Buy-to-let housing investors in the Nordic countries

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Abstract

The last few decades have seen high population and housing price growth in the Nordic capital cities. The high prices have led to concerns about affordability of housing and unsustainable mortgage levels. Policy makers and media have argued that buy-to-let investors contribute to increasing prices. Simulations in a model with a buy-to-let sector suggest that this has been the case in some Nordic capital cities. However, high population growth creates price pressures independently of the presence of buy-to-let investors. Even the cities with rent regulations experience clear growth in both housing prices and rents.

Keywords: Housing prices, rents, rent regulations, housing search.

JEL codes: D83, R21, R31, R38.

1 Introduction

In the last few decades, housing demand in the Nordic capital cities has been high, and housing prices have seen large increases. This is likely connected with high population growth (Gyourko et al. 2013), due to inflow from less central regions, an international trend for urban living and EU enlargement. There are some differences between the cities. Reykjavík was harder hit by the 2008 recession, and its housing market is more impacted by tourism, while Helsinki has seen slower population growth than the other cities. But all Nordic capitals have had large population inflows and subsequent increases in housing prices.[27]

The high housing prices have led to worries that housing is becoming increasingly unaffordable for low and middle-income inhabitants, and that the high level of mortgage debt needed to finance housing purchases leads to risks in the financial system. Buy-to-let housing investors have been a special concern in policy circles in many countries, due to worries that they amplify price increases, and are vulnerable to negative interest rate and price shocks (Bank of England 2015, Reserve Bank of New Zealand 2016, Reserve Bank of Australia 2017, De Nederlandsche Bank 2018, Norges Bank 2020). Housing investors are also often pinpointed as price drivers by the media. Buy-to-let investors are defined here as investors who buy housing units for letting them out.[28]

In the housing literature, different mechanisms are proposed to explain the high volatility of housing prices. It is a common observation that housing prices are more volatile than can be explained by fundamentals such as income growth. In a previous paper (Bø 2020), I argue that observed shocks to population inflow can create substantial volatility in a search model with buy-to-let investors. The presence of buy-to-let investors and a rental market amplify the frictions in the search model and create larger price responses to increased housing demand. Central to the model are rental prices that react to demand and housing investors competing for the same houses as owner-occupiers. The model, calibrated with data from Oslo, can explain a large share of the increase in housing prices in Oslo in the housing boom period 2007–2014.

This paper expands on Bø (2020) to give an overview of the presence and impact of buy-to-let in the housing markets of the Nordic capital cities: Copenhagen, Helsinki, Oslo, Reykjavík and Stockholm. Here, I explore to which extent changes in housing prices in different cities can be explained by population growth and amplification by buy-to-let investors. There are significant differences in the structure of housing and rental markets between the Nordic countries. For example, condominiums are common in Norwegian cities and almost non-existing in Finland and Sweden. Finland, Iceland and Norway have mostly unregulated rent setting, Sweden has a system of collective rent bargaining, and Denmark has a large non-profit rental sector. These differences are likely to matter for prices, rents and ownership structure. I apply the buy-to-let model of Bø (2020) to data from Helsinki, in addition to Oslo, and a version of the model without a buy-to-let sector to data from Stockholm. The buy-to-let model is well suited to Helsinki and Oslo, which have few

27. See Torstensen and Roszbach (2019) for a coverage of Oslo and Stockholm.
28. The definition used in this paper is not dependent on financing the property with a specific buy-to-let mortgage. A discussion of the differences between small-scale private investors and larger commercial firms follows in Section 3.

rental regulations. The model without a buy-to-let sector can match some, but not all, of the high Swedish price growth. However, it is unable to explain observed rent increases. Comparing simulations from the models with and without a buy-to-let sector indicates that the combination of freely set rents and buy-to-let investors increases price growth by around 60 percent compared to a market with constant rents and without a buy-to-let sector during periods of relatively high population inflow.

Section 2 discusses data sources, and presents descriptive evidence on the population growth of the Nordic capital cities and on housing price and rent developments over the period 2000–2019. I present some institutional details, such as rent regulations, and the size and development of the commercial rental sectors in Section 3. In Section 4, I discuss previous research on buy-to-let. Section 5 presents the model from Bø (2020), and applies it to compare the impact of buy-to-let in two different systems, (Helsinki and Oslo versus Stockholm). Concluding remarks are presented in Section 6.

2 Descriptive statistics

2.1 Data

Unless otherwise noted, the data in this paper are collected from databases of the national statistical offices of the respective countries i.e., Statistics Denmark, Statistics Finland, Statistics Iceland, Statistics Norway and Statistics Sweden.[29]

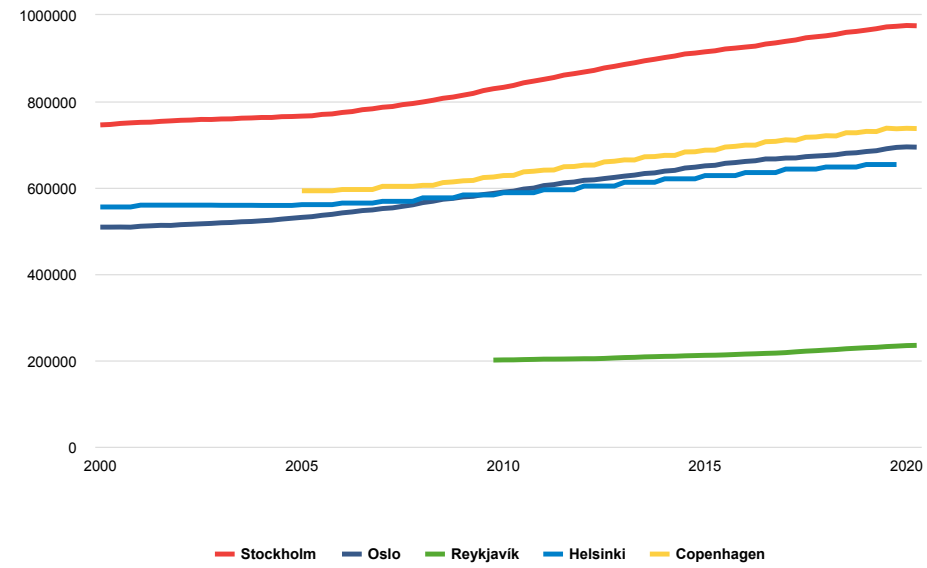
Although I mostly use the administrative (municipal) borders of the respective cities, some statistics are only available for other geographical areas. Where I have not been able to find the required data from the statistical offices (such as a price index for Swedish apartments), I have tried to find other sources, such as municipal governments or private companies.

2.2 Population, housing prices and rents

Here, I show the development of population, housing prices and rents from 2000 (or when available) to 2019.

29. Statistics Denmark StatBank: https://www.statbank.dk/statbank5a; Statistics Finland StatFin: http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin; Statistics Iceland Statistical database: http://px.hagstofa.is/pxen/pxweb/en; Statistics Norway StatBank: https://www.ssb.no/en/statbank; Statistics Sweden Statistical database: http://www.statistikdatabasen.scb.se/pxweb/en/ssd.

Figure 1 Population growth in Nordic capitals



Note: Quarterly population (yearly for Copenhagen before 2008 and for Helsinki) of Nordic capital cities. Population is measured at the municipality level, except for Copenhagen, which consists of the municipalities of Copenhagen and Fredriksberg, and Reykjavík, consisting of the capital region.

Source: Statistics Denmark, Statistics Finland, Statistics Iceland, Statistics Norway and Statistics Sweden.

Figure 2a Average yearly population growth in Nordic capitals, from 2000 (or start date)

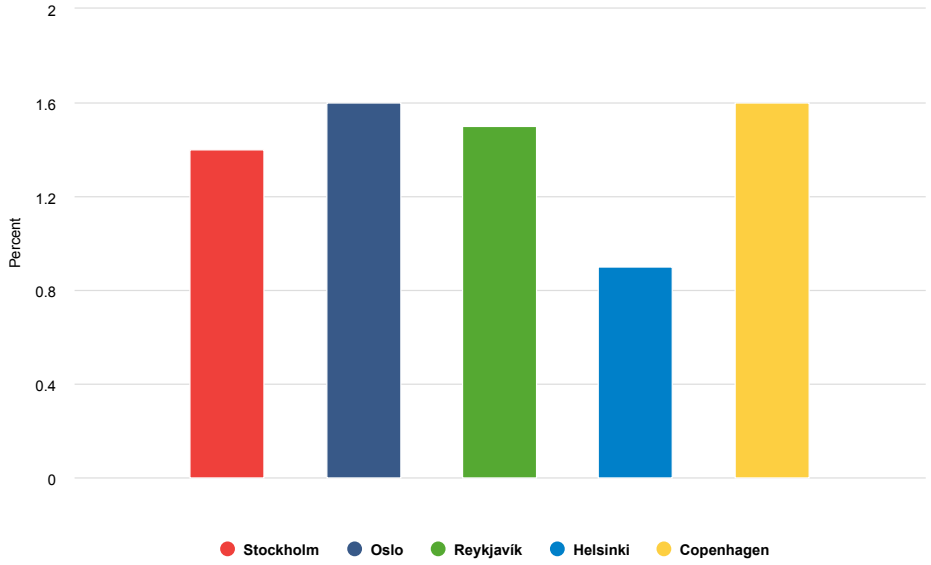
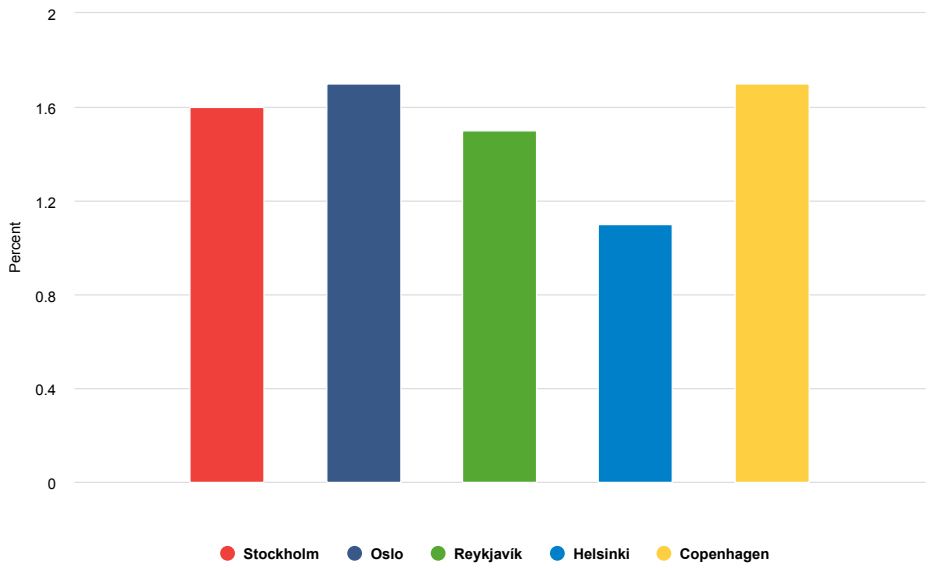


Figure 2b Average yearly population growth in Nordic capitals, from 2010

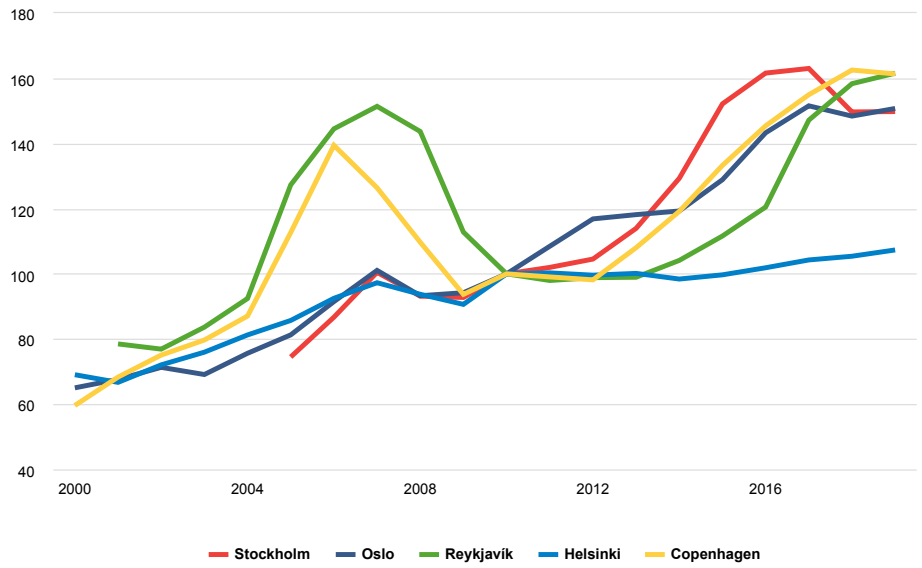


Note: These two graphs show average yearly percentage population growth. Figure 2a uses 2000, or first available year of data as starting point (2005 for Copenhagen, 2010 for Reykjavík), while Figure 2b shows growth from 2010 for all cities. Population is measured at the municipality level, except for Copenhagen, which consists of the municipalities of Copenhagen and Fredriksberg, and Reykjavík, consisting of the capital region.

Source: Statistics Denmark, Statistics Finland, Statistics Iceland, Statistics Norway and Statistics Sweden.

In the years since 2000, the populations of the Nordic capital cities have seen strong growth, see Figure 1. The average yearly percentage growth in population is shown in Figure 2a and 2b. Since 2010 (Figure 2b), all cities have had a yearly population growth of more than one percent, with Oslo and Copenhagen as the fastest growing cities. Helsinki has grown markedly slower and is the only city with an average growth less than one percent (Figure 2a).

Figure 3 Real housing price indices for Nordic capitals



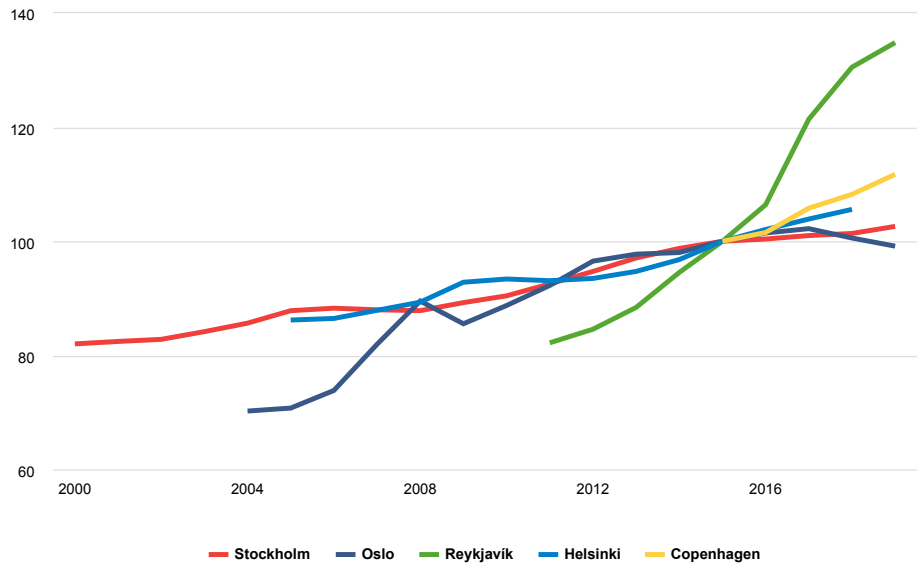
Note: The indices are adjusted for inflation using HICP, 2010=100. Due to methodological differences between indices, comparisons between cities may not be straightforward.

Source: Own calculations. See Appendix for discussion on data sources and aggregation of sub-indices.

Housing price indices for the different cities are shown in Figure 3. The figure shows inflation adjusted price indices for all housing, but for some of the cities I have had to aggregate several indices, as no aggregate price index is available. Details on how I construct these indices are found in the Appendix.

Housing prices grew fast before the financial crises in all cities. Copenhagen and Reykjavík had particularly high growth, but were also more affected by the crisis. From around 2010, prices have again been growing quite fast, except towards the end of the period. The exception is Helsinki, where there has been almost no real price growth since 2010.

Figure 4 Real rent indices for Nordic capitals



Note: The indices are adjusted for inflation using HICP, 2015=100. Due to methodological differences between indices, comparisons between cities may not be straightforward.

Source: Own calculations. See Appendix for discussion on data sources and aggregation of sub-indices.

Rent statistics are usually less methodologically advanced than housing price statistics. The indices used in this paper are mostly based on average yearly rent per square meter, which does not control for composition changes (smaller flats generally have a higher rent per square meter). With that caveat, inflation adjusted rental indices for the capital cities are presented in Figure 4 (details on the different rental indices can be found in the Appendix).

As can be seen from Figure 3 and 4, rents are clearly less volatile than prices.[30] They mostly grow slowly and steadily, though there are some episodes of very fast growth, as in Oslo 2006–2009 and Reykjavík 2014–2019. Stockholm and Copenhagen have different forms of rent control. Rents are set freely (for the most part) in Helsinki, Oslo and Reykjavík. No clear differences in rent developments are visible between capitals with and without rent control, but the number of observations is low.[31]

30. The comparison may overestimate differences in volatility as most rent indices measure the average rent over all rental contracts, not rents of new contracts. To the extent that rents are sticky over time, average rents are less volatile than new rents.
31. These indices only show growth. The rent level may well be more affected by rent control than the growth rate.

3 Institutional framework

In this section, I give a quick overview of housing regulations affecting housing ownership, transactions and rents in the Nordic countries, as well as available data on the distribution of ownership and rental housing in the respective capitals. There are differences in types of housing ownership, transaction rules, and rent regulations.[32] The most important features are summarized in Table 1. For an overview of housing policies in the OECD, including all Nordic countries, see Andrews et al. (2011).

Throughout the paper, I separate the rental market into commercial and non-commercial, where commercial is for-profit rental housing (owned either by private persons or corporations) and non-commercial is municipal, subsidized or non-profit rental housing. The term buy-to-let investor is often (including in Bø 2020) reserved for individual investors, but here I use the term buy-to-let investors to include individuals as well as corporations unless otherwise noted.[33]

3.1 Denmark

Denmark has two sorts of housing ownership, regular ownership and ownership through cooperatives.[34] Cooperative apartments are price controlled, with a maximum price usually set by estimating what the value would be as a rental apartment (Rasmussen & Sandager 2019). There can also be restrictions on subletting apartments in cooperatives. The rent is regulated when subletting is allowed. About 23 percent of housing units in Copenhagen[35] are owner-occupied and 33 percent are owned by cooperatives.

Non-profit rentals (*almene boliger*) are common in Denmark. Slightly more than 20 percent of the total number of housing units in Copenhagen are non-profit rentals. The construction of such units is subsidized, and rents are not market based. Another 20–22 percent of housing units are private rentals. Rents in private rental units in Copenhagen are restricted by law to be comparable to similar rental units, with some exceptions, i.e. recently built units (København kommune 2020). There is also a possibility to increase rents after renovations, a possibility that is said to be used (or misused) by investors (Transport- og Boligministeriet 2019).

The rental market in Copenhagen has increasingly been dominated by large corporations buying portfolios of rental buildings (Cushman & Wakefield RED 2019). Such corporations have been accused of strategical renovation to be able to increase rents. Their alleged proclivity for this practice has recently led to changes in Danish rent regulations (DR 2020). The share of housing units owned by corporations increased from 9.4 to 13.2 percent of the housing stock (30 000 to 46 000 housing units) between 2010 and 2019, while there was a small decline in the share owned by other investors, from 10.5 to 9.3 percent. In total, the share of the housing stock in

32. In this limited overview, I do not discuss tax systems, supply regulations or several other factors that might affect housing markets in the capitals.
33. This is discussed in more detail in Section 4.
34. Formally, ownership of a cooperative apartment gives the owner the right to occupy a given apartment owned by the cooperative.
35. The numbers on tenure status in this section are for the Copenhagen city province (the municipalities of Copenhagen, Fredriksberg, Dragør and Tårnby).

Copenhagen owned by for-profit landlords has increased from 19.9 to 22.5 percent.

3.2 Finland

Prices of houses and apartments are set freely. Finnish apartments are mostly organized as cooperatives. Rents are also freely set, with no regulations on price, price growth or term.

In Helsinki, the share of rental housing is 49 percent. Of these, 40 percent are subsidized, mainly municipally owned, while the remaining are commercial. The ownership structure of commercial rental units in Helsinki is unknown. Nationwide, about 55 percent are owned by small-scale private investors and the rest by corporate investors (KTI Finland 2019).

In the period from 2006 to 2017, the number of buy-to-let housing units in Helsinki increased from around 20 000 to 33 000 (Kannisto 2019).[36] This represents an increase from 6.9 to 10.1 percent of the housing stock. The corporate rental sector increased from 18.6 to 19.6 percent of the housing stock (54 000 to 64 000 housing units) in the same period. Total commercial rental housing thus increased from 25.5 to 29.7 percent of the housing stock in Helsinki.

3.3 Iceland

Iceland has a high home ownership share. Even in Reykjavík, 73 percent of households live in owner-occupied housing (down from over 80 percent before the financial crisis). Around 15 percent of households live in rental apartments owned by corporations and individual investors (up from 10 percent before the financial crisis).[37] The remaining share of households live in subsidized rental housing. There are no price restrictions on housing prices. Limits on short-term rentals (like Airbnb) have recently been introduced, but there are few other rental regulations.

From around 2010 on, there has been a boom in tourism to Iceland and Reykjavík. This has led to an increasing number of Airbnb rentals. At the end of 2017, roughly 1 200 housing units in Reykjavík (1.4 percent of the housing stock) were estimated to be full time Airbnb rentals (Elíasson & Ragnarsson 2018). The same authors estimate that around 15 percent of housing price growth over the period 2014–2017 can be connected to the growing Airbnb market. The study by Elíasson and Ragnarsson (2018) does not give any estimates on the Airbnb effect on rents. For Barcelona, Garcia-López et al. (2020) finds the effect on rents to be roughly half the effect on housing prices.

36. Where buy-to-let is defined as housing units that are not owner-occupied, but owned by private persons who also report rental income.
37. The share of commercial rental housing owned by small investors is unknown.

3.4 Norway

Housing units are sold freely on the market. Apartments are either condominiums or owned through cooperatives, which may have rules regulating subletting.

In Oslo, around 30 percent of households are renters. The non-commercial rental sector are small. Around 13 000 housing units (less than four percent of the housing stock) owned by the city, and there is some student housing. The remaining rental market is commercial. Rents are set freely. There are restrictions on rent increases within a rental term, but rental periods are generally short (the normal period is three years), and there are no restrictions on rents in new contracts.

Most rental housing is owned by private landlords. Nationally, only around 10–15 percent of rental housing is owned by corporations or organizations (Sandlie & Sørvoll 2017). During the period 2013–2019, the share of secondary housing in Oslo has been quite stable at around 17 percent of the housing stock, or 55 000–59 000 units (NEF 2020). Around 20 percent of housing buyers in Oslo over the period 2007–2014 were buy-to-let investors.

3.5 Sweden

Price setting is free for houses and apartments. Most Swedish apartments belong to housing cooperatives, which usually do not allow subletting except for specific reasons and for a limited period.[38] Swedish rents, both in private and municipally owned housing units, are regulated. Rents are determined by collective bargaining between the tenants' association and landlords and apply to all tenants (Hyresgästforeningen 2020). Rents are in principle based on the so-called use value of an apartment, which in practice also means that comparable apartments should have equal rent. The same rules apply to sublets. Thus, there is limited room for rents to respond to demand.

In Stockholm, around 60 percent of households own their housing (directly or through a cooperative), while the remaining 40 percent rent, almost all from either private or municipal housing corporations (with roughly equal shares). The limitations on subletting and rent setting mean that the market for private buy-to-let investors is very small.[39] The share of housing units owned by corporations in Stockholm was stable at around 20 percent over the period 2013–2019 (increasing in number from 83 000 to 92 000), but total commercially owned rental properties decreased from 24.7 to 23.5 percent of the housing stock due to fewer private investors.

38. Condominiums were allowed in 2009 but very few have been built.
39. Nationwide, 2 percent of households were subletting in 2013. Statistics for Stockholm are not available, but the share is likely significantly higher. Long-term buy-to-let is likely confined to single-household houses. A small fraction of cooperative and rental housing is sublet for specific reasons and a limited period, such as trial cohabitation and work elsewhere. A 2014 rule change loosened the restrictions on subletting somewhat, going from requiring notable reasons to allow subletting to requiring reasons to allow subletting. Still, buy-to-let investors cannot assume that they will be legally allowed to sublet a cooperative apartment long-term. Illegal subletting does occur at some scale (SOU 2017).

Table 1 Summary of institutional differences

	Copenhagen	Helsinki	Reykjavík	Oslo	Stockholm
Rent control	Partial	No	No	No	Yes
Ownership type suitable for BTL	Partially	Mostly	Yes	Mostly	No
Small private investors as landlords	< 0.5	< 0.5	Common	> 0.5	Rare
Owner-occupier share**	0.56	0.51	0.73	0.69	0.61
Private rental share*	0.23	0.3	0.13	0.27	0.23

Note: This table summarizes the most central information in Section 3.1–3.5. Data for the municipalities of Helsinki, Oslo and Stockholm, while Copenhagen covers the Copenhagen city province and Reykjavík the capital region. ** In the last year available in data, including cooperatives. * In the last year available in data.

4 Related literature

Buy-to-let investors are motivated by the return they can get on the rental market. They are thus a different sort of investors than so-called flippers (Bayer et al. 2020), who intend to quickly re-sell at higher prices. Only a few papers have previously analysed the role of buy-to-let investors, empirically or theoretically.

Scanlon et al. (2016) and Bracke (2019) describe the buy-to-let market in the UK, and England and Wales respectively. In the UK, buy-to-let investors are mostly individuals intending to hold the investment long-term for the purpose of having extra retirement income (Scanlon et al. 2016).[40] The importance of a well-functioning private rental sector is emphasized by Scanlon et al. (2016). Neither study offers any explicit modelling of the interaction between buy-to-let and housing prices.

Bracke (2019) reports that the share of the housing stock owned by buy-to-let landlords increased from 9 to 19 percent in the period 2000–2013.[41] The study finds that buy-to-let housing units are relatively small, are mostly found in large, well-performing housing markets, and buy-to-let investors are less likely to sell their property over the next six years than other buyers. In the Nordic countries, the Norwegian buy-to-let sector seems most similar to the English.

Only very few papers model the buy-to-let market. Sommer et al. (2013) explores

40. Scanlon et al. (2016) also describes the development of buy-to-let in the UK and gives a detailed description of the tax system for private renters in the UK, as well as short overviews of some other countries (of which Denmark is the only Nordic country).
41. Sprigings (2008) reports a share of buy-to-let transactions in the UK of around 20 percent in the years before the financial crisis.

the role of credit constraints, down payment requirements, and income growth when housing prices and rents interact. The model can explain high housing prices and a more modest rent increase consistent with data for the US, but only half of the increase in the price-to-rent ratio during the housing boom of 1995-2006. The paper does not quantify the size or development over time of the buy-to-let sector.

Bø (2020) investigates the size of the buy-to-let share of the housing market, and how the share is related to the housing cycle. Based on transactions microdata from Oslo, the share of buy-to-let investors fluctuates between 15 and 25 percent of total transactions in the period 2007–2014, and seems to be pro-cyclical.[42] These empirical observations serve as input for a housing search model (in the mould of Wheaton 1990 and a number of later papers) with buy-to-let investors and a rental market. The calibrated model can explain the high observed price volatility. It can also explain the high share of investment buyers found in the data, and fits qualitatively with a number of unmatched moments, such as the correlation of rents and housing prices, although it severely underestimates transaction volatility. The model matches the price growth, and much of the increased price-to-rent ratio in a housing boom, without any role for factors such as exogenous shocks to credit supply. The boom is driven by an exogenous increase in population inflow, which increases demand for both owned and rented housing, with housing price increases amplified by search frictions as more investors enter the market.

Bø (2020) also shows positive, but small welfare gains from taxing buy-to-let investment, which result from a redistribution of housing units from low utility renters to higher utility owners as the ownership share increases. The welfare analysis may underestimate welfare gains, since the tax reduces housing prices and price volatility. This does not matter in the model, but may be positive for financial stability and for agents if they are risk-averse. However, fewer non-owners will be able to rent, and if vulnerable renters lose their housing, they may be negatively affected.

The focus in Bø (2020) is on individual buy-to-let investors, i.e. individuals buying secondary housing units. This was a choice made partly because individual buy-to-let investors were the prevalent investor class in Oslo during the period of study. As we have seen, this does not hold for all Nordic capitals. Individual investors are mostly competing with non-investor buyers for housing units. Housing corporations, on the other hand, often buy or whole buildings or portfolios of buildings, and thus do not compete as directly with non-investor buyers. In a modelling framework with search frictions (as in next section), the addition of buy-to-let investors competing with owner-occupier buyers increases housing prices.

5 Model and results

In this section, I summarize the buy-to-let model in Bø (2020), before using it on data for Helsinki, Oslo and Stockholm. The basic idea is that owners of a housing unit can become landlords by investing in a second unit. Their incentives to do so are

42. Buy-to-let investors are defined as buyers who buy a second (or subsequent) house, and retain that house, as well as at least one previous house for a period of above 12 months.

determined by the expected rental return. Rents are determined by the demand and supply of rental housing. When there is high population inflow, this increases demand both in rental and buyer markets. The increase in rental demand will also increase the number of investors, which through competition with other buyers increases buyer demand and thereby housing prices even more.

The model is based on standard housing search and matching models (a recent survey of the literature is Han and Strange 2015). In search and matching models (which are common also in modelling labour markets), search frictions hinder the efficient matching of buyers and sellers found in Walrasian markets. Markets thus clear over time as well as through prices. It is reasonable to think that there is so much heterogeneity between housing units (much of it only observable on site) and so many housing units for sale at any point in time that buyers have difficulties finding the housing unit best suited for them.

This friction is modelled as a matching process, where the number of random matches between buyers and sellers in each period is determined jointly by the number of buyers and sellers. Each buyer visits the matched housing unit and finds out how well it matches the buyer's preferences (by drawing a random match quality). Housing heterogeneity is modelled through this match quality, which is specific to each buyer-housing unit match. Agents are in other respects homogeneous and risk-neutral, and housing units are homogeneous. The transaction price is determined by bargaining between buyer and seller.[43] If the buyer's match quality is too low there is no transaction, as the housing unit is worth more to the seller than to the buyer. With high housing demand (many buyers relative to sellers), the value of being a seller is higher, as sellers can expect high demand also in next period; the required match quality that gives a buyer higher valuation than the seller thus increases. A higher required match quality increases housing prices through the bargaining and leads to persistence of market conditions.[44] Because a lower share of matches leads to transactions in high demand markets, excess demand and high prices last over multiple periods.

In the model from Bø (2020), owners can buy a secondary housing unit to let out and rents are determined in the model in a frictionless rental market where non-owners meet landlords.[45] Rental prices then equal the willingness to pay for rental housing by the marginal renter. Non-owners have a heterogeneous willingness to pay for rental housing.[46] If there are more non-owners than rental units, the non-owners with a willingness to pay lower than the rent do not get any housing. They can be thought of as people sharing flats with others or living in their parents' household and do not pay any rent. The relative number of prospective renters to rental units determines rent in the model, and this number changes over time.

In the model, there is a distribution both over the per-period utility to owning (match quality) and renting (heterogeneity in the returns to rent). The utility of owning is higher on average than the utility of renting, which means that non-owners are interested in buying housing.[47]

43. Complete information Nash bargaining.
44. Thus, standard search models, which implicitly or explicitly feature constant rents, have a price-to-rent ratio that increases with housing demand.
45. For simplicity, they can only buy one additional housing unit. Kannisto (2019) finds that Finnish buy-to-let housing is mostly held by small investors, with 200 000 units (nationwide) owned by 172 000 persons.
46. If the willingness to pay were homogeneous, rents would only have two possible values, either the common willingness to pay or 0, depending on whether there were more renters or landlords. The willingness to pay is distributed through draws from a random distribution.
47. This is not an assumption in the model, but a result of the calibration. Outside the model, tax advantages,

Agents in the model do not choose when to sell, but are hit by random mismatch shocks, which make them unhappy with their current housing unit (this also holds for landlords, who are matched with their primary housing). Thus, investors in this model are motivated by rental income. Although their total return also depends on the expected capital gain, they are not able to time selling to when the price is high.

The population inflow to the city fluctuates over time, and inflow shocks drive the dynamics of the model.[48] The outflow is constant and equals average inflow, so the population is stable over time on average. The housing stock is fixed. Value functions, descriptions of the matching and transaction processes, and further details can be found in Bø (2020).

The buy-to-let model has two additional mechanisms that increase price volatility compared to a 'standard´ search model with constant rents and no landlords. First, the endogenous, demand driven correlation of rents and housing prices makes it more attractive for non-owners to buy in 'hot' markets than if rents were constant. If they remain on the rental market, they will face higher rents, and therefore their willingness to pay for housing increases. Second, it is more attractive to invest in buy-to-let in periods with high rents, as the rental return is higher. The additional buy-to-let investors increase the total number of buyers, amplifying the effect of high demand on housing prices. The increased competition for housing due to additional investors drives up the price-to-rent ratio as the required match quality for a transaction increases.

The model is solved for different combinations of parameters, and then simulated over a sequence of inflow shocks, which correspond to the real inflow over the 30 quarters 2007q1–2014q2.[49] A number of pre-determined moments from the simulations, such as the share of investment buyers, are calculated, and compared with the same moments from real data to find the parameter vector which gives the closest fit.

The model lacks a role for interest rates, mortgages and mortgage regulation, and housing supply, all of which have been shown in the literature to be important for housing price development. It is not meant to give a full explanation of all forces driving housing prices, but to illustrate to what extent population inflow is able to affect prices in a model with housing investors and search frictions.

5. 1 Helsinki, Stockholm and Oslo

The model is applied to Helsinki, Oslo and Stockholm. Copenhagen would be hard to fit to the model, with three different rental regimes and two types of price setting for owner-occupied housing. While Reykjavík housing market is regulated similarly to the markets in Helsinki and Oslo, it was hard hit by the financial crisis, which strongly affected the housing market through mortgage defaults. The present buy-to-let

tenure security and negative selection of neighborhoods with rental units may all be reasons for a preference to own.

48. A sequence of high inflow shocks will lead to high housing demand.
49. I use the method of simulated moments (MSM). A number of parameters are calibrated directly against suitable data, and some are given values commonly used in the literature. The remaining parameters are calibrated using MSM against six data moments: mean rent to housing price ratio; coefficient of variation of rents; coefficient of variation of housing prices; mean investor share of buyers; coefficient of variation of the investor share of buyers; mean housing turnover rate.

model is not suited to deal with such shocks. There are obviously many other differences between these cities, such as tax systems, supply regulations, geographical constraints and interest rates, which all may impact prices and rents.

In the simulations, I use the parameters calibrated for Oslo, assuming they hold for the three cities involved.[50] The inflow shocks are however specific to each city. For comparability, I use a similar length of simulation as in Bø (2020): 30 quarters, from 2007q1 to 2014q2.[51] I have gross inflow data (domestic plus foreign in-migration as a share of the total population) for Helsinki and Stockholm in addition to Oslo. For Helsinki, the available data is yearly. I split the yearly inflow into four equal quarters, possibly decreasing measured volatility. The monthly data available for Stockholm is aggregated into quarters and adjusted for seasonal effects. The pre-shock simulation periods use inflow with mean and variance based on the period 2000–2006 for the respective cities. Outflow is assumed constant over the period and equals mean inflow for the period 2000–2006 for each city.

In the model, prices are continuously increasing during periods of high gross inflow, as the only driver of prices is the inflow shock. In the real world, housing prices fluctuate for many other reasons, such as the business cycle, credit supply and seasons. The model is based on quarterly data, but the data on prices and rents is yearly. I approximate housing prices and rents from 2007q1 as the average of data from 2006 and 2007, and for 2014q2 as 2014. This may introduce measurement errors in the rates of increase as shown below.

The model is first applied to Helsinki. In many ways, the Helsinki housing market should be well suited for the model, as there are few rent regulations, and an institutional framework similar to that in Oslo. An important difference is that Helsinki had a lower population inflow than Oslo during the simulation period.

50. This is certainly a strong assumption, as e.g. the rate of mismatch shocks may depend on age structure, and bargaining weights may differ depending on bids being binding or not. However, several of the moments needed for recalibration of the model are lacking in the data available for Helsinki and Stockholm.
51. Bø (2020) does not model housing supply. As housing stock and (average) population in the model are constant, one can implicitly assume that housing supply grows with average population growth. The longer the period of a population boom being simulated, the more problematic is the choice not to model housing supply responses.

Figure 5a Results, housing prices

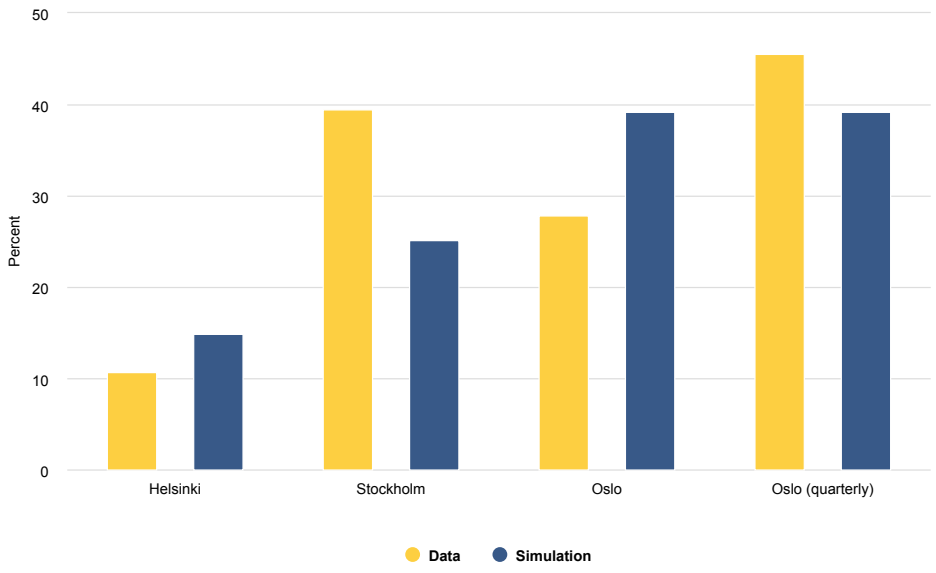
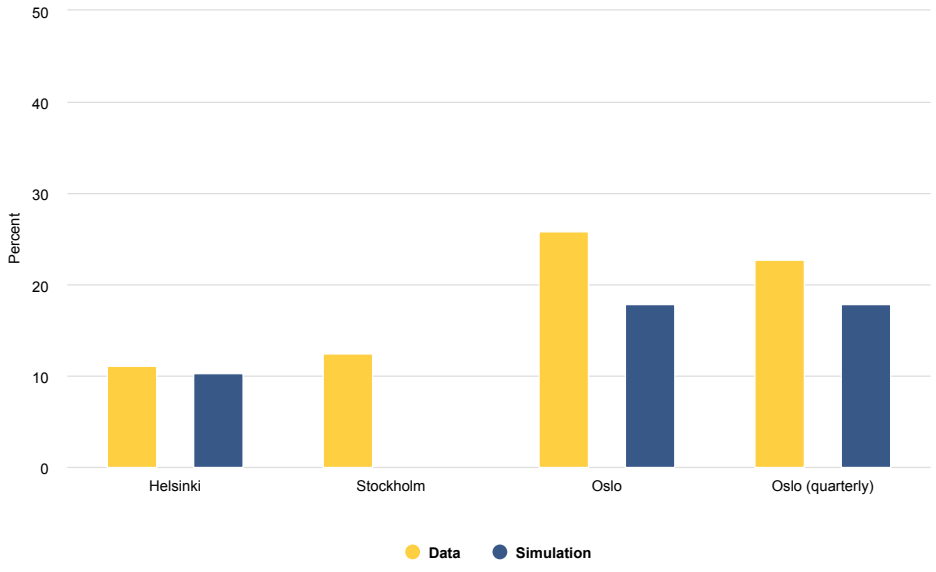


Figure 5b Results, rents



Note: These two graphs show the housing price and rent increases in data and simulations. The bars marked Oslo (quarterly) are the results from Bø (2020).

Source: Statistics Finland, Statistics Norway, Statistics Sweden, Bø (2020) and own calculations.

As shown in Figure 5a and 5b, prices and rents are simulated to increase by respectively 14.9 and 10.3 percent in Helsinki, compared to actual increases of 10.7 and 11 percent. The share of buy-to-let housing units increases from 16.4 to 17.3 percent, while the observed share (based on Kannisto 2019) increased from 8.9 to 11.6 percent over the same period, excluding government-subsidized rental housing from the housing stock.[52]

Stockholm has a very different rental market that necessitates some changes to the model. I assume that housing owners cannot invest in secondary housing to let out.[53] In the model there are only buyers, owners and sellers, as in a standard search model. Implicitly, this model includes a rental sector with constant rents, that does not interact with the owner-occupier housing sector. Rents are set at 85 percent of the simulated rent in the baseline (Oslo) model in 2007q1, based on a comparison of 2005 PPP adjusted rent levels between Norway and Sweden in Andrews et al. (2011). The model assumes that all non-owners have access to this implicit rental market. It may thus underestimate the effect of excess demand for rental housing on housing demand.

Running the model with these assumptions, and with the population inflow to Stockholm in 2007q1 to 2014q2, housing prices are found to increase by 21.9 percent, while rents are by assumption unchanged. Actual prices increased by 39.4 percent and rents by 12.4 percent. The results are shown in Figure 5a and 5b. The model thus underestimates the price increase, but even in a model with no rental growth, the inflow to Stockholm is high enough to increase housing prices substantially. More advanced modelling of rent-setting could improve the model fit, as data show that real rents are clearly increasing. With some room for rents increasing because of high demand, prices would likely increase more, as discussed earlier in Section 5.

The sizable commercial rental business in Stockholm is not modelled here, but it is interesting to think of their economic model. With constant rent, as assumed in the model, buy-to-let investors would lose out if competing directly for housing against owner-occupier buyers in high demand periods. Rental housing is here assumed completely separate from owner-occupied housing. However, there is certainly some substitutability between rental apartments and cooperative apartments. The large commercial firms owning most of the private rental housing in Stockholm may be able to buy housing cheaper through large scale purchases, exploit efficiencies in management and maintenance, or achieve higher rents through size leverage in rent bargaining.

The simulation results for Oslo are shown in the third group of bars in Figure 5a and 5b, together with actual housing price and rent data. Prices and rents are simulated to increase by 39.2 and 17.8 percent, compared to actual increases of 27.9 and 25.4 percent based on yearly data. The share of buy-to-let housing is simulated to increase from 16.2 to 18.2 percent. The actual share of secondary housing was 17.1 percent of the housing stock in Oslo in the final quarter of 2013 (NEF 2020).

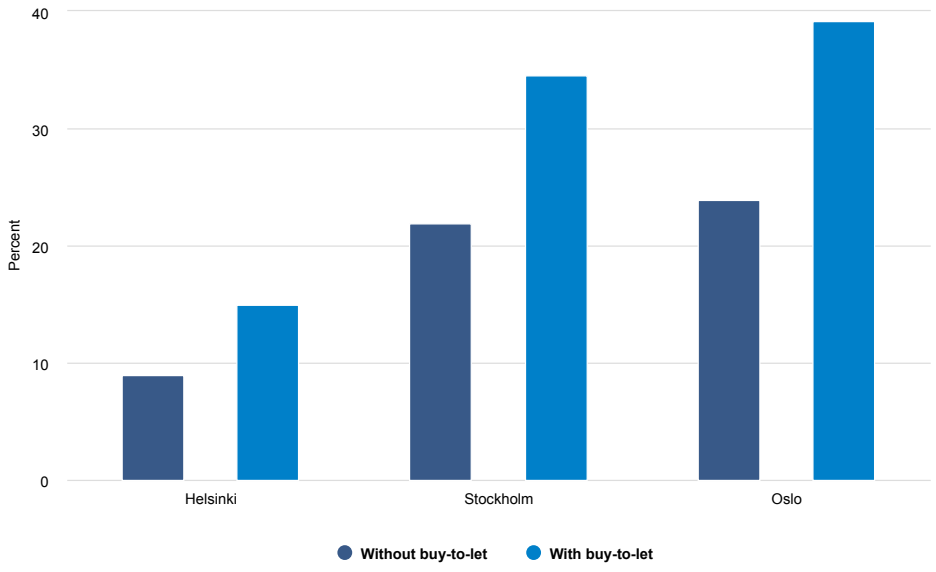
The last pair of bars in Figure 5a and 5b compares the simulation results for Oslo with quarterly data (from Bø 2020). The fit is clearly better. Housing prices increase a lot less using yearly data than quarterly data, while rents increase more using the yearly measure. This should be seen as a caveat; yearly data may not accurately measure the relevant outcomes.

52. From 7 to 9.1 percent of total housing mass including subsidized rental housing.
53. Owner-occupied, detached housing can easily be let out, but apartments, which are more attractive as rental units, are cooperatively owned. They can only be sublet for specific reasons and limited periods.

Next, I look at the effect on prices and rents of the *existence* of a buy-to-let sector compared to *not* having a buy-to-let sector within this modelling framework. Figure 6 shows the results of simulating the counterfactual of having no buy-to-let sector in Helsinki and Oslo, and of having a buy-to-let sector in Stockholm.[54]

As shown in Figure 6, the housing price effect in the model without a buy-to-let sector is only around 60 percent as large as in the model with buy-to-let in all three cities. In other words, the simulations show that buy-to-let serves to amplify price movements in the housing market. In addition, the counterfactual buy-to-let model for Stockholm features rents that increase by 16.4 percent, somewhat more than the observed 12.4 percent, while the counterfactual Helsinki and Oslo simulations have constant rents by assumption.

Figure 6 Simulated housing prices, with and without buy-to-let



Note: Simulation results for the models with and without a buy-to-let sector, using inflow shocks from the different cities. The bars show percentage growth in housing prices over the simulation period.

Source: Own calculations.

6 Concluding remarks

All Nordic capital cities have experienced large increases in housing prices, which worries policy makers as housing becomes increasingly unaffordable for low-income households. In policy and media discussions on house price growth, buy-to-let

54. It could be argued that having a buy-to-let sector may affect inflow; I assume it does not.

housing investors are often identified as price drivers. In this paper, I collect relevant data on the rental markets in the Nordic capital cities and use a previously developed model of buy-to-let investors to analyse the impact of buy-to-let investors. I modify the model to fit the regulated rental market in Stockholm.

All the cities have sizable private rental sectors. However, the institutional framework for owning rental housing and setting rents clearly differs, as does the structure and development of the rental sector.

The buy-to-let model appears to fit data well in cities where rents are set freely. The modified version without buy-to-let and with constant rents underestimates the increase in both housing prices and rents in Stockholm. To explain different rates of price increases, population growth is clearly important, as the comparison of Oslo and Helsinki shows.

The simulations suggest that price increases could be reduced substantially by regulating rents and restricting buy-to-let, as shown by the comparison of the simulations with and without buy-to-let. The presence of a buy-to-let sector amplifies the price increase by about 60 per cent in the simulations. It is worth noting that the constant rent in the model without buy-to-let is not consistent with the substantial rent increases in actual data from Stockholm in our data. During a period with high population pressure, the existing regulations in Stockholm did not keep rents constant. The existing regulations of rents and buy-to-let in Stockholm are therefore likely to result in both higher rent and housing price increases than simulated in the model.

The existence of buy-to-let investors thus drives prices to some extent in markets where regulations allow their existence, according to the model, which may be an argument for regulating buy-to-let. On the other hand, private landlords play an important role in those housing markets, housing people who do not wish, or cannot afford to buy housing (Scanlon et al. 2016). If buy-to-let is regulated out of existence, some other form of rental housing has to meet the demand.

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Appendix

Housing price indices

The methodology of housing price indices differs between the countries. While the indices are mostly based on hedonic methods (Hill 2013), there are several different ways of constructing hedonic indices. Going into methodological detail is outside the scope of this paper. Methodological differences may distort comparisons between the cities. For some of the countries, there is no single housing price index available for all housing. Rather, there are separate indices for e.g. single-family housing and flats. In those cases, I weight together the indices based on the respective share of the housing types in the total building mass. The geographical base of indices also does not always cover only the city municipalities. Below, I give details where this is relevant.

Denmark: There are separate indices for single-family housing and apartments for the Copenhagen city province (Copenhagen, Fredriksberg and the two neighbouring municipalities Dragør and Tårnby). Using available data for 2010–2020 on the composition of the housing stock, the share of single-family houses in the Copenhagen city province decreased slowly from 10.44 percent to 10.27 percent over the period. I thus use a weight of 10 percent on the single-family price index, and 90 percent on the multi-family index. A constant weight is used over the whole period 2000–2019.

Finland: There are separate indices for single-family housing and housing companies. The single-family index can only be obtained for the Greater Helsinki area, consisting of Helsinki and a dozen neighbouring municipalities. I use this index for the price development of single-family housing in Helsinki municipality. The share of houses (detached and attached) in the Helsinki housing stock fluctuates around 13.5 percent, which is the weight I use for the single-family index. I assume that the housing company index has the weight of the share of apartments (i.e. that all apartments, and only apartments are sold as housing companies).

Iceland: There are separate indices for single-family housing and apartments, produced by Registers Iceland. The indices are weighted by the share of single-family housing in the total housing stock, which decreased from around 28 to 25 percent over the period 2001–2019 (Register Iceland 2011).

Norway: An index for all housing types exists for the Oslo area. The housing price index covers Oslo and the neighbouring municipality of Bærum.

Sweden: Housing price indices for single-family housing and for apartments (cooperatives) in Stockholm can be obtained from the company Valueguard from 2005 on. Valueguard creates hedonic indices based on transaction data from real estate agents (Valueguard 2020). The single-family index is based on data for the Stockholm labour market region, the apartment index for Stockholm municipality (Valueguard 2011). I weight the indices by the share of single-family houses over apartments, based on dwellings data from Statistics Sweden. Thus, I assume that the cooperative index is a proxy for the price of all apartments, no matter the ownership structure. The Valueguard index is monthly. I average over months, with equal weight for each month (for simplicity) to get a yearly index.

Rent indices

Rent statistics are usually less developed than housing price statistics, covering shorter time periods, and are based on less available data and simpler methodologies. The available indices or statistics are mostly based on average prices per square meter, which do not control for composition changes.

Denmark: The Copenhagen rent index is based on average yearly rent per square meter for the municipality of Copenhagen published by the Danish Transport, Construction and Housing Authority (Bolig og planstyrelsen 2020). The series starts in 2015. Rents are published separately for non-profit rentals, cooperatives and condominiums for the municipality of Copenhagen. I weight the rents together based on the share of housing types in the statistics for dwellings from Statistics Denmark.

Finland: Statistics Finland produce a rental price index for Helsinki from 2010. Using an older statistic with a different methodology expands the time series to 2005, at the cost of getting a trend break in 2010.

Iceland: A monthly rental index for the capital region is produced by Registers Iceland from January 2011. I average prices over months within each year.

Norway: For Oslo, Boligbygg (the housing department of the municipality of Oslo), creates a statistic based on all housing units advertised for rent at the web page Finn.no, quarterly from 2004 q4 (Boligbygg 2020). The rent per square meter and quarter is calculated using advertised rental prices and characteristics in a hedonic regression. I average rents over quarters within each year. Notice that this is based on the rents of new rental contracts, in contrast to the indices from the other countries. Eiendom Norge, also produces a hedonic rental price index for the four largest cities in Norway, based on signed rental contracts (Eiendom Norge 2020). However, that index only covers apartments rented out by a few, large rental companies. It is available from 2012.

Sweden: The municipality of Stockholm has published a yearly rent index since 1998 (Stockholms stad 2020). The index is based on the units from Statistics Sweden's survey ´Rents for dwellings´ that are located in Stockholm. The rents are average rents for existing rental contracts.

Inflation adjustment

Both housing price and rent indices are inflation adjusted with harmonized indices of consumer prices (HICP) from the respective countries, sourced from Eurostat.