

Macroprudential measures, household leverage and tenure choice*

Background report for the Finnish Economic Policy Council

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1 Introduction

Over the past ten years, many countries have introduced a wide range of different types of macroprudential policies affecting housing markets. One way to classify the measures is to think about the mechanisms through which they are expected to operate in the housing market. In principle, one could divide the measures in those that influence the banks' ability to supply credit and those that affect the demand for credit. The latter measures work through their effects on households' budget constraints. Therefore, their aggregate effects should depend on the extent that households are credit constrained.¹

The main rationale for these measures is related to financial stability. By reducing how much people can borrow relative to their income or how much collateral to put forth, macroprudential measures restrain household leverage thereby improving households' ability to service debt, deal with adverse shocks or otherwise prevent default. Consequently,

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¹On the use of different types of supply and demand measures especially after the financial crisis, see e. g. Cavalleri et al. (2019).

such measures contribute to both the resilience of the credit market and the aggregate economy. It is important to note that through the labour market, the construction and financial sector, house prices and economic cycles are closely linked. Moreover, rising house prices can boost consumption through wealth effects as households' collateral values increase.² Inversely, when house prices drop, a negative wealth effect can lead households to reduce consumption. As such, house price fluctuations can either trigger or amplify economic shocks. Macroprudential measures therefore can help restrain the build-up of systemic risks and maintain financial stability by reducing household leverage or moderating house price fluctuations.

However, while targeted at reducing aggregate risks, the measures are likely to have direct efficiency and distributional effects. The potential negative welfare effects for households come in the form of reduced possibilities to smooth consumption over the life cycle, reduced transition from renting to owner-housing and redistribution of wealth. The quantitative importance of these effects depends on the tax system: For instance, in countries with sizable advantages for owner-housing the effects on wealth distribution are likely larger.

To date, most research on the effects of macroprudential measures in the housing market is focusing on aggregate outcomes like house price development and credit stock using cross-country comparisons. Quite little is known about the distributional effects of the reforms as well as the geographic incidence of the reforms. When analysing these effects, it is useful to take a longer perspective to understand the general trends in household indebtedness and to examine the impact of the measures also through the lens of the literature on household tenure choice, which pays particular attention to socio-economic, demographic and geographic determinants of tenure over the life cycle.

In this paper, we use population wide individual level data to describe the development of housing tenure choices and household debt during recent decades in Finland, and to analyse the effects of policy measures designed to constrain household leverage.

Besides the overall development of tenure choices and indebtedness, we focus specifically on first-time buyers and young households. We will also analyse the geographic distribution of leverage. This is potentially important as the differences in local housing market conditions largely determine how risky household indebtedness is. High leverage relative to disposable income is especially problematic when house prices are high and volatile. Even a small negative house price shock causes a large decline in household net wealth.

We study two policies directed at influencing the demand for housing credit in Finland.

²See e.g. Cloyne et al. (2019) and the references therein.

First, we analyse the introduction of a loan-to-collateral (LTC) limit in Finland in 2016. We analyse the effects of the LTC limit on loan-to-value (LTV) ratios by comparing LTV distributions before and after the reform. In addition, we analyse the effects of the reform on debt-to-income (DTI) ratios using a simple before-after regression analysis. We find clear evidence that the LTC limit constrained LTV ratios of apartment buyers, but this effect seems weaker among high-income households. Examining debt-to-income ratios instead, we find no evidence that the reform led to a decrease in leverage relative to income, particularly not for apartment buyers. These contrasting findings can be reconciled by the fact that the regulation was tied to property prices (through the collateral) and the observation that prices for apartments have been increasing strongly which allowed for more borrowing within the scope of the regulation but simultaneously drove up debt relative to income.

Second, we discuss the potential effects of a recent proposal to limit debt-to-income (DTI) ratios at 4.5 times household gross income. Our findings suggest that especially in more recent years, this measure would be most binding for young, single and highly educated first-time buyers in (inner) urban areas. The highly leveraged households also tend to have lower income levels but stronger income growth in years following the borrowing than other first-time buyers. Note however that banks would be exempt from this rule for 15% of their quarterly lending volume which should limit the potentially negative impact of the reform on first-time buyers actually able to service the loan.

Although both LTV limits and DTI or debt-service-to-income (DSTI) limits influence the demand for housing credit through the household budget constraint, they are likely to affect different types of households and have different aggregate effects depending on the housing market condition. For instance, rising house prices can mitigate the effects of LTC or LTV limits and current household income level and interest rates are decisive when assessing the effectiveness of DTI and DSTI limits.³

The structure of the report is as follows: In Section 2 we discuss and assess related literature. In Section 3, we present the institutional context and in Section 4 our data. Section 5 presents the descriptive analysis on the recent development regarding home-ownership and housing debt. Section 6 presents the results on the reform analysis and Section 7 concludes.

³For a discussion on the mechanisms see, e.g. Kuttner and Shim (2016).

2 Related literature

In this section, we first review empirical literature evaluating macroprudential measures aimed at reducing household borrowing. We focus on studies using micro data and with research designs allowing for causal inference.⁴ Second, we discuss the broader literature studying household tenure choices and housing consumption choices over the life cycle. This is a very large literature and we will focus on studies that seem relevant when thinking about the effects of borrowing constraints or credit conditions more generally.⁵

van Bakkum et al. (2019) study the effects of a loan-to-value (LTV) limit in the Netherlands using household data and show that the LTV limit reduced mortgage leverage ratios and debt servicing cost among the affected homebuyers. They also conclude that the LTV limit reduced household liquidity in the short-run, led to fewer defaults and reduced transitions from rental housing to owner-housing. This reduction was largest for the most financially-constrained households. Carozzi (2019) studies the drop in house prices and transaction volumes in 2008-2009 in the UK and its link with the tightening credit conditions. He also finds that especially transactions of cheaper housing units decreased markedly during the financial crisis. Tightening credit conditions is a likely explanation for this change. These results suggest that the LTV limit may have important distributional effects and thereby long-run consequences on wealth distribution. Most closely aligned with the Finnish setting, Aastveit et al. (2020) analyse the impact of LTV limits on household leverage using Norwegian linked micro data on real estate transactions, household debt and financial wealth. The introduction of the LTV limit of 90% in 2010 and a further reduction to 85% in 2012 led to a clearly visible bunching in the LTV distribution below the limit, and quantitative estimates indicate a reduction in leverage both at the extensive and intensive margins. Moreover, the authors find evidence that constrained household reduced their liquid assets to meet the LTV limit. This effect persisted in the years following the house purchase.

Our study is also related to the large literature studying household tenure choices. Main questions of interest in this literature include (i) what factors explain the life cycle profile of homeownership, (ii) what are the reasons for changes in the homeownership rate of young adults and (iii) what are the welfare effects of different policies affecting housing tenure choices over the life cycle. The literature has explored several explanations like

⁴Previous studies on the relationship between macroprudential measures and housing market development are mostly cross-country comparisons of outcomes like house price appreciation or credit growth (see, e.g. Morgan et al. (2019) for a review.)

⁵See Piazzesi and Schneider (2016) for a more general survey on home ownership and consumption over the life cycle.

borrowing constraints, tax treatment of owner-housing relative to renting, illiquidity of housing as an asset combined with uncertain labour income, mobility and riskiness of owner-housing relative to renting. These analyses are important also from the macroprudential point of view as they are able to shed light on the direct effects of introducing different measures.

For instance, Halket and Vasudev (2014) offer an interesting analysis with labour income uncertainty, location and tenure choice. They build a life-cycle housing choices model and conduct counterfactual experiments to evaluate the relative impact of different factors affecting the tenure choice. The model economy consists of islands characterized by productivity differences and households that i) face uninsurable earnings shocks, ii) are able to locate to another island at a cost and iii) live in rental or owner-housing. In equilibrium, in each location, the price of housing depends on the location's productivity.

The authors show that borrowing constraints are important along the intensive margin; if down payment constraints are relaxed first-time buyers buy larger houses rather than buy earlier in their life cycle. Moreover, strict down payment requirements induce households to choose locations with lower house prices and reduce house price dispersion across locations. The inability to borrow against future earnings reduces the desire of young high ability households to move to expensive locations. When borrowing constraints are relaxed, more young households want to live in productive locations which pushes up the price of housing in those locations and decreases the price in low productivity locations.

Acharya et al. (2020) find evidence consistent with Halket and Vasudev (2014) when studying house prices and mortgage credit development after an introduction of LTV and DTI limits in Ireland in 2015. They show that after the reform mortgage credit is reallocated from low-income to high-income borrowers and from urban (hot housing market areas) to rural (cooling housing market areas) counties. This reallocation weakens the feedback loop between credit and house prices and slows down house price growth in hot housing markets.

In the literature, special attention has been paid to the tenure decision of young households. Presumably, one reason for this has been the increasing house prices in large cities combined with uncertain income development which may affect transitions from renting to owning. Young adults are typically first-time buyers with sizable mortgages relative to house value when acquiring their housing. They are probably also the group most affected by macroprudential measures aimed at reducing household leverage. For instance, Nielsen and Jensen (2011) show that homeownership has been declining among the young households in Denmark. They look at the share of 35-39 year old households owning their housing between 1985-2005. During this period the overall share declines

from roughly 60% to 50%. When dividing the households into income quartiles, the authors conclude that the drop is mainly driven by the lowest quartile (55% to 20%). In the discussion immigration is put forward as one potential explanation. Ma and Zubairy (2019) show that in the US the share of owners among the young was increasing up until 2005 but has been decreasing after the financial crisis. Lennartz et al. (2015) study the shifts in the living arrangements of young adults in 15 EU countries after the financial crisis using EU-SILC data. The authors compare the situation in 2007 and 2011 (before and after crisis) and conclude that in many countries ownership rates go down, but renting does not become more popular indicating that a bigger share of young adults live in co-residence with their parents.

On the modelling side, Fisher and Gervais (2011) use an equilibrium life-cycle model calibrated to study the declining homeownership rate among the 25-to-44-year-old households between 1980-2000 in the US. They argue that the trend toward marrying later mechanically lowers young homeownership rate after 1980. The rise in earnings risk that occurred after 1980 is shown to be able to account for the remaining decline in young homeownership. Mnasri (2015) looks at the interaction of borrowing constraints, geographic mobility and earnings risks and assesses their effect separately on the tenure decisions of young, middle-aged and old households. A tighter borrowing constraint affects mostly old households who are not very mobile and do not face income risk anymore (pensioners). Geographic mobility dominates for young households: low homeownership rate is mainly driven by mobility, not by borrowing constraints. Reduced mobility in the US also largely explains the increasing homeownership rate among the young households. Earnings risk affects mostly the middle-aged; their homeownership rate goes down if earnings risk increases.⁶

Sommer et al. (2013) do not focus explicitly on young households but combine in an interesting manner the markets for owner-housing and rental housing. In the model, households derive utility from non-housing consumption and housing that is obtained either by renting or owner-housing. Households face idiosyncratic income shocks and make joint decisions on housing and non-housing consumption as well as other savings. The authors compare the effects of exogenous changes in interest rates and borrowing constraints on equilibrium house prices, rents and tenure choices. In the model economy, changes in borrowing constraints influence homeownership rate but seem to have only a small effect on house prices, because the resulting housing market responses are mostly driven by low-income, low-saving households. However, lower interest rates reduce the

⁶The calibrated model analyses discussed here are steady state analyses and are therefore silent about the transitional effects of potential policy changes.

cost of household borrowing and reduce the rate of return on savings for all households who own their house. Therefore, lower interest rates increase the demand for housing services due to the lower opportunity cost and to the lower costs of financing a mortgage. As a result, house prices rise, which pushes out some of the less wealthy households from the owner-housing market.

Finally, young adults' tenure decisions are likely to depend on tenure, wealth or other characteristics of their parents. There are several important aspects to this ranging from social mobility to wealth concentration. From the macroprudential policy point of view an important question is whether policies that limit the possibility to borrow against future labour income affect especially young adults with wealth-poor parents. We are not aware of any studies on this issue specifically in the context of macroprudential policies. But more generally, there is a large literature studying, for instance, the association of parental wealth and homeownership on young adults' tenure choices. For instance, for Sweden there is evidence suggesting that parents' homeownership has become more important in predicting transitions to first-time homeownership for young adults (see Enström Öst (2012)).

In summary, the existing empirical studies focusing on macroprudential measures and using household level data show that LTV limits reduce mortgage leverage and that the affected households reduce their liquid assets to meet the credit constraint. The limits also change the composition of buyers as they affect people differently depending on a range of correlated factors including age, education, location, wealth and earnings (risk). These studies do not assess the potential effects on migration from one labour market area to another and are thereby silent on outcomes like aggregate employment and productivity. Also, the studies are not designed to directly answer the question how useful these measures have been in reducing the aggregate risks.

Given the wave of various macroprudential measures implemented especially after the financial crisis, the trend of lower ownership rates among young households may be explained by tightening credit conditions. However, based on the empirical and theoretical literature on tenure choice over the life cycle, there are also other changes (especially geographic mobility, earnings risks and family formation, house price appreciation in growing cities) that strongly influence the importance of credit constraints. The theoretical analyses incorporating both tenure choice decisions and location decisions between labour market areas, further suggest that credit conditions and more generally the cost of borrowing, influence both migration and tenure choice.

3 Background

3.1 Institutional setting

The share of Finnish households living in owner-occupied housing has been slightly decreasing during the recent decades but still more than 60% of households own their housing. The importance of owner-housing varies somewhat geographically. Owner-housing is most common in rural areas and small towns.⁷

The most common alternative to owner-housing is renting. The Finnish rental market can be divided into the private rental market and social housing.⁸ In the private rental market, roughly half of the rental units are owned by large institutional landlords. The other half are owned by private individuals.

Housing is also the single most important form of wealth for Finnish households. In 2016, according to the Statistics Finland Wealth Survey, roughly 50% of net wealth of the households was in the form of owner-housing (principal residence), 6% in secondary houses and 10% in other real estate.

In the analysis, we will distinguish between properties (or detached houses) and housing units in housing co-operatives. In Finland, residential buildings with multiple housing units are housing co-operatives that own the building (or sometimes multiple buildings on the same lot) and often also the lot under the building. Owning the shares to a specific housing unit implies owning the unit. In the case of properties, the ownership structure is simpler: one directly owns the structure and typically also the lot under the structure.

The co-operatives have often outstanding loans obtained during the construction of the building or at some later stage for renovation. The housing co-operative loan is linked to the shares of each apartment. The loan is formally a debt of a housing co-operative, but in practice the repayment of a housing co-operative loan is a joint responsibility of the shareholders.

Until 2012, the mortgage interest payments were fully tax deductible at the capital income tax rate.⁹ Since 2012, the degree of tax deductibility has been gradually reduced. In 2020, 15% of the interest payments was deductible. Owner-housing is not subject to capital gains taxation, if the unit has been the permanent residence of the owner

⁷In the capital city of Helsinki the share of owner-occupiers is slightly less than 50%.

⁸In the social housing sector, rents and tenant selection are regulated. The housing units are owned by municipalities and non-profit organizations that are not subject to regular capital income taxation.

⁹In 2021, capital income is subject to a 30% tax rate and 34% if taxable income exceeds an annual threshold of 30,000 euros. The tax rate has been slightly increasing during the recent decades, and progressivity was introduced in 2012.

for at least two years. Otherwise the regular capital income tax applies. In addition, transactions are subject to a housing transfer tax which is either 2% or 4% depending on the type of the housing unit. Imputed rent of owner-housing is not taxed.

Household indebtedness has increased in Finland during the 2000's. The share of households with a mortgage has however remained relatively constant at roughly one third of all households. Roughly half of the households living in owner-housing hold a mortgage. In 2019, the average mortgage size was roughly 102,000 euros which is double the size of the average mortgage in the early 2000's. Due to decreasing interest rates, however, the overall housing interest payments were nevertheless some 44% lower than in 2002 (Statistics Finland, 2020).

At the same time, the structure of the housing-related debt has changed. The share of housing co-operative loans has risen from less than 7% in the early 2000's to about 15% (Putkuri, 2020).

Despite rapid increase in household indebtedness, there have been no significant credit losses on mortgages. Extending mortgages have made debt management easier, but on the other hand, slowdown in repayment is likely to contribute to increased indebtedness (Putkuri, 2020).

According to the Bank of Finland, credit losses on household loans, especially consumer loans, have increased between August 2018 and July 2019. Most of the losses are related to unsecured consumer loans and credit card loans. In general, the annual amount of credit losses on secured consumer loans and mortgages has not exceeded 0.05% of the overall loan portfolio since 2010 (Bank of Finland, 2019).

Financial markets are regulated by the Financial Supervisory Authority (FSA). Before 2016 the FSA steered mortgage lending only through recommendations.¹⁰ This changed in July 2016 when the FSA introduced a loan-to-collateral (LTC) limit for housing debt (including debt held by the housing co-operative). The LTC limit was initially 90% or 95% for first-time buyers. The FSA has authority to tighten the limits by 10%-points. In July 2018, the limit for other than first-time buyers was lowered to 85% and in July 2020 it was raised back to 90%.

The LTC limit has been seen as inadequate because it does not set requirements for solvency and the committee report by the Ministry of Finance (2019) proposed the following additional restrictions for household borrowing:

- Debt-to-income ratio (DTI) limit of 450% of gross-income (including loan held by

¹⁰For example in 2010, the FSA recommended a maturity limit of 25 years and the use of hypothetical 6% interest to assess solvency

the housing co-operative). Banks can depart from this rule in 15% of their lending each quarter.

- Maturity limit of 25 years. Longer maturities are allowed for 10% of lending each quarter.

In addition the committee proposed the following limits to debt held by housing co-operatives (new construction)

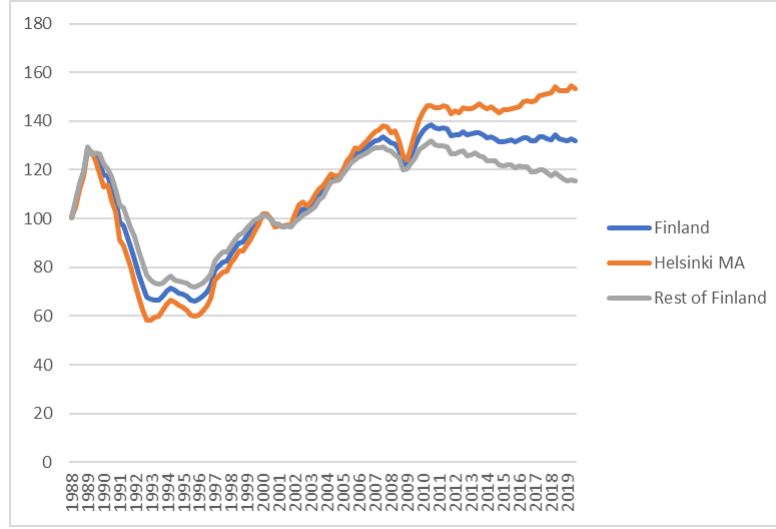
- Housing co-operative debt should not exceed 60% of the purchase price of apartment (free of debt)
- Maturity limit of 25 years, but longer maturities allowed in 10% of loans each quarter
- Loan terms should include regular instalments for the first five years since completion (i.e. no interest-only period)

Figures 1 and 2 show the real price development in the Helsinki Metropolitan Area and the rest of Finland for resales of apartments in multi-storey buildings and for resales of detached houses. As the figures show, Finland has experienced very large price fluctuations especially in the 1990's. Until mid-1980s, loan volumes were controlled which resulted in very tight household credit rationing. Bank lending to households was gradually liberalized in the late 1980's. This led to a rapid relaxation of household borrowing constraints and induced a rapid growth of household credit (Vihriälä, 2005). The consecutive housing market bust coincided with the depression of the early 1990's.

In the 2000's the development has been more stable than in many other European countries and the US. Regional price divergence has increased especially when looking at apartments (Figure 1). In real terms, resale prices of apartments have been increasing in Helsinki Metropolitan Area and decreasing in the rest of Finland. House prices in turn have been slightly decreasing also in large cities (Figure 2).¹¹

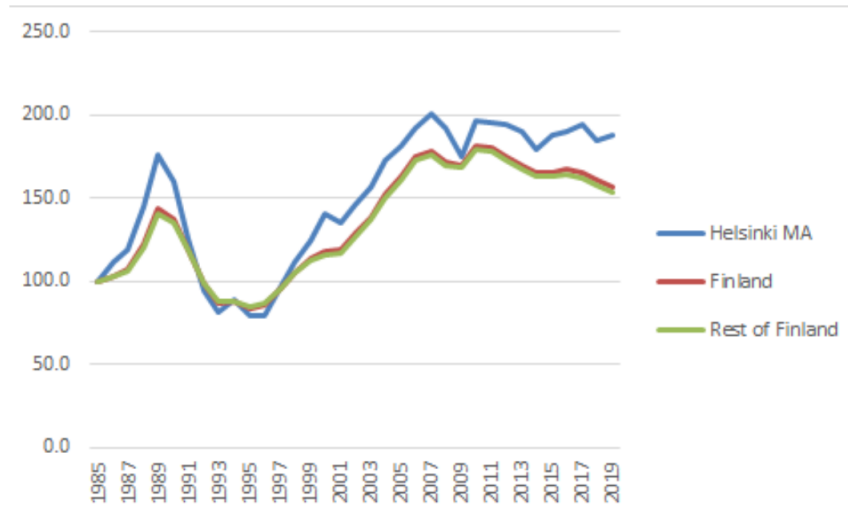
¹¹Eerola et al. (2020) analyse in more detail the regional divergence of housing prices after the financial crisis.

Figure 1: Real prices - apartments, 1988/1-2019/3.



Notes: Dwelling resales in apartment buildings. Helsinki MA consists of four cities (Helsinki, Espoo, Vantaa and Kauniainen). Quarterly data. 2000=100. Source: Statistics Finland.

Figure 2: Real prices - houses, 1985-2019.



Notes: Resales of detached houses. Helsinki MA consists of four cities (Helsinki, Espoo, Vantaa and Kauniainen). Annual data. 1985=100. Source: Statistics Finland.

The average time on the market has also been quite volatile. Díaz and Jerez (2013) and Ngai and Sheedy (2017) report similar evidence for the US and the UK, respectively. Finnish data also suggest that changes in the average time on the market are closely related to changes in household credit conditions (Eerola and Määttänen, 2018).

4 Data

We use register data from Statistics Finland on the total Finnish population combined with register data on the universe of housing loans as well as data on transactions of apartments (that is, dwellings in housing co-operatives). The data cover years 2002–2018. The household data contain a rich set of socio-economic characteristics and housing characteristics, including the location of the housing unit. The housing co-operative loans are included in the analysis in Section 6. Otherwise they are only included when explicitly mentioned, the main reason being that we only have this data since 2006. In Appendix A.1 we provide an overview of the datasets used, references to their source and detailed definitions of the main variables we examine.

For each transaction, the transaction data contain the personal identification code of the buyer(s) which enables us to link the transaction data to the household data. The data also contain exact timing of the transaction. We identify first-time buyers by using leverage and tenure information in the household data. More specifically, we classify a household as a first-time buyer if the household head has become homeowner, has no mortgage debt history and had been renting for the past two years. We look back only two years because tenure status is defined not at the individual but at the dwelling level and at some point before becoming homeowners, these individuals may have been part of a household that held mortgage debt (young adults living with parents). We do not separately look at buy-to-let investors, because our data do not allow us to accurately identify them.

We focus on households in dwellings with only one household. Some dwellings are inhabited by individuals that do not constitute a household and others by multiple households or a combination of the two. Since we cannot easily distinguish how much debt or income exists at the household-level, we leave these dwellings out of our sample.¹² For all households in our sample, we aggregate debt and gross income at the household level. We use the characteristics of the household head (age, education level, socio-economic status) when analysing leverage and tenure choice by socio-economic groups. Although our data include a rich set of socio-economic characteristics, we are not able to link parents to adult children. This means that we are not able to study the relationship between, for instance, parents' tenure or wealth and their children's tenure choices. In fact, we have no comprehensive data on wealth, so we cannot examine the role of available collateral other than that produced by the purchase of a house. Finally, following other studies and the regulations they examine, we measure debt to income ratios as debt relative to *gross*

¹²We discuss the restriction in more detail in Appendix A.2.

income which includes transfers and income generated from labor or property.

Geographic differences are potentially important notably as house price development varies from one housing market area to another but also because household income levels tend to differ between densely populated urban areas and small towns and rural areas. Geographic differences partly reflect also differences in age structure and household composition. Household age is important in its own right, because housing consumption and tenure choices are strongly connected to the life cycle of the individuals.

It is not straightforward to draw geographic boundaries to a housing market area. In reporting the results, we will employ the Urban-rural classification by the Finnish Environment Institute SYKE, which is implemented using a nationwide 250 x 250 m grid of cells. Each cell is classified into one of seven categories according to the following criteria:

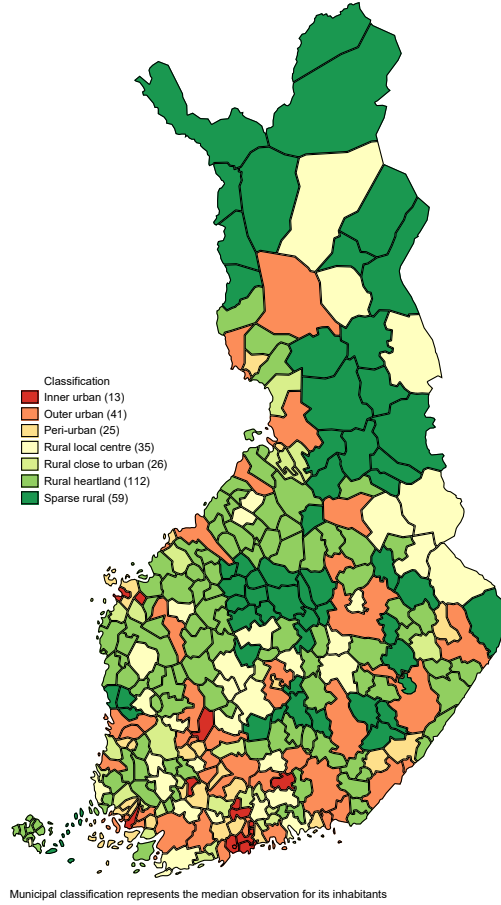
Urban areas are population centres of agglomerations with more than 15 000 residents. *Inner urban areas* are compact and densely built areas with continuous development, *outer urban areas* are dense urban areas extending from the boundary of the inner urban area to the outer edge of the continuous built area, and *peri-urban areas* are part of the intermediate zone between urban and rural, which is directly linked to an urban area.

Rural areas are in turn divided into *local population centres* outside urban areas, *rural areas close to urban areas* (areas with a rural character that are functionally connected and close to urban areas), *rural heartland* areas (rural areas with intensive land use, with a relatively dense population and a diverse economic structure at the local level) and *sparsely populated rural areas* (sparsely populated areas with dispersed small settlements that are located at a distance from each other with most of the land areas are forested).

The classification does not follow administrative borders. However, in order to visualize the division, Figure 3 shows the division at the municipality level by assigning each municipality to a category based on the median resident's location.

Figure 3: Rural-urban classification by municipality in year 2019

Urban-rural classification of municipalities



When analysing the distribution of ownership and debt by household characteristics, we divide the households into four age and disposable income groups. When allocating the households into age quartiles, we use the age of the household head. When allocating the households into income quartiles, we adjust for household size in order to take into account economies of scale in consumption.¹³ In both cases, all quartiles consist of the same number of households, not individuals in the households. That is, if household size varies systematically with age or income, the number of individuals may vary from one quartile to the other.

¹³This adjustment is made using the OECD's adjusted consumption unit scale.

5 Development of homeownership and leverage

In this section, we review the housing market development, including housing loans during the early 2000s.

5.1 Homeownership rate

We first focus on the homeownership rate. We start with a breakdown of the tenure status in Figure 4. The upper panel shows the share of households owning a house, an apartment (that is, shares in a housing co-operative) and renters. Clearly, the share of households owning an apartment or a house has been decreasing while the share of renters has been increasing.

There are large differences between income and age groups. Figures A5 and A6 in the Appendix show that the ownership rate has been decreasing especially among the young and the low-income households.

The lower panel shows the share of first-time buyers relative to all households. For first-time buyers, transitions to apartments are much more likely than transitions to houses, but there is also a clear reduction in these transitions especially during the last five years.

Figure 4: Homeownership rate and renting over time.

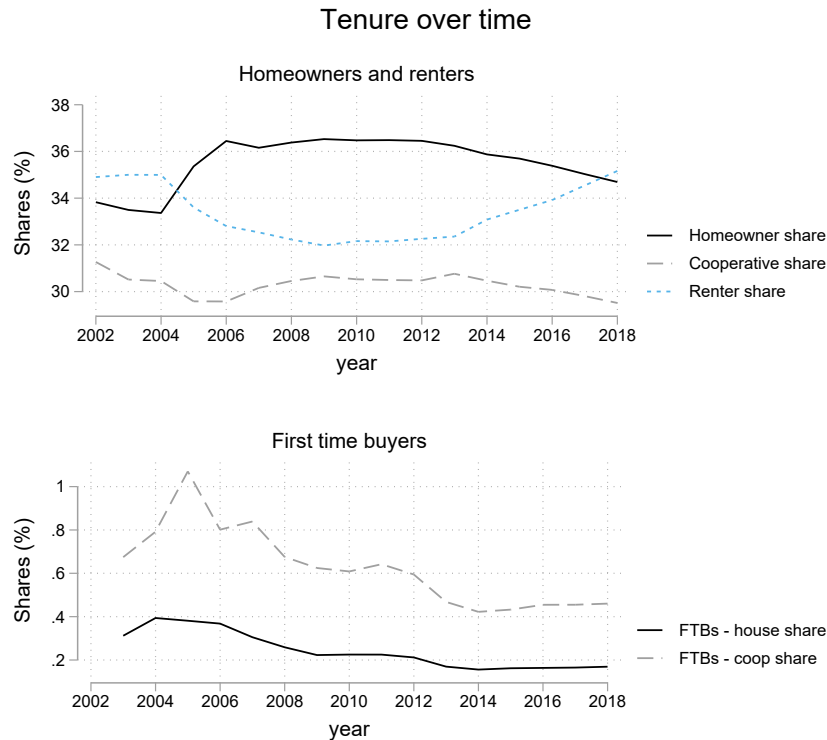
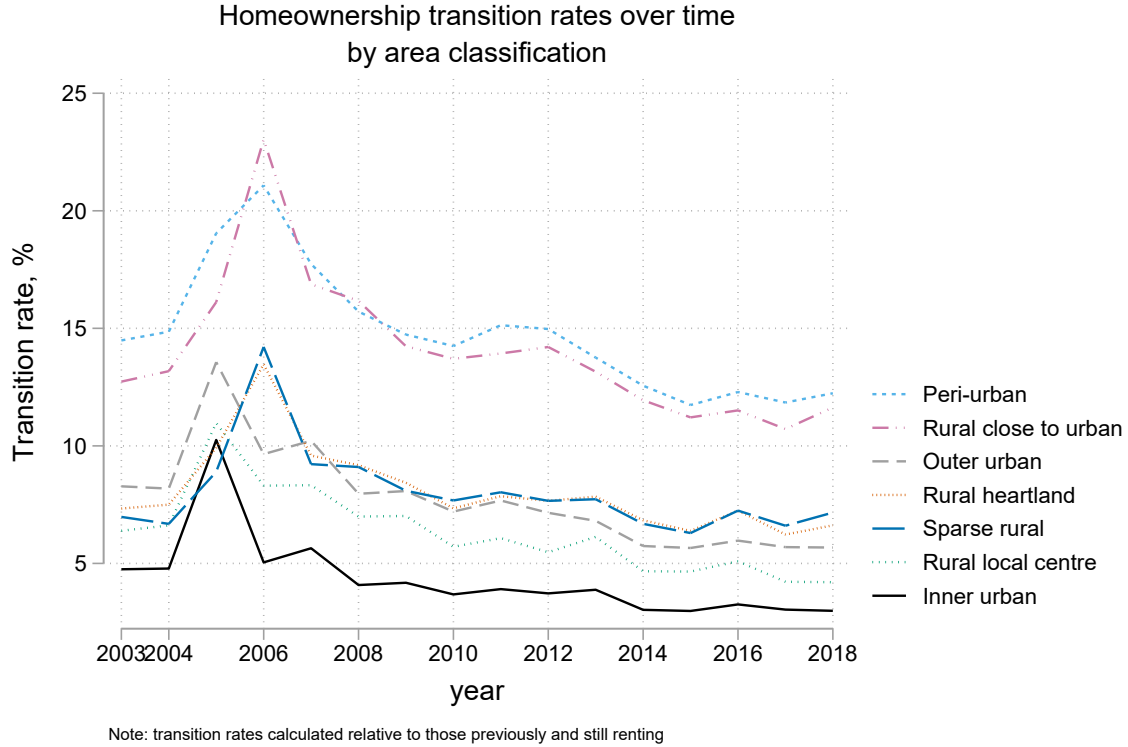


Figure 5 shows the share of all transitions from renting to owning by housing market type based on the urban-rural classification shown in Figure 3. As the figure shows, the share of transitions first increased across the board but has been declining in all types of areas since then.

Figure 5: All transitions from renting to owning by area type in 2003-2018.



Reduced transition from renting to owning may be due to a combination of several different trends. One issue that has attracted attention in the literature especially after the financial crisis is whether young households are postponing becoming owners or whether they are permanently excluded from the owner-housing market for instance, because of increasing house prices, reduced availability of credit or uncertain labour market situation.

We therefore next examine in more detail how the tenure choices of first-time buyers have evolved over time in different age and income groups.

Of course, tenure decisions are closely related to the life cycle of the household. Figure 6 shows the probability of transition from rental housing to owner-housing in different age quartiles over time. For each year, the age quartiles are marked in red numbers on the graph, with the top line tracking the transition of the first age quartile (households with household head less than 37 years of age). In the first age quartile, transitions happen

nowadays with roughly 4% probability while in the older quartiles the transitions become very unlikely especially towards the end of the period.

Figure 6: Share of first-time buyers by age quartiles

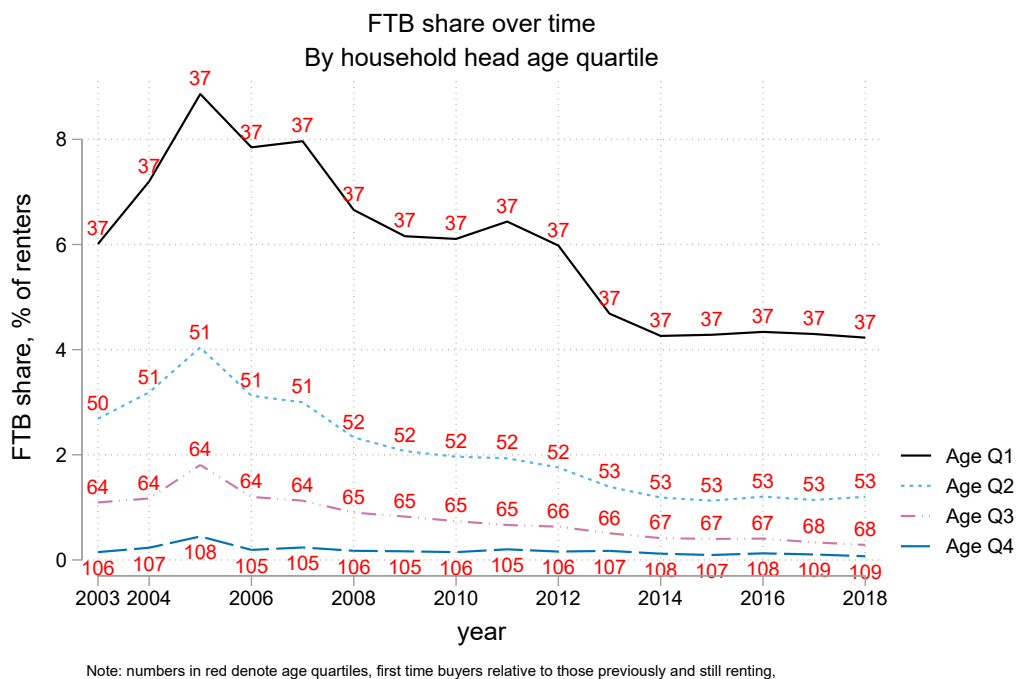
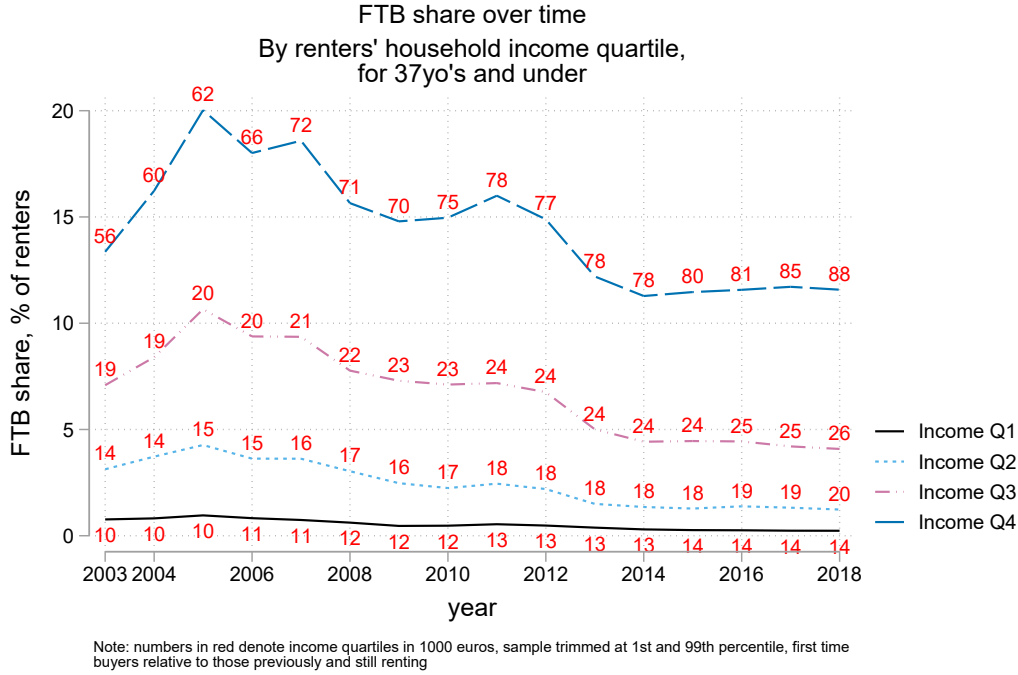


Figure 7 focuses on young households (households with the household head age less than 37 years). The figure clearly shows that there is no notable change in the first income quartile: The share becoming owners is small and stable over time. However, in all other income quartiles the probability of becoming an owner has decreased over time. On the other hand, Figure 6 does not show increased transitions for older age quartiles. Combined, these two figures therefore suggest that the reason for lower ownership rates among the young is not only postponing.

Figure 7: Share of first-time buyers in the youngest age quartile, by income quartiles



Our conclusion on this subsection is as follows: Renting has become more prevalent during the last two decades. This general trend is not explained by changes in the tenure choices of low-income households. The young, low-income households are almost always renting. However, the transitions from renting to owning among the high-income young households have clearly become less common. The reason does not seem to be (at least not exclusively) young households postponing transitions from rental housing to owner-housing. This is because there is no increase in the probability of transition among the older households.

5.2 Household debt

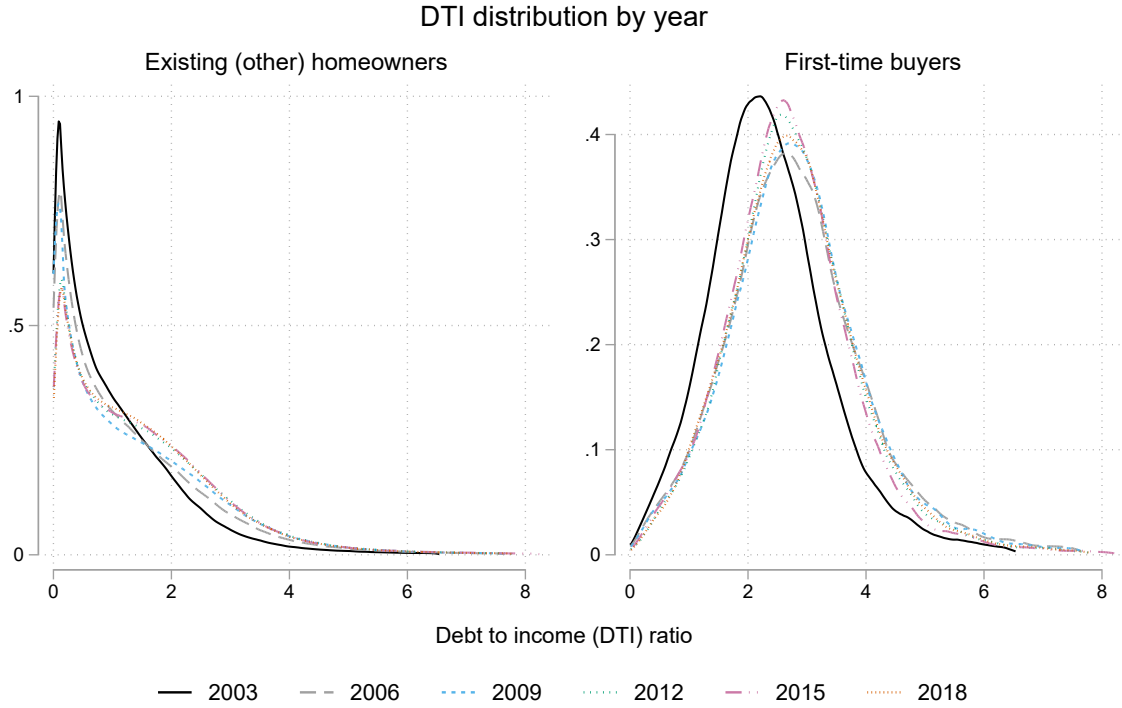
We next focus on household debt. The first thing to note is that the share of households with a mortgage was slightly increasing before the financial crisis but has remained quite stable since then. Roughly one third of all Finnish households holds a mortgage.

In order to get an overall picture of the development of the debt, we first show the distribution of the debt-to-income (DTI) and mortgage-debt-to-income (MDTI) ratios between 2003 and 2018 separately for first-time buyers and other home owners (conditional on having debt) in Figures 8 and 9. From the point of view of macro risks, it is presumably the overall level and distribution of debt that is important. However, from the point of

view of the direct welfare effects of the macroprudential measures, it is probably the distribution of recent buyers that is important.

In the figures, two observations stand out: First, on average, all owners are much less leveraged than first-time buyers. This is likely a combination of at least two things: first-time buyers tend to be younger than other owners and they are also by definition very recent buyers and have therefore had no time to repay the debt.

Figure 8: Distributions of DTI ratio for debt-holding home-owners and first-time buyers, excluding housing co-operative loans

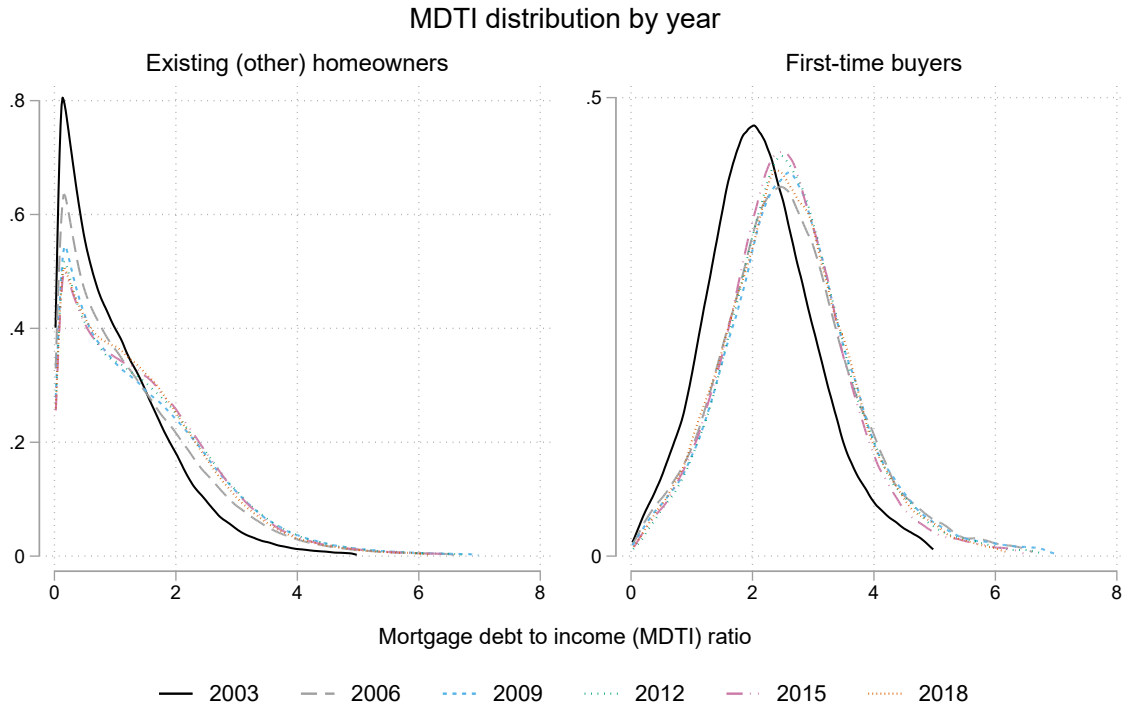


Note: sample trimmed at 1st and 99th percentile of DTI. Sample excludes debt-free households

Second, especially the distribution of the first-time buyers has shifted to the right from 2003 to 2006, but remained quite stable since then. There are also slight changes in the distribution of other owners.

Comparison of the figures also shows that there are no large differences between the development of DTI and the MDTI ratios.

Figure 9: Distributions of MDTI for debt-holding home-owners and first-time buyers, excluding housing co-operative loans



Note: sample trimmed at 1st and 99th percentile of MDTI. Sample excludes debt-free households

As Table 1 shows also according to Statistics Finland, the debt-to-income ratio of Finnish households increased before the financial crisis but has since then remained quite stable and is currently at 111%. However, as to be expected there are large differences between age groups.

Table 1: Debt-to-income ratio of Finnish households by age groups in 2002-2018

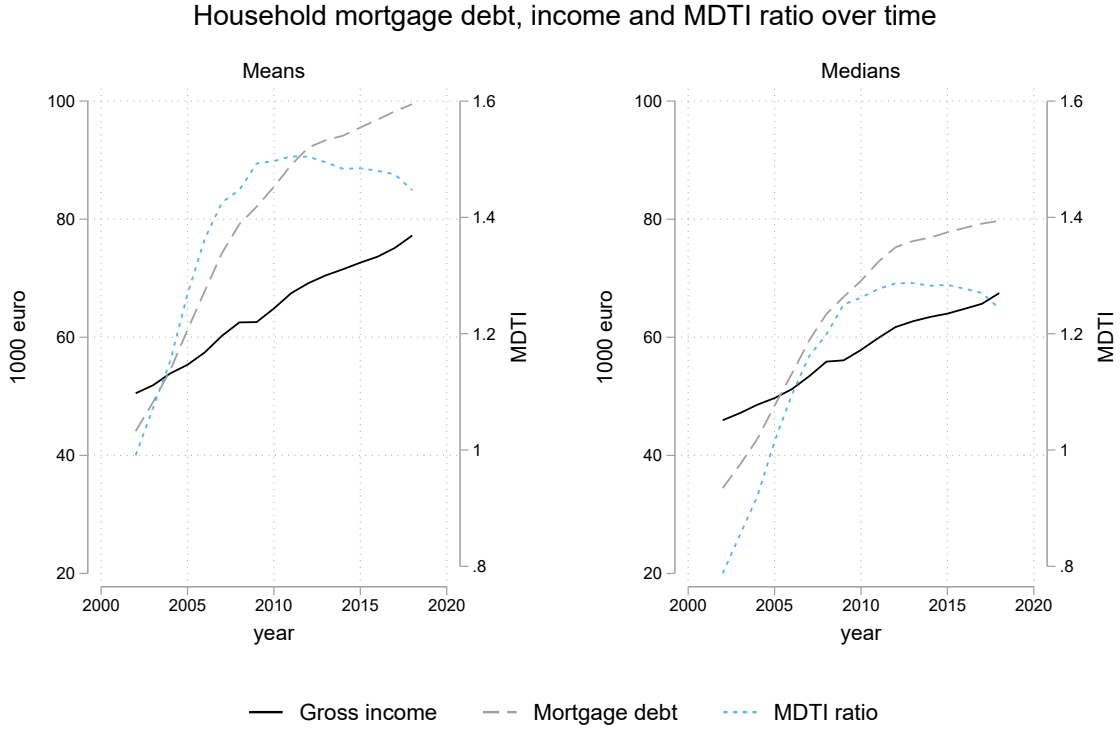
	2002	2008	2010	2013	2014	2015	2016	2017	2018
All	70	105	110	110	111	112	113	112	111
0-24	58	86	80	71	68	65	64	66	68
25-34	125	188	195	187	182	180	177	174	170
35-44	104	161	175	181	185	187	188	189	186
45-54	64	100	110	117	120	124	126	126	124
55-64	38	57	63	68	70	72	75	76	75
65-74	16	27	33	38	40	42	45	44	43
75-	5	9	10	12	13	14	16	17	17

Note: Statistics on indebtedness describe the debts of private persons and household-dwelling units. The data does not include housing co-operative loans. Source: Statistics Finland (2020).

Figure 10 shows the mean and median mortgage debt, gross income and MDTI ratios for all owners.¹⁴ The mortgage debt increases rapidly before the financial crisis, but then levels off. As result, the MDTI ratios are decreasing in Figure 10. For the interpretation of these figures, it is useful to keep in mind that transitions from renting to owning have become less common during this time period and especially low-income households are less likely to become owners now than before the financial crisis. This means that the composition of households with a mortgage is now different.

¹⁴Note that debt and income are not deflated as it does not matter when we compare their trends or examine their ratio.

Figure 10: Mortgage debt and income (in euros, left axis) and MDTI ratio (right axis), households with mortgage only



Note: sample trimmed at 1st and 99th percentile of MDTI and excludes debt-free households

In the following figures we track the evolution of DTI for different housing types. In Figure 11 we show separately renters and owners. In addition, we divide owners into those who occupy a house and those who own housing co-operative shares to an apartment. The latter division is potentially important as apartment owners are responsible of their share of the housing co-operative loans.

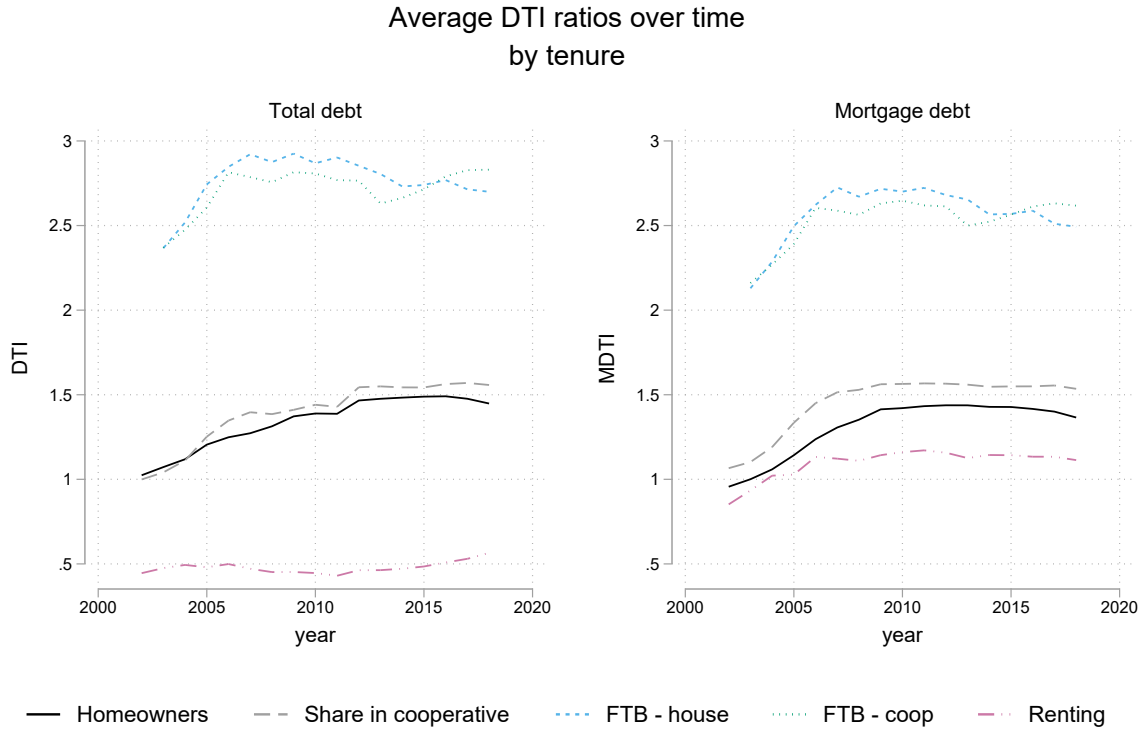
In general, the average DTI and MDTI ratios of first-time buyers are much higher than those of other owners. However, there are no important differences between those who own houses and apartments. If anything, the ratios are higher for apartment owners than for house owners.

Finally, as the figure shows, also some renters hold a mortgage which may be related to timing of changes in ownership and mobility decisions. The average total debt of renters is substantially lower than the mortgage debt. This is explained by differences in the composition of these two groups: renters with any debt is a much larger group of households than renters with a mortgage.

The debt ratios in Figure 11 do not include the housing co-operative loans as our data series only goes back to 2006. In Figure 12, we plot the shorter time series including the

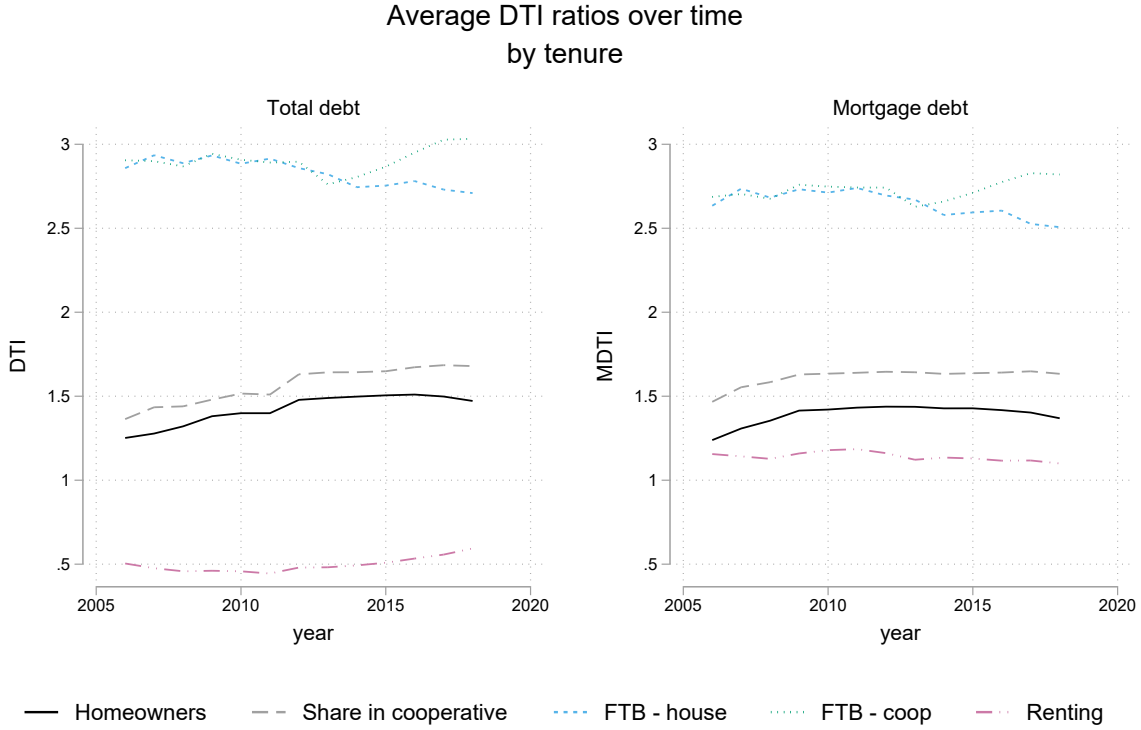
housing co-operative loans. Not surprisingly, we now observe an upward shift in (M)DTI ratios for apartment owners. The difference is especially clear for first-time buyers. When comparing first-time buyers of houses and apartments, we observe a clear divergence starting in around 2013.

Figure 11: Evolution of debt-to-income ratio by tenure status



Note: sample trimmed at 1st and 99th percentile of debt ratio. Sample excludes debt-free households

Figure 12: Evolution of debt-to-income ratio by tenure status, including housing co-operative loans



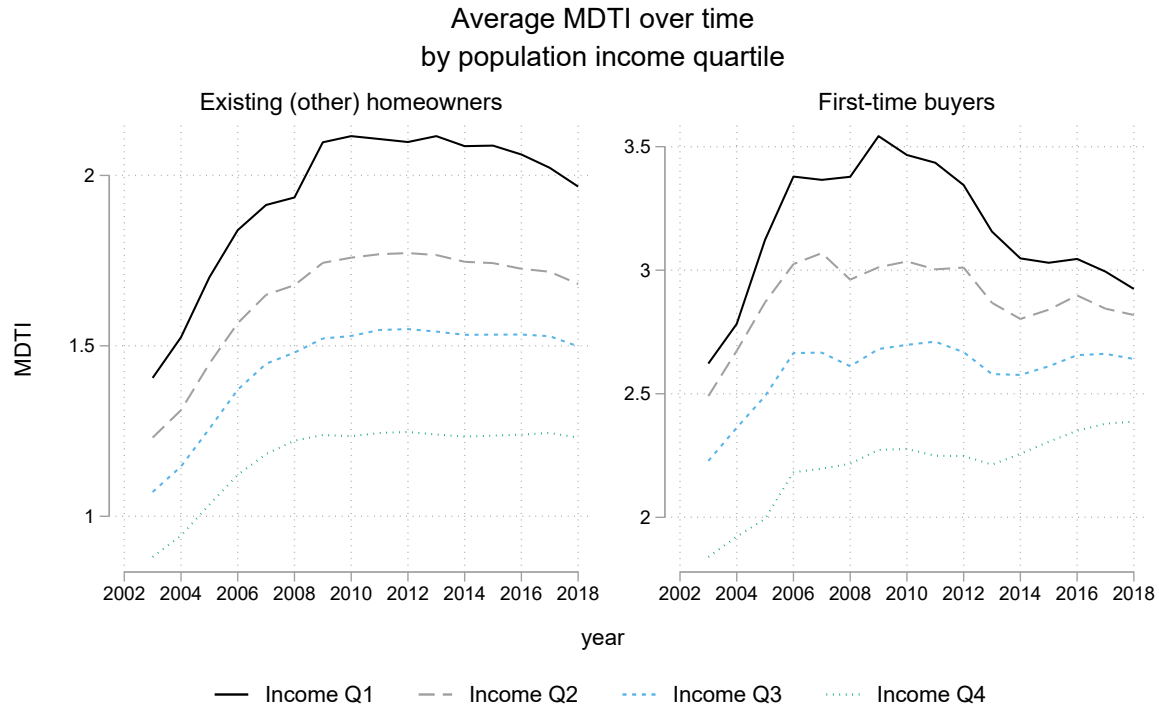
Note: sample trimmed at 1st and 99th percentile of debt ratio. Cooperative-held debt is included in the ratio. Sample excludes debt-free households

In the following figures, we focus on owner-occupiers and document the evolution of MDTI by income and age quartiles (Figures 13 and 14) and finally, by different types of location (Figure 15).

As Figure 13 shows, the MDTI ratios are highest for low-income households but have been decreasing also for these households during the last ten years or so. This is especially true for first-time buyers. Interestingly, it seems that the MDTI ratios of first-time buyers in different income groups have been converging: For those in the fourth income quartile, the MDTI ratio has been clearly increasing in recent years.

Given that transitions from renting to owning become less likely during this same time period, changes in the composition of first-time buyers may explain the reduction in MDTI ratio. For instance, increasing apartment prices or changes in banks' screening practices may lead to especially wealth-poor young adults being excluded from transitions.

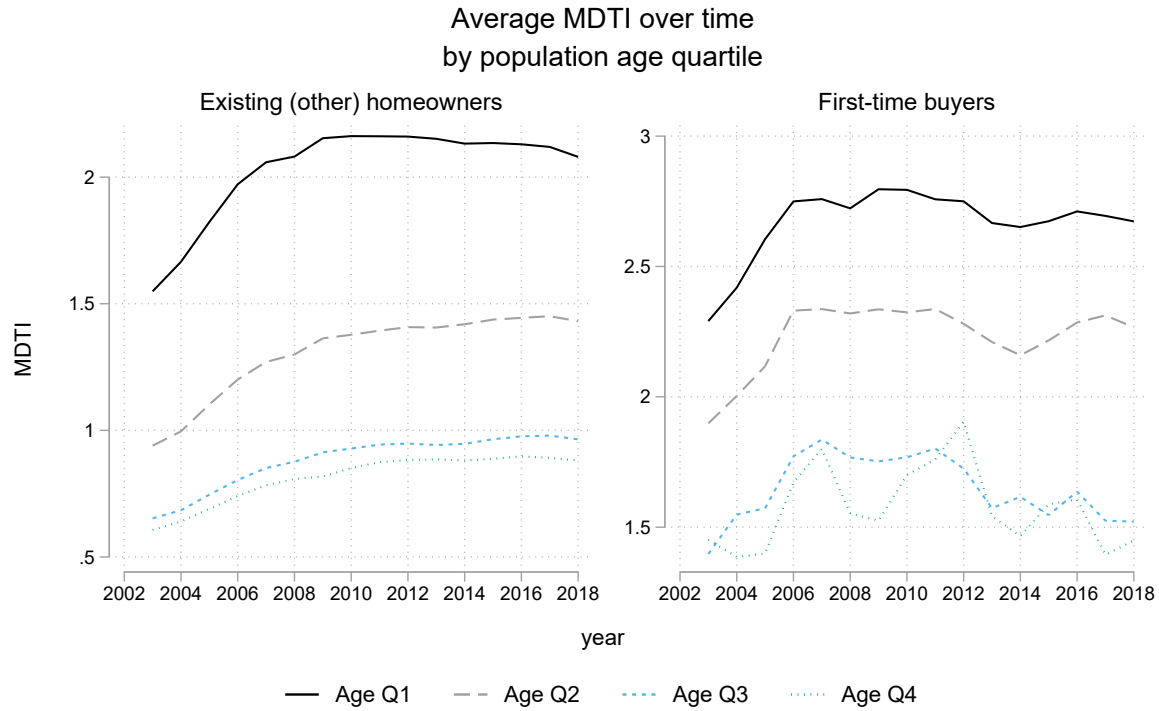
Figure 13: Evolution of MDTI ratio by income quartile, excluding housing co-operative loans



Note: sample trimmed at 1st and 99th percentile of income and MDTI. Sample excludes debt-free households

In general, Figure 14 depicts similar development for age quartiles for other owners (left panel) and first-time buyers (right panel). However, when focusing on older other homeowners, one sees that the MDTI have been gradually increasing over time. This may be explained by longer mortgages and hence slower repayment.

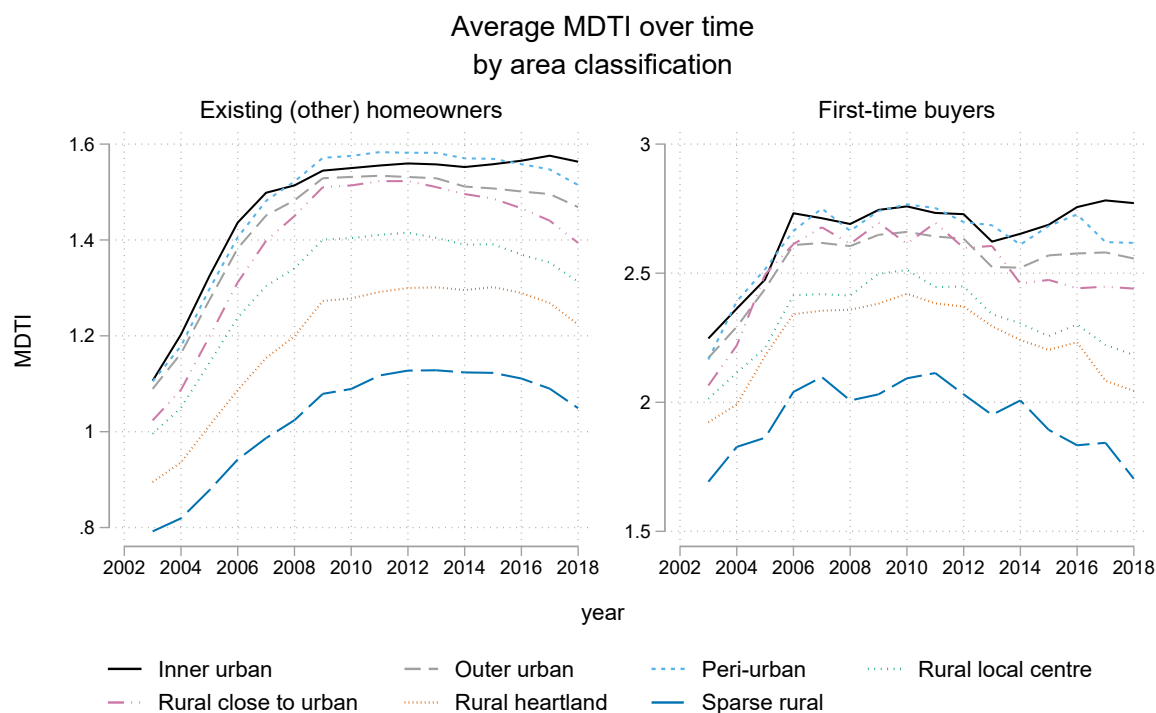
Figure 14: Evolution of MDTI ratio by age quartile, excluding housing co-operative loans



Note: sample trimmed at 1st and 99th percentile of MDTI. Sample excludes debt-free households

Finally, Figure 15 shows interesting differences between housing market areas. In general, it seems that mortgage loans relative to income have been decreasing in rural areas while in the city centers the mortgage debt-to-income ratios have remained quite stable or even increased when looking at first-time buyers.

Figure 15: Evolution of MDTI ratio according to the urban-rural classification



Note: sample trimmed at 1st and 99th percentile of MDTI. Sample excludes debt-free households

Our tentative conclusion on this subsection is as follows: The overall distribution of debt relative to income has shifted to the right especially before the financial crisis and for first-time buyers. Maybe somewhat surprisingly, there are no sizable differences between owners of shares in apartment buildings and house owners. However, since 2015 there is some indication that the first-time buyers in co-operatives have higher debt ratios than the first-time buyers in houses when housing co-operative loans are included.

Across the board, the DTI and MDTI ratios were increasing rapidly before the financial crisis. The first-time buyers are much more leveraged relative to income than other owners. However, especially for the low-income first-time buyers the MDTI ratio has been decreasing after the financial crisis. First-time buyers are more leveraged in urban areas than in rural areas and this difference has been increasing after the financial crisis.

6 Reform analysis

6.1 LTC reform in 2016

The FSA introduced a loan-to-collateral (LTC) limit for housing debt (including debt held by the housing co-operative) in July 2016. The LTC limit was initially 90% or 95% for first-time buyers.¹⁵ The LTC limit pertains to the market value of the collateral (typically the purchase price of the house or apartment). Thus, the buyer needs to cover at least 10% (or 5% for first-time buyers) of the purchase price with own savings or provide additional collateral.

We analyse the introduction of the LTC limit first by documenting the evolution of the LTV distribution of co-operative apartment buyers. We focus on buyers of apartments because the data does not include purchase prices for single family houses. The data does not include information on the amount of collateral either. Thus, some of the buyers with LTV above the limit might have LTC below the limit. Nevertheless, the apartment bought is likely the only hard collateral for a large share of buyers. Thus, we would expect to observe bunching in the LTV distribution below the limit, if the limits were successful in constraining leverage.

Ministry of Finance (2019) documents the LTC and LTV distributions after the reform for new housing loans of first-time buyers and other new housing loans. A key difference between Ministry of Finance (2019) and our analysis of the LTV distributions is that our data allows for comparisons between years before and after the reform. Moreover, we can analyse heterogeneity by individual characteristics in order to see which groups are more strongly affected by the reform.

In addition to the LTC limits, other institutional details are likely to be important. Banks accept typically only 70-75% of the purchase price as collateral. This means that the buyer needs additional collateral to get a loan corresponding to the LTC limit. This might include other assets or guarantees by the state or banks. First-time buyers are entitled to a state guarantee for 20% of the value of the loan. However, in order to qualify for the state guarantee, the total amount the loan cannot exceed 85% of the purchase price or 90% for those who participate in a subsidized housing savings program (so called ASP account).

We calculate the LTV ratio as the sum of an individual's housing loans and the co-operative loan associated with the apartment he/she bought, over the debt-free purchase

¹⁵The FSA has authority to tighten the limits by 10%-points. In July 2018 the limit for other than first-time buyers was lowered to 85% and in July 2020 it was raised back to 90%.

price of the apartment. If there are several buyers (e.g. a couple) we allocate purchase price and co-operative loans to the buyers according to their ownership shares. The LTV ratio is calculated only once, at the time of purchase.

Table 2 shows that the mean LTV ratio of first-time buyers has declined slightly in the 2010s while non-first-time buyers' LTV ratio has increased from 76% in 2010 to 85% in 2018. Figures 16 and 17 show the distribution of LTV for first-time buyers and other buyers in three years before the reform (2011, 2013 and 2015) and in one year after the reform (2017).

Table 2: Mean LTV of co-op apartment buyers

	First-time buyers		Non-first-time buyers	
Year	Mean	N	Mean	N
2010	0.963	16,150	0.764	42,910
2011	0.947	17,813	0.770	42,852
2012	0.958	15,948	0.777	42,188
2013	0.928	12,248	0.765	35,996
2014	0.934	12,008	0.784	33,663
2015	0.938	12,046	0.806	34,455
2016	0.942	12,406	0.826	34,851
2017	0.928	13,111	0.845	36,190
2018	0.938	12,417	0.845	31,467

Notes: LTV is calculated as individuals' housing loans and co-op loans over debt-free price of the apartment bought weighted by ownership share.

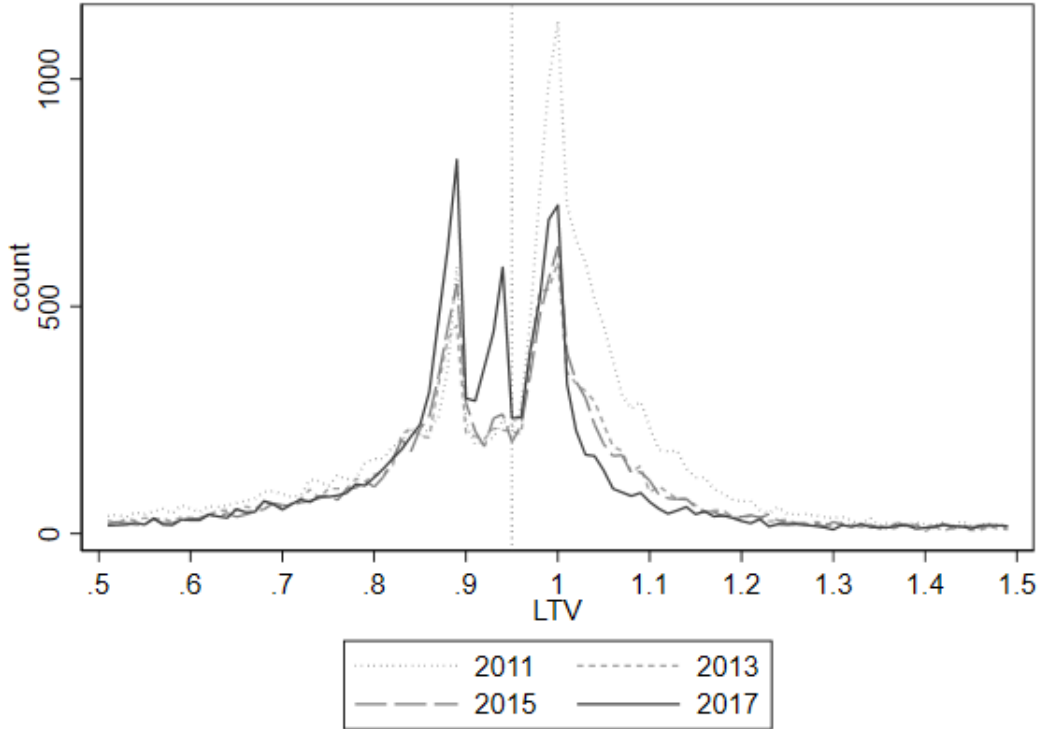
The LTV distribution of first-time buyers (Figure 16) had clear spikes at $LTV = 1$ and $LTV = 0.9$ in 2011. The spike at $LTV=1$ became less pronounced in 2013. The shape of the distribution remained stable between 2013 and 2015, but after the reform in 2017 a spike just below 0.95 emerged coinciding with the LTC limit for first-time buyers. This suggests that the reform constrained the leverage of some first time apartment buyers. At the same time as the spike at $LTV=0.95$ emerges there is a reduction in mass between $LTV=1$ and $LTV=1.15$. This suggests that the reform contained excessive leverage to some extent.

The overall amount of first-time buyers increases slightly from 2015 to 2017 indicating that substantial extensive margin responses to the LTC limit are unlikely. First-time buyers seem to respond mainly by reducing their LTV. This may happen either through

reducing non-housing consumption as is documented by van Bakkum et al. (2019) or through adjustment of the housing consumption, for instance, by choosing a different location or smaller apartment.

As discussed above, a potential explanation for the clear and persistent peak at $LTV=0.9$ is that the eligibility criteria for the government's guarantee for first-time buyers constrain LTV to 0.9.

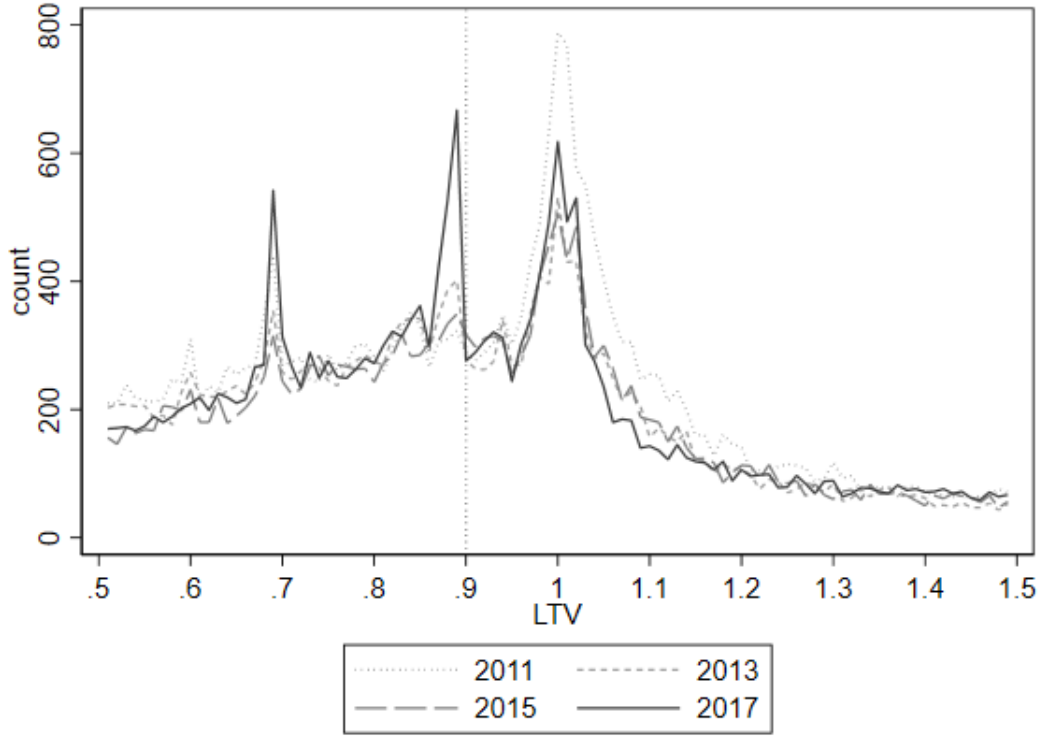
Figure 16: First-time apartment buyers' LTV distribution



The LTV distribution of other than first-time buyers (Figure 17) has a less steep profile than first-time buyers' distribution as low LTV ratios are more common than for first-time buyers. Similarly to Figure 16, the spike at $LTV=1$ seen in 2011 becomes less pronounced already in 2013. After the introduction of the 0.9 LTV limit, clear bunching below 0.9 emerges. At the same time mass between $LTV=1$ and $LTV=1.15$ decreases. This indicates that the LTV limit is binding for part of the apartment buyers and the reform reduced excessive leverage. There is no clear indication of an extensive margin response.

The spike at 0.7 is likely due to the fact that collateral value accepted by banks is typically 70% of the purchase price of the apartment. Therefore, as a rule, buyers with no additional collateral cannot get housing loans with LTV ratio higher than 0.7.

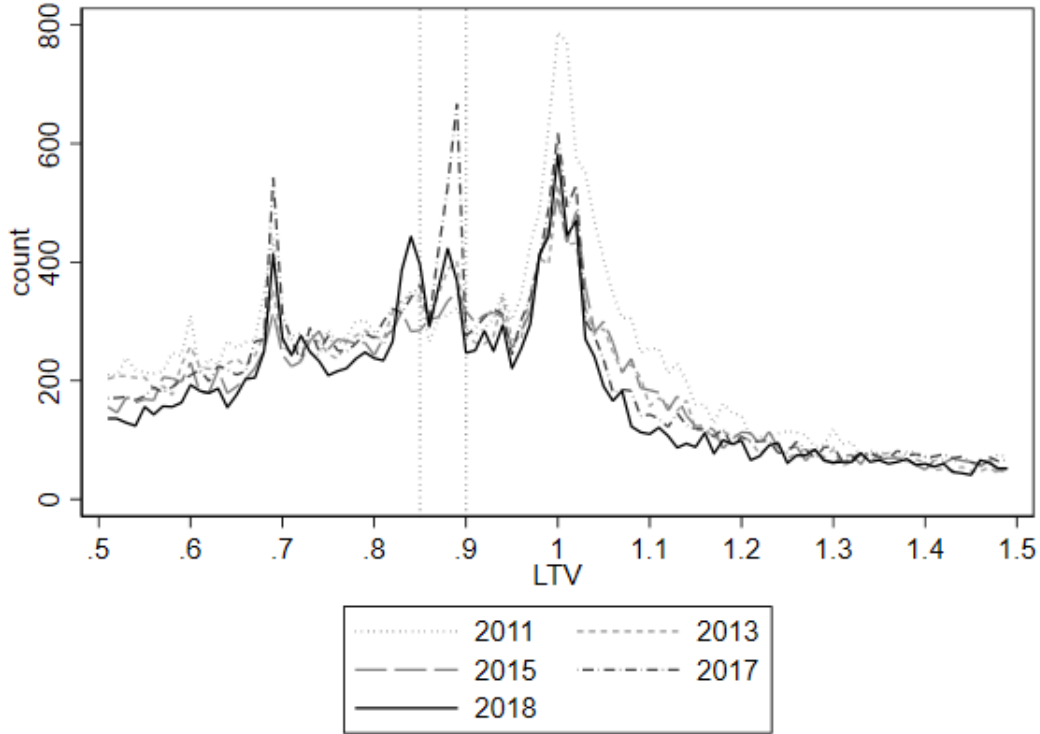
Figure 17: Non-first-time apartment buyers' LTV distribution 2011-2018



Notes: LTV ratio is calculated as individuals' housing loans and co-op loans over debt-free price of the dwelling weighted by ownership share. Vertical line at LTV=0.9 indicates the LTC limit introduced in 2016.

In figure 18 we add year 2018 when the LTC limit was further reduced to 0.85 in July. Consistent with a behavioural response, bunching at 0.9 is less strong than in 2017 and a new spike below 0.85 emerges.

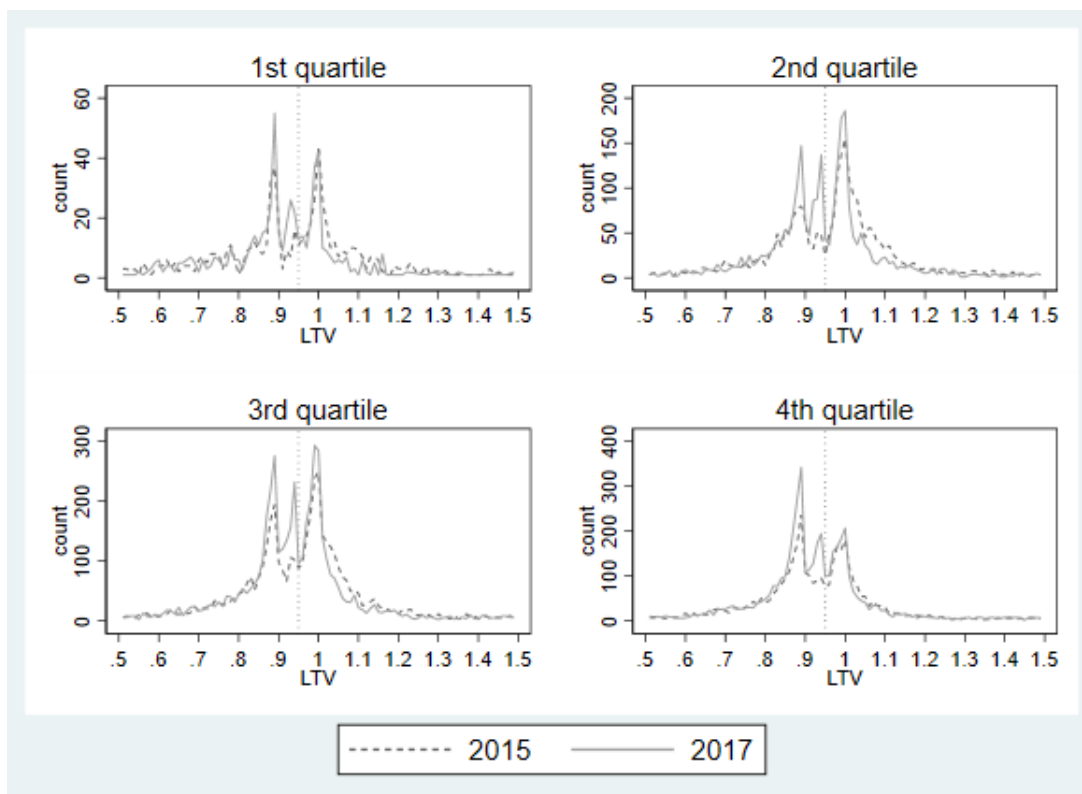
Figure 18: Non-first-time apartment buyers' LTV distribution 2011-2018



Notes: LTV is calculated as individuals' housing loans and co-op loans over debt-free price of the dwelling weighted by ownership share. Vertical lines indicate the LTC limit introduced in 2016 (LTV=0.9) and the revised limit (LTV=0.85) implemented in July 2018.

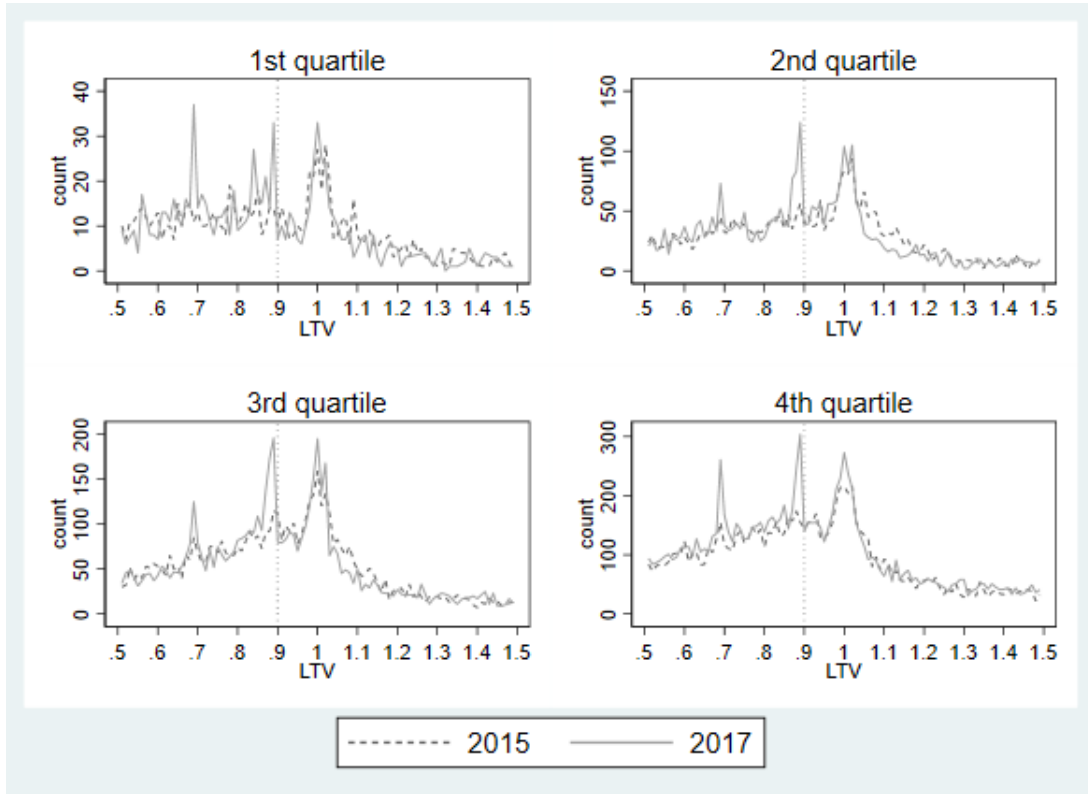
Finally, we analyse heterogeneity in responses to the LTC limit by income quartiles. The income quartiles are constructed with data on the whole population and the income measure used is the household's disposable equivalent income (using the OECD equivalence scale). Figures 19 and 20 show the LTV distributions of first-time buyers and other co-operative buyers before and after the 2016 reform by income group. The figures indicate that bunching below the LTC limits is weaker in the highest quartile, and also the reduction in the mass above LTV=1 is smaller in the highest quartile. These findings indicate that the LTC limit was more often binding for lower income groups.

Figure 19: First-time apartment buyers' LTV distribution in 2015 and 2017 by income quartile



Notes: LTV is calculated as individuals' housing loans and co-op loans over debt-free price of the dwelling weighted by ownership share. Vertical line indicates the LTC limit introduced in 2016 (LTV=0.95). The income quartiles are constructed with data on the whole population. The income measure used is the household's disposable equivalent income (using the OECD scale).

Figure 20: Non-first-time apartment buyers' LTV distribution in 2015 and 2017 by income quartile



Notes: LTV is calculated as individuals' housing loans and co-op loans over debt-free price of the dwelling weighted by ownership share. Vertical line indicates the LTC limit introduced in 2016 ($LTV=0.90$). The income quartiles are constructed with data on the whole population. The income measure used is the household's disposable equivalent income (using the OECD scale).

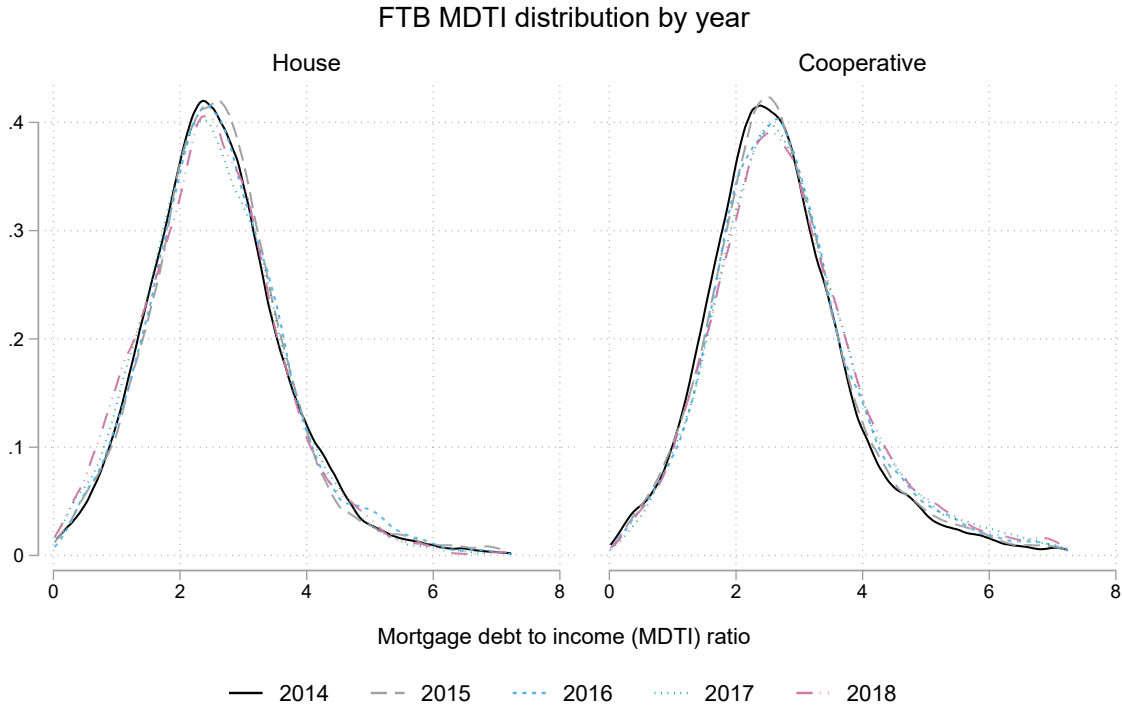
Taken together, Figures 16 - 18 give strong evidence that the LTC limit led to behavioural responses by banks and apartment buyers. Estimating the quantitative significance of the reform effect is beyond the scope of this report. However, Figures 19 and 20 indicate that high income households were less affected by the regulation than the rest of the population. We conclude that the LTC limits reduced risky leverage measured in terms of LTV ratio especially among medium and low income households. The regulation may have in addition affected the opportunities of households in these groups to become home-owners or distorted home-buyers' consumption and savings patterns, but identifying these potential effects requires more research.

Next we zoom in on the MDTI distributions around the time of the reform. We focus on the first-time buyers because they tend to have the highest MDTI ratios. We can now include both apartment buyers and house buyers in the analysis. Debt held by

co-operatives is included in the ratios.

In Figure 21 we distinguish between first-time buyers who buy a house and those who buy an apartment. The left panel (houses) reveals not much change but in the right panel (apartments) there is a small but noticeable and growing outward shift of the MDTI distribution.

Figure 21: Evolution of first-time buyer MDTI ratio before and after the LTC reform, by dwelling type



Note: sample trimmed at 1st and 99th percentile of MDTI (including cooperative-held debt), MDTI includes cooperative-held debt

Reduction in LTV ratios does not directly imply that leverage relative to income is also reduced. This is because, at least in principle, LTV ratios may be decreasing as a result of increasing house prices.

We therefore next examine the MDTI ratios of first-time buyers before and after the reform in a regression framework where we control for income, age, household size, location, education, civil status and the socio-economic status.¹⁶ Because of the gradual increase in the DTI and MDTI ratios for first-time buyers in housing co-operatives, we also include a time trend to the regressions.

¹⁶Statistics Finland classification distinguishes between self-employed, students, manual workers, lower-level employees, upper-level employees, the unemployed and pensioners.

Table 3 shows the results without the time trend (columns (1)-(3)) and with the time trend (columns (4)-(6)). In all cases, the housing co-operative loans are included in the MDTI ratio.

Conditional on controlling for household characteristics, the average MDTI ratio of first-time buyers is some 9% higher in the post-reform period (column (1)). Dividing the sample by housing type further shows that the increase is entirely driven by first-time buyers buying into housing co-operatives (columns (2)-(3)) with a 12% higher MDTI ratio than before the reform. This in line with the visual evidence in Figure 21.

Adding the time trend (columns (4)-(6)) shows that the increase in the MDTI ratio is driven by the time trend. That is, there is no indication that the reform would have led to more moderate mortgages relative to income. Instead the MDTI ratios among the households buying an apartment have continued to increase.

Table 3: Regression of MDTI ratio on post-reform period and controls, with and without time trend, including housing co-operative loans (2014-2018)

	(1)	(2)	(3)	(4)	(5)	(6)
	Without time trend			With time trend		
	All	House	Co-op	All	House	Co-op
After	.0890232*	-0.0203049	.1207681*	.0252315*	0.041869	0.016587
	(0.0195378)	(0.0248856)	(0.0285187)	(0.0057533)	(0.03046)	(0.00697)
Time trend				.0320119**	-0.03128	.0522799***
				(0.0046385)	(0.01239)	(0.00226)
R^2	0.3926418	0.4423482	0.4221092	0.3928382	0.442544	0.422618
N	53403	13437	39676	53403	13437	39676
vce	year	year	year	year	year	year

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Regressions control for income percentile, age decile and postcode fixed effects as well as the size of the household and fixed effects for the highest level of education, civil and socio-economic status. Regression results in the first three columns do not include a time trend, while the results in the last three columns do. Columns (1) and (4) include all first-time buyers, columns (2) and (5) include only owners of houses and columns (3) and (6) include only shareholders in housing co-operatives. Sample trimmed at 1st and 99th percentile of MDTI (including housing co-operative loans).

We find no evidence suggesting the reform led to a decrease in debt when measured relative to household gross income. In fact, controlling for a wide range of socio-economic characteristics we see that MDTI ratios increase after the reform. The increase is exclusively driven by mortgages to buy an apartment.

These results are in line with the recent house and apartment price development in Finland. Since the financial crisis, house prices have been stagnating while apartment

prices especially in growing cities have been increasing. Given the regulation imposed in 2016 was tied to house prices (through the collateral limit formula) and not to income, it allowed more borrowing in areas and in cases where prices are appreciating. As a result, increasing DTI ratios for households buying in apartment buildings are consistent with decreasing LTV ratios.

6.2 Hypothetical reform

In this section, we aim to provide insights for the policy discussion regarding the implementation of a DTI limit equal to 4.5 times the household gross income. We do this by examining the share of population that has exceeded this limit when buying a house and by comparing this group to those with smaller DTI ratios. The idea is to assess which kind of households would be directly affected by such regulation. Note however that the proposed reform includes a waiver allowing banks to exceed the DTI limit of 450 in 15% of the volume of their lending in each quarter.¹⁷ Finally, the proposed reform includes the housing co-operative loans in the DTI measure. We therefore include the housing co-operative loans to the DTI calculations throughout this section although this implies that we cannot analyse the early 2000s.

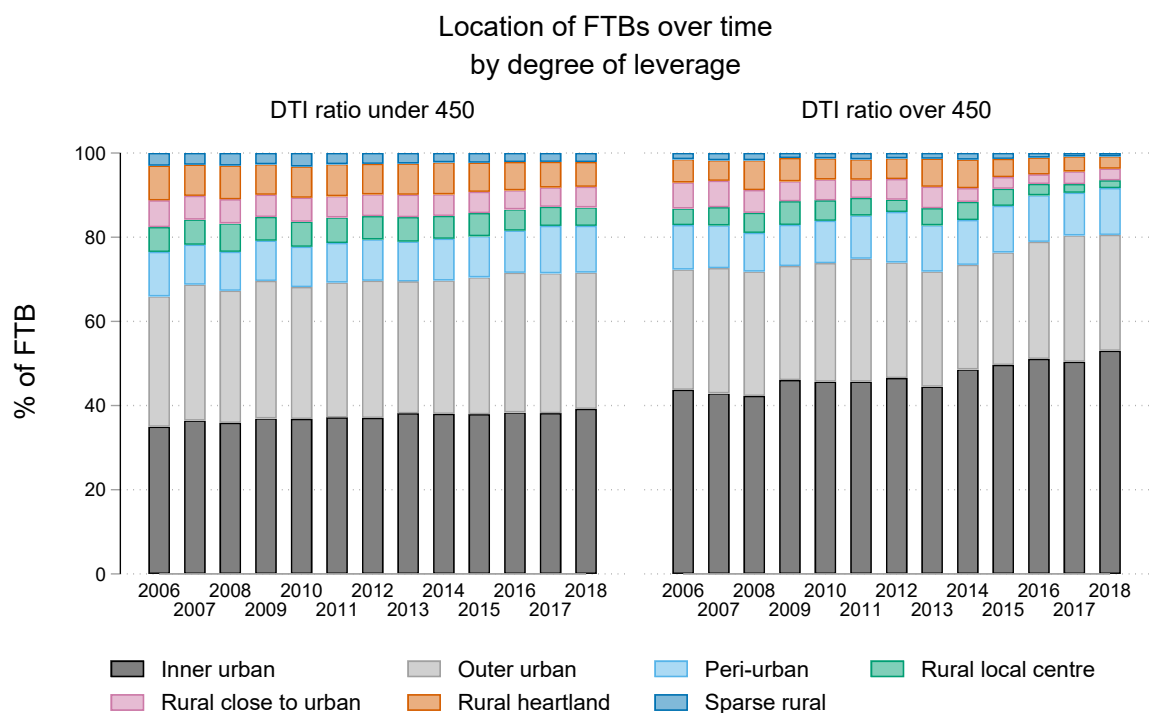
Overall, roughly 9% of first-time buyers have had a DTI ratio above 4.5 when buying their house or apartment.¹⁸ So, even when focusing on first-time buyers only with large DTI ratios, the share of households exceeding the proposed DTI limit is relatively small.

Figure 22 shows the dwelling location for first-time buyers with high DTI ratios (above 4.5 times income) and for first-time buyers with lower DTI ratios (below 4.5 times income). The figure shows that especially in recent years, the share of highly leveraged first-time buyers has been bigger in inner urban areas and smallest in sparsely populated rural areas. This is similar to other first-time buyers but much more pronounced for the highly leveraged ones.

¹⁷The aim of the exception would be to give the lender discretion in its credit decisions so that it can take into account the individual situation of the borrower, for example, the amount of financial savings.

¹⁸See Figure A7 in Appendix A.4 for the share over time.

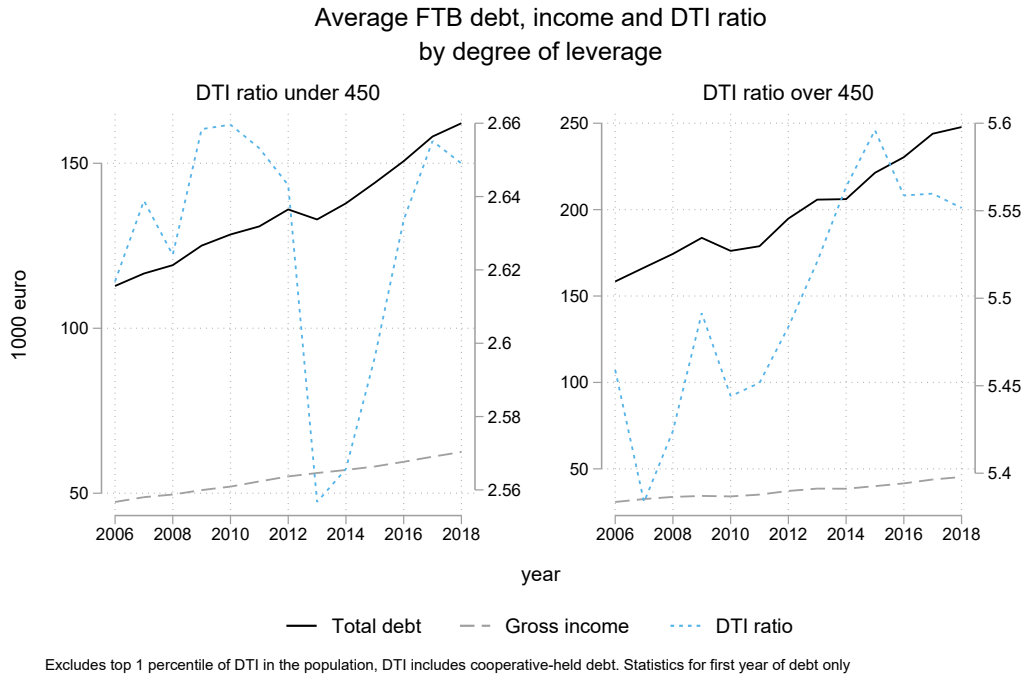
Figure 22: Dwelling location between highly leveraged and other first-time buyers



Excludes top 1 percentile of DTI in the population, DTI includes cooperative-held debt. Statistics for first year of debt only

Next we have a look at the evolution of debt, income and the debt-to-income ratio for highly leveraged first-time buyers in Figure 23. Apart from a dip around 2013, the average DTI for first-time buyers with a DTI ratio below 4.5 appears rather stable since 2006. In contrast, for highly leveraged first-time buyers it was mainly increasing until 2015.

Figure 23: Evolution of debt, income and debt-to-income ratios for highly leveraged first-time buyers

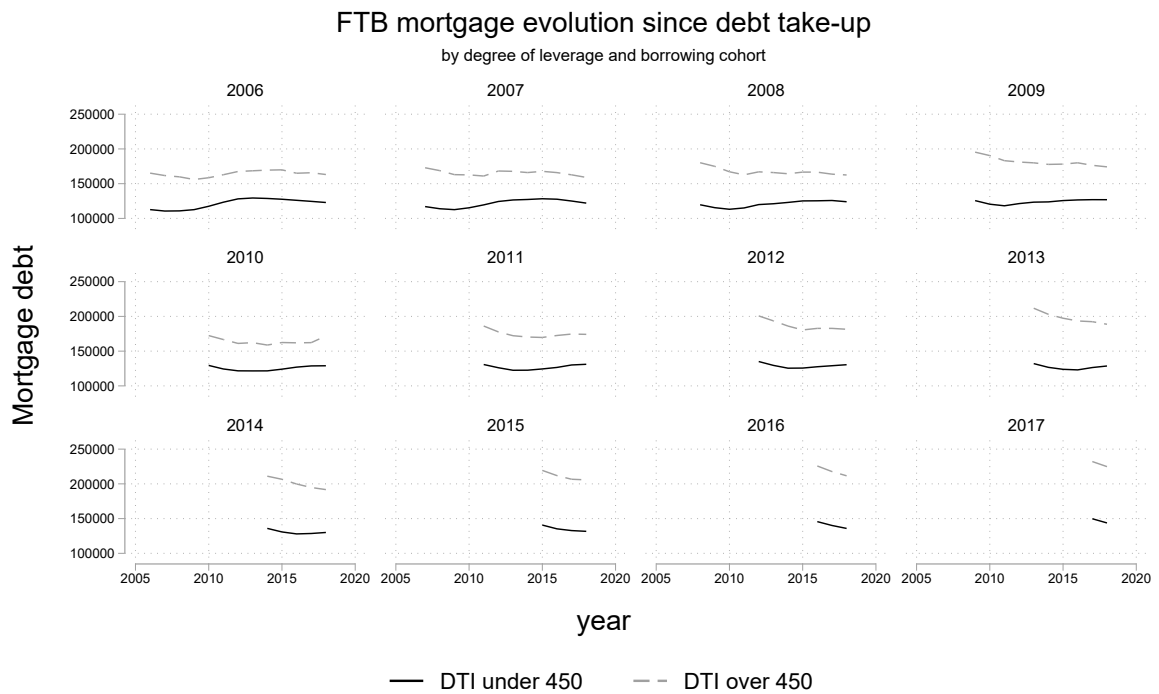


In the following two figures we show the evolution debt and income for first-time buyers separately for highly leveraged first-time buyers and others. To do so, we first group first-time buyers into cohorts according to the year in which they started borrowing. Each cohort is shown in a separate cell of the figure. We then compare the evolution of average debt and income of the highly leveraged and other first-time buyers, from the time each cohort started borrowing until 2018.

In Figure 24, it is clear that highly leveraged first-time buyers effectively have more mortgage debt than others. Additionally, for more recent cohorts the difference in mortgage debt levels has widened. At the same time however, within cohorts, mortgage debt has gone down more strongly for highly leveraged first-time buyers, especially since the financial crisis.

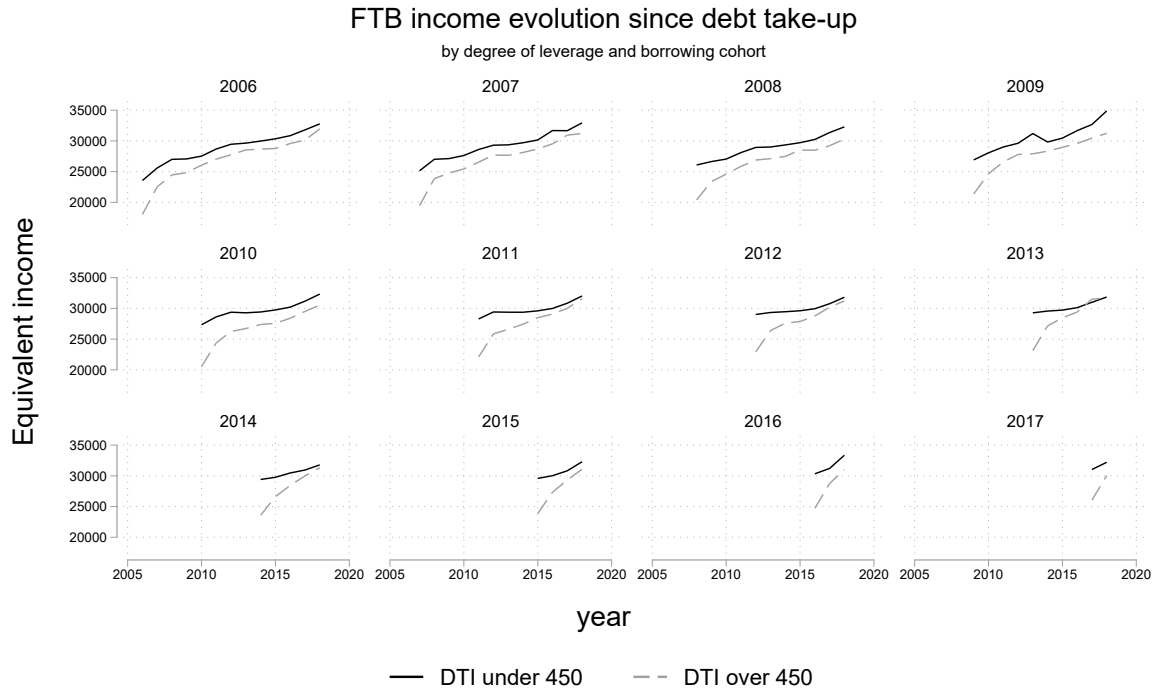
Looking in turn at the development of disposable equivalent income in Figure 25, we note that while highly leveraged first-time buyers clearly have lower average incomes at the time of the transaction, their incomes catch up with those of the others quite quickly. So, we observe systematic convergence of incomes together with bigger mortgages. Together these two observations suggest that the large mortgages of highly leveraged first-time buyers are at least partly explained by their expectations of higher future incomes.

Figure 24: Comparison of the evolution of mortgage debt between highly leveraged and other first-time buyers



Excludes top 1 percentile of DTI in the population, DTI includes cooperative-held debt. A borrowing cohort consists of FTBs that started borrowing in the same year

Figure 25: Comparison of the evolution of income between highly leveraged and other first-time buyers



Excludes top 1 percentile of DTI in the population, DTI includes cooperative-held debt. A borrowing cohort consists of FTBs that started borrowing in the same year

In the remainder of this section we compare the characteristics of highly leveraged first-time buyers to other first-time buyers and assess whether they have changed over time.

First, we see from Figure 26 that highly leveraged first-time buyers are younger on average than other first-time buyers. This may explain the income difference at the time of the transaction and the subsequent catching up in Figure 25. In addition to being more likely to live in the city (as demonstrated by Figure 22), we also see that highly leveraged first-time buyers were traditionally less educated and more often single than other first-time buyers (see Figures 27 and 28). These differences have decreased over time however, particularly with respect to education and especially since the financial crisis. This might indicate that banks are screening more carefully and less risky borrowing is occurring.

Figure 26: Age comparison between highly leveraged and other first-time buyers

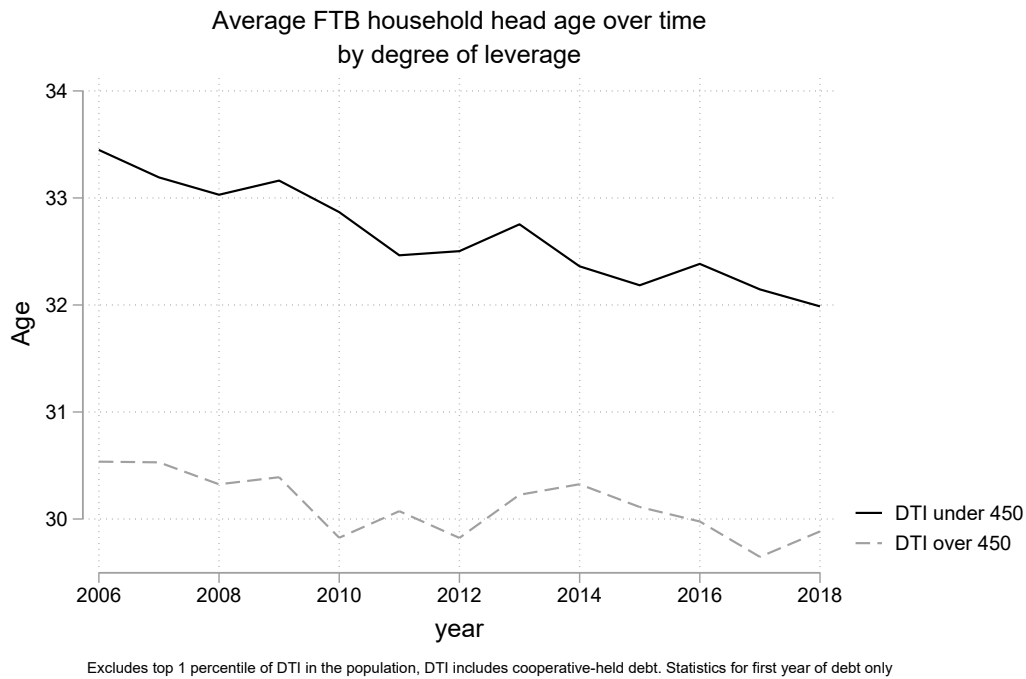


Figure 27: Comparison in highest education level between highly leveraged and other first-time buyers

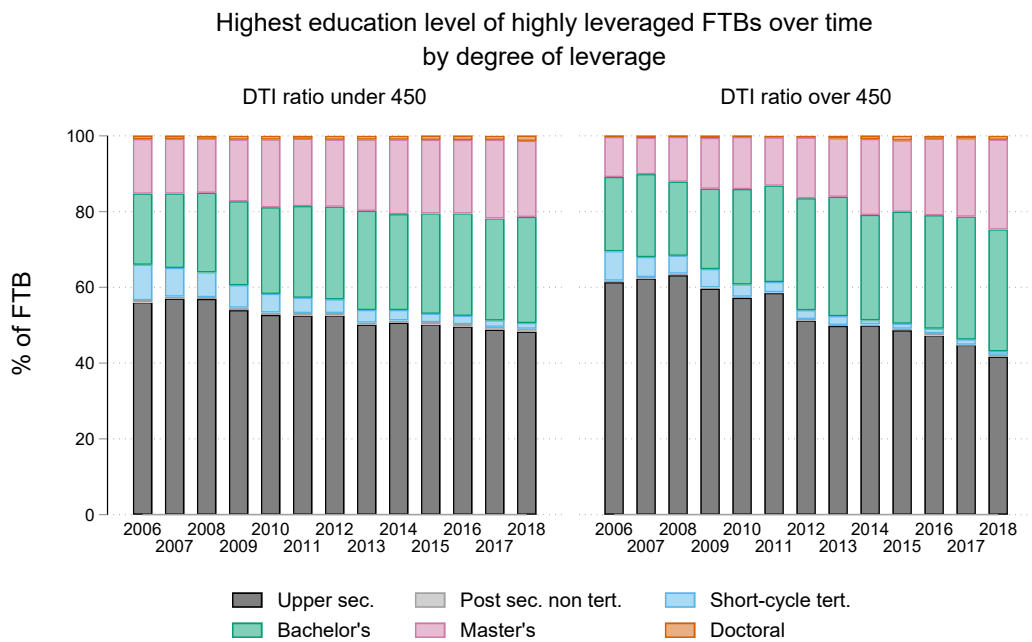
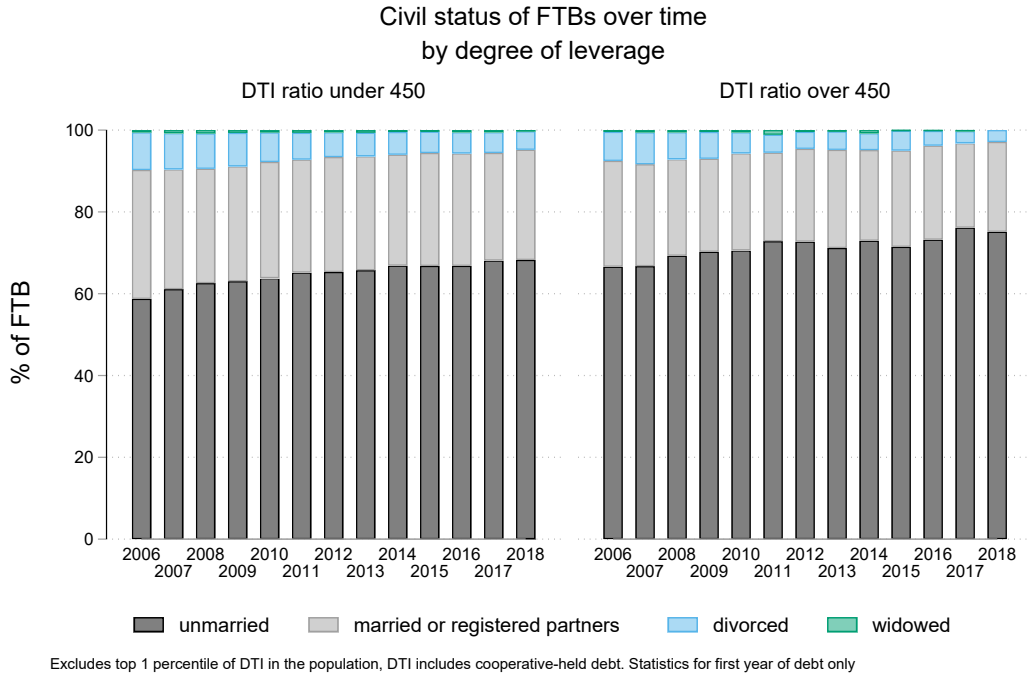


Figure 28: Comparison in civil status between highly leveraged and other first-time buyers



7 Conclusions

We have analysed the development of household tenure choices and the distribution of debt during the 2000s. When assessing the recent development it seems that renting has become more common during the last two decades. The main reason is likely related to young households remaining renters instead of transiting to owner-housing. However, transitions from renting to owning do not become more frequent among the older households. This suggests that young households are not only postponing transiting from renting to owning, but remain more permanently in rental housing. As we discuss in section 2 similar trend has been observed also in other countries. In part, this may be related to higher house prices in large and growing cities, but other explanations have also been put forward in the literature.

When looking at the development of total debt and mortgage debt, there is a clear difference in the development before and after the financial crisis. Across the board, the debt-to-income and mortgage-debt-to-income ratios were increasing rapidly before the financial crisis. Since then, the development has been mostly moderate or the debt levels relative to income have been quite stable. The first-time buyers are much more leveraged relative to income than other owners. Also, first-time buyers are more leveraged in urban

areas than in rural areas and this difference has been increasing after the financial crisis. The same pattern emerges, when we look at leverage relative to house value. Interestingly, when focusing on loan-to-value ratios, we observe that during the last ten years, the loan-to-value ratios of non-first-time buyers has been steadily increasing.

When analysing the loan-to-collateral limit reform of 2016, we consider the effects on loan-to-value and debt-to-income ratios. Taken together, our analysis on loan-to-value ratios suggests that the loan-to-collateral limit led to behavioural responses by banks and apartment buyers. The loan-to-collateral limit reduced risky leverage measured in terms of loan-to-value ratio. These effects seem heterogeneous: high-income households seem to have been less affected by the reform than others. Interestingly this is true also when focusing on first-time buyers only.

It is important to note however, that also other institutional details seem to be important in determining the observed distribution of loan-to-value ratios.

For debt-to-income ratios the evidence is less clear. Debt-to-income ratios have been increasing for first-time buyers also after the reform. This increase is entirely driven by those buying apartments. The debt-to-income ratios of those buying a house have remained quite stable. One potential explanation is related to the differences in price development shown in Figures 1 and 2: Prices of apartments in multistorey buildings have been increasing especially in Helsinki Metropolitan Area while prices of detached houses have stagnated. This means that for those buying dwellings in multistorey buildings, loan-to-value ratios could be coming down at the same with increasing debt-to-income ratios.

Finally, our analysis of the hypothetical reform that would limit debt-to-income ratios, suggests that the share of first-time buyers above the 4.5 limit is quite small and consists of households that are somewhat different from all first-time buyers. They tend to live more often in city centers and are younger and more highly educated than first-time buyers with lower debt-to-income ratios. In addition, their incomes seem to grow faster than incomes of those with lower debt-to-income ratios. This may imply that a reform limiting high debt-to-income ratios would affect especially young households borrowing against high future labour income in productive densely populated areas.

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Appendix

A Appendix

A.1 Data definitions

The data used in this report are obtained from Statistics Finland. Two of the datasets are ready-made research data available as so-called FOLK-modules, covering households' debt and income statistics and individual socio-economic characteristics, see links and descriptions in table A1. In addition, we requested three custom-made datasets which include dwelling characteristics, links between dwellings and occupants and mortgage debt data at the individual level. The main outcome variables of interest are leverage and income, aggregated over members of a household.

Regarding leverage, we distinguish between a household's total level of debt and debt from housing loans. In addition to housing loans, total debt consists of debts from trade and business activities (except between 2007 and 2013), debts relating to agriculture, debts from business groups (until 2005) and other liabilities, including student loans and consumer credit (from 2012 onward the latter only consists of consumer loans and no longer includes continuous credit). Due to the inconsistency in some series of debt categories we focus mainly on mortgage debt in this report. Unless explicitly mentioned, mortgage debt only includes debt held by the household, not debt held by the housing cooperative, the main reason being that we only have this data since 2006. More information on Statistics Finland's debt data can be found [here](#), [here](#) and in the data description referenced in table A1.

Regarding income, we calculate gross income as the sum of entrepreneurial income, property income, earned income and income from current transfers received. Entrepreneurial income aggregates agricultural and forestry entrepreneurial income (MATU and METU), entrepreneurs' entrepreneurial income (MUUYRTU), business groups' entrepreneurial income (YHTYRTU) and entrepreneurial income from copyrights, patents etc. Property income includes rental, interest and dividend income and pensions based on private insurance. Transfers received cover earnings-related and national pensions and other social security benefits and social allowances (child benefits, housing allowances etc.). Finally, when we compare households across income quartiles, we adjust for household size using the OECD's adjusted consumption unit scale, made available by Statistics Finland. In doing so we take into account shared consumption benefits (economies of scale in consumption), see [this page](#) for more details on this adjustment. More information on

Statistics Finland’s gross income data and related concepts can be found here and in the data description referenced in table A1.

Table A1: Dataset descriptions and sources

Name	Short description	Source
Askun	FOLK dataset on household level debt and income	Statistics Finland (more info here)
Perus	FOLK basic dataset with individuals’ socio-economic characteristics	Statistics Finland (more info here)
Asunto	Dataset on dwelling locations, characteristics, and mortgage debt	Statistics Finland (custom-made)
Henkilo paikkatiedot	Dataset connecting dwellings to their respective occupants	Statistics Finland (custom-made)
Henkilo asuntovelat	Individual mortgage debt dataset	Statistics Finland (custom-made)
Varainsiirtovero	Transfer tax dataset containing purchase prices and cooperative-held debt for apartments since 2006	Statistics Finland (custom-made)

A.2 Sample population vs. overall population

The analysis in the report is restricted to heads of families or single persons living alone, to be able to correctly aggregate variables such as debt and income to the household level. In restricting the sample in this way, we capture 91.1% of the overall population in 2018 (Figure A1). Also comparison of the tenure status in our sample and in the overall population shows no notable differences between the two (Figure A2). Additionally, this share of the population represents 95.5% of mortgage debt (Figure A3).

Figure A1: Distribution of household types

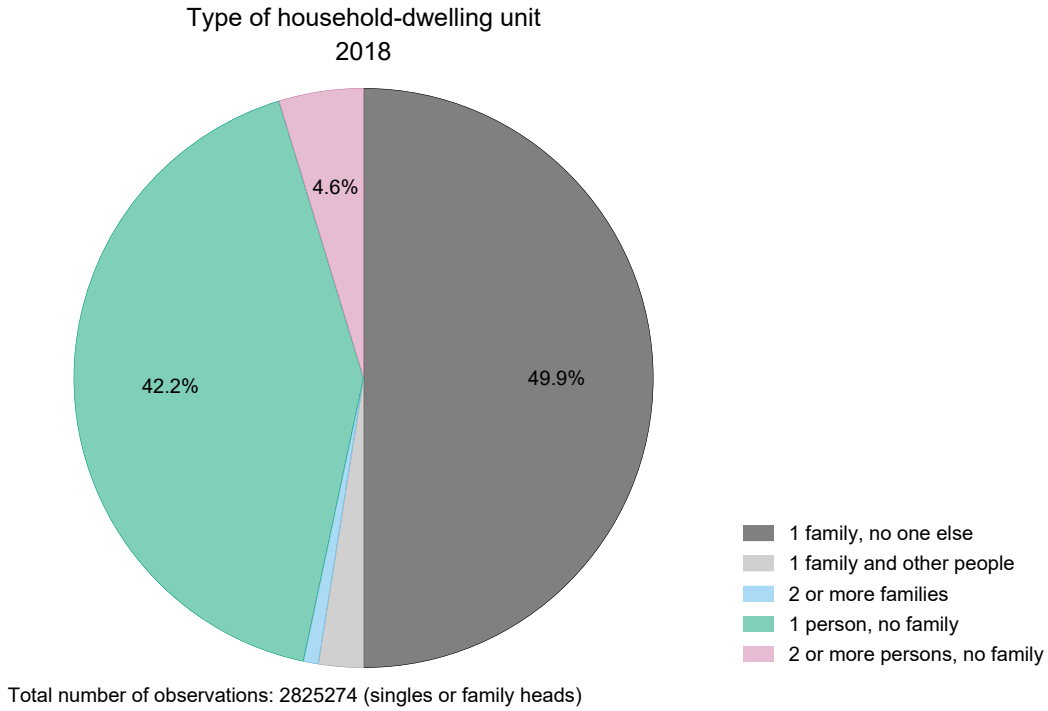
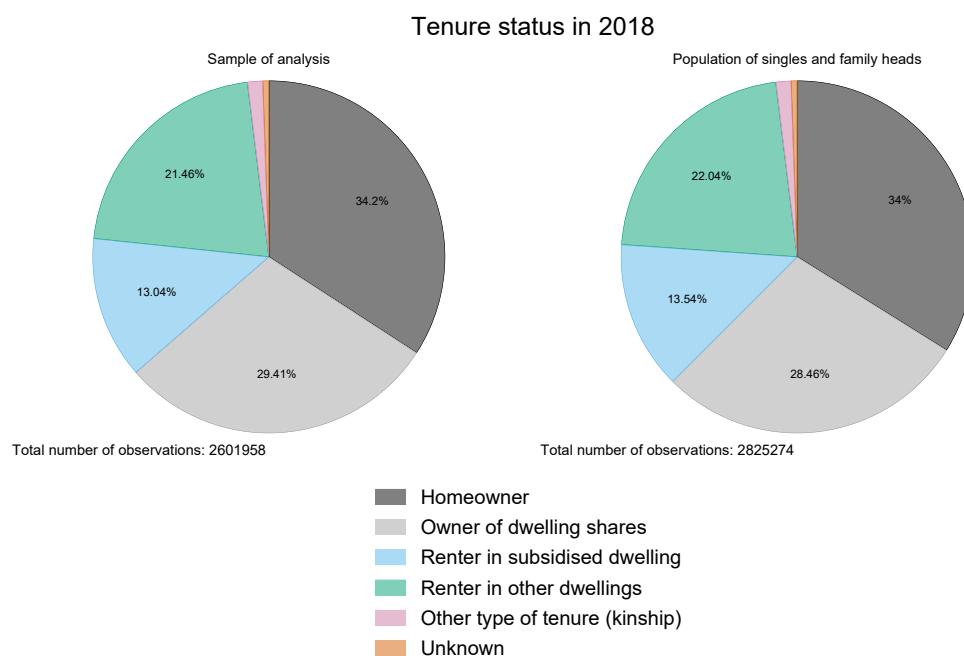
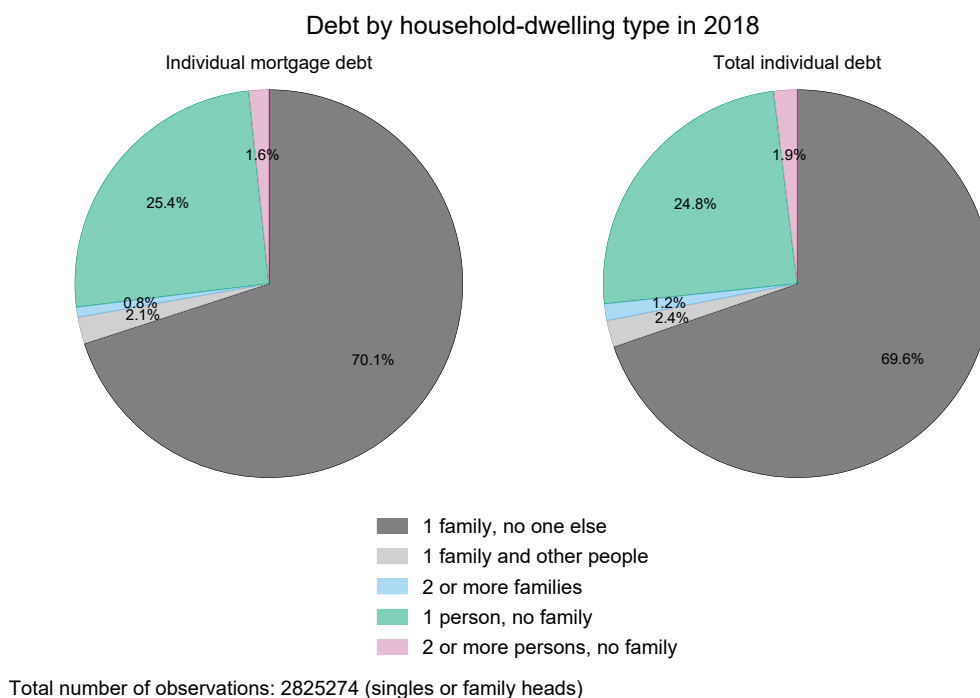


Figure A2: Tenure status in sample and overall population



Sample of analysis only includes singles living alone and family heads living only with their family

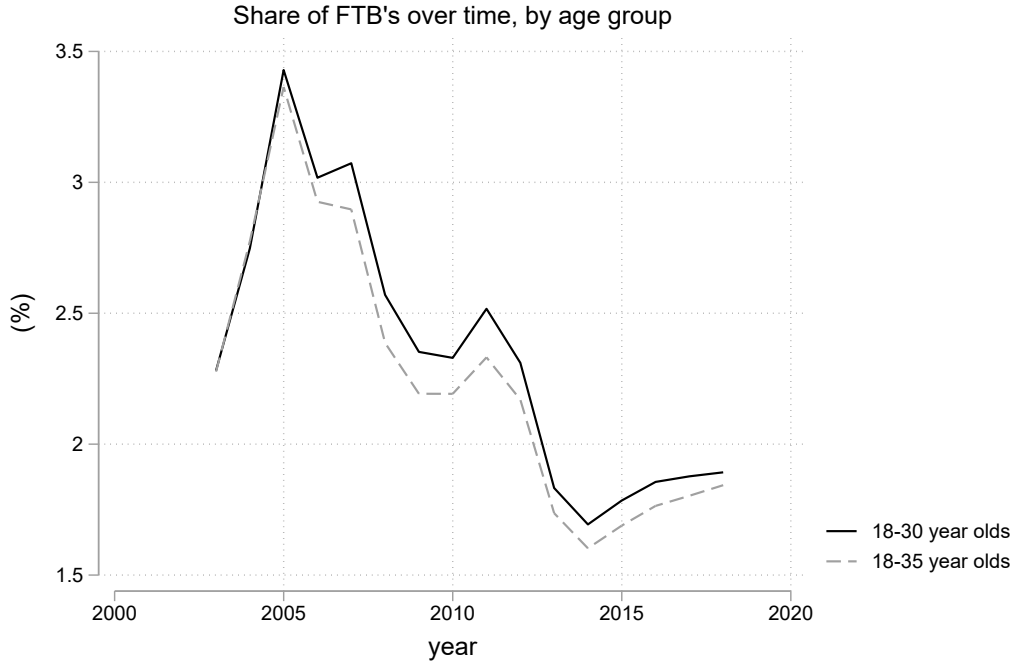
Figure A3: Distribution of mortgage debt and total debt over household type



Finally, because our sample does not include those flat-sharing or living at home, there

may be a concern that we don't accurately capture the transition towards home-ownership for young adults. In Figure A4 therefore, we plot the number of first-time-buyers as a share of all young adults in the overall population. The figure shows the same trend as in our sample.

Figure A4: Young first-time-buyers in the population



A.3 Analysis of missing observations

The sample for this analysis was constructed starting from a dataset relating dwellings to occupants, which was consequently matched to a dataset on dwelling characteristics (asunto), a dataset on household and dwelling characteristics (askun) and a dataset on individuals (perus). For some years, individuals in the original dataset were not matched to one or more of the others, which is quickly analysed below.

Conditional on not being matched to one of the other datasets for at least one year, the average share of missing years falls between a fifth and a fourth of the years observed in the original dataset. As such, it is not an all or nothing situation. Table A2 also shows the number of individuals with missing observations.

Table A2: Number of individuals with at least one year of missing/unmatched data and the average share of missing years per individual, by dataset

	mean share	count
No Asunto Data	.2258259	6289579
No Askun Data	.2350034	6891565
No Perus Data	.2276031	2392151

Note from table A3 that the correlation between unmatched individual-years (logically) is very strong between the dwelling and household-dwelling dataset. While seemingly this is not the case for the individual (perus) dataset, many of the same individual-years, although matched to the perus dataset have missing perus data.

Table A3: Correlation between missing observations across (unmatched) datasets

	No Asunto Data	No Askun Data	No Perus Data
No Asunto Data	1		
No Askun Data	0.935***	1	
No Perus Data	0.00559***	0.0369***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Missing individual-years are not concentrated in specific years as can be observed in A4. Looking at the total share of missing observations in the last line of table A4 it is clear that very few of individual-years were not matched to the perus data, while about 1.5% of the original individual-years were not matched to the dwelling and household-dwelling datasets.

Table A4: Share of missing observations by year and main dataset

	No Asunto Data	No Askun Data	No Perus Data
2002	0	.0111404	.0000227
2003	0	.0126993	.0000274
2004	0	.014277	.0000576
2005	.0146691	.0146918	.0000279
2006	.0156436	.0156696	.0000316
2007	.0162418	.0162698	.0000348
2008	.0169314	.0169601	.000035
2009	.0175685	.017598	.0000373
2010	.0179897	.0180247	.0000427
2011	.0196079	.0196213	.0000178
2012	.0195866	.0196149	.000019
2013	.0199092	.0199225	.0000165
2014	.020189	.0202028	.0000167
2015	.0207837	.0207973	.0000181
2016	.0211996	.021211	.0000147
2017	.0213187	.0213318	.0000169
2018	.0213612	.0213612	.0000176
Total	.0156057	.0177942	.0000266

Overall, from this analysis there does not seem to be a concern that the unmatched data is a structural problem, rather it is spreads across individuals and time.

A.4 Additional figures on ownership rate and indebtedness

Figures A5 and A6 show that the ownership rate has been decreasing among the young and the low-income households.

Figure A5: Homeownership rate over time by income level.

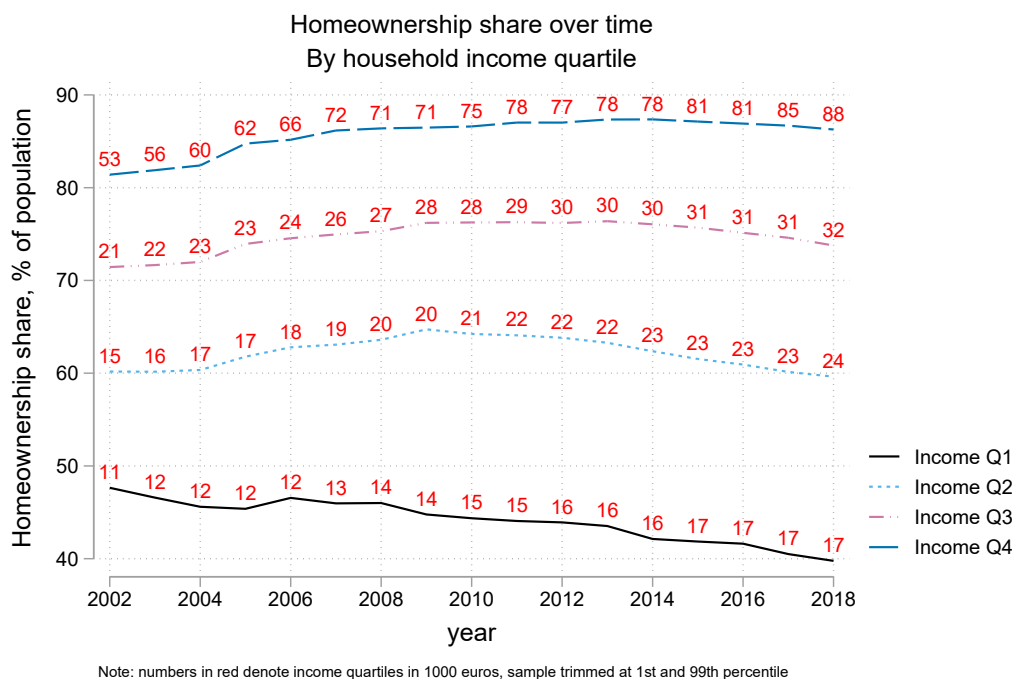


Figure A6: Homeownership rate over time by age.

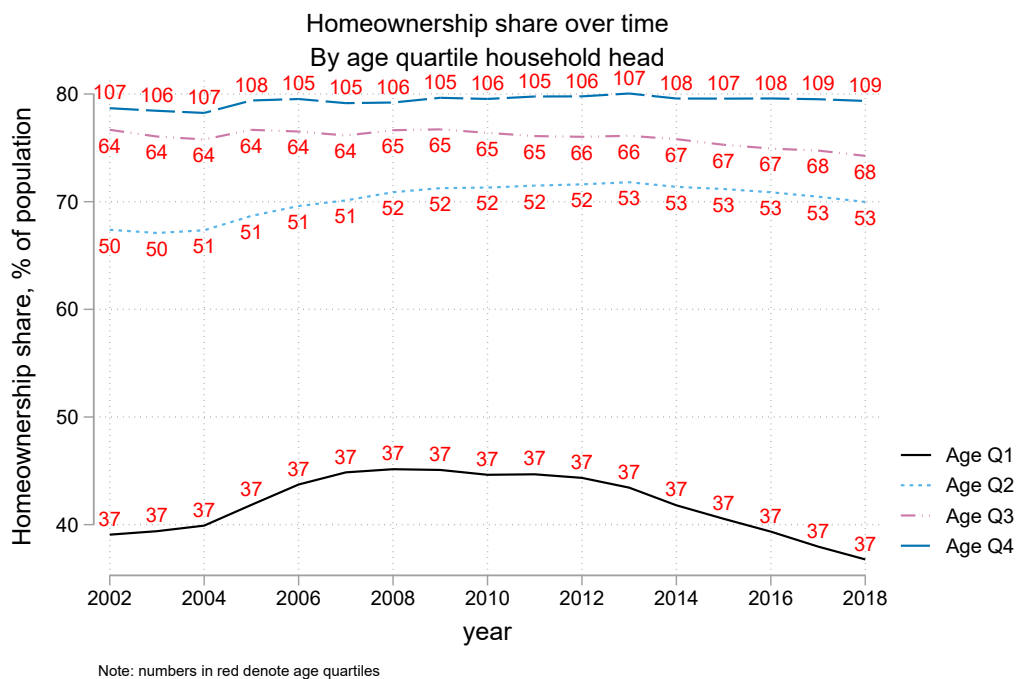


Figure A7: Share of highly-leveraged first-time buyers over time

