House prices in Norway since 1819

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PRELIMINARY, DO NOT QUOTE[*]

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Abstract

Annual house price indices for four Norwegian cities were compiled using observations from Norwegian administrative data on housing transactions. The house price indices were constructed using the weighted repeat sales method. Real house prices are constructed by deflating the house price indices with a consumer price index taken from the Norges Bank Historical Monetary Statistics (HMS) database, producing reasonably valid and reliable real house price indices for a period covering near two centuries. As part of the preparations of the book projects in connection with Norges Bank's bicentennial in 2016, a substantial amount of new and/or improved historical data have been compiled. These data will be made available at Norges Bank's web-site and documented in a third volume (HMS III), which will appear in Norges Bank's series occasional papers. Preliminary results from applying tests for house price bubbles show evidence of bubble-behaviour in Norwegian house prices on 1895-1899 and 1985-1988.

1 Introduction

We provide some evidence regarding house price bubbles in Norway on the basis of historical developments in Norwegian real house prices since the 1880s. This note contains a brief description of the methods and econometric indicators which have been applied, and we should make clear that what we present here obviously should be regarded as work in progress. The historical data for house prices and consumer prices are taken from Norges Bank's Historical Monetary Statistics (HMS) database, which is documented in Eitrheim, Klovland and Qvigstad (2004, 2007). For details regarding the construction of historical house price indices using the weighted repeat sales method, see Eitrheim and Erlandsen

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(2004, 2005),[1] and for details regarding the construction of the consumer price index, see Grytten (2004) and Klovland (2013).

The Norges Bank HMS-database has been substantially extended during the work with the book projects in connection with Norges Bank's bicentennial in 2016. A third volume (HMS III) which documents this work will be Norges Bank's contribution to a HMFS-BIS network between interested central banks which starts this year under the coordination of BIS. References to the books belonging to Norges Bank's bicentenary project are Lie, Kobberrød, Thomassen and Rongved (2016), Bøhn, Eitrheim and Qvigstad (2016), Bordo, Eitrheim, Flandreau and Qvigstad (2016) and Eitrheim, Klovland and Øksendal (2016) respectively.

Stiglitz (1990) offered the following definition of market imbalances which he subsumed into the concept of a "bubble".

> ... if the reason that the price is high today is only because investors believe that the selling price will be high tomorrow - when fundamental factors do not seem to justify such a price then a bubble exists.

2 How to detect a bubble?

2.1 The method

Anundsen (2016) employ four econometric methods to assess imbalances in Norwegian, Finnish and US house prices in the 2000s.

- Large systematic deviations between housing prices and the price implied by fundamental factors such as income, housing stock and interest rates.

- Systematic and significant forecast errors from a dynamic and theory consistent econometric model

- Lack of adjustment towards long run equilibrium house prices implied by fundamentals ("steady state") (cointegration breaks down).

- Sign of explosive behaviour in housing prices

The first two methods lends themselves first and foremost to ex-post evaluations. The two latter method can be used in real time assessments and in the following we denote these as method 1 and 2 respectively. Anundsen and Jansen (2013, JHE) have studied, using Norwegian data (1986q2-2008q4), the self-reinforcing effects between housing prices and credit.[2] Anundsen and Heebøll (2016, JHE) report how interactions between housing

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[1]Data for the 19th century and early 20th century were collected from the National Archives of Norway. From 1935 onwards these public registers have been digitalised and made available through the internet by Ambita AS (previously Norsk Eiendomsinformasjon AS), which is owned by the Norwegian Ministry of Trade and Industry. For the more recent period we have used house price indices constructed by the Norwegian Association of Real Estate Agents (NEF).

[2]More than two decades ago, in the aftermath of the Norwegian banking crisis 1988-1993, researchers in Norges Bank made an early attempt to model self-reinforcing effects between housing prices and credit on Norwegian data. A new submodel involving the interaction between housing prices and credit was included in Norges Banks macroeconometric model RIMINI already from 1994 onwards, see e.g. Eitrheim (1993, PEK) and Eitrheim and Gulbrandsen (2001, BIS Paper) for details. These interactions also played a significant role in later empirical studies of monetary policy rules, based on more aggregated empirical models of the Norwegian economy, cf. Akram et al. (2006) and Akram and Eitrheim (2008).

supply restrictions, mortgage credit constraints and a price-to-price feedback loop affects house price volatility using a panel with regional data (2000-2006) for USA.

Method 1 is based on a simple error correction model for real house prices rph_t (variables in small caps are in logarithms)

$$\Delta rph_t = \mu + \alpha(rph - rph*)_{t-1} + dynamics + \epsilon_t$$

$rph_t = ph_t - p_t$ where ph_t denote house prices and p_t consumer prices. The long run equilibrium house price implied by fundamentals is given by

$$rph^* = f(\text{real income, real housing stock, real (after tax) interest rate})$$

Data for real income and real housing stock are measured per capita.

1. If $\alpha < 0$, house prices reacts negatively to positive deviations from the fundamental equilibrium rph^* and house prices are dynamically correcting themselves towards this equilibrium.

2. If $\alpha = 0$, this is consistent with, but does not in itself imply imbalances since alternative stabilisators may exist.

3. If $\alpha < 0$ for $t \in [1, \ldots, s]$, but shifts to $\alpha = 0$ for $t > s$ this implies a shift to a regime without direct self correcting housing prices. A sequence of recursive p-tests of $H_0 : \alpha = 0$ may provide evidence that such a shift has occurred.

Method 1 is based on a bubble indicator which depends on the extent to which housing prices and fundamentals are cointegrated at different points in time, and we may interpret this as a method to operationalise the Stiglitz (1990) definition of a bubble. This approach was followed by Anundsen (2015, JAE) in a study of the recent boom-bust episode using US data before and after the subprime crisis, i.e. from 1977q2 to 2010q4. These results suggest that cointegration broke down in 2001 when the subprime credit explosion started and eventually became a major driver of US housing price dynamics.

Method 2 is based on an econometric procedure for detecting explosive behaviour in real housing prices, which applies the framework developed in Phillips et al. (2011, 2015a,b) where they proposed a recursive variant of the univariate ADF-test based on the coefficient ρ in a standard ADF-equation given by:

$$\Delta x_t = \mu + \rho x_{t-1} + \sum_{j=1}^{p} \phi_j \Delta x_{t-j} + \varepsilon_t$$

Under $H_0 : \rho = 0$, x_t contains one unit root. Critical values for this recursive test are non-standard under $H_0 : \rho = 0$, which is tested against the alternative $H_1 : \rho > 0$ (explosivity), and needs to be simulated using Monte Carlo methods (5000 replications are used in this exercise). We can illustrate these methods drawing on a recent application by Anundsen (2016) on data for Finland, Norway and the US.

2.2 Illustration of the method

In Section 2.1 above we outlined two of four alternative ways of detecting overheating in the housing market, as suggested by Anundsen (2016). Resulting bubble-indicators for

the US and Norway when the first method of detecting equilibrium correction breakdown is applied to quarterly aggregate data for Norway and the US area displayed in Figure 1. The figure clearly demonstrates bubble behavior in the US housing market in the early to mid-2000s, which corroborates the findings of Anundsen (2015), who constructed a similar indicator. Compared to Anundsen (2015), we have extended the sample for the calculation of the indicator to also include the years from 2010 through 2014, and we see that it suggests that current house prices in the US are not characterized by bubble behavior. Turning to Norway, there is no evidence of bubble behavior based on this approach.
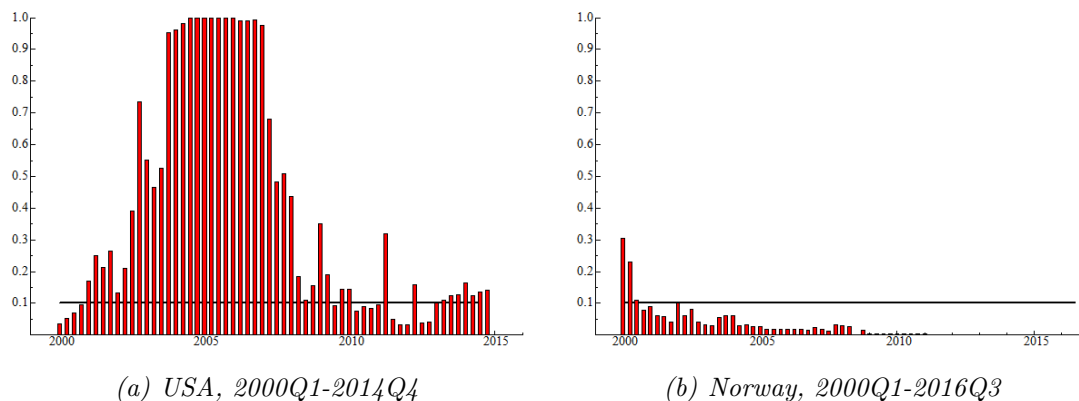

(a) USA, 2000Q1-2014Q4   (b) Norway, 2000Q1-2016Q3

Figure 1: Bubble indicator 1: P-values for the test for cointegration breakdown reported in Anundsen (2016). Black line denotes 10% level of significance, red bars bubble indicator 1 (p-values)

The second measure of housing market imbalances is constructed similar to Pavlidis et al. (2015) and is aimed at testing for explosiveness in the price-to-income ratio. However, as opposed to them, we consider the log of the ratio, which moves the residuals in the ADF regressions closer to satisfying normality. We consider an ADF regression with four lags and a deterministic trend. The sequence of finite sample critical values have been simulated using $M = 5000$ Monte Carlo replications.

In Figure 2, the recursive test-statistic is plotted along with the 5 percent critical values. It is evident that these results corroborate the results from the other approach, i.e. while there is no evidence of explosive behavior in Norwegian house prices over the period considered, whereas there is clear evidence that the US housing market transitioned into a bubble regime in the early 2000s. Moreover, in line with the other measure, the bubble is dated to have started in the first quarter of 2001 and ended in the middle of 2006.

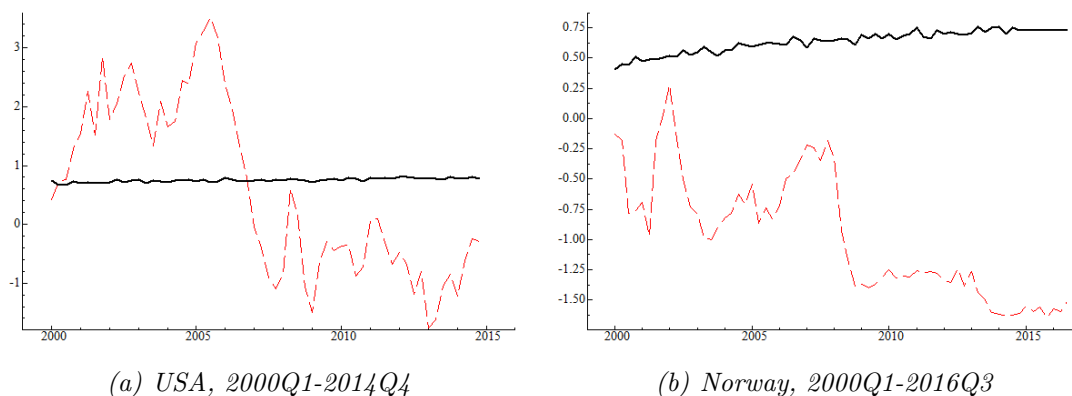*(a) USA, 2000Q1-2014Q4*   *(b) Norway, 2000Q1-2016Q3*

Figure 2: Bubble indicator 2: Test for explosivity in house price-to-income reported in Anundsen (2016). Black line denotes critical values, red line bubble indicator 2

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3   Our contribution

3.1   Historical evidence on bubbles in real house prices 1880 onwards

Historical data for Norwegian real house prices are shown in Figure 3. Average real house prices for the country as a whole are plotted together with real house prices for the capital Oslo (named Kristiania before 1925). The population in the capital increased by fifty per cent to a quarter of a million in the 1890s. This led to increased demand for housing and a strong boom in construction and widespread land speculation followed. The Kristiania crisis was homespun and the boom was fuelled by an easy money market. In the late 1890s, six new banks were established in a city which was already served by eight incumbent banks. All these banks were heavily exposed to real estate markets and came in severe distress in the aftermath of the real estate burst of 1899.
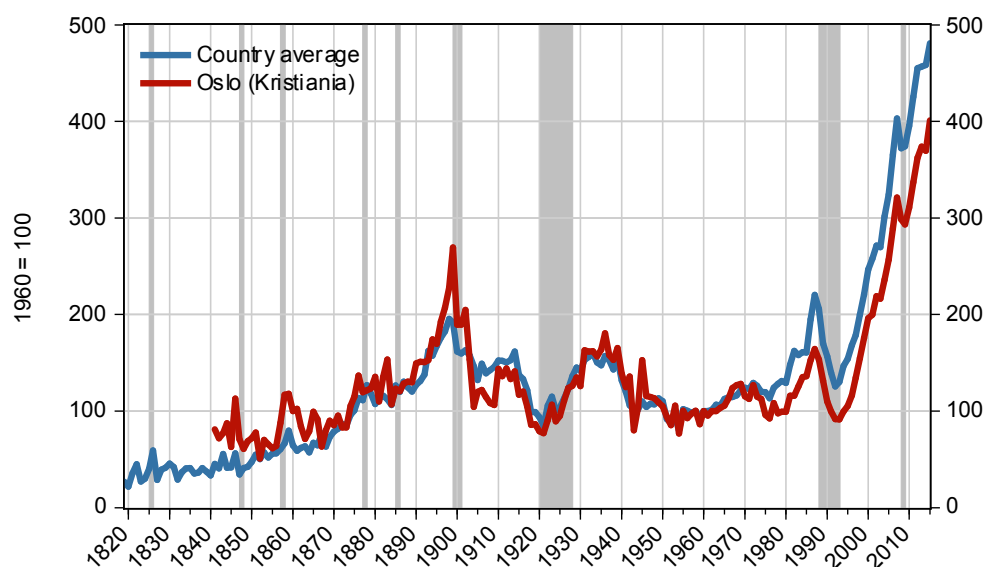

Figure 3: Real house prices for Norway 1819-2015. For details regarding the construction of historical house price indices using the weighted repeat sales method, see Eitrheim and Erlandsen (2004, 2005), and for details regarding the construction of the consumer price index, see Grytten (2004) and Klovland (2013)

The management of the 1899 financial crisis was the first full scale testing of Norges Bank's commitment to the stability of the Norwegian payment system, see Chapter 6 in Eitrheim, Klovland and Øksendal (2016) for a detailed discussion. Norges Bank took the role as lender of last resort to the troubled banks. Although the capital Kristiania shows the clearest sign of a boom-to-bust development during the 1890s, there were also significant increases in housing prices in Bergen and Trondheim in this period. This explains that also the aggregate house price index for the country as a whole showed significant increases during the years up to 1899. These developments are also mentioned

in earlier studies, such as e.g. in Rygg (1954), which also describes in some detail the situation in Kristiania in the five-year period following the 1899 crash. This was a period with population decline, strong decline in building and construction industries, and in 1904 there were more than 8,500 vacant flats in Kristiania (Rygg, 1954, p. 246). We see from Figure 3 that the real house price index for the country as a whole fluctuated around a considerably lower level than 1899 for the next 85 years. It was not until the more recent boom-to-bust episode of the 1980s following the deregulation of Norwegian housing and credit markets, that the 1899 real house price level was surpassed. We recall that this boom-to-bust episode was followed by the 1988-1993 banking crisis. For the capital Oslo we see that the real house price had not resumed its pre-Kristiania crash level until a full century had passed in the early 2000s.

In Figure 2, the recursive test-statistics for explosive behaviour is plotted along with their 5 percent critical values. Interestingly, we find evidence of explosive behavior in the Norwegian real house price index, which is denoted "Country average" in Figure 3, both around the time when real house prices peaked in 1899 (the Kristiania crash) and around the time when real house prices peaked in the late 1980s.
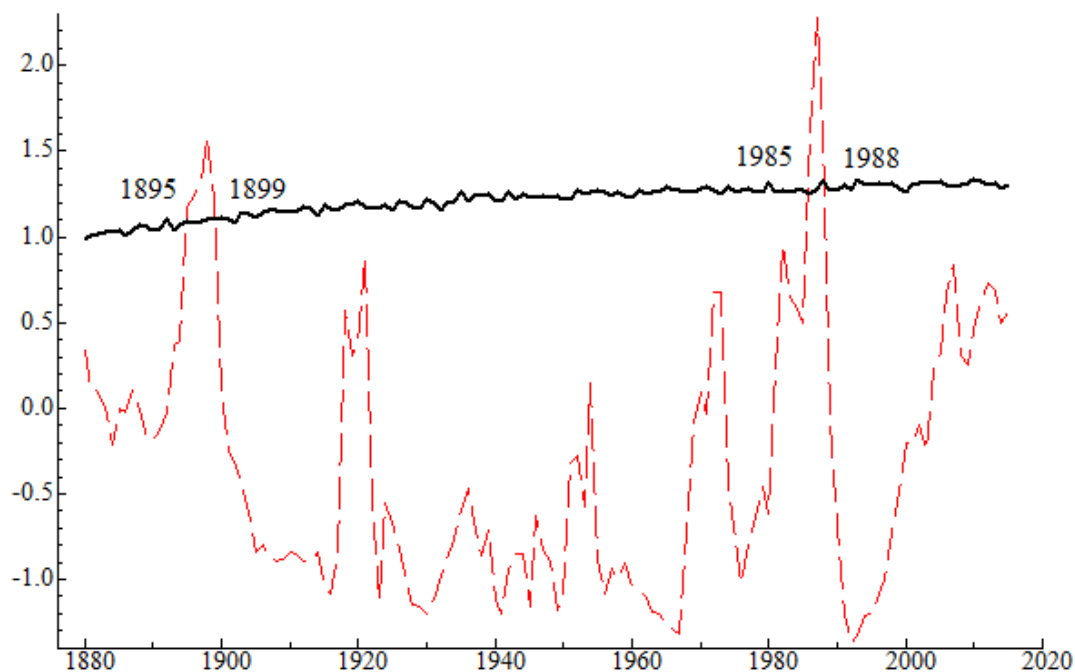

Figure 4: Bubble indicator 2: Test for explosivity in Norwegian real house prices since 1880. Black line denotes critical values, red line bubble indicator 2

4 Evidence of regional variation in house prices

The historical house prices show significant regional variation when we study the development between the four Norwegian cities Bergen, Oslo, Kristiansand and Trondheim, for which we can estimate prices per square meter back to the 19th century, see Figure 5(a). These estimates show a significant degree of convergence over time, at least until the 1980s. From the mid 1990s and until 2013, there was a gradual divergence between house price developments in Norwegian cities, as illustrated in Figure 5(b). It is evident that both Oslo and the oil rich city of Stavanger were growing at a much higher rate than the country as a whole, while another big Norwegian city, Kristiansand, saw a more moderate development in house prices. In Stavanger, prices started to drop following the recent plunge in oil prices in mid 2014, while prices in Oslo have been growing at an even higher rate in the post-2013 period. The price divergence between local markets has therefore continued, but now seems to be more Oslo-specific than in the pre-2013 period, with current square meter prices in Oslo being about twice as high as in Kristiansand. The large regional variations have attracted much attention among both policymakers and the popular press, who are trying to understand what factors may explain this – given that monetary policy and macro prudential policy is conducted at the national level.

Large regional differences are, however, not specific to the Norwegian market. For instance, while house prices increased by more than 160 percent in some coastal areas of Florida and California from 2000 to 2006, they increased by less than 20 percent in inland open space areas of the Midwest. Also during the 2006-2010 bust period, there were large regional differences, with some areas experiencing a cumulative drop in house prices of nearly 60 percent, while other areas did not experience a cumulative decline in house prices over this period.

The major heterogeneities in US housing markets have sparked a large literature, which may also be relevant in the Norwegian context. The literature has partly attributed the local differences to regional variations in supply side restrictions (see e.g. Malpezzi (1996), Green et al. (2005), Gyourko et al. (2008), Saiz (2010) and Glaeser (2009)). In several areas located in Florida and California, housing construction is geographically restricted by the coast line or mountains etc., while inland areas face less such restrictions. Further, some local governments try to influence building activity through their regulatory framework. Both topographic and regulatory restrictions on housing supply are likely to affect the elasticity of supply. In this context, both Glaeser et al. (2008), Huang and Tang (2012) and Anundsen and Heebøll (2016) have shown that more supply-inelastic areas witnessed greater house price booms, and the latter two also document that supply inelastic areas faced a larger bust, implying that the boom-bust dynamics have a higher amplitude in areas with a low supply elasticity. Anundsen and Heebøll (2016) argue that supply inelastic areas are more prone to self-reinforcing feedback loops, since the initial increase in house prices following a given demand shock is much larger in these areas. The authors show that this implies more volatile price dynamics over the boom-bust cycle in supply inelastic areas. At the same time, they show that this may imply less differences in construction activity, which is consistent with the developments in local US housing markets during the recent boom episode.

The mechanisms that have been found important in explaining regional differences in the US housing market may be at play also in the Norwegian housing market, where Oslo stands out as a city dominated by many supply side restrictions, while Kristiansand being a more elastic market. That said, such mechanisms may be less relevant to explain the
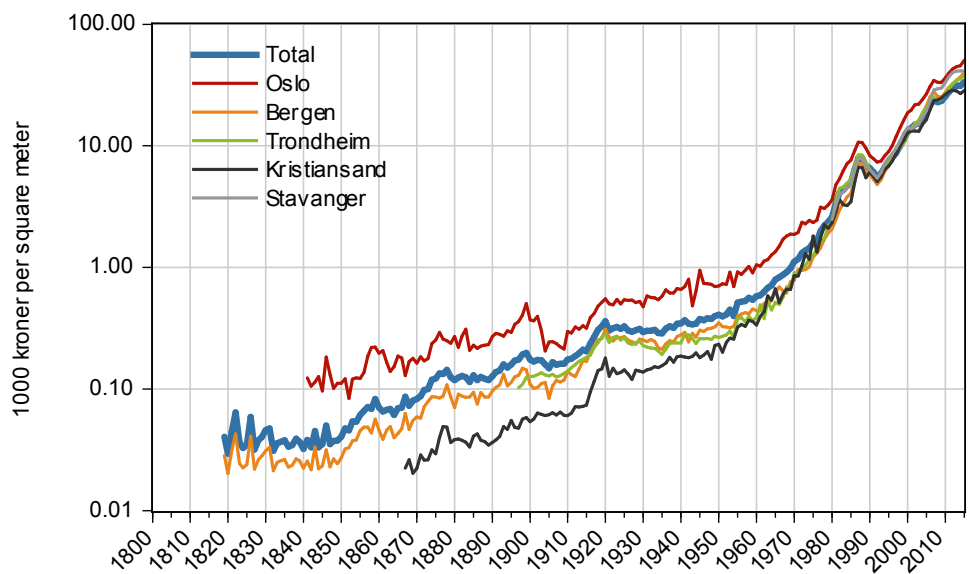
(a) Historical house prices 1819-2015
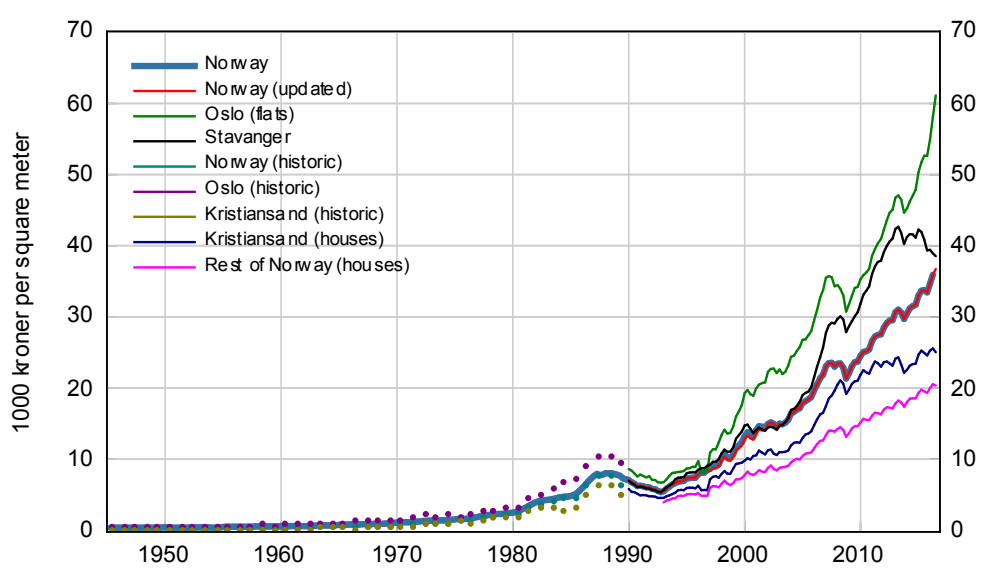
(b) Quarterly house prices 1946:1-2016:3

Figure 5: Top: Annual data for nominal house prices in Norway 1819-2015. Bottom: Quarterly data for nominal house prices 1946:1-2016:3. Source: Eitrheim and Erlandsen (2004, 2005), Norges Bank HMS, Norges Eiendomsmeglerforbund.

recent price divergence, since this seems to be more concentrated in Oslo and surrounding areas. In that context, it is interesting to note that an increasing fraction of housing transactions in the capital are made by existing home owners. This may shift the dynamics of the housing market from the purchase of a consumption good to an investment good. With interest rates close to 0, investors must expect a relatively large drop in prices for the net present value calculations not to show this as a profitable investment.

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1   Appendix: Data on regional characteristics

The major heterogeneities in US housing markets have sparked a large literature, which may also be relevant in the Norwegian context. The literature has partly attributed the local differences to regional variations in supply side restrictions (see e.g. Malpezzi (1996), Green et al. (2005), Gyourko et al. (2008), Saiz (2010) and Glaeser (2009)). In several areas located in Florida and California, housing construction is geographically restricted by the coast line or mountains etc., while inland areas face less such restrictions. Further, some local governments try to influence building activity through their regulatory framework. Both topographic and regulatory restrictions on housing supply are likely to affect the elasticity of supply.

Figure 6 shows areas of Norway's capital Kristiania (the name changed to Oslo from 1925 onwards) between 1880 and 1900. The peak in construction activity and in house prices around 1899 are shown in Figure 7.
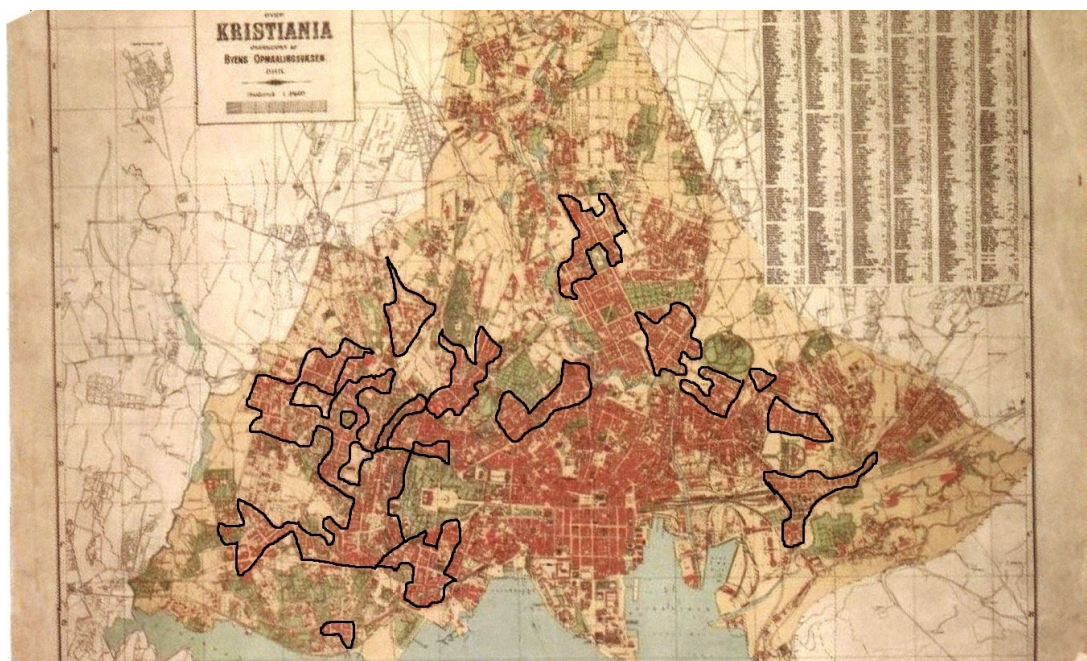

Figure 6: Areas in Kristiania predominantly developed between 1880 and 1900 are marked with pencil.
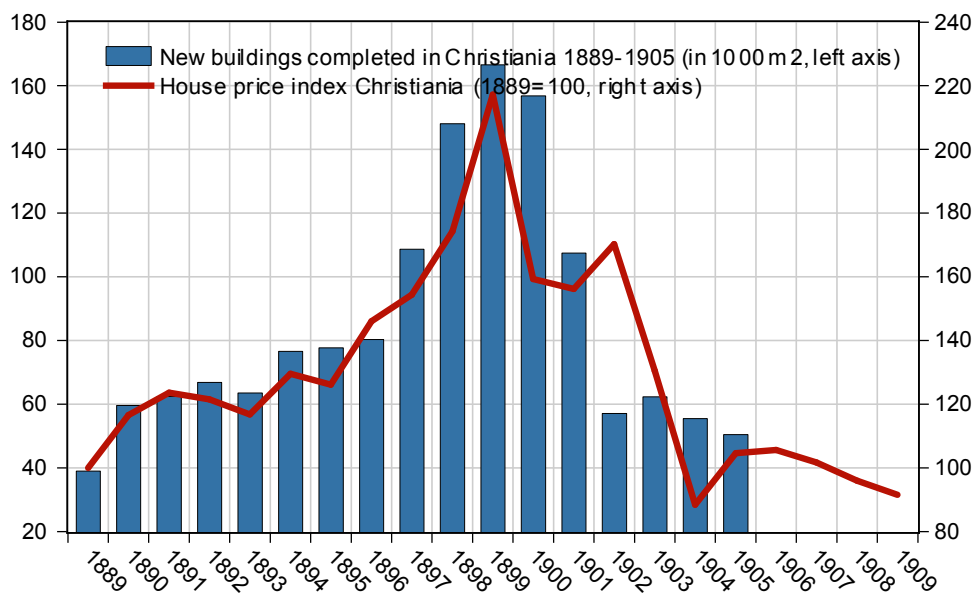
Figure 7: Kristiania: House price index 1889-1909, completed new buildings 1889-1905. Source: Norges Bank HMS, Eitrheim and Erlandsen (2004) and Statistics Norway.