Housing Returns over the Income Distribution

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Abstract

We explore differences in the return to housing across the income distribution using detailed administrative data from Denmark. Richer buyers earn higher housing returns. Differences in property characteristics, market timing and other buyer characteristics explain little of the variation, but most of the gap in returns is eliminated when we control for location. The higher return for richer households does not appear to be compensation for risk. Our results are important for understanding the determinants of inequality, and suggest that we should focus on understanding differences in location choice between rich and poor households.

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1 Introduction

Recent studies on the origin of wealth inequality has shown that wealthier households achieve higher returns on their wealth (Fagereng, Guiso, Malacrino and Pistaferri, 2020; Bach, Calvet and Sodini, 2020), a mechanism that plays a fundamental role in explaining the high concentration of wealth in the United States and elsewhere (Benhabib, Bisin and Zhu, 2011; De Nardi and Fella, 2017). Since housing is the largest asset on the balance sheet for most households (Campbell, 2006), movements in house prices are important for understanding wealth inequality (Kuhn, Schularick and Steins, 2020).

But while it is relatively straightforward to motivate why richer households earn higher returns in financial markets, understanding the return on housing is complicated by the dual role of housing as a consumption and investment good. While either investment skill or loading on systemic risk can help explain differences in returns in the stock market, for instance, these are not the only relevant factors for understanding housing returns. Both the consumption dividend and the return divided is related to the location (Bilal and Rossi-Hansberg, 2021). Housing also differs from most other financial assets in that the owner can personally affect the return in ways that is difficult to capture in the data, i.e., by renovating the property (Girshina, Bach, Sodini and Team, 2021) or because they can restrict supply (Ortalo-Magné and Prat, 2014). In addition, houses are idiosyncratic assets traded at infrequent times subject to high transaction costs that often require financing at the time of purchase. These distinct features means that housing differs from other financial assets, like stocks or pension savings, which makes explanations related to skill or risk taking less intuitive as an overarching underlying reason for the differences in returns.

In this paper, we document differences in the returns to housing across the income distribution using detailed and accurate data at the household level from Denmark. Specifically, we use transaction-level data to estimate differences in unlevered annualized housing returns across the income distribution. We find a significant, positive relation between income ranking and housing returns: households above the 90th percentile of the income distribution earn a 1.12 percent higher annualized return than households in the 10th percentile. This translates to 9.3 percent cumulative return over a 10-year holding period and signifies an economically significant difference in outcomes in the most important asset for most households.

Why would high-income households earn higher returns on their housing investments? First, richer households may purchase different types of properties that appreciate more in value. For instance, returns on apartments have generally outpaced the returns to single-family housing in Denmark. Second, richer households may be able to buy in more attractive markets. Prices in urban areas have appreciated considerably in value over the last 50 years (Gyourko, Mayer and Sinai, 2013; Amaral, Dohmen, Kohl and Schularick, 2021). Richer households may be more skilled in choosing locations that will increase in value, or may be buying in areas where they can limit supply growth (Ortalo-Magné and Prat, 2014). Note that richer households are causing house prices to increase if they restrict supply. Alternatively, richer households may be less constrained in their housing choices, allowing them to pick better locations. Third, richer households may be able to time the market better. For example, empirical evidence suggest that poorer households tend to buy at the peak of housing booms, and that poorer households may be more exposed to housing market risk in downturns (Fischer, Khorunzhina and Marx, 2023).

We incrementally add control variables and fixed effects to understand whether these explanations explain the gap in housing returns. We find little impact of property types (controls, for e.g., size and property type) but find that an interaction of time of purchase and municipality makes the coefficient on income close to zero and insignificant. The main driver of the differences in returns is thus a combination of where you buy and when you buy. Examining heterogeneity, we find that the coefficient on income rank is considerably larger outside of the capital region of Copenhagen.

Richer households may also live in riskier housing markets and may require more compensation for this risk. We therefore examine how housing risk and returns differ across the distribution. We first show that in the cross-section of housing returns across municipalities, return and risk are *negatively* correlated. Han (2013) shows that this negative correlation between risk and return, the opposite of predictions from standard models in finance, can be rationalized in markets with a large hedging demand and constrained supply. On the households level, we show that richer households live in areas that experience higher returns, but that the standard deviation of housing returns is relatively constant across the distribution. In other words, richer households live in areas with higher return but not higher risk.

Finally, richer households may be more willing or able to invest in renovations and home im-

provements. This channel essentially represents a bias in the estimation of housing returns, as home improvements and renovations ought to be accounted for in the return but is often assumed away (Nowak and Smith, 2020). While richer households are more likely to renovate, we find that adding controls for renovations does not meaningfully affect the coefficient on income rank after adding other controls.

We contribute to a recent literature that uses detailed administrative data to examine differences in asset returns across households. Recent papers have examined how housing returns are related to gender (Goldsmith-Pinkham and Shue, 2023; Girshina et al., 2021), race (Kermani and Wong, 2024; Gupta, Hansman and Mabille, 2022a) and wealth (Wolff, 2022). We add to this literature by examining how housing returns relate to income rankings using transaction data. A related literature documents differences in returns on assets across the distribution (Fagereng et al., 2020; Bach et al., 2020; Kuhn et al., 2020). We contribute to this literature by providing a thorough examination on the returns to housing, the largest asset on the household balance sheet. Recent papers provide empirical support and argue that persistent heterogeneity in returns can arise due to risk aversion (Bach et al., 2020; Fagereng et al., 2020). This explanation is less intuitive for housing that is part investment and part consumption, and the return to housing relates to location choice.

2 Danish housing market

2.1 Institutional background

The Danish housing market is characterized by a high level of homeownership, with approximately two-thirds of Danish households owning their homes. The homeownership share has been relatively stable across time (Bäckman and Lutz, 2020). The market is generally perceived as well designed and regulated (Campbell, 2013), with low levels of speculation and a high degree of transparency. The Danish housing market is also characterized by relatively high prices, particularly in major cities such as Copenhagen and Aarhus.

Homeowners are subject to a range of taxes related to their housing. This includes property taxes, which are levied annually based on the value of the property, as well as capital gains taxes on any profits earned from the sale of a home. Capital gains taxes are not applied if the owner has resided in the property for a certain amount of time at some point during ownership

and if the lot size is below a threshold. Most homeowners do not pay transaction taxes when they sell their property. In addition, homeowners can deduct 30% of their mortgage interest payments from their taxes. This applies to both primary residences and summer houses.

As with many other countries, housing is the most important asset on the balance sheet for Danish households. In 2014, the first year with comprehensive data on pension wealth, housing wealth represents 53.6 percent of total gross wealth on average, making it the most important asset for all but the very poorest of households. The housing share of gross wealth appears somewhat lower than the one reported in Fagereng et al. (2020), where housing represents 66 percent of gross wealth for the 20-50th percentile, and 86 percent for the 50-90th percentiles.[1] The share allocated to residential real estate in Bach et al. (2020) is 45 percent for the 70th to 90th percentile. Kuhn et al. (2020) report similar statistics for the United States, where housing dominates the portfolios of the bottom of the income spectrum and middle class. Overall, based on these metrics, the importance of housing appears to be similar in Denmark and other countries studied in the literature so far.

Most Danes own housing on their personal balance sheet for consumption purposes. The share of owners with multiple properties has increased from 14 percent in 1996 to close to 18 percent in 2016. If we exclude summer houses, the share was 9 percent in 2016, increasing to a little above 10 percent in 2020. About 250,000 Danes own summer houses, corresponding to approximately 5 percent of the population. Ownership of multiple properties is concentrated in the very top of the income distribution, with 25.43 percent of the top 10 percent owning multiple properties. The share if we exclude summer houses is 15.52 percent. Part of the reason is likely the strict rental protection laws in Denmark. To rent out a property for a limited period, the owner typically has to provide a valid reason that can be tested in court. In addition, properties constructed before 1991 are subject to rent control. If the owner has not lived in the property themselves with "a view toward a permanent stay," they have to pay capital gains tax. There is also a favorable tax treatment for owning multiple properties through an incorporated entity.

Danish house prices have experienced considerable volatility over the last twenty years. Figure 1 plots the average house price growth over time along with the 25th and 75th percentile, based on zip-code level data. There has also been sizable differences across different areas and property types, with the large cities and apartments generally increasing more in value. The average

[1] A potential explanation is the considerably higher homeownership rate in Norway (78.3 percent compared to 59.2 percent). See https://ec.europa.eu/eurostat/cache/digpub/housing/bloc-1a.html.

year-over-year growth rate in real house prices at the zip-code level from 1996 to 2016 was 3.1 percent, with very large increases from 2003 to 2006 followed by a rapid decline in 2008 and 2009.[2] Even with a large decline in prices in 2007, however, foreclosures and default remained low. For example, a little more than 600 homes per quarter were repossessed at most, on an outstanding stock of 2.5 million properties.

Compared to aggregate developments in other countries, however, Denmark is not an outlier. Using data on real house price growth from the Bank of International Settlement, the average year-over-year return in Denmark was 2.7% from 1997 to 2019. These growth rates are comparable to the United States (2.1% real growth) and somewhat above the Euro-area average of 1.5%. Denmark experienced lower real house price growth than France (3.1%), the United Kingdom (3.9%), Norway (4.4%), and Sweden (5.5%), but higher than Germany (0.004%). The standard deviation of returns in Denmark over the same period was 7.4%, which is comparable to the United States and the UK (both 7.3%), but is more volatile than the housing market in the other countries mentioned.

Overall, the Danish housing market is broadly comparable to a range of other countries studied in the literature so far. Housing market dynamics, the importance of housing wealth for most households, the homeownership rate, and the tax system are all broadly similar to other countries, suggesting a degree of external validity to our results.

2.2 The Danish mortgage market

The Danish mortgage market is dominated by a system of "mortgage credit institutions" known as "realkreditinstitutter." These institutions provide long-term mortgage loans to homeowners, which are financed through the issuance of mortgage bonds on the capital markets. The mortgage bonds are typically issued with a fixed interest rate and a maturity of up to 30 years, and are highly rated by credit rating agencies due to strict regulations and collateral requirements imposed on the mortgage credit institutions.

Danish borrowers have the option to choose between a fixed-rate mortgage and a variable-rate mortgage. In the case of a variable-rate mortgage, the interest rate is tied to the prevailing market interest rates and is adjusted periodically over the life of the loan. Approximately half of outstanding mortgage debt has a maturity of 30 years. Danish borrowers can also choose

[2]See Bäckman and Lutz (2025) for an analysis of the role of interest-only mortgages for this dynamic.

between annuity repayment plans and a 10-year interest-only period. If a borrower defaults on a mortgage, the mortgage bank can trigger a forced sale of the property that serves as collateral. In case the proceeds from the sale is insufficient to cover the full loan amount, the residual claim is converted to a personal unsecured loan. For more details about the mortgage market, see Bäckman and Lutz (2025).

3 Data

3.1 Data sources

We obtain high-quality administrative data from Denmark Statistics. The data comprises housing transaction information, corresponding underlying property characteristics, as well as detailed demographic and financial data linked to all individuals. The data structure involves separate registers within Denmark Statistics that can be merged based on unique individual identifiers. We obtain comprehensive demographic and financial data from the official Danish Civil Registration System (CPR Registeret) and Danish Tax and Customs Administration (SKAT) register. Each individual in Denmark is assigned a unique CPR number, which in turn can be linked to a household identifier. We use the CPR number to collect detailed demographic and financial data for each individual. Individual wealth and income data is provided by the official tax records at SKAT. We also obtain demographic data such as age and place of residence, which we can link to wealth data and property ownership through the individual CPR number. We then collapse data to the household level using household identifiers.

Our main variable of interest is the income ranking. For each year, we rank all households in Denmark in age-specific cohorts based on their total income that year. We make sure that the households consist of at most two members. Children above 18 are allocated the same household identifier as their parent. Since we later focus on homebuyers above the age of 25, we remove individuals below age 25 in this step as well. Andersen, Johannesen and Sheridan (2020) notes that young households with low income are usually students who receive transfers from their parents, making their own income an unreliable measure of their financial resources. Finally, we use the average income for the household to ensure that we can compare couples and singles.

We acquire detailed administrative data on the ownership and characteristics of the housing

stock of all registered properties in Denmark, as well as all transactions of those properties, from 1996 to 2019 from the SKAT register and the Danish housing register (Bygnings-og Boligregistret, BBR). We restrict our analysis to properties where we know the ID of the buyer in order to match housing transactions to income data. We exclude transactions that Denmark Statistics flags as anomalous or unusual, and transactions where the buyer is not an individual. Since we are interested in housing returns, we focus on transactions where we observe at least two transactions. We also select transactions with at most two buyers. This represents all a clear majority of all transactions. Finally, we restrict our attention to residential dwellings that serve the purpose of a primary home, i.e., we exclude summer houses or investment properties from our analyses. This somewhat restricts our ability to study the very top of the distribution, where ownership of multiple properties is more common. However, ownership of multiple properties is generally limited in Denmark due to tax reasons. We discussed this in more detail in Section 2.

Next, we generate a sample of repeat sales and merge the income ranking information of the buyer(s) at the time of purchase using the household identifier. If there is more than one buyer, we check if the household identifier is the same across buyers. This case represents 80% of two-buyer transactions, and in that case we use the income ranking of the household. In the 20% of cases where the household identifier differs, we use the average ranking. We use the income ranking in the year prior to the housing purchase as our main variable of interest. We also merge relevant property characteristic variables such as number of rooms and living area square footage. The final sample consists of 174,759 repeat sales transactions.

3.2 Measuring housing returns

We calculate housing returns at the repeat sale transaction level. This represents an advantage over alternative approaches that use register data, which instead rely on local house price indices combined with property types to infer housing returns (e.g., Fagereng et al., 2020; Bach et al., 2020).

We calculate the unlevered rate of return r_i^u for owner i using the following formula:

$$1 + r_i^u = \left(\frac{P_{i1}}{P_{ib}}\right)^{\frac{1}{T_{is} - T_{is}}}, \tag{1}$$

where P_{ip} and P_{is} are the purchase and sales prices, and $T_{is} - T_{ip}$ is the length of ownership in

years. Both transaction prices and dates are recorded in the data, making it easy to calculate accurate unlevered returns. Since we observe the exact dates, we allow T_{i1} and T_{i0} to be nonintegers to better measure the exact holding period.

An important limitation is that the unlevered return solely reflects capital gains on housing, and not other dividends associated with owning. We lack data on rents, property taxes, transaction costs, insurance and maintenance costs. In addition, the calculations noted above are the *realized* returns to housing conditional on a sale. To account for unrealized capital gains, we later impute house price gains for all buyers using municipality house price indices.

Table 1 provides summary statistics for the final estimation sample. We provide statistics for the full sample in column 1 and divide the sample into three groups based on the rank in columns 2-4. The rank variable is constructed based on all households in Denmark. A few noteworthy differences between high income buyers in column 4 and middle income buyers in column 3 is that high income buyers are more likely to live in the capital region, have higher mortgage debt and leverage values, and a higher propensity to renovate.

4 Income Gaps in Housing Returns

We now provide evidence for large gaps in housing returns by income and explore their determinants. We start with a non-parametric examination of annualized returns and income rank in Figure 2. The figure depicts a positive relationship between income rank and the average annualized return using a binned scatterplot. Dividing the sample into three (unequal-sized) groups, the average annualized unlevered returns are 2.975% for low-income buyers, compared to 2.599% for the middle income buyers and 3.271% for the high income buyers. This compares to an average real annual house price growth in Denmark of 2.6%.[3] There are little differences in the standard deviation of returns across the income groups, suggesting that the higher returns for high-income buyers is not a compensation for risk. In fact, the standard deviation of returns is lower for high-income buyers. We return to a discussion on house price risk in more detail later.

The differences in returns could reflect many underlying factors. For example, it is possible that higher income households buy properties with characteristics that appreciate more in value. A

[3]We calculate the annual house price growth using data on the average square meter price from FinansData, and so the numbers are not directly comparable.

salient example from recent years of how property characteristics correlate with returns is the differential effect on prices across space during COVID-19 (D'Lima, Lopez and Pradhan, 2022; Gupta, Mittal, Peeters and Van Nieuwerburgh, 2022b). Similarly, richer households could be more able to time the market, could buy in areas that later appreciate more in value, or be able to do more renovations and maintenance due to characteristics like income, wealth or credit availability. The income gaps in returns could reasonably be economically explained by differences in these factors across the income distribution.

To analyze the importance of these factors, we use a linear regression framework to estimate the relation between income rank and annualized return after controlling for a wide range of factors:

$$Y_{it} = \beta_0 + \beta_1 Income\ Ranking_{it} + X_{it}\Gamma + \mu_i + \epsilon_{it} \tag{2}$$

The specification regresses the outcome Y_{it}, either the unlevered return r_i^u or the levered return r_i^{lev} on the main variable of interest, $Income\ Ranking_i$, and vectors of control variables X_{it} and fixed effects μ_i that capture homeowner and property characteristics.[4] $Income\ Ranking_i$ is the average income ranking of the buyer(s) at the year before purchase. We progressively introduce controls and fixed effects to evaluate the share of gaps that can be explained by observed factors. This approach will absorb both causal effects and selection (Kermani and Wong, 2024).

We present the results in Figure 3. The baseline specification, in the first line, does not include any control variables. The coefficient of 0.0112 on $Income\ Ranking$ is positive and statistically significant at the 1% level and implies that a one-unit increase in rank is associated with 0.112 percent increase in returns. To understand the economic significance we compute the differential effects across income ranks. The cumulative difference in unlevered returns to housing between the 10th and 90th percentile over 10 years is equal to $(1 + 0.0112 * (90 - 10)/100)^{10} - 1 = 9.3\%$. Note that Table 2 presents the corresponding detailed regression results.

Property and homebuyer characteristics. Property characteristics explain a small share of the returns. The second line in Figure 3 presents an estimate on the effect of income rank on returns with controls for property type (apartment or single family house), property size in square meters, and the number of floors. The coefficient is somewhat smaller in magnitude, but remains large and statistically significant. We next add controls for homebuyer characteristics,

[4]The methodology is similar to that of Goldsmith-Pinkham and Shue (2023) and Kermani and Wong (2024), who study the difference in housing returns based on gender and race, respectively.

specifically buyer age and net worth, and the results are depicted in the third line. The inclusion of these controls do not meaningfully affect the coefficient on Income Rank. The differences in returns is not driven by differences in property or homebuyer characteristics.

Market timing. We next introduce a control for market timing and a control for time between sale. The Danish housing market experienced considerable volatility during our sample period, as documented in Figure 1. Systematic differences in market timing by income rank can plausibly generate large differences in returns. To assess this hypothesis, the fourth line in the figure adds fixed effects for $T_{ip} \times T_{is}$, i.e., fixed effects for time of purchase interacted with time of sale. This specification accounts for the general house price trend between the purchase and sale dates and allow us to better understand the importance of market timing. The coefficient on *Income Ranking* is reduced from 0.0112 in the baseline specification to 0.00927, meaning that the difference in returns cannot be explained by market timing.

Geographical location. We next show that geographical location by itself explains the entire remaining variation in the income gap in housing returns. To do this, we incrementally include fixed effects for Purchase Time × Municipality and Sale Time × Municipality. Danish municipalities are relatively small administrative areas that exists within greater administrative regions. For instance, the capital region consists of two municipalities in central Copenhagen (Copenhagen and Frederiksberg), and a further 27 municipalities on the outskirts.[5] Controls for municipality captures both causal effects and selection, which makes interpretation more complex. For example, municipality fixed effects will capture both the characteristics of the buyers in a certain area, which is likely a function of their own characteristics such as income, wealth, their jobs and social ties, as well as the causal effect of the municipality.

The coefficient on *IncomeRanking* is no longer statistically significant. An alternative approach is to use zip-codes, which are even smaller geographical units. Especially in bigger cities, zip codes captures smaller neighborhoods better than municipalities. In fact, they tend to be small enough that we occasionally do not have a sufficient number of observations to estimate the effect of income rank. The estimated coefficients are similar for zip codes and municipality related fixed effects, hence for the rest of the paper we therefore proceed to use municipality fixed effects. There is considerable variation in house price growth at the zip-code level not

[5]Each municipality has an administrative function, and certain taxes are collected by the municipality. There are 98 municipalities in Denmark today. A municipality reform in 2007 reduced the number of municipalites from 315 to 98. We use unique identifiers provided by Denmark Statistics to assign properties before 2007 to the new municipality codes.

captured by the broader geographical regions. A regression of zip-code level house price return on $Municipality \times YearQuarter$ has an R-squared of 34 percent.

Finally, we include interactions between municipality and time dummies, i.e., Sale Time $\times$ Purchase Time $\times$ Municipality. Denmark experienced a large housing boom between 2003 and 2007, followed by a major fall. The effect of the boom was heterogeneous across areas and time (see, for e.g., Bäckman and Lutz, 2025, for a discussion around the causes of the housing boom between 2003 and 2007), implying that controls for location or market timing by themselves may fail to capture the effect. As in the previous specification, the coefficient on income rank is not statistically significant.

Summarizing the results. The results of the sequentially estimated regressions suggest that the entire difference in returns across the income distribution can be accounted for by location and market timing. Richer buyers are able to buy properties in areas that appreciate more in value at the right time, which explains their greater housing returns. Importantly, these returns are likely not widely shared in the population. Figure 4 shows that there is an negative correlation between housing returns and the homeownership rate.

Compared to prior research, Bach et al. (2020) use an asset pricing model with 389 property and location types to calculate returns. Table 6 of Bach et al. (2020) reports housing returns ranging from 4.19% for the bottom decile to 6.14% for the top 0.01 percent. Using data from their Table 6 and regressing the historical housing return on wealth deciles, the coefficient on wealth group is 0.1345 for the bottom 90 percent, which is comparable to our estimate in the baseline specification of Figure 3.[6] Fagereng et al. (2020) documents an average housing return of 4.85% with a standard deviation of 6.53% in Norway. Neither of these studies document household-level returns or study the determinants of the returns to housing.

4.1 Robustness and heterogeneity

Renovations. One reason for the observed relation between income rank and housing return may be that higher income households may simply renovate more due to greater financial ability or differential consumption preferences. As a result, the sale price may be higher and this will feature in the form of greater returns. We use data for a renovation tax break available from 2011 to examine the impact of renovations on housing returns. The same tax break for renovations

[6] We use the bottom 90% because the top 10% is more finely divided. Using returns for all groups reported in Table 6 of Bach et al. (2020) yields a coefficient of 0.16.

was previously used in Andersen, Badarinza, Liu, Marx and Ramadorai (2022). We use the sum and the number of tax breaks used by each buyer between purchase and sales dates. Since the tax break is available from 2011 only, the sample is limited to properties where the sale occurred after 2011. Column 7 of Table 2 provides the results. The coefficient of the binary variable indicating renovations is positive and statistically significant, showing that households who renovate earn higher housing returns. Richer buyers are more likely to use the tax break, and on average apply for a larger amount, as shown in Figure 5. However, including renovations does not strongly impact the coefficient on income rank.

Non-linearities. We next explore non-linearities in the relation between income rank and housing return. We divide buyers into 10 groups based on their income rank, and estimate separate coefficients for each group. We provide results from the baseline specification and for the specification with all controls and fixed effects in Figure 6. The baseline estimates with no control variables shows a U-shape between income rank and returns. This specification is marked in orange, and measures the difference in average returns for each group relative to the median income group. Relative to the middle income group, the coefficient pertaining to buyers in income groups one to four is positive and significant in the baseline specification. The highest income buyers in group 10 have an average return that is 1.2 percentage points higher than the buyers in the lowest income group. Once we introduce controls, the difference in returns is insignificant at the 5 percent level and close to zero for all groups except the 9th decile. Most of the difference in returns between households across the income distribution can be explained by detailed control variables for market timing and location.

Heterogeneity by holding period. The holding period may differ for households across income ranks due to differential constraints and objectives. Figure 7 depicts the coefficients of the baseline specification and the specification with all controls and fixed effects in Figure 6 for subsets based on the holding period length, i.e., the length of the period between the purchase and sale dates. Without including controls or fixed effects, shorter holding periods are associated with higher returns. Once we introduce controls, however, the coefficient on income rank are relatively closer to zero.

Heterogeneity across types of areas. It appears that market timing and geography may play a role in the heterogeneous relation between income ranking and housing returns. To explore this further, we estimate the regression specification as in Column (3) of Table 2 and

additionally fixed effects for Purchase-Year Quarter × Sale-Year Quarter, for different types of municipalities and plot the coefficient of $Net\,Income\,Ranking$ for each municipality in Figure 8. We use a classification from Denmark Statistics that sort municipalities into broader categories, such as Capital region and Cities, Provincial cities, Countryside, or Rural. The figure depicts some variation in the estimated coefficients. Overall, the coefficient on income rank is close to zero in the capital region – there is little difference in housing returns between high and low income buyers in the Greater Copenhagen region. Instead, we find a positive coefficient on income rank in provincial cities.

5 Mechanisms

In this section, we provide evidence on different mechanisms that can account for differences in returns across the income distribution.

5.1 Housing returns and risk

We first explore the relationship between risk and return in the Danish housing market. We use market-level data merged to the location where households live. Figure 9 shows that housing returns and risk are *negatively* correlated in the cross-section between 1996 and 2016. A negative relationship between risk and return is puzzling in the frame of standard finance models, where return would be positively related to risk. This finding is not unique to the Danish housing market, however, and has for instance been observed also in some US housing markets. A plausible explanation for this negative relationship is hedging demand, where the current house provides a hedge against future housing consumption (Han, 2013).

Using municipality-level data, we calculate the average return and risk for local housing markets and relate this to income rank for all individuals. Figure 10 provides the results. The average (quarterly) return is increasing in income rank after the 30th percentile, going from an annualized rate of 2.6 percent to 3.2 percent for the very richest households. Using a simple back-of-the-envelope calculation, note that over a 20 year holding period, a 2.6 percent increase in house prices leads to total increase of 167 percent, compared to 188 percent for the 3.2 percent. We find similar results for the average housing market beta, which measures the correlation in municipality returns to the return on the house price index for Denmark. Importantly, the higher returns do not seem to be compensation for risk. Panel c) shows that there is little

difference in the riskiness of housing based on income rank. The standard deviation of returns is decreasing in rank, but note that the difference in magnitudes is small. Panel d) shows that the number of negative housing returns is *decreasing* in income rank, although the effect is again small.

6 Conclusion

The effect of inequality is a topic of discussion in contemporaneous academic and policy debates. We contribute to this discussion by exploring the relation between income ranking and housing returns. Through detailed administrative data from Denmark that enables us to characterize an households's income ranking, and purchase and sale transactions, we find that households that have a higher income ranking earn higher unlevered returns. Furthermore, the results suggest that market timing and location choice (for example, are better at picking appreciating markets, or are less constrained in their location choice) explain the entire difference in returns across the income distribution. Our results highlight that it is important to understand location choice when studying wealth inequality. Our work motivates further questions on the underlying mechanisms.

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7 Figures

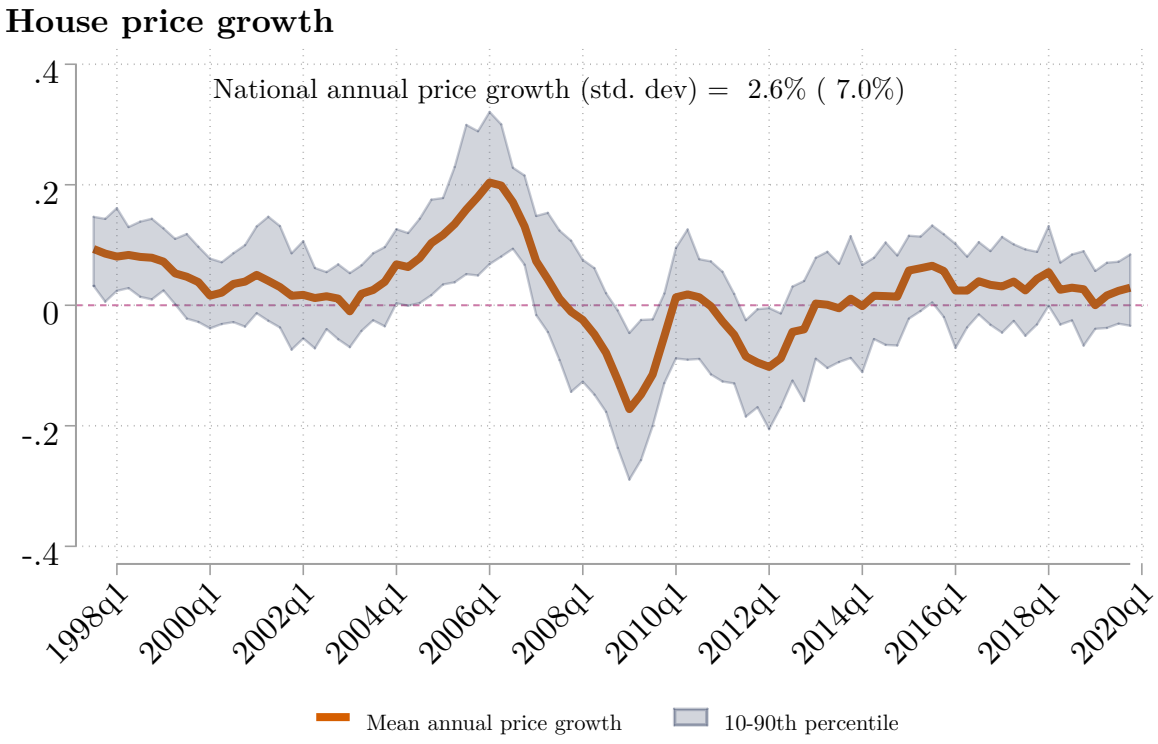


Figure 1: House price growth over time

Notes: The figure plots the growth rate in house prices and apartment prices over time.

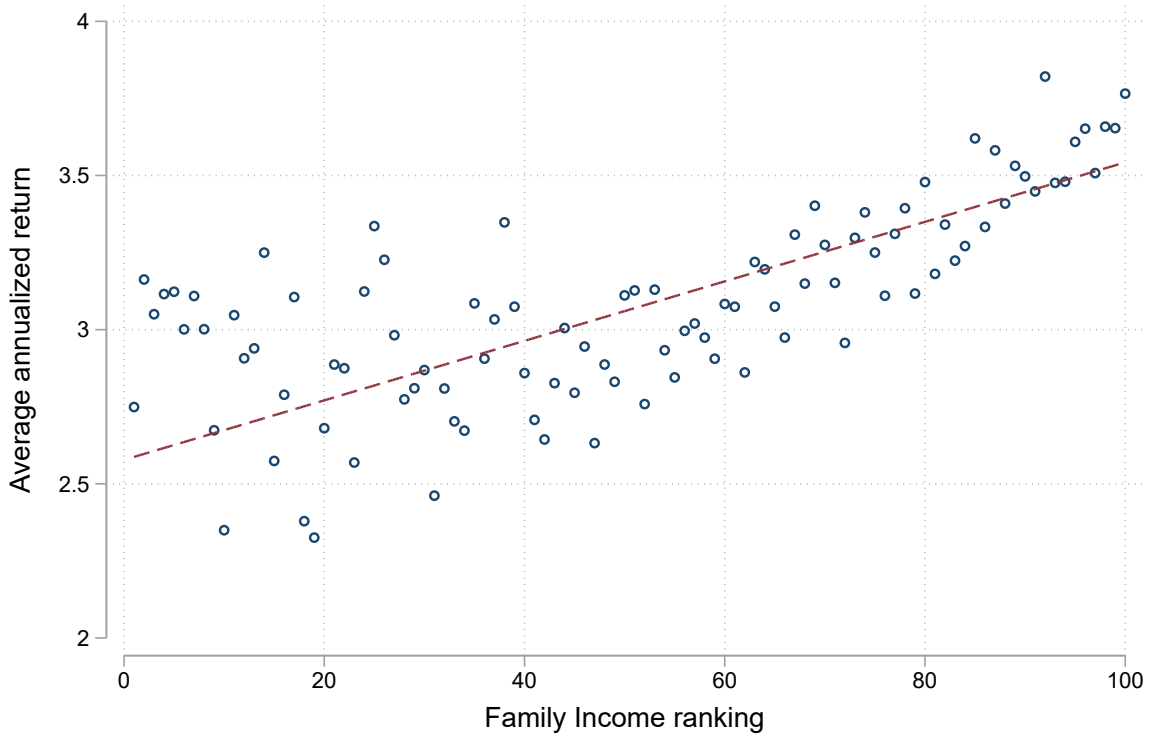


Figure 2: Return by income ranking

Notes: This figure plots the average annualized return by income ranking.

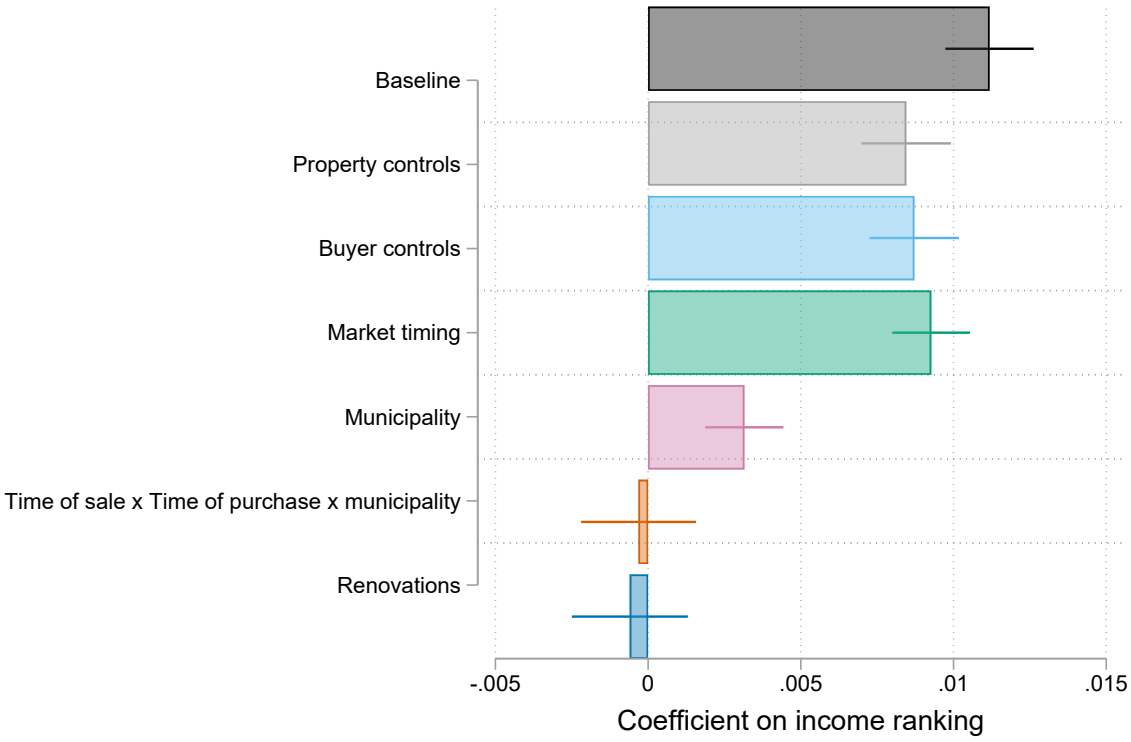


Figure 3: Coefficient on Income rank

Notes: The figure plots the coefficient on Income Rank for various specifications.

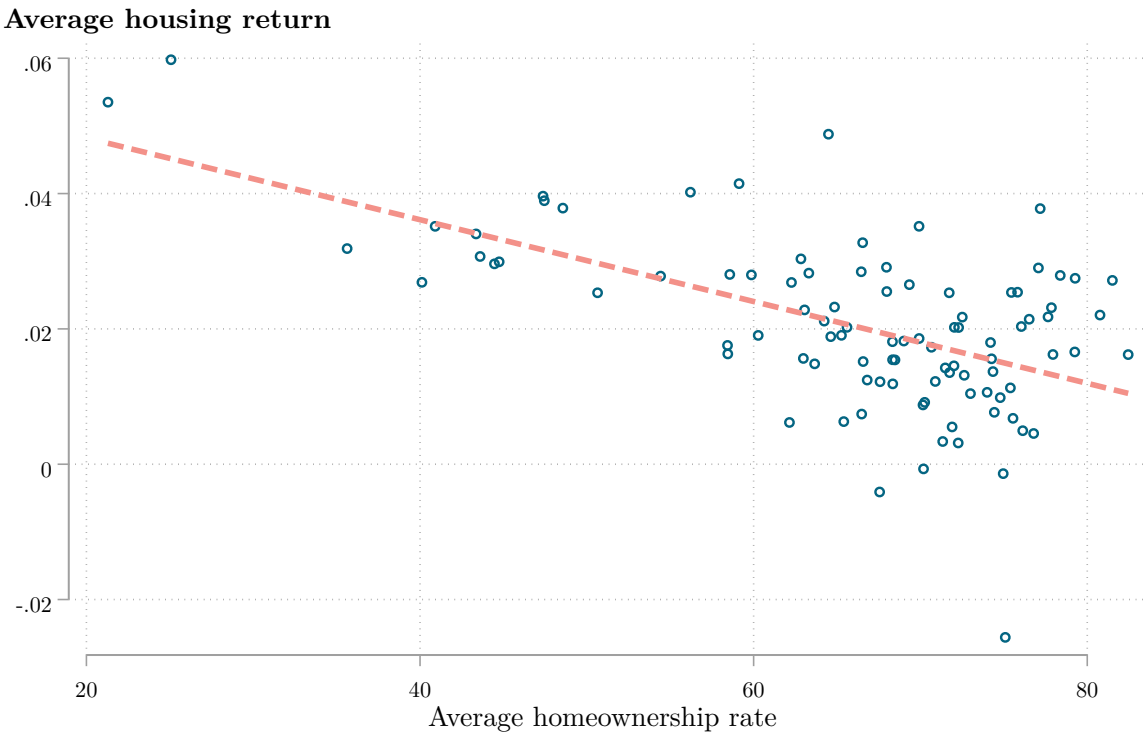
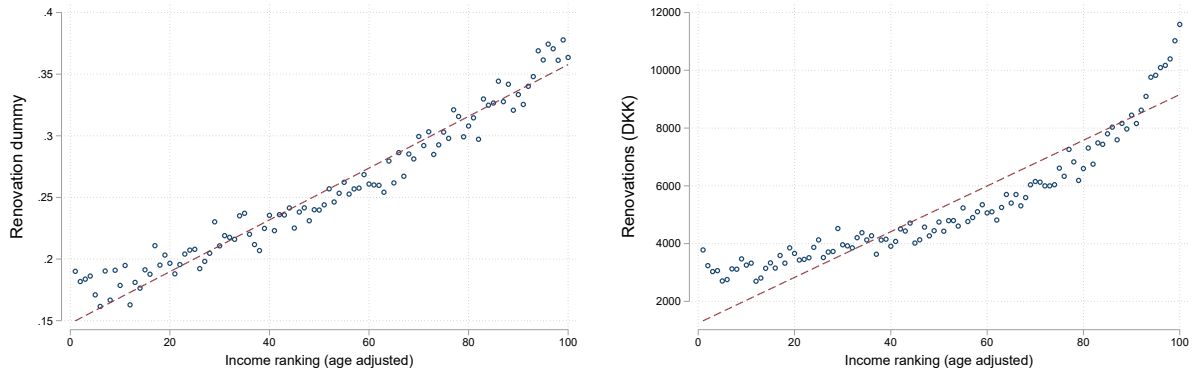


Figure 4: Homeownership and housing returns on the municipality level

Notes: The figure plots the average homeownership rate against average house price growth using municipality-level data. Returns are calculated as the average year-over-year percent change in the square meter price.



(a) Renovation Usage and Income Rank

(b) Renovation Amount and Income Rank

Figure 5: Renovations and Income Rank

Notes: These figures plot renovation usage and renovation amount by income rank.

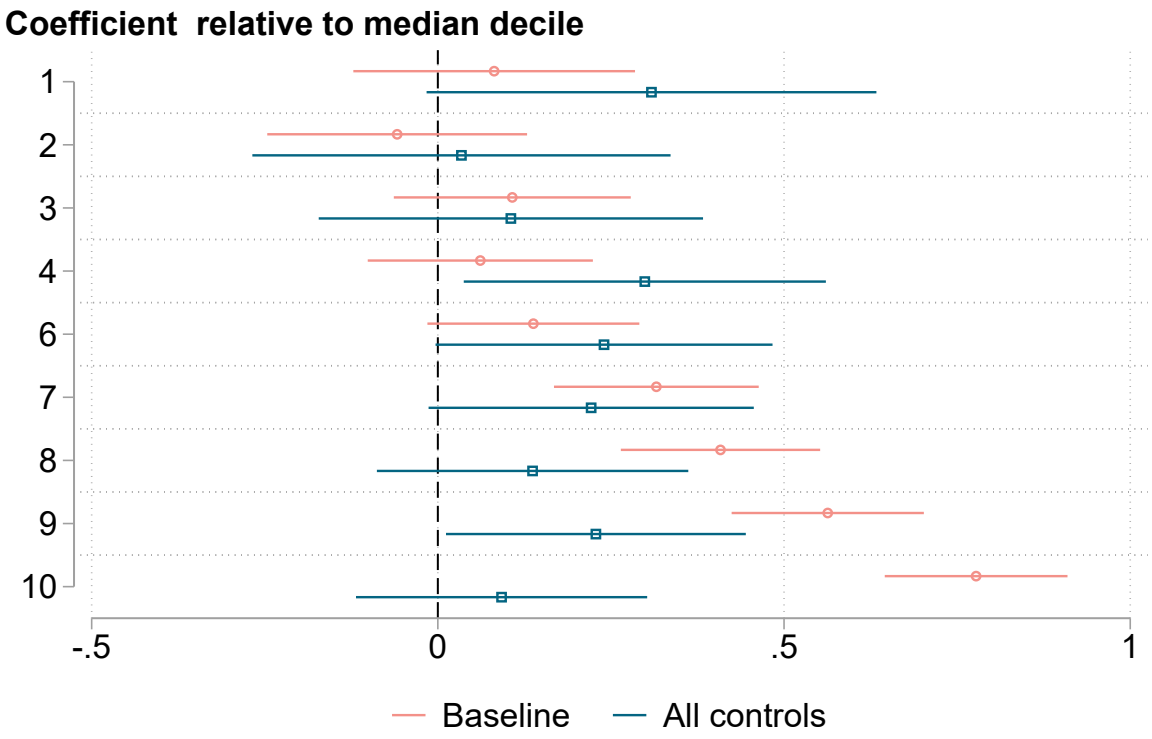


Figure 6: Non-linear effects, relative to median decile

Notes: The figure plots the coefficient for deciles of Income Rank, with and without control variables. The control variables are as the last row of Figure 3. Decile 5 is the excluded category.

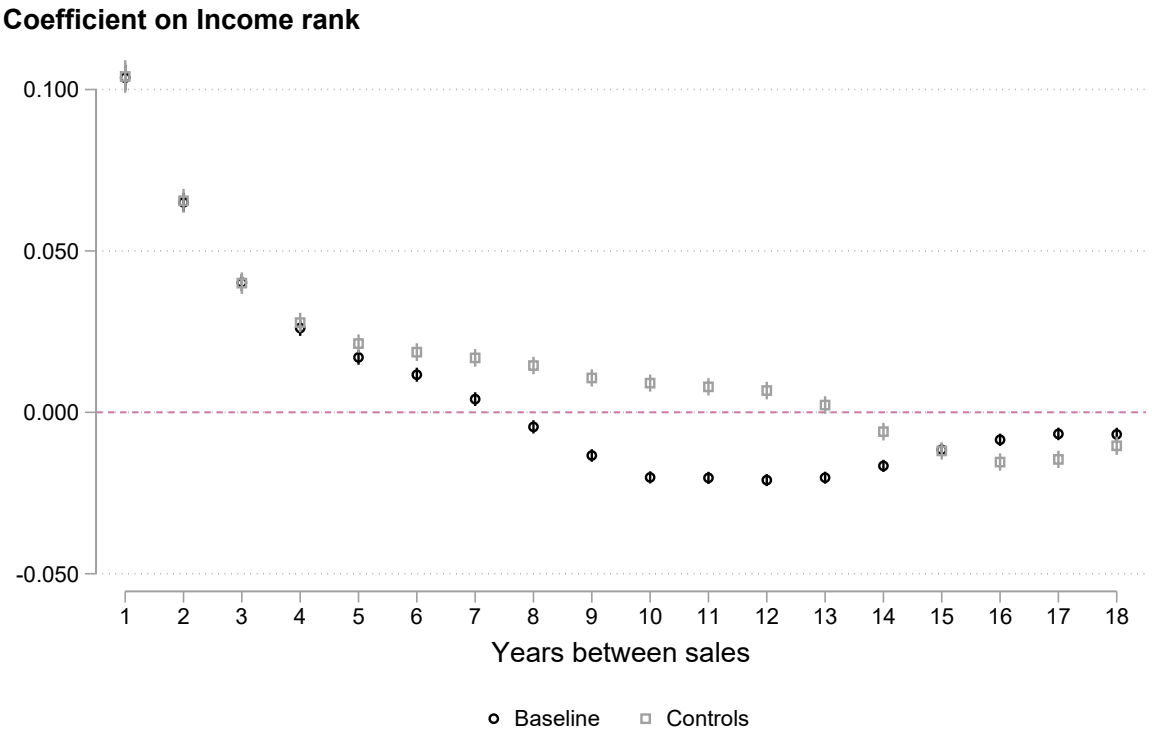


Figure 7: Coefficient on income rank by holding period

Notes: The figure plots the coefficient for income rank by holding period, with and without control variables. The control variables are as the last row of Figure 3. Decile 5 is the excluded category.

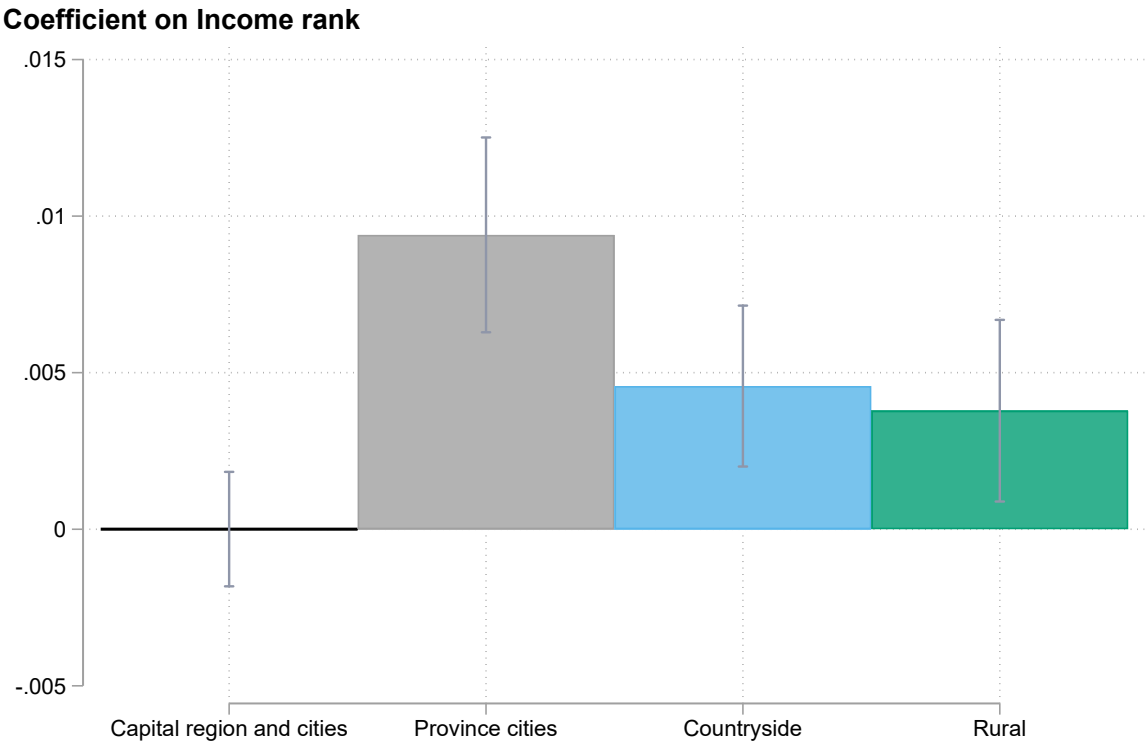
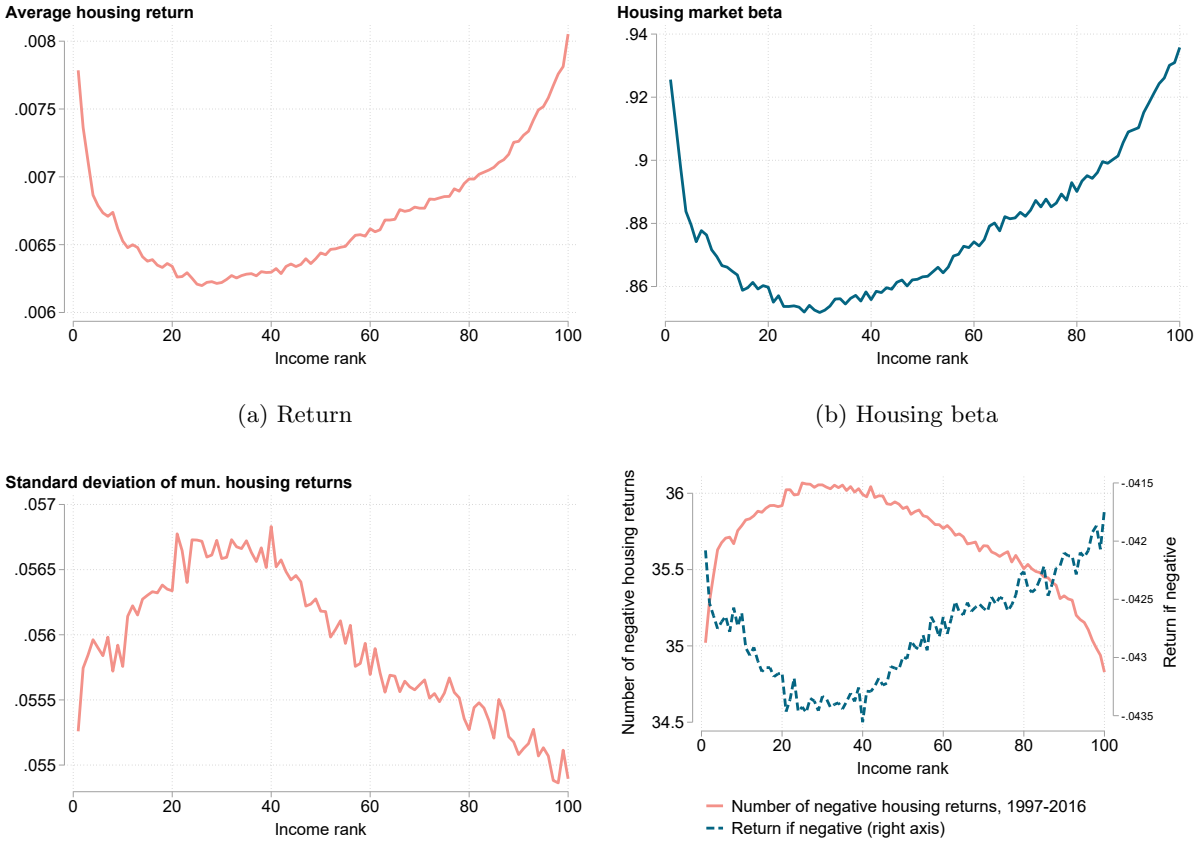


Figure 8: Coefficient on income rank by area

This figure plots the coefficient of income rank based on the location of the property, in the regressions that involve annualized returns as the dependent variable, and property characteristics and Purchase-Year Quarter × Sale-Year Quarter fixed effects as controls.

Figure 9: Risk and return in Danish housing markets

Notes:



(a) Return

(b) Housing beta

(c) Risk

(d) Downside risk

Figure 10: Municipality-level returns, risk and income rank

Notes:

8 Tables

Table 1: Descriptive statistics

	(1) All transactions	(2) Bottom	(3) Middle	(4) Top
Purchase price	1,273,311	993,748	1,091,781	1,497,219
	(894,686)	(651,683)	(621,821)	(1,054,919)
Sales price	1,516,851	1,135,509	1,261,328	1,827,508
	(1,192,206)	(834,024)	(798,489)	(1,419,778)
Purchase year	2003.554	2003.196	2003.473	2003.741
	(4.173)	(3.962)	(4.159)	(4.247)
Year between transactions	7.703	7.536	7.599	7.833
	(4.840)	(4.888)	(4.863)	(4.802)
Apartment indicator	0.277	0.227	0.218	0.335
	(0.448)	(0.419)	(0.413)	(0.472)
Capital	0.287	0.187	0.205	0.378
	(0.452)	(0.390)	(0.403)	(0.485)
City	0.130	0.116	0.125	0.138
	(0.336)	(0.320)	(0.331)	(0.344)
Countryside	0.222	0.223	0.247	0.205
	(0.416)	(0.416)	(0.431)	(0.404)
Province	0.162	0.182	0.187	0.138
	(0.368)	(0.386)	(0.390)	(0.345)
Rural	0.200	0.293	0.236	0.141
	(0.400)	(0.455)	(0.425)	(0.348)
Income (1000s DKK)	324.817	156.113	242.527	441.898
	(480.250)	(46.506)	(45.488)	(661.789)
Net wealth (1000s DKK)	411.796	257.857	188.348	616.814
	(2939.936)	(1211.577)	(794.572)	(4065.107)
Mortgage (1000s DKK)	549.088	365.388	403.596	713.562
	(1912.676)	(1229.975)	(870.758)	(2514.053)
Leverage	0.859	0.739	0.844	0.914
	(0.552)	(0.529)	(0.502)	(0.583)
Renovation indicator	0.279	0.197	0.247	0.331
	(0.449)	(0.398)	(0.431)	(0.471)
Renovation amount (DKK)	6199.827	3549.969	4719.570	8163.070
	(1.5e+04)	(1.0e+04)	(1.2e+04)	(1.7e+04)
Age	41.531	42.693	40.180	41.994
	(12.184)	(13.432)	(11.522)	(12.043)
Share of all transactions		0.183	0.326	0.492
N	255,299	46,614	83,107	125,578

Notes: This table presents the summary statistics for the final estimation sample.

Table 2: Returns and Income Ranking

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income rank (age adjusted)	0.0112***	0.00845***	0.00872***	0.00927***	0.000898	-0.000313	-0.000597
	(15.16)	(11.30)	(11.66)	(14.27)	(1.37)	(-0.33)	(-0.62)
Apartment indicator		0.519***	0.209***	-0.400***	-1.169***	-1.244***	-1.240***
		(7.89)	(3.18)	(-7.09)	(-20.53)	(-14.37)	(-14.32)
Floor number		0.249***	0.275***	0.345***	0.0304**	0.0879***	0.0878***
		(16.07)	(17.73)	(26.00)	(2.29)	(4.82)	(4.82)
Rooms		0.119***	0.124***	0.0859***	0.0491**	0.0406	0.0401
		(5.03)	(5.29)	(4.25)	(2.47)	(1.26)	(1.24)
Size M2		-0.00955***	-0.00611***	-0.00283***	0.000934	0.00206*	0.00209*
		(-12.00)	(-7.73)	(-4.08)	(1.34)	(1.85)	(1.89)
Building age		0.0111***	0.00990***	0.0113***	0.00938***	0.0110***	0.0110***
		(19.42)	(17.55)	(22.61)	(17.82)	(14.47)	(14.38)
Age			-0.0653***	-0.0433***	-0.0281***	-0.0295***	-0.0296***
			(-41.10)	(-31.49)	(-20.34)	(-13.95)	(-14.02)
Net wealth ranking (age adjusted)			-0.00725***	0.000256	-0.00240***	-0.00120	-0.00130
			(-10.60)	(0.43)	(-4.03)	(-1.39)	(-1.50)
Renovation indicator							0.192***
							(4.10)
Year between transactions	No	No	No	Yes	Yes	Yes	Yes
PurchaseTime	No	No	No	Yes	No	No	No
SaleTime	No	No	No	Yes	No	No	No
PurchaseTime x Mun.	No	No	No	No	Yes	No	No
SaleTime x Mun.	No	No	No	No	Yes	No	No
SalesTime x PurchaseTime x Mun.	No	No	No	No	No	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes	Yes
Economic significance	0.011	0.008	0.009	0.009	0.001	0.001	
Cumulative difference	0.093	0.070	0.072	0.077	0.007	-0.005	
R-squared	0.00135	0.0148	0.0358	0.269	0.404	0.578	0.578
N	174758	174758	174758	174758	174758	108576	108576

Notes: This table presents the regression results that relate returns and income ranking.