of the bias is not clear. If there's a tendency for immigrants to settle down in prosperous areas where employment opportunities are good, the OLS- estimates may be positive biased since some of the effect ascribed to immigration rather is caused by the good state of the economy. If, on the other hand, immigrants prefer to settle down in areas with more affordable housing and low house price inflation, the OLS- estimates may be biased towards zero (Nordbø, 2013).

In order to overcome this potential endogeneity problem, Saiz (2006) introduces an instrument variable (IV) approach, which is also followed by all the other works I've discussed here. He generates two instrument variables for the main independent variable based on the fact that immigrants tend to move to areas where other immigrants of the same nationality settled previously (Altonji & Card, 1991, referred to by Saiz, 2006, p. 15). An instrument variable must satisfy two requirements: First, it must be exogenous, meaning that it must be uncorrelated with the omitted variables that affect the dependent variable. Second, it must be relevant, meaning that it must be correlated with the independent variable of interest (here: the immigration ratio). It is plausible to assume that the historical settlement pattern of immigrants was not driven by omitted variables that affect current housing prices. The second assumption is also likely to be fulfilled. I will here present the second instrument variable discussed by Saiz, as this is the IV mainly used in the literature. This IV takes the form:

$$\Delta \widehat{\widehat{immigrants}}_{i,t} = \sum_{j=1}^{M} \phi_{j,i,1983} \cdot \Delta \widehat{immigrants}_{J,US,t} \quad (2.2)$$

(Saiz, 2006, relation (III))

The dependent variable is the predicted inflow of immigrants to city *i* in year *t* ($\Delta \widehat{\widehat{\text{immigrants}}}_{i,t}$). The independent variable is the predicted inflow of immigrants from country *j* to the US in year *t* ($\Delta \widehat{\text{immigrants}}_{j,US,t}$). To find the inflow of immigrants from country *j* to city *i* in year *t*, the inflow of immigrants to the US that year is multiplied by the share of immigrants from country *j* in city *i* in 1983 ($\emptyset_{j,i,1983}$). The predicted inflow of immigrants to one city is then found by summarizing the estimated number of immigrants from the different countries. This instrument variable "(..) expresses how the immigration in the different areas would have developed if the settlement pattern of new immigrants was equal to the historical settlement pattern"(Nordbø, 2013, p. 8). Gonzalez and Ortega (2013) point out that if the main source countries in the recent years are very different from those in the historical pattern, "(…) the regional variation in immigration flows from these countries of origin cannot be captured by the ethnic networks instrument" (Gonzales & Ortega, 2013, p. 43). As this is applicable for the case of Spain, they use an additional IV in their analysis. I will not go further into their second IV as this is not relevant for any of the other studies.

For most of the studies, the estimated price effects through immigration are more positive when using an instrument variable approach than when estimating with OLS (Akbari & Aydede, 2012; Degen & Fischer, 2009; Gonzalez & Ortega, 2013; Saiz, 2006). This indicates that the OLS estimates are biased towards zero, for example because immigrants tend to settle down in areas with more affordable housing and low price inflation.

In the case of Sá (2011) and Stillman and Maré (2008), which found a negative relationship between immigration and house prices, the effect is more negative when using the IV method than when using OLS. This indicates that the OLS estimates are positive biased, for example due to "a tendency of immigrants to locate in prosperous areas where house prices are growing faster" (Sá, 2011, p. 14).

Nordbø (2013) cannot find that the estimates when using the IV method is statistical significantly different from the OLS- estimates. He suggests that the IV- instrument used in the international studies is not valid in the case of Norway. He argues that Saiz (2006) requires that two assumptions must hold in order for the instrument variable to meet the exogenous- requirement, and thus being a valid instrument for the immigration ratio. First, the inflow of immigrants in 1983 cannot be driven by omitted variables that will affect prices in the future. Second, the national immigration inflows cannot be affected by the economic conditions of the immigrant cities. This is explained by: "(…) the annual national immigration to the US is determined by political and administrative matters. Thus he means that the total immigration to the US will be independent of the economic development." (Saiz, 2007, referred to by Nordbø, 2013, p. 8). Nordbø (2013) points out that it seems difficult to obtain this requirement in the case of Norway. He argues that "(…) the immigration to Norway from the Eastern European countries is positively correlated with the economic conditions in Norway" (Grangård & Nordbø, 2012, referred to by (Nordbø, 2013, p.8). This suggests that the instrument variable used by the international studies discussed here is not applicable for studies using data from Norway.

3 Hypothesis and Methodology

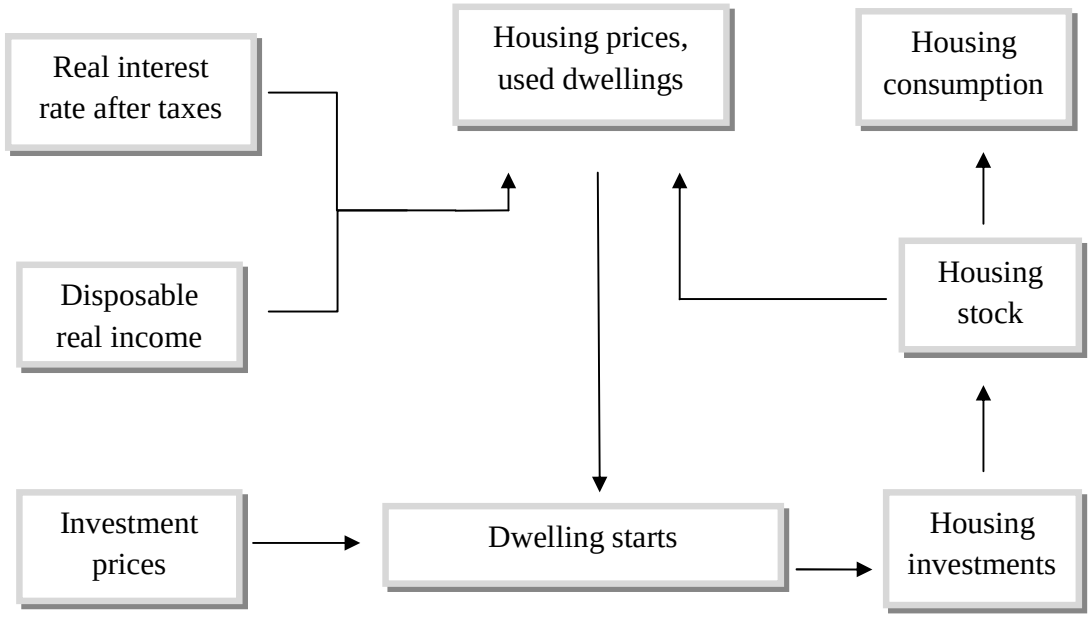
In this section I will first give a description of the relevant economic theory for housing prices. Thereafter, I will present the hypothesis which I will test empirically. At last I will give a description of the empirical model and the methodology which I will use to investigate whether immigration affects Norwegian housing prices.

3.1 Theoretical Background

To explain the development of the residential housing prices I will use a model described in chapter 5.5 in Statistics Norway's macroeconomic model for the Norwegian economy, MODAG (Boug & Dyvi, 2008). According to this model, the residential housing prices are determined by supply and demand of residential housing.

To change the supply of housing requires time. Thus, in the short run, the supply of housing is assumed to be fixed. In the short run, the housing prices are determined by the housing demand for a given supply of housing stock. The housing investments are determined by the profitability of this type of investment. Figure 3.1 illustrates the relationship between the housing prices and the relevant determinants.

Figure 3.1: Model for determining housing prices



Source: Figure 5.5.1, MODAG, Boug and Dyvi, 2008

3.1.1 Demand

The demand for housing is depending on the housing prices, the household income and the real interest after taxes.

$Price^D = \beta_1$ Disposable real income $+\beta_2$ Real interest rate after taxes $+ \beta_3$ Housing stock

The model defines the demand for total housing stock as C^D and the households' disposable real income as Y. The cost of consuming one housing unit in one period is affected by the housing price (P_C), the real interest rates after taxes (r) and wear and tear. The latter is omitted for simplification.

The total demand for housing stock can be expressed as follows:

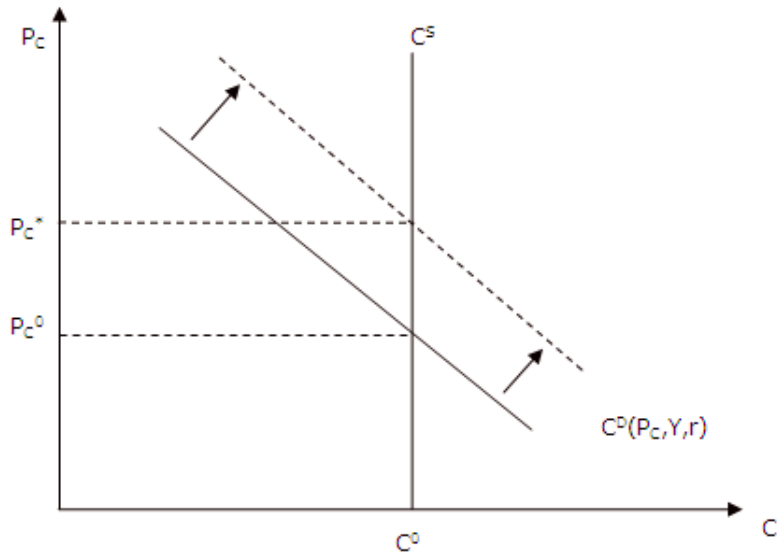
$$C = C^D(P_C,\ Y,\ r) \tag{3.1}$$

(Boug & Dyvi, 2008, relation (5.5.1))

$$\frac{dC^D}{dP_C} < 0 \qquad \frac{dC^D}{dY} > 0 \qquad \frac{dC^D}{dr} < 0 \tag{3.2}$$

When the households' disposable real income (Y) increases, the housing demand is expected to increase. When the housing prices (P_C) or real interest after taxes (r) increases, the housing demand is expected to decrease.

Figure 3.2: Supply and demand of total housing stock, short term



Source: Boug & Dyvi, 2008, figure 5.5.2

In figure 3.2, the vertical housing supply curve (C^S) illustrates that in the short run the supply of housing is fixed. The housing demand curve (C^D) is declining, meaning that the demand declines when the prices rise. In the short run, the housing prices (P_C) are found where the demand curve crosses the vertical supply curve. A positive shift in the demand curve, caused by increased

disposable real income or decreased real interest rate after taxes, will result in increased housing prices. This is illustrated by the dotted demand curve, and the new price (P_C*). Since the supply is given in the short run, the housing stock will remain at the initial level (C^0).

Another source of demand shift is a change in the population. An increase in the population shifts the demand curve to the right (Rødseth, 1987), and will lead to an increase in the housing prices in the short run. Immigration is one source of population growth, and following this theory, immigration should cause house prices to rise in the short run. When immigrants settle down in an area, they will need housing right away, while it takes time to increase the supply of housing (Nordbø, 2013). Another point of view is that it may take some time for the local population to respond to the rising housing costs by out-migration. Thus, in the long run a new supply of housing and out-migration of the local population might dampen immigration's impact on house prices (Akbari & Aydede, 2012).

3.1.2 Supply

The supply of housing consists of the total existing stock of dwellings. The supply shifts due to construction of new dwellings and disposal of existing dwellings (for example due to fire, demolition or depopulation). The annual construction of new dwellings amounts to a modest share of the total number of dwellings, in Norway it is about 1% of the housing stock (NOU, 2002).

The level of new dwellings is determined by the profitability of housing construction. The profitability is depending on the housing prices (P_C) and the investment costs. The investment costs consist of building costs (P_I) and land costs (P_L).

The total supply of new housing stock can be expressed as follows:

$$J_{start\ ups} = J(P_{C,} P_I,\ P_L) \tag{3.3}$$

(Boug & Dyvi, 2008, relation (5.5.3))

The construction of housing requires time, and the start up of a new building in one period often won't end up as a new dwelling until the period after, or even several periods after. The relationship between a period's level of new dwellings and the dwelling starts in the present and previous periods can be expressed as follows:

$$J=0{,}6083\ J_{\text{start ups } t}+0{,}3451\ J_{\text{start ups } t-1}+0{,}0437 J_{\text{start ups } t-2}+0{,}0030\ J_{\text{start ups } t-3} \quad (3.4)$$

(Boug & Dyvi, 2008, relation (5.5.4))

We then can express the total supply of housing stock:

$$C = C_{t-1} + J - FD \quad (3.5)$$

(Boug & Dyvi, 2008, relation (5.5.5))

The supply of housing stock is determined by the existing level of housing (C_{t-1}), investments in new dwellings (J) and depreciations (FD). The depreciations are a fraction of the existing level of housing:

$$FD = \delta C_{t-1} \quad (3.6)$$

(Boug & Dyvi, 2008, relation (5.5.6))

The long term supply of new housing stock can be expressed as follows:

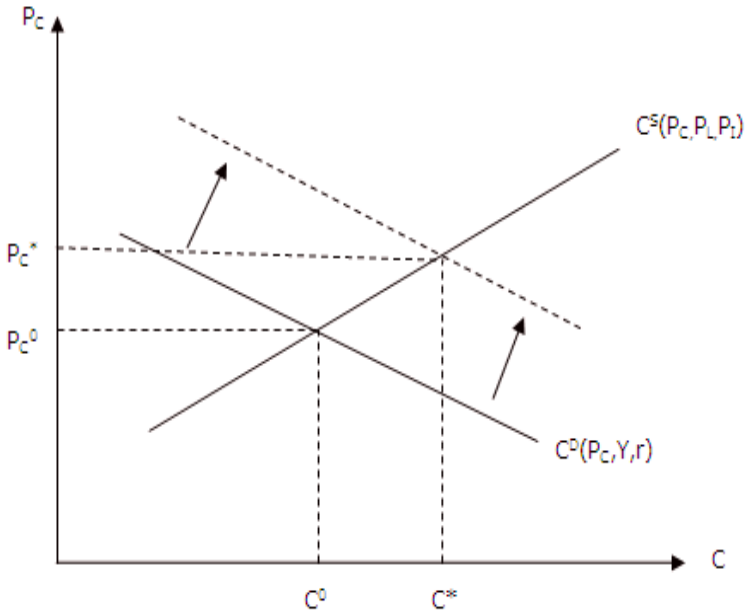
$$C = C^S(P_C,\ P_{I,}P_L) \quad (3.7)$$

(Boug & Dyvi, 2008, relation (5.5.7))

$$\frac{dC^S}{dP_C} > 0 \qquad \frac{dC^S}{dP_I} < 0 \qquad \frac{dC^S}{dP_L} < 0 \quad (3.8)$$

When the housing prices increase, the housing supply is expected to increase. When the investment costs or the land costs increase, the housing supply is expected to decrease.

Figure 3.3: Supply and demand of total housing stock, long term



Source: Boug & Dyvi, 2008, figure 5.5.3

A positive shift in the demand curve affects the housing prices less in the long run than in the short run. The reason for this is that in the long run, the increased house prices will make house construction more profitable, and thus the supply of housing will increase as well ($C^* > C^0$). Thus, the equilibrium price will rise less in the long run than in the short run (Nordbø, 2013).

3.2 Hypothesis

As discussed in section 2, several international studies have found that immigration has had a positive effect on housing prices. In Norway, both immigration and housing prices have increased significantly during the past two decades. This motivates my first hypothesis.

Hypothesis I: *Immigration has contributed to the increase in the house prices seen in Norwegian cities during the past two decades.*

This hypothesis will be tested by estimating the short term and long term effect of immigration on housing prices.

Further, as discussed in section 2 and 3.1, the housing prices are expected to be less affected by changes in demand in the long run than in the short run, since the supply of housing will have time to adapt to the new demand. This leads to my second hypothesis.

Hypothesis II: *Immigration's effect on housing prices is greater in the short run than in the long run.*

I will check if this is consistent with my findings by testing whether the short term coefficients are significantly larger than the long term coefficients. To perform these tests I will use one- sided t-tests where the null hypothesis is $\hat{\beta}_{\text{Short-term}} = \hat{\beta}_{\text{Long-term}}$ and the alternative hypothesis is $\hat{\beta}_{\text{Short-term}} > \hat{\beta}_{\text{Long-term}}$.

3.3 Empirical Model

The baseline model I will use is based on the models used in the studies discussed in section 2, particularly the ones used by Saiz (2006), Degen and Fischer (2009) and Nordbø (2013).

$$\Delta log\left(p_{it}\right) = \delta_t + \beta\left(\frac{\Delta I_{it}}{POP_{it-1}}\right) + \gamma_1 \Delta u_{it} + \gamma_2 \mathbf{X}_{it} + \alpha_i + \varepsilon_{it} \qquad (4.1)$$

The dependent variable is the annual change in the log of real mean housing price per square meter in city *i* at time *t*.

The main independent variable is the annual immigrant flow relative to the total population in the previous year ($\frac{\Delta I_{it}}{POP_{it-1}}$). β is interpreted as the percentage change in house prices associated with an annual inflow of immigrants equal to 1% of a city's population. Both the total population and the total number of immigrants are measured at the first of January. Thus, the model predicts how the house prices in one year are influenced by the previous year's immigration.

Δu_{it} denotes the change in unemployment rate from the previous year to the current year. The unemployment rate is defined as the yearly average of total unemployed persons in percentage of the labor force. I use the change in unemployment rate from t-1 to t. In the literature it is more common to lag this variable; Δu_{it-1}. I have chosen not to lag this variable, since this caused heteroscedastic residuals.

I use year dummies (δ_t) to capture trends in the housing prices which are common for all the cities. For example this controls for changes in macroeconomic variables like inflation and interest rates.

$\boldsymbol{X}_{it}$ is a set of control variables which captures regional- specific characteristics that varies over time. Here I include demographic trends of the non- immigrant population ($\frac{\Delta Nonimm.pop_{it}}{POP_{it-1}}$), and the number of new dwellings started the previous period on logarithmic form (*log dwelling starts*$_{it-1}$). Ideally, I would also include the change in the regional income per capita here, but these data are only available for the period 1993 to 2009. I will estimate additional regressions using this limited sample to check whether omission of the income effect is a weakness of the baseline model.

α_i is regional dummies capturing regional-specific attributes which don't change over time.

I will estimate equation (4.1) by using Ordinary Least Squares (OLS). In order to control for a potential endogeneity- problem in the model, all of the studies discussed in section 2 use instrumental variable estimation in addition to OLS estimation. Nordbø (2013) uses this approach on Norwegian data, but he suggests that the instrument variable used by the international studies is not applicable for studies using data from Norway. He argues that it seems difficult to obtain the requirement that the national immigration inflows cannot be affected by the economic conditions of the immigrant cities. He points out that "(…) the immigration to Norway from the Eastern European countries is positively correlated with the economic conditions in Norway" (Grangård &

Nordbø, 2012, referred to by Nordbø, 2013, p.8). Based on this argument, as well as limited data availability[1], I will not estimate the model using an IV- approach.

3.3.1 Short term effect

My baseline model captures the annual price change. The estimated coefficient of the main independent variable can be interpreted as the short term effect of immigration on housing prices. I will first estimate the baseline model using OLS. I will run three different regressions, and all the three regressions will be run using three different samples.

The first regression only controls for year dummies (year fixed effects) and the change in the unemployment rate. The second regression additionally includes regional fixed effects to control for regional- specific characteristics which don't vary over time. The third regression includes both regional fixed effects and a set of regional- specific characteristics ($\boldsymbol{X}_{it}$), thus controlling for both regional- specific characteristics which varies and don't varies over time.

The first sample uses data for the whole period, from 1986 to 2012. Since the increase in both the housing prices and the immigration to population ratio has been stronger during the last half of the period, I will additionally estimate the periods before and after year 2000 separately. This might indicate whether a potential effect of immigration on housing prices is of recent character.

3.3.2 Long term effect

To find the long term effect of immigration on housing prices I will estimate a model where the price change refers to the change over a decade. I will estimate a version of the baseline model:

$$\Delta log\left(p_{it}\right) = \delta_t + \beta\left(\frac{\Delta I_{it}}{POP_{it-10}}\right) + \gamma_1 \Delta u_{it} + \gamma_2 \mathbf{X}_{it} + \alpha_i + \varepsilon_{it} \qquad (4.2)$$

[1] The main IV used in the literature is the historical settlement pattern for immigrants from different countries. The only available data on the city- level is the immigrant's continent of origin, not country of origin. I believe this classification is too broad to serve this purpose.

I form 17 decades based on the annual data from 1986 to 2012:

1986-1996	1989-1999	1992-2002	1995-2005	1998-2008	2001-2011
1987-1997	1990-2000	1993-2003	1996-2006	1999-2009	2002-2012
1988-1998	1991-2001	1994-2004	1997-2007	2000-2010	

In this long term model, δ_t denotes decade fixed effects. The main independent variable is the inflow of immigrants into a city during the decade relative to the total population in the beginning of the decade. $\Delta\, u_{it}$ denotes the change in unemployment rate from the first to the last year of the decade. I use the same set of control variables, $\boldsymbol{X}_{it,}$ as in the short term model where $\frac{\Delta Nonimm.pop_{it}}{POP_{it-10}}$ is the change in the native population during the decade relative to the total population in the beginning of the decade, and the *log dwelling starts*$_{it-10}$ is the number of new dwellings started in the first year of the decade.

I will only estimate the long term model using the full sample, since splitting the full sample in two will result in samples with very few observations.

4 Data, Sample and Summary Statistics

To perform the analysis I use yearly data from 1986 to 2012 for the four largest cities in Norway; Oslo, Bergen, Trondheim and Stavanger. These four cities are chosen based on the tendency that housing prices in larger cities fluctuate more than the prices in more peripheral areas (Medby & Barlindhaug, 2008). At the same time, immigrants tend to settle down in urban areas, particularly in and near the largest cities, to a greater extent than the native population (NOU, 2011).

The data is collected from the web pages of The Norwegian Labour and Welfare Administration (NAV) , Statistics Norway (Statistisk sentralbyrå), Norwegian Social Science Data Services (NSD) and The Real Estate Agents' Association (Eiendomsmeglerforetakenes Forening).

I will here introduce all the variables used in the analysis. If not specified otherwise, the data is obtained from the web site of Statistics Norway (Statistisk sentralbyrå).

4.1 Change in Housing Prices

I use the real estate industry's statistic of housing prices developed by The Real Estate Agents' Association (Eiendomsmeglerforetakenes Forening), Eiendomsverdi AS and FINN[2]. The statistic reports the yearly nominal mean value per square meter for an average dwelling of a size of 100 m^2. There are separate mean values for the four different cities.

[2] Eiendomsverdi is a company that develops and supplies information tools and systems to estimate market value for the Norwegian residential real estate market. FINN is the company that operates Finn.no, the primary marketing site for sale of residential real estate in Norway.

In order to avoid picking up structure from general price development I've transformed the nominal values by the inflation level (CPI). The real values are computed as follows:

$$Real\,value_t = \frac{Nominal\,value_t}{1 + CPI_t} \tag{4.3}$$

To reduce the negative skew of the data, I use the data on log form.

Table 4.1 shows the real mean price per square meter in the different cities in 1986, 2000 and 2012. The housing prices are highest in Oslo, while Stavanger has had the highest relative changes. The housing prices have increased considerable more during the 12 years after the millennium change than the 14 years prior to year 2000.

Table 4.1: The real mean price pr. m^2 in 1986 and 2012 (NOK)

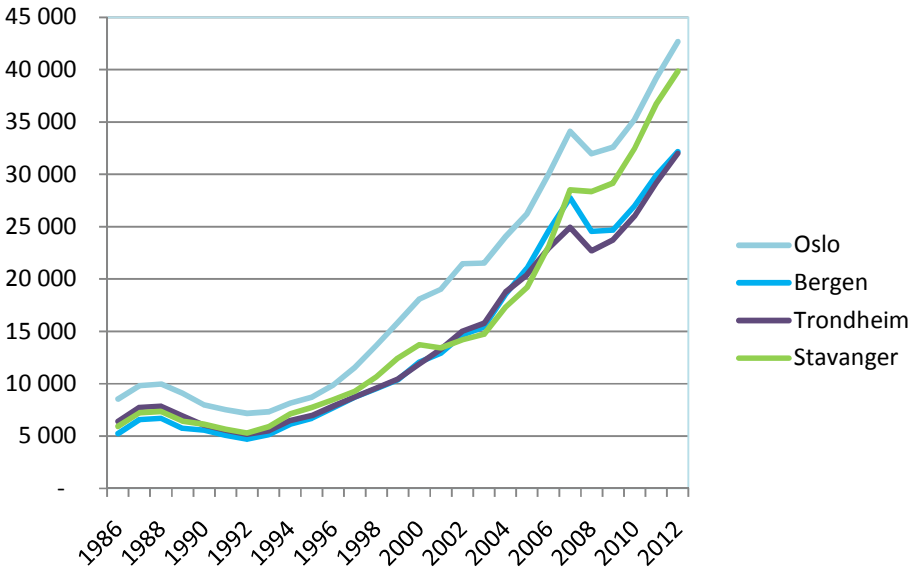
	Real mean price pr. m^2			Relative change		
City	1986	2000	2012	1986-2012	1986-2000	2000-2012
Oslo	8 539	18 099	42 662	400 %	112 %	136 %
Bergen	5 241	12 072	32 174	514 %	130 %	167 %
Trondheim	6 419	11 877	31 988	398 %	85 %	169 %
Stavanger	5 926	13 715	39 848	572 %	131 %	191 %

Source: Eiendomsmeglerforetakenes Forening, Eiendomsverdi and Finn.no

Figure 4.1 shows the development in the housing prices in the four different cities. Throughout the whole period, the housing prices have been highest in Oslo, Norway's capital. The housing prices of the other three cities have been quite similar for the first twenty years of the period analyzed. However, after the beginning of the financial crisis in 2007, the housing prices in Stavanger have increased more than the prices in Bergen and Trondheim. It seems like the housing prices in Stavanger were less affected by the financial crisis than the other three cities. By the end of the

period, the mean price per square meter for dwellings in Stavanger was almost as high as the ones in Oslo.

Figure 4.1: Development in real mean price pr. m^2, split by city (NOK)



Source: Eiendomsmeglerforetakenes forening, Eiendomsverdi and Finn.no

4.2 Population and Immigrants

An immigrant is defined as a person who is born abroad of two foreign- born parents and four foreign- born grandparents. Immigrants immigrated to Norway at some point (www.ssb.no).

Table 4.2 shows the population and number of immigrants in the different cities in 1986, 2000 and 2012. Oslo has the highest population and the highest share of immigrants. Stavanger has the smallest population, while Trondheim has the lowest share of immigrants.

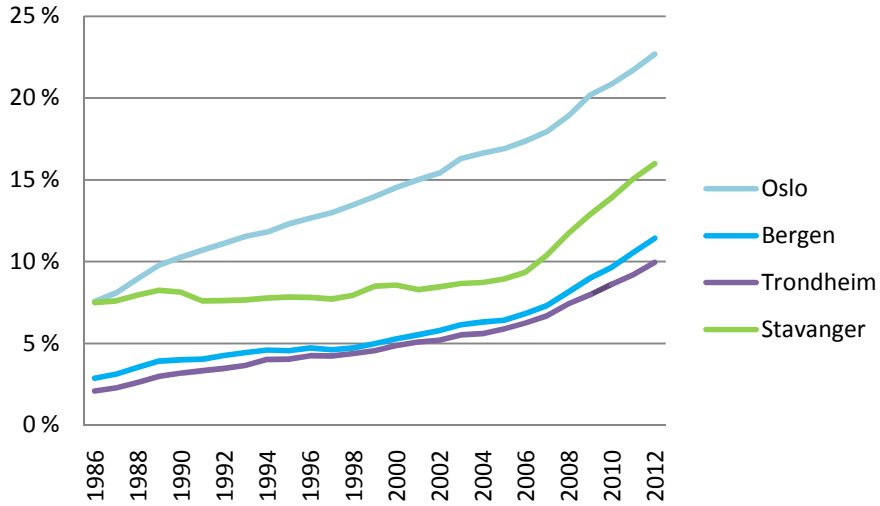
Table 4.2: Distribution of the variables "Population" and "Immigrants" in 1986 and 2012 (number of persons)

	Population			Immigrants			Immigrants to population ratio			Change in immigrants over population previous period		
	Year			Year			Year			Period		
City	1987	2000	2012	1987	2000	2012	1987	2000	2012	1986-2012	1986-2000	2000-2012
Oslo	451 345	507 467	613 285	36 614	73 777	139 081	8 %	15 %	23 %	23 %	8 %	13 %
Bergen	208 886	229 496	263 762	6 572	12 134	30 183	3 %	5 %	11 %	11 %	3 %	8 %
Trondheim	134 537	148 859	176 348	3 105	7 275	17 569	2 %	5 %	10 %	11 %	3 %	7 %
Stavanger	95 463	108 818	127 506	7 258	9 348	20 407	8 %	9 %	16 %	14 %	2 %	10 %

Source: Statistics Norway

Figure 4.2 shows the development in the immigrants to population ratio in the four different cities. The ratio has increased significantly during the period in all the cities, and the increase has been largest during the years after year 2000. We see that this pattern is similar to the development in the housing prices discussed above.

Figure 4.2: Development in immigrants to population ratio, split by city (%)



Source: Statistics Norway

In 1987 every thirteenth inhabitant in Oslo was an immigrant, while in 2012 every fifth inhabitant in Oslo was an immigrant. In the appendix, figure A1 shows that the yearly inflow of immigrants relative to the total population has been greatest in Oslo. The annual change in the number of immigrants over the total population has been most volatile in Stavanger. One possible explanation for this is Stavanger's position as the capital of the Norwegian oil and gas industry, and that the city's inflow/ outflow of immigrants follows the cyclical fluctuations of this industry.

Table 4.3: The immigrants' continent of origin in 1986 and 2012

City	Europe		Asia		Africa		North-America		South- and Central America		Oceania	
	1986	2012	1986	2012	1986	2012	1986	2012	1986	2012	1986	2012
Oslo	51 %	42 %	33 %	37 %	8 %	15 %	5 %	1 %	3 %	4 %	0 %	0 %
Bergen	52 %	52 %	28 %	28 %	4 %	12 %	10 %	2 %	5 %	6 %	1 %	0 %
Trondheim	55 %	47 %	26 %	34 %	5 %	12 %	9 %	2 %	5 %	4 %	0 %	0 %
Stavanger	62 %	54 %	13 %	28 %	3 %	9 %	21 %	4 %	1 %	5 %	1 %	1 %

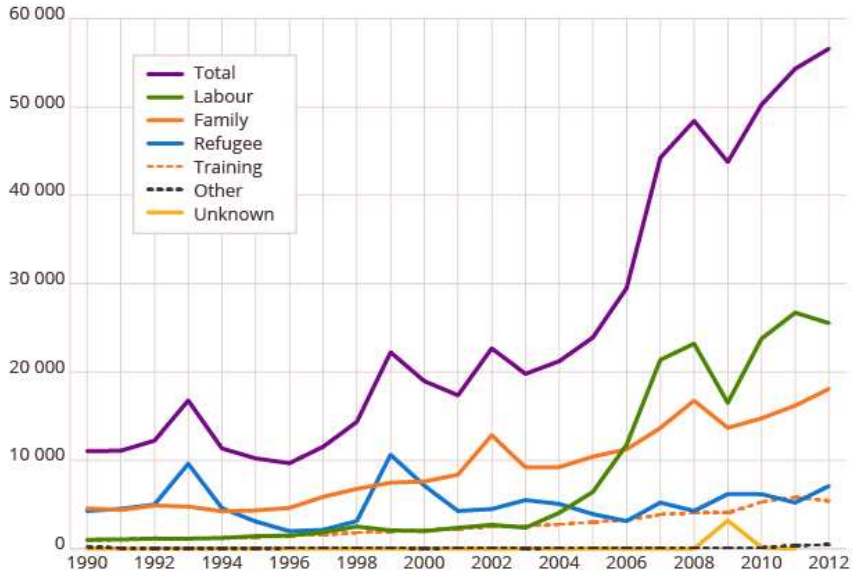
Source: Statistics Norway

Table 4.3 shows the immigrants' continent of origin in 1986 and 2012. The percentage is calculated as the city's number of immigrants from each of the continents divided by the city's total number of immigrants.

In 1986 more than half of the immigrants came from Europe. Except from in Bergen, the share of European immigrants has decreased some during the 26- year period, but still the majority of the immigrants come from Europe. Oslo has a higher share of non- western immigrants (Asian and African) than the other cities. Stavanger has a higher share of western immigrants (Europe and North- America) than the other cities. One possible reason for this is that a great demand for skilled labor in the petroleum industry has attracted workers from abroad, primarily from Europe and North- America.

Figure 4.3 illustrates the development of the non- Nordic immigrants' motivation for immigrating to Norway. The figure is discussed in Dzamarija (2013).

Figure 4.3: Immigration to Norway from non- Nordic countries by reason for immigration 1990-2012 (number of persons)



Source: Statistics Norway

In 1990 the main reasons for immigration to Norway were family or escape. The peaks in the refugee curve are due to the war in the former Yugoslavia in the nineties. The picture alters after 2004, when the labor- related immigration started to rise. This was due to the expansion of the EU in May 2004, where 10 additional countries were included[3]. The increased work- related immigration led to a rise in the family- related immigration as well, as many of those who came to Norway for work brought their family with them. Since 2005 the labor- related immigration accounted for 40-50% of all migration from non- Nordic citizens. Poland was the main country of origin for these immigrants (table A1).

4.3 Change in Unemployment Rate

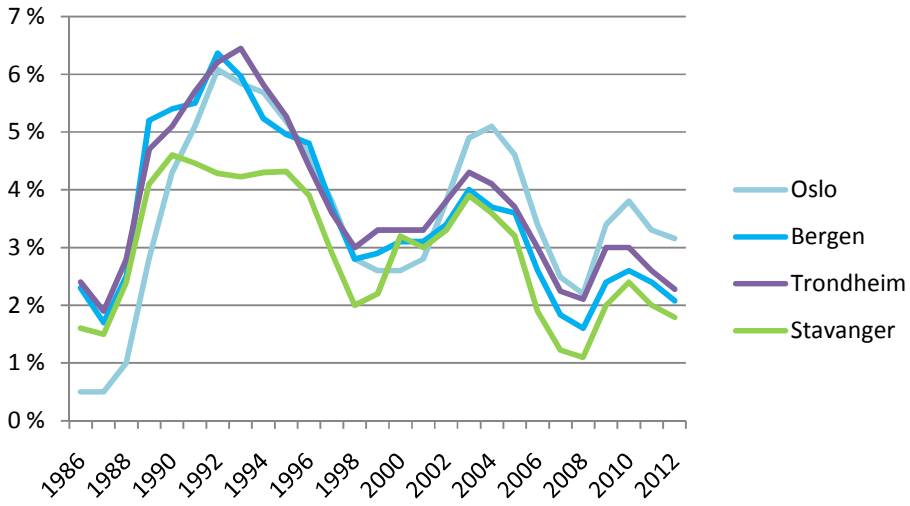
The unemployment rate is defined as the yearly average of total unemployed persons in percentage of the labor force. The source of these data is The Norwegian Labor and Welfare Administration

[3] The new EU- countries were Poland, Estonia, Latvia, Lithuania, Slovakia, Slovenia, Czech Republic, Hungary, Cyprus and Malta. Romania and Bulgaria were included in the union in August 2007.

(NAV). These data are only available at the county- level for the whole period. At the city- level the data availability is limited to the period after year 2000. I will use the change in yearly average unemployment rate for the counties where the four cities' belong as a proxy for the cities' change in unemployment rate.

The unemployment rate is reflecting the income level. Unemployed persons normally have a lower income level than employed persons. As the unemployment rate increases, people's average purchasing capacity is expected to decrease, and this is expected to have a negative effect on the dependent variable.

Figure 4.4: Development in the unemployment rate in the different cities from 1986 to 2012 (%)



Source: NAV

Figure 4.4 illustrates the development in the unemployment rates in the different cities. The unemployment rates exhibit a similar pattern. They had a peak in the early nineties, after the bank crisis in the late eighties. After the recovery of this recession, the unemployment rates have been fluctuating around a trend of around 3%. This is rather low compared to other European countries and to the US. The unemployment rates increased some in the years following the financial crisis, but the average yearly rates still weren't very high. The relatively low unemployment rate must be

one reason for the recent years' increased work- related immigration, since the employment opportunities for new immigrants are negatively correlated with the unemployment rate. Stavanger seems to have had the overall lowest unemployment rate throughout the period, while the unemployment rate in Oslo seems to vary the most with the business cycle.

4.4 Dwelling Starts

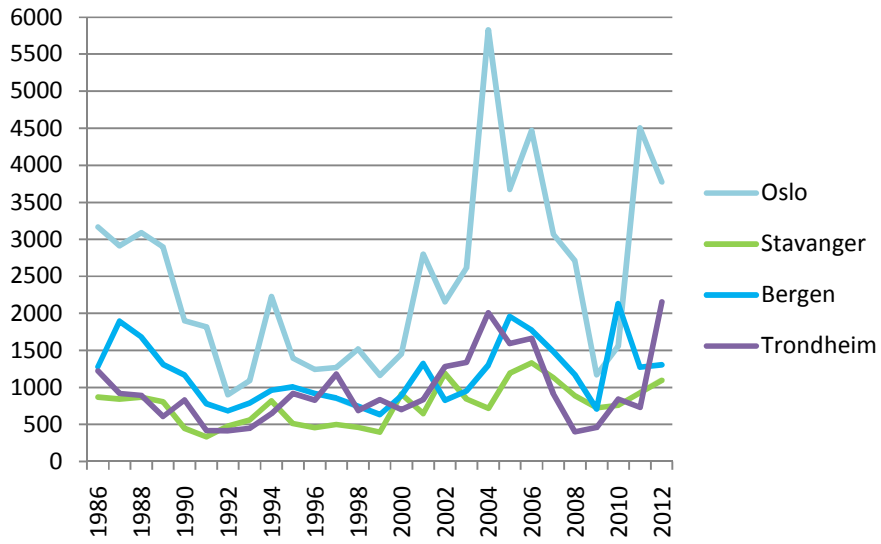
I use data for number of dwellings started for each of the four cities. Until 1999, building work was considered started when the work with the foundation wall began. From 2000, the starting date used is the date when the starting permission is given. A building permit does not always mean that construction will be started at once. Especially in a recession it might be that construction projects are not realized, or may be postponed after a building permit has been granted (www.ssb.no).

Since the start up of a new building in one period often won't end up as a new dwelling until one or several periods later, I lag the data with one period. To reduce the positive skew of the data, I use the data on log form.

When the number of start- ups of new dwellings increases, the supply of housing increases (ref. equation 3.5). According to economic theory, an increase in the supply will reduce the equilibrium price given a fixed level of demand.

Figure 4.5 shows that the number of dwellings started in the different cities exhibit a similar pattern. After the bank crisis in the late eighties the number of dwellings started dropped. In the beginning of the new millennium there was an increase in the construction activity, until the financial crisis in 2007-2008 when the level of activity dropped significantly. From 2009 there has been an increase in the construction activity.

Figure 4.5: Development in dwelling starts in the different cities from 1986 to 2012 (number of dwellings)



Source: Statistics Norway

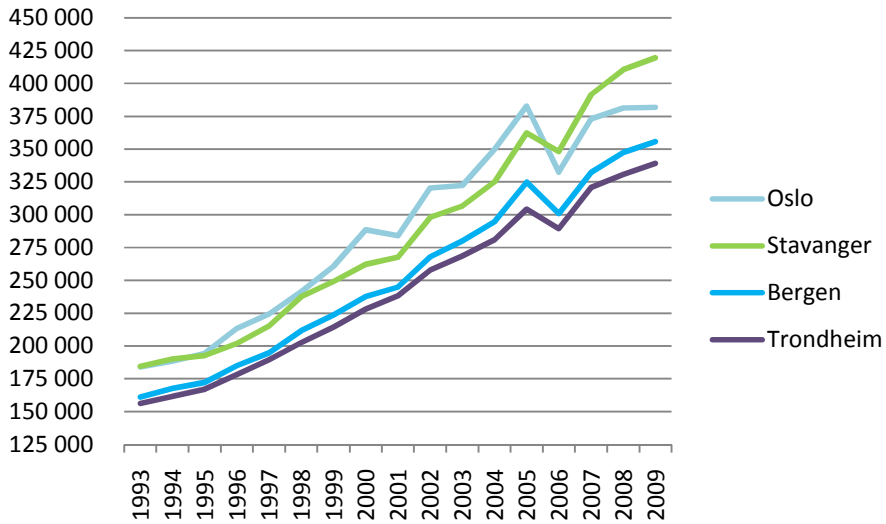
4.5 Change in Income per Capita

Due to data availability I use gross income per capita as a proxy for disposable income per capita. The source of these data is the tax return statistic downloaded from the regional database of Norwegian Social Science Data Services (NSD). The statistic is based on data collected from the Norwegian Directorate of Taxes.

The statistic reports the yearly nominal mean gross income per capita for all residents of age 17 and older for each city for the period 1993 to 2009. Gross income is defined as the sum of all taxable income, including salaries, pensions, trade revenue and capital revenue. In order to avoid picking up structure from general price development I've transformed the nominal values by the inflation level (CPI). To reduce the negative skew of the data, I use the data on log form.

Figure 4.6 shows that the gross real income per capita exhibit increasing patterns in all of the four cities. The income level in Bergen and Trondheim has been quite similar, while Oslo and Stavanger have had a higher income level throughout the period.

Figure 4.6: Development in gross real income per capita in the different cities from 1993 to 2009 (NOK)



Source: NSD's regional database and the Norwegian Directorate of Taxes

5 Empirical Results

In this section I will present the results of my analysis. I've found that immigration inflows have a positive effect on housing prices in Norway's largest cities.

First I will present the estimated short term effect of immigration on housing prices. Thereafter, I will present the estimated long term effect, and at last I will test whether the short term effect is significantly greater than the long term effect.

5.1 Short Term Effect

Table 5.1 reports the results of OLS- estimations of different specifications of equation (4.1). The dependent variable is the annual change in the log price of housing per square meter in a city. The main independent variable is the annual change in the immigrant population relative to the total population the previous year. All regressions are estimated with year fixed effects to capture national trends in inflation and other economic variables.

Columns 1 to 3 present the estimates of regressions without any regional control variables, columns 4 to 6 report estimates for regressions with regional fixed effects, and columns 7 to 9 show the estimates for regressions with both regional fixed effects and regional time- varying control variables. The coefficients of the constant term and the fixed effects are not reported in the table. Each of the three specifications is estimated using three different data samples. First the period from 1986 to 2012 is estimated. This estimation is followed by separate estimations for the periods before and after year 2000.

Table 5.1: OLS- results, short term model

	(1) Without regional control variables			(2) With regional fixed effects			(3) With regional fixed effects and regional control variables		
Δ Log Price_it	Whole period	Pre 2000	Post 2000	Whole period	Pre 2000	Post 2000	Whole period	Pre 2000	Post 2000
Δ Imm_it/ pop_it-1	1,22**	0,70	1,62**	2,94***	2,59	3,81***	3,47***	2,53	4,43***
	(0,59)	(0,89)	(0,80)	(0,81)	(1,60)	(0,99)	(0,90)	(1,71)	(1,04)
Δ Unempl. rate_ it	-1,10**	-1,05*	-1,15	-1,06**	-1,08*	-0,90	-0,94*	-1,32*	-0,88
	(0,52)	(0,62)	(0,96)	(0,49)	(0,60)	(0,87)	(0,50)	(0,67)	(0,87)
Δ Nonimm. pop_it/ pop_it-1							0,60	0,20	0,44
							(0,56)	(1,21)	(0,75)
Log dwelling starts_it-1							-0,01	0,02	-0,03*
							(0,01)	(0,03)	(0,01)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	104	52	52	104	52	52	104	52	52
Adjusted R^2	0,88	0,92	0,78	0,90	0,92	0,82	0,90	0,92	0,83
Sample	1986-2012	1986-1999	2000-2012	1986-2012	1986-1999	2000-2012	1986-2012	1986-1999	2000-2012

Notes: 1. Standard errors in parentheses. 2.* significant at 10%; ** significant at 5%; *** significant at 1%.

There is a clear pattern for the estimated results of the different samples. For all the specifications, the immigration's impact on housing prices seems stronger for the period after year 2000. The estimated coefficients of the main independent variable are higher for the post 2000- period than the two other samples estimated. Regardless of the control variables included, the immigration does not seem to have had a statistically significant impact on housing prices in the period prior to year 2000. The other two samples show statistically significant estimates of the main independent variable at a significance level of minimum 5% for all the three specifications.

Another point worth noting is that the model seems to capture the variation in the dependent variable better in the beginning of the 26- year period than in the more recent years. The adjusted R^2 is somewhat higher for the pre 2000- sample and the full sample than for the post 2000- sample. This might indicate that the estimates of the post 2000- sample are biased due to omitted variables that affect the housing prices. Thus, one should be cautious when drawing conclusions based on the

estimates of the post 2000- sample. There might be unobserved factors that are correlated to the immigrant inflow which are more relevant for the recent years. This might cause exaggerated estimates of the immigrations' impact on house prices.

The estimated effect of immigration on housing prices is reported in the first row of table 5.1. The estimated effect is quite different for the different specifications. The specification with no regional control variables predicts the lowest price change caused by immigration. The estimates indicate that an immigrant inflow of 1% of the total population causes house prices to increase by 1,2% to 1,6%.

Immigration's estimated impact on house prices increases when regional control variables are included. In specification (2) the predicted effect of the main independent variable is 2,94% for the full sample and 3,81% for the post 2000- period. Table 5.2 shows two sided t- tests of the null hypothesis that the estimates of (2) are not significantly different from the estimates of (1). H_0 is rejected for the full sample and for the post 2000- sample.

Table 5.2: Hypothesis testing of specification (2) vs. specification (1), short term model

	Whole period	Pre 2000	Post 2000
t^{obs}	2,12	1,18	2,21
t^{crit}	1,99	2,04	2,04
	$\|t^{obs}\| > t^{crit}$	$\|t^{obs}\| < t^{crit}$	$\|t^{obs}\| > t^{crit}$
Conclusion	Reject H0 in favor of H1: Specification (2) is statistically different from specification (1)	Cannot reject H0: Specification (2) is not statistically different from specification (1)	Reject H0 in favor of H1: Specification (2) is statistically different from specification (1)
Level of significance	5 %	5 %	5 %
n-k-1	73	34	34
Sample	1986-2012	1986-1999	2000-2012

The estimated effect of immigration on house prices increases even more when adding regional time- varying control variables. In specification (3) the predicted effect of the main independent

variable is 3,47% for the full sample and 4,43% for the post 2000- period. However, two sided t-tests show that the estimates are not significantly different from the estimates in (2) (see table A2).

The effect of a change in the unemployment rate is only statistically significant for the pre 2000 sample and for the full sample, though for the pre 2000 sample the level of significance is only 10%. For the full sample the estimated effect of a change in the unemployment rate of one percentage point is associated with a price drop of about 1%. The variable is statistically significant at the 5% level in specifications (1) and (2), and at the 10% level in specification (3).

None of the time- varying regional control variables in specification (3) are statistically significant at a 5% significance level. The change in the non- immigrant population consists of excess of births and net native in-migration. Nordbø (2013) explains why immigration inflow has a larger effect on housing prices than the increase in the native population by pointing out that the housing demand don't increase much due to births, while most immigrants are adults and need housing from day one. In section 4 we saw that the number of dwelling starts had a drop in times when the economy went through a rough patch. We also saw that the level of dwelling starts in the different cities exhibited a similar pattern. This indicates that the number of dwelling starts fluctuates with the national economic trends captured by the year fixed effects. This might explain the estimates' lack of statistical significance.

The regressions show that controlling for regional factors matters. The more regional control variables are included, the higher are the estimated effects of immigration. This is in contrast to the findings of Degen and Fischer (2009) which found that the price impact from immigration in the Swiss housing market were highest for a specification without regional controls. Nordbø (2013) on the other hand, found that immigration's predicted impact on Norwegian housing prices increased when including regional fixed effects. However, due to the uncertainty of the estimates, he found that the difference of the estimated effects with and without regional fixed effects were not statistically significant.

As described in section 4 both the immigration inflow and the housing prices have increased more in the post 2000- period than in the period prior to year 2000 (see table 4.1 and 4.2). It seems like when the inflow of immigrants increases, the immigrations' effect on housing prices increases as

well. One possible explanation of this finding is that the main purpose of the inflowing immigrants has changed during the 26- year period. Figure 4.3 shows quite clearly that the reason for non-Nordic immigrants to immigrate to Norway has evolved from being dominated by escape and family reunion to labor- related immigration. Further, one might suggest that the immigrants who come to the country for work have higher income- level than those who come as refugees, and thus have a higher purchasing capacity, either to spend on rent or to spend on the purchase of a home. In the case that new immigrant demand dwellings to rent, the demand for rented dwellings will rise. Simple demand- supply theory says that this will cause rents to increase in the short run. Increased rents will cause housing prices to rise as well. Thus, whether immigrants live in a rented or owned dwelling does not matter for the development of the house prices.

My preferred specification of the short term model is specification (2). This specification explains more of the variance in the data than (1) by controlling for regional fixed effects. Since hypothesis testing shows that the estimates of the effect of the independent variable in (3) are not significantly different from (2), I believe that (2) is the best specification. This indicates that an immigrant inflow of 1% of a city's total population causes house prices to increase by 2,9%. This result is consistent with the findings of Saiz (2006) and Degen and Fischer (2009).

5.2 Long Term Effect

Table 5.3 reports the results of OLS- estimations of different specifications of equation (4.2). The dependent variable is the decennial change in the log price of housing per square meter in a city. The main independent variable is the decennial change in the immigrant population relative to the total population in the beginning of the decade. All regressions are estimated with decade fixed effects to capture national trends in inflation and other economic variables.

First of all we can see that for all the specifications, the adjusted R^2 is higher than for the short term model. This indicates that the long term model captures the variation in the dependent variable better than the short term model. As for the short term model, the estimated effect of immigration on housing prices increases when more control variables are added to the model, so does the adjusted R^2. The main independent variable is statistically significant at the 1% level in

specifications (2) and (3), and at the 5% level in specification (1). For all the three specifications, the estimated coefficients of the main independent variable are smaller than in the short term model. This supports the theory of housing demand which says that prices are less affected by changes in demand in the long run than in the short run. I will investigate this further in section 5.3.

Table 5.3: OLS- results, long term model

Δ Log Price_it	(1) Without regional control variables	(2) With regional fixed effects	(3) With regional control variables
Δ Imm_it/ pop_it-10	0,67**	1,64***	2,89***
	(0,27)	(0,58)	(0,96)
Δ Unempl. rate_ it	-4,00***	-3,40***	-3,55***
	(0,84)	(0,81)	(0,80)
Δ Nonimm. pop_it/ pop_it-10			0,83*
			(0,49)
Log dwelling starts_it-10			0,03
			(0,04)
Decade fixed effects	Yes	Yes	Yes
Number of observations	68	68	68
Adjusted R^2	0,94	0,95	0,96
Sample	1986-2012	1986-2012	1986-2012

Notes:1. Standard errors in parentheses. 2.* significant at 10%; ** significant at 5%; *** significant at 1%.

Column 1 shows the estimated effect for the specification without regional control variables. The regression result indicates that an immigrant inflow of 1% of the total population causes house prices to increase by 0,67%. In column 2 we see that the estimated effect increases to 1,64% when adding regional fixed effects. However, the uncertainty of the estimate has increased as well. A t-test rejects that the estimated effect of immigration on housing prices from specification (2) is significantly different from what found in specification (1) (see first column of table 5.4). The estimated price effect of immigration increases even more when adding regional time- varying control variables. In specification (3) the predicted effect of the main independent variable is

2,89%, but the estimate's uncertainty has increased as well. T- tests reported in table 5.4 show that the estimates of specification (3) is statistically different from specification (1), but not from specification (2).

Table 5.4: Hypothesis testing of the long term model

	(2) vs. (1)	(3) vs. (1)	(3) vs. (2)
t^{obs}	1,67	2,31	1,30
t^{crit}	2,02	2,02	2,02
	$\|t^{obs}\| < t^{crit}$	$\|t^{obs}\| > t^{crit}$	$\|t^{obs}\| < t^{crit}$
Conclusion	Cannot reject H0: Specification (2) is not statistically different from specification (1).	Reject H0 in favor of H1: Specification (3) is statistically different from specification (1).	Cannot reject H0: Specification (3) is not statistically different from specification (2).
Level of significance	5 %	5 %	5 %
n-k-1	46	44	44
Sample	1986-2012	1986-2012	1986-2012

These findings are somewhat consistent with what was found in the short term model. For both the models, the estimated price effect of immigration found by estimating specification (3) is not statistically different from the results of specification (2). In the short term model both effects estimated by specification (2) and (3) were statistically different from what was found in specification (1). In the long term model, only the estimates of specification (3) were found to be statistically different from what was found in specification (1).

The effect of a change in the unemployment rate is estimated to be higher in the long term model than in the short term model. Also, the variable's level of significance is estimated to be higher than what was found in the short term model. The estimated effect is quite similar for all the three specifications. A change in the unemployment rate of one percentage point from the beginning to the end of the decade is associated with a price drop of 3% - 4%. Equivalent to what was found in

the short term model, none of the time- varying control variables are statistically significant at a significance level of 5%.

My preferred specification of the long term model is (3). This specification explains more of the variance in the data than both (1) and (2). Since hypothesis testing shows that only the estimates of the effect of the independent variable in (3) is significantly different from (1), I believe that (3) is the best specification. This indicates that an immigrant inflow of 1% of the total population causes house prices to increase by 2,9%. This is the same result as from the short term model.

5.3 Comparison of the Short Term and Long Term Effect

I will here analyse whether the estimated short term effect of immigration on housing prices is significantly greater than the estimated long term effect. Theoretically, the short term effect should be greater than the long term effect since in the long run the supply of housing will adapt to the demand, and thus dampen the price pressure. We saw in section 5.2 that the estimated coefficients of the main independent variable were greater for each specification of the short term model compared to the long term model. Thus it seems like the theory fits well to the data. However, this apparent difference needs to be analysed more thoroughly in order to make any conclusions.

Table 5.5 shows the results of one- sided t- tests where the null hypothesis is that the short term effect is equal to the long term effect. The alternative hypothesis is that the short term effect is greater than the long term effect. The conclusions of the t- tests are equal for all the three specifications; the short term effect of immigration on house prices is not statistically greater than the long term effect.

Given these results, my analysis shows that an immigration inflow equal to 1% of a city's population is coincident with an increase in housing prices of about 2,9%. I cannot find that the short term effect is significantly larger than the long term effect.

Table 5.5: Hypothesis testing of short term vs. long term effects of immigration on housing prices

	(1) Without regional control variables	(2) With regional fixed effects	(3) With regional control variables
t^{obs}	0,93	1,60	0,64
t^{crit}	1,67	1,67	1,67
Conclusion	$t^{obs} < t^{crit}$ Cannot reject H0: Short term effect is not statistically greater than the long term effect.	$t^{obs} < t^{crit}$ Cannot reject H0: Short term effect is not statistically greater than the long term effect.	$t^{obs} < t^{crit}$ Cannot reject H0: Short term effect is not statistically greater than the long term effect.
Level of significance	5 %	5 %	5 %
n-k-1	76	73	71
Sample	1986-2012	1986-2012	1986-2012

In order to better understand the estimated effect, I calculate the average impact of immigration on house prices. First, I find the average immigrant inflow over the four cities from 1986 to 2012. This annual average is 0,49% of a city's population. Thus this annual inflow of immigrants causes housing prices to increase with 0,49%*2,9%=1,42%. By comparing this figure with the average yearly growth rate of the housing prices, I find the share of the annual increase in housing prices caused by immigration. The average yearly growth rate of housing prices in the four cities from 1986 to 2012 was 7,3%. This means that nearly one fifth[4] of the total price increase is associated with immigrant inflows. This is lower than the average impact of two- thirds found on Swiss data by Degen and Fischer (2009), and the average impact of one quarter found on Spanish data by Gonzalez and Ortega (2013). However, my findings are not perfectly comparable with the findings from Switzerland and Spain, since the two other studies only use data from after 2000. If I do this calculation using the post 2000 sample instead of the full sample, I find that immigration was responsible for 29% of the annual increase in housing prices.

[4] 1,42%/7,3%≈19%

5.4 Robustness Test

Finally I will test the robustness of the model by checking whether the omission of the regional income level in the baseline model affects the estimated results.

Table 5.6: Robustness test

Δ Log Price_it	(1) Without regional control variables	(2) With regional fixed effects	(3) With regional fixed effects and regional control variables	(4) With regional fixed effects and regional control variables, including income effect
Δ Imm_it/ pop_it-1	2,03**	4,29***	4,70***	4,68***
	(0,77)	(1,03)	(1,08)	(1,08)
Δ Unempl. rate_ it	-0,84	-0,75	-0,75	-0,63
	(0,79)	(0,75)	(0,74)	(0,75)
Δ Nonimm. pop_it/ pop_it-1			0,46	0,53
			(0,74)	(0,75)
Log dwelling starts_it-1			-0,03	-0,02
			(0,02)	(0,02)
Δ Log Real income pr. capita_it				0,24
				(0,24)
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	64	64	64	64
Adjusted R^2	0,76	0,79	0,80	0,80
Sample	1993-2009	1993-2009	1993-2009	1993-2009

Notes: 1. Standard errors in parentheses. 2.* significant at 10%; ** significant at 5%; *** significant at 1%.

As explained in section 3, the model does not control for the change in the regional income level due to data availability. Data regarding the annual average taxable income per capita for each city is only available for the period 1993-2009. Table 5.6 reports the results of OLS- estimations of different specifications of equation (4.1) for the period 1993-2009. The first three columns are the

same specifications as used in the main analysis, but with a different sample than reported in table 5.1. They are included for the purpose of comparison. Column 4 shows the regression results of a model which in addition to the control variables of specification (3) also includes the annual change in income per capita.

We see that for specification (1) to (3) the estimated price effect of immigration has increased compared to what was found in section 5.1. This must be due to the different samples used. What is of more interest is that the estimated effect of the main independent variable is nearly identical for specification (3) and (4). This suggests that the omission of the change in income per capita does not affect the estimated results of the baseline model. One explanation of this might be that the income effect is accounted for by the regional fixed effects.

6 Conclusion

The objective of this thesis is to show how the inflow of immigrants affects the housing prices in Norway. The analysis focuses both on the short term and the long term effect of immigration.

Using annual data on immigration and house prices for Norway's four largest cities from 1986 to 2012, I find that immigration has had a significantly positive effect on house prices. I find that an immigration inflow equal to 1% of the total population increases house prices by 2,9%. This is consistent with the findings of Saiz (2006) and Degen and Fischer (2009).

My results suggest that immigration is responsible for 19% of the average annual increase in housing prices for the period 1986 to 2012. For the post 2000- period, immigration's share of the average annual price growth seems to be even higher.

Contrary to what is expected from economic theory, I did not find evidence that the short term effect is significantly larger than the long term effect.

By splitting the sample in two, one for the period prior to year 2000 and one for the period after year 2000, I find that immigration only has had a statistically significant effect in the post 2000 period. This finding suggests that there has been a shift in how the inflow of immigrants affects the housing prices. During the first decade of the 21st century the immigrants to population ratio has increased significantly. Much of this increase is due to work- related immigration from Eastern Europe. After the EU- expansions in 2004 and 2007 the citizens from the new EU- countries are much freer to settle down in Norway than previously. This, combined with the good state of the Norwegian economy, has attracted many new immigrants in search of work. The results of my regressions indicate that this inflow of immigrants has had a positive impact on the housing prices.

My main conclusions are based on estimates of the full sample. By splitting the sample in two, the number of observations in the sample is halved. The reduced sample size might reduce the robustness of the estimates. Further research could be to estimate the post 2000- effect of immigration on Norwegian housing prices five to ten years ahead, when there will be data available for more years. The increased sample size might give a more robust analysis.

Other studies on this subject have included IV- estimation in order to remove potential endogeneity from the model. This has worked well in international studies, but not on the study on Norwegian data performed by Nordbø (2013). Due to the findings of Nordbø and to data availability, I have not included IV- estimation as part of my analysis. The full sample- model seems to capture the variation in the dependent variable quite well, with an adjusted R^2 of 0,90. However, the adjusted R^2 is reduced to 0,82 for the estimation of the post 2000- sample. This might indicate that the estimates of the post 2000- sample are biased due to omitted variables that affect the housing prices. There might be unobserved factors that are correlated to the immigrant inflow which are more relevant for the recent years. This might suggest that IV- estimation is more appropriate for the period after year 2000 when immigration and housing prices both have increased significantly. Further research could aim to find a suitable instrument variable which obtains the necessary requirements of exogeneity.

The findings of this thesis might be useful when predicting the future development of the housing prices. The prospective development of the housing market is of great interest for the construction industry as well as investors and private participants. Statistics Norway's population projections for the period 2014 to 2100 suggests that the immigration inflow to Norway will not be as high in the future as it has been in recent years (Tønnesen, Cappelen, & Skjerpen, 2014). The prognosis is based on the anticipation that the Norwegian petroleum revenue will diminish in combination with the expectations of improved economic conditions for many of the countries of departure. This will make it less favorable to immigrate to Norway. This prognosis combined with my results suggests that the recent years' housing boom will not continue into the future. This should be accounted for by the various participants in the housing market. In the case of net immigrant outflow, we might see a decline in the housing prices.

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Web- pages:

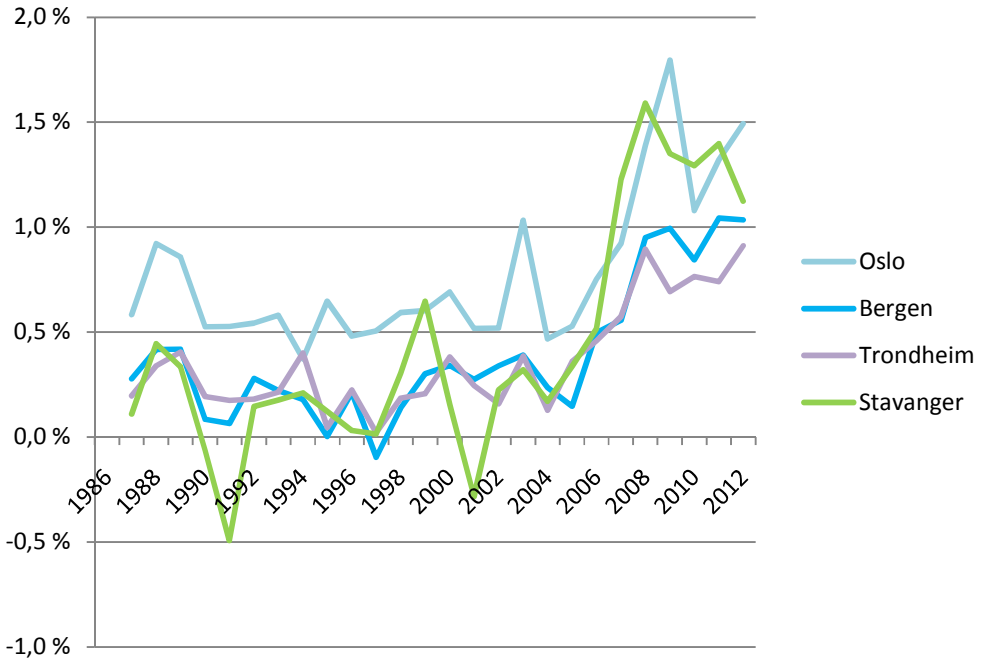
www.eff.no Eiendomsmeglerforetakenes Forening

www.nav.no NAV

www.ssb.no Statistics Norway

Appendix I: Descriptive Statistics

Figure A1: Development in the change in immigrants over population previous period, split by city (%)



Source: Statistics Norway

Table A1: The main countries of origin of the net immigration inflow to Norway, divided by five- year intervals from 1987 to 2011

1987-1991		1992-1996		1997-2001		2002-2006		2007-2011	
Iran	12 %	Bosnia-Hercegovina	30 %	Irak	15 %	Russia	9 %	Poland	25 %
Chile	10 %	Serbia and Montenegro	9 %	Sweden	13 %	Somalia	8 %	Lithuania	7 %
Sri Lanka	9 %	Sweden	7 %	Serbia and Montenegro	9 %	Irak	8 %	Germany	6 %
Vietnam	8 %	Vietnam	6 %	Somalia	7 %	Poland	8 %	Sweden	6 %
Pakistan	8 %	Somalia	6 %	Russia	4 %	Afghanistan	7 %	Kosovo	5 %

Source: Statistics Norway

Appendix II: Empirical Tests

Table A2: Hypothesis testing of specification (3) vs. specification (2), short term model

	Whole period	Pre 2000	Post 2000
t^{obs}	0,59	- 0,04	0,60
t^{crit}	1,99	2,04	2,04
	$\|t^{obs}\| < t^{crit}$	$\|t^{obs}\| < t^{crit}$	$\|t^{obs}\| < t^{crit}$
Conclusion	Cannot reject H0: Specification (3) is not statistically different from specification (2).	Cannot reject H0: Specification (3) is not statistically different from specification (2).	Cannot reject H0: Specification (3) is not statistically different from specification (2).
Level of significance	5 %	5 %	5 %
n-k-1	71	32	32
Sample	1986-2012	1986-1999	2000-2012

Appendix III: Dataset

Table A3: Dataset

Area	Year	CPI	Mean price pr. m2	Real mean price pr. m2	Log real mean price pr. m2	Population	Immigrants	Non-immigrant population	Unemployment rate	Gross income per capita	Real gross income per capita	Log real gross income per capita	Dwelling starts	Log dwelling starts
Oslo	1986	7,1 %	9 146	8 539	3,93	449 395	33 994	415 401	0,5 %				3167	3,50
Oslo	1987	8,7 %	10 684	9 829	3,99	451 345	36 614	414 731	0,5 %				2912	3,46
Oslo	1988	6,7 %	10 656	9 987	4,00	453 730	40 774	412 956	1,0 %				3091	3,49
Oslo	1989	4,6 %	9 540	9 120	3,96	456 124	44 667	411 457	2,8 %				2897	3,46
Oslo	1990	4,1 %	8 303	7 976	3,90	458 364	47 063	411 301	4,3 %				1898	3,28
Oslo	1991	3,5 %	7 795	7 531	3,88	461 644	49 479	412 165	5,1 %				1819	3,26
Oslo	1992	2,3 %	7 333	7 168	3,86	467 441	51 984	415 457	6,1 %				903	2,96
Oslo	1993	2,3 %	7 485	7 316	3,86	473 454	54 695	418 759	5,8 %	188 300	184 066	5,26	1093	3,04
Oslo	1994	1,4 %	8 263	8 149	3,91	477 781	56 459	421 322	5,7 %	191 000	188 363	5,27	2227	3,35
Oslo	1995	2,5 %	8 945	8 727	3,94	483 401	59 548	423 853	5,2 %	199 200	194 341	5,29	1396	3,14
Oslo	1996	1,2 %	10 010	9 891	4,00	488 659	61 875	426 784	4,6 %	216 100	213 538	5,33	1242	3,09
Oslo	1997	2,6 %	11 855	11 554	4,06	494 793	64 351	430 442	3,8 %	230 200	224 366	5,35	1268	3,10
Oslo	1998	2,2 %	13 972	13 671	4,14	499 693	67 290	432 403	2,8 %	246 700	241 389	5,38	1521	3,18
Oslo	1999	2,3 %	16 223	15 858	4,20	502 867	70 301	432 566	2,6 %	266 700	260 704	5,42	1161	3,06
Oslo	2000	3,1 %	18 660	18 099	4,26	507 467	73 777	433 690	2,6 %	297 400	288 458	5,46	1452	3,16
Oslo	2001	3,0 %	19 603	19 032	4,28	508 726	76 404	432 322	2,8 %	292 500	283 981	5,45	2798	3,45
Oslo	2002	1,3 %	21 745	21 466	4,33	512 589	79 049	433 540	3,8 %	324 500	320 336	5,51	2154	3,33
Oslo	2003	2,5 %	22 044	21 506	4,33	517 401	84 343	433 058	4,9 %	330 300	322 244	5,51	2616	3,42
Oslo	2004	0,4 %	24 144	24 048	4,38	521 886	86 763	435 123	5,1 %	351 400	350 000	5,54	5828	3,77
Oslo	2005	1,6 %	26 669	26 249	4,42	529 846	89 523	440 323	4,6 %	388 900	382 776	5,58	3673	3,57
Oslo	2006	2,3 %	30 711	30 020	4,48	538 411	93 507	444 904	3,4 %	340 100	332 454	5,52	4470	3,65
Oslo	2007	0,8 %	34 373	34 100	4,53	548 617	98 479	450 138	2,5 %	376 100	373 115	5,57	3069	3,49
Oslo	2008	3,8 %	33 175	31 960	4,50	560 484	106 102	454 382	2,2 %	395 900	381 407	5,58	2708	3,43
Oslo	2009	2,1 %	33 269	32 585	4,51	575 475	116 167	459 308	3,4 %	389 900	381 881	5,58	1171	3,07
Oslo	2010	2,5 %	36 118	35 237	4,55	586 860	122 379	464 481	3,8 %				1560	3,19
Oslo	2011	1,2 %	39 681	39 211	4,59	599 230	130 133	469 097	3,3 %				4504	3,65
Oslo	2012	0,8 %	43 004	42 662	4,63	613 285	139 081	474 204	3,2 %				3777	3,58

Area	Year	CPI	Mean price pr. m2	Real mean price pr. m2	Log real mean price pr. m2	Population	Immigrants	Non-immigrant population	Unemployment rate	Gross income per capita	Real gross income per capita	Log real gross income per capita	Dwelling starts	Log dwelling starts
Bergen	1986	7,1 %	5 613	5 241	3,72	207 922	5 996	201 926	2,3 %				1284	3,11
Bergen	1987	8,7 %	7 172	6 598	3,82	208 886	6 572	202 314	1,7 %				1895	3,28
Bergen	1988	6,7 %	7 142	6 694	3,83	209 831	7 442	202 389	2,5 %				1680	3,23
Bergen	1989	4,6 %	6 012	5 747	3,76	211 095	8 321	202 774	5,2 %				1311	3,12
Bergen	1990	4,1 %	5 800	5 571	3,75	211 826	8 500	203 326	5,4 %				1165	3,07
Bergen	1991	3,5 %	5 286	5 107	3,71	213 344	8 639	204 705	5,5 %				778	2,89
Bergen	1992	2,3 %	4 818	4 709	3,67	216 066	9 233	206 833	6,4 %				681	2,83
Bergen	1993	2,3 %	5 281	5 162	3,71	218 144	9 711	208 433	6,0 %	164 900	161 193	5,21	790	2,90
Bergen	1994	1,4 %	6 213	6 127	3,79	219 884	10 103	209 781	5,2 %	170 100	167 751	5,22	962	2,98
Bergen	1995	2,5 %	6 858	6 690	3,83	221 717	10 109	211 608	5,0 %	176 500	172 195	5,24	1005	3,00
Bergen	1996	1,2 %	7 793	7 701	3,89	223 238	10 581	212 657	4,8 %	187 300	185 079	5,27	917	2,96
Bergen	1997	2,6 %	8 961	8 734	3,94	224 308	10 367	213 941	3,7 %	199 800	194 737	5,29	856	2,93
Bergen	1998	2,2 %	9 742	9 532	3,98	225 439	10 680	214 759	2,8 %	216 400	211 742	5,33	744	2,87
Bergen	1999	2,3 %	10 645	10 406	4,02	227 276	11 359	215 917	2,9 %	228 800	223 656	5,35	632	2,80
Bergen	2000	3,1 %	12 446	12 072	4,08	229 496	12 134	217 362	3,1 %	245 100	237 730	5,38	891	2,95
Bergen	2001	3,0 %	13 321	12 933	4,11	230 948	12 764	218 184	3,1 %	252 300	244 951	5,39	1324	3,12
Bergen	2002	1,3 %	14 880	14 689	4,17	233 291	13 550	219 741	3,4 %	271 300	267 818	5,43	827	2,92
Bergen	2003	2,5 %	15 851	15 464	4,19	235 423	14 461	220 962	4,0 %	286 900	279 902	5,45	951	2,98
Bergen	2004	0,4 %	18 619	18 545	4,27	237 430	15 016	222 414	3,7 %	295 900	294 721	5,47	1301	3,11
Bergen	2005	1,6 %	21 386	21 050	4,32	239 209	15 365	223 844	3,6 %	330 000	324 803	5,51	1959	3,29
Bergen	2006	2,3 %	25 193	24 627	4,39	242 158	16 553	225 605	2,6 %	307 700	300 782	5,48	1774	3,25
Bergen	2007	0,8 %	27 995	27 772	4,44	244 620	17 902	226 718	1,8 %	334 900	332 242	5,52	1482	3,17
Bergen	2008	3,8 %	25 475	24 542	4,39	247 746	20 225	227 521	1,6 %	360 500	347 303	5,54	1171	3,07
Bergen	2009	2,1 %	25 194	24 676	4,39	252 051	22 688	229 363	2,4 %	363 200	355 730	5,55	710	2,85
Bergen	2010	2,5 %	27 635	26 961	4,43	256 600	24 815	231 785	2,6 %				2132	3,33
Bergen	2011	1,2 %	30 275	29 916	4,48	260 392	27 491	232 901	2,4 %				1273	3,10
Bergen	2012	0,8 %	32 432	32 174	4,51	263 762	30 183	233 579	2,1 %				1307	3,12

Area	Year	CPI	Mean price pr. m2	Real mean price pr. m2	Log real mean price pr. m2	Population	Immigrants	Non-immigrant population	Unemployment rate	Gross income per capita	Real gross income per capita	Log real gross income per capita	Dwelling starts	Log dwelling starts
Trondheim	1986	7,1 %	6 875	6 419	3,81	134 362	2 842	131 520	2,4 %				1220	3,09
Trondheim	1987	8,7 %	8 424	7 750	3,89	134 537	3 105	131 432	1,9 %				919	2,96
Trondheim	1988	6,7 %	8 395	7 868	3,90	135 524	3 563	131 961	2,8 %				892	2,95
Trondheim	1989	4,6 %	7 271	6 951	3,84	136 601	4 112	132 489	4,7 %				609	2,78
Trondheim	1990	4,1 %	6 287	6 040	3,78	137 346	4 375	132 971	5,1 %				832	2,92
Trondheim	1991	3,5 %	5 776	5 580	3,75	138 058	4 615	133 443	5,7 %				419	2,62
Trondheim	1992	2,3 %	5 311	5 191	3,72	139 630	4 866	134 764	6,2 %				413	2,62
Trondheim	1993	2,3 %	5 641	5 514	3,74	140 656	5 164	135 492	6,4 %	159 900	156 305	5,19	448	2,65
Trondheim	1994	1,4 %	6 579	6 488	3,81	142 188	5 727	136 461	5,8 %	163 700	161 440	5,21	646	2,81
Trondheim	1995	2,5 %	7 144	6 970	3,84	142 927	5 793	137 134	5,3 %	171 300	167 122	5,22	918	2,96
Trondheim	1996	1,2 %	7 965	7 871	3,90	143 829	6 114	137 715	4,4 %	180 500	178 360	5,25	825	2,92
Trondheim	1997	2,6 %	8 939	8 712	3,94	144 670	6 144	138 526	3,6 %	194 500	189 571	5,28	1179	3,07
Trondheim	1998	2,2 %	9 805	9 594	3,98	145 778	6 412	139 366	3,0 %	207 000	202 544	5,31	687	2,84
Trondheim	1999	2,3 %	10 685	10 445	4,02	147 187	6 713	140 474	3,3 %	219 300	214 370	5,33	836	2,92
Trondheim	2000	3,1 %	12 245	11 877	4,07	148 859	7 275	141 584	3,3 %	235 000	227 934	5,36	698	2,84
Trondheim	2001	3,0 %	13 697	13 298	4,12	150 166	7 642	142 524	3,3 %	245 300	238 155	5,38	833	2,92
Trondheim	2002	1,3 %	15 235	15 039	4,18	151 408	7 880	143 528	3,8 %	260 900	257 552	5,41	1281	3,11
Trondheim	2003	2,5 %	16 182	15 787	4,20	152 699	8 464	144 235	4,3 %	275 300	268 585	5,43	1340	3,13
Trondheim	2004	0,4 %	18 815	18 740	4,27	154 351	8 660	145 691	4,1 %	282 000	280 876	5,45	2007	3,30
Trondheim	2005	1,6 %	20 735	20 408	4,31	156 161	9 217	146 944	3,7 %	309 000	304 134	5,48	1590	3,20
Trondheim	2006	2,3 %	23 464	22 936	4,36	158 613	9 934	148 679	3,0 %	296 100	289 443	5,46	1662	3,22
Trondheim	2007	0,8 %	25 129	24 930	4,40	161 730	10 846	150 884	2,2 %	323 300	320 734	5,51	910	2,96
Trondheim	2008	3,8 %	23 560	22 698	4,36	165 191	12 293	152 898	2,1 %	343 400	330 829	5,52	402	2,60
Trondheim	2009	2,1 %	24 258	23 759	4,38	168 257	13 439	154 818	3,0 %	346 100	338 981	5,53	458	2,66
Trondheim	2010	2,5 %	26 670	26 019	4,42	170 936	14 724	156 212	3,0 %				842	2,93
Trondheim	2011	1,2 %	29 553	29 202	4,47	173 486	15 989	157 497	2,6 %				729	2,86
Trondheim	2012	0,8 %	32 244	31 988	4,50	176 348	17 569	158 779	2,3 %				2154	3,33

Area	Year	CPI	Mean price pr. m2	Real mean price pr. m2	Log real mean price pr. m2	Population	Immigrants	Non-immigrant population	Unemployment rate	Gross income per capita	Real gross income per capita	Log real gross income per capita	Dwelling starts	Log dwelling starts
Stavanger	1986	7,1 %	6 346	5 926	3,77	95 084	7 154	87 930	1,6 %				860	2,94
Stavanger	1987	8,7 %	7 879	7 248	3,86	95 463	7 258	88 205	1,5 %				843	2,93
Stavanger	1988	6,7 %	7 851	7 358	3,87	96 439	7 683	88 756	2,4 %				870	2,94
Stavanger	1989	4,6 %	6 739	6 442	3,81	96 948	8 006	88 942	4,1 %				806	2,91
Stavanger	1990	4,1 %	6 383	6 131	3,79	97 570	7 944	89 626	4,6 %				448	2,65
Stavanger	1991	3,5 %	5 874	5 676	3,75	98 180	7 463	90 717	4,5 %				333	2,52
Stavanger	1992	2,3 %	5 415	5 294	3,72	99 808	7 606	92 202	4,3 %				476	2,68
Stavanger	1993	2,3 %	6 032	5 896	3,77	101 403	7 782	93 621	4,2 %	188 800	184 555	5,27	562	2,75
Stavanger	1994	1,4 %	7 222	7 123	3,85	102 637	7 996	94 641	4,3 %	192 800	190 138	5,28	818	2,91
Stavanger	1995	2,5 %	7 950	7 756	3,89	103 590	8 121	95 469	4,3 %	197 500	192 683	5,28	512	2,71
Stavanger	1996	1,2 %	8 587	8 486	3,93	104 373	8 153	96 220	3,9 %	204 300	201 877	5,31	454	2,66
Stavanger	1997	2,6 %	9 522	9 280	3,97	105 626	8 168	97 458	2,9 %	220 800	215 205	5,33	499	2,70
Stavanger	1998	2,2 %	10 898	10 664	4,03	106 858	8 490	98 368	2,0 %	242 600	237 378	5,38	458	2,66
Stavanger	1999	2,3 %	12 717	12 431	4,09	108 019	9 182	98 837	2,2 %	254 800	249 071	5,40	397	2,60
Stavanger	2000	3,1 %	14 140	13 715	4,14	108 818	9 348	99 470	3,2 %	270 200	262 076	5,42	911	2,96
Stavanger	2001	3,0 %	13 844	13 441	4,13	108 848	9 039	99 809	3,0 %	275 600	267 573	5,43	645	2,81
Stavanger	2002	1,3 %	14 389	14 204	4,15	109 710	9 283	100 427	3,3 %	301 900	298 026	5,47	1188	3,07
Stavanger	2003	2,5 %	15 119	14 750	4,17	111 007	9 634	101 373	3,9 %	314 300	306 634	5,49	842	2,93
Stavanger	2004	0,4 %	17 390	17 321	4,24	112 405	9 823	102 582	3,6 %	326 400	325 100	5,51	715	2,85
Stavanger	2005	1,6 %	19 504	19 197	4,28	113 991	10 201	103 790	3,2 %	368 200	362 402	5,56	1194	3,08
Stavanger	2006	2,3 %	23 654	23 122	4,36	115 157	10 789	104 368	1,9 %	356 000	347 996	5,54	1333	3,12
Stavanger	2007	0,8 %	28 748	28 520	4,46	117 315	12 204	105 111	1,2 %	394 700	391 567	5,59	1135	3,05
Stavanger	2008	3,8 %	29 454	28 376	4,45	119 586	14 071	105 515	1,1 %	426 100	410 501	5,51	890	2,95
Stavanger	2009	2,1 %	29 792	29 179	4,47	121 610	15 687	105 923	2,0 %	428 300	419 491	5,52	726	2,86
Stavanger	2010	2,5 %	33 269	32 458	4,51	123 850	17 260	106 590	2,4 %				759	2,88
Stavanger	2011	1,2 %	37 176	36 736	4,57	126 021	18 991	107 030	2,0 %				926	2,97
Stavanger	2012	0,8 %	40 167	39 848	4,60	127 506	20 407	107 099	1,8 %				1094	3,04

Source: Statistics Norway, Eiendomsmeglerforetakenes forening, Eiendomsverdi, Finn.no, NAV, NSD’s regional database and the Norwegian Directorate of Taxes.