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Housing Allowance and Rents: Evidence from a Stepwise Subsidy Scheme

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Abstract

This paper studies the effect of housing demand subsidies on rents using discontinuities in the Finnish housing allowance system as a quasi-experimental setting. The stepwise dependence of housing allowance on the floor area of the dwelling and the year of construction of the building causes economically and statistically significant discontinuities in the amount of housing allowances. However, our results show that there are no discontinuities in rents of the recipient households at these cut-offs. Instead, differences in the amount of the housing allowance are translated roughly one-to-one into differences in the rent net of housing allowance.

Keywords: housing demand subsidies, housing allowance, incidence, rents

JEL Classifications: H22

1 Introduction

In most countries, governments subsidize the housing consumption of low-income households through various, often overlapping housing programs. Over the last few decades, the general trend has been towards less construction of social housing and increased reliance on direct subsidies for low-income households. Given this tendency, it is vital to understand the effects of these direct subsidies and to be aware of how the details of the programs affect their efficiency and distributional effects.

A typical feature of housing allowance (henceforth HA) programs is that the subsidy depends on the characteristics of the household, such as income and household size. In addition, the subsidy is typically more generous in more expensive areas and also depends on other unit characteristics related to rent. The aim of these details is to level the out-of-pocket rents (rent net of housing allowance) and non-housing consumption of recipients. However, these differences likely affect the recipient households' willingness to pay for rental housing, and could thereby affect the rents they pay. If the incidence of differences in HA generosity is to a large extent on the landlords, the redistributive goals of the scheme are not achieved.

In this paper, we study whether and to what degree differences in HA generosity for different housing units affect rents. We consider the Finnish HA system where the HA is capped by a rent ceiling which depends in a stepwise manner on the floor area of the unit and the construction year of the building. We test for the existence of a similar stepwise pattern in rents using a regression discontinuity type approach and register data covering the universe of HA recipients in Finland. The discontinuities provide a quasi-experimental setting which makes it possible to isolate the impact of HA from other determinants of rent.

Figure 1 illustrates our research design and presents the main results. The red vertical lines indicate the location of discontinuities in the rent ceiling. The dots correspond to the sample means by 0.5 m^2 bins, and the black lines represent 2^{nd} order polynomials fitted separately for each interval between the floor area cut-offs. Panel A shows that the discontinuities in the rent ceiling lead to clearly visible discontinuities in the amount of HA. In our econometric analysis, we demonstrate that, for example, on the right hand side of the first cut-off monthly HA is on average 15 euros lower than on the left hand side. This corresponds to 6.7% lower HA or 1.9% lower income. Panel B, in turn, shows that the relationship between floor area and rent does not have similar stepwise pattern. This indicates that the differences in HA do not translate into differences in rents.

In an instrumental variables regression, utilizing the discontinuities as instruments, we again find no effect of the HA on the rents of recipient households. The upper limit of the 95% confidence interval for our preferred estimate for the effect of a 1 euro higher housing allowance is about 0.2 euros. In our subsample analysis, we find some indication of rent effects when we focus on long term HA recipients or flats inhabited by HA recipients for several years. This suggests that the dynamics of recipient status and the rental market may matter for the incidence of HA.

We contribute to the small literature on the incidence of housing demand subsidies by utilizing a plausibly exogenous source of variation in HA generosity. Our paper is closely related to the studies analyzing reforms which change the parameters of the scheme and therefore affect the distribution of benefits across households. Our finding that the incidence of differences in HA scheme is largely on the tenant is in line with the recent study by Brewer et al. (2016), but in contrast with most earlier studies.

Brewer et al. (2016) study the incidence of housing benefits in the UK exploiting a package of housing benefit cuts in 2011–2012 as a natural experiment. Similar to our data, their data contain the universe of subsidy recipients, which implies relatively precise estimation and permits analyzing heterogeneous effects. Their results suggest that the incidence is 90% on the tenants, but they also report substantial variation between claimant groups. These findings differ substantially from Gibbons and Manning (2006) who use a similar reform in 1996–1997 and find that the incidence is only 40% on the tenants.

Fack (2006) and Laferrère and Le Blanc (2004) study French reforms which extended the housing subsidy program to households not previously eligible. Both studies find that the rents of housing benefit claimants increased faster than those of non-claimants after the reforms.

Also in Finland, two previous studies have analyzed the incidence of HA exploiting variation in the rent ceilings used in calculating the HA. Kangasharju (2010) utilizes a reform in the rent ceilings in 2002 to analyze the impact of HA on rents. The main result is that one additional euro in HA led to a 60–70 cent increase in the rents paid by the claimants. In Appendix B, we repeat the analysis of the reform using the same data and the methods described in Kangasharju (2010) but find different results. In particular, we do not find evidence of substantial effects on rents.

Viren (2013) in turn regresses rents on maximum achievable HA. His results suggest that 30–50% of the HA is shifted to rents. Our results imply a much smaller rent effect, but we argue that the internal validity of our research design is higher as we focus on the discontinuities in the rent ceilings at certain cut-offs that generate plausibly exogenous variation in the allowance, and perform extensive robustness and validity checks. We return to the relationship to the previous studies after having presented and discussed our results.

The incidence of housing demand subsidies has also been analyzed in the context of the US voucher system.[2] Collinson and Ganong (2016) exploit two different reforms of the system. The first reform increased the rent ceiling across-the-board and seems to have led to higher rents with little evidence of neighborhood quality improvements.[3] The second reform, in turn, replaced the metropolitan area level rent ceilings with zip code level rent ceilings. As a result, rents increased in expensive neighborhoods and decreased in low-cost neighborhoods. The reform also led to improved neighborhood quality with little change in overall rents paid by voucher households.

Our analysis is not directly informative about the effects of the size of the HA system on overall rent level. These effects are studied by Eriksen and Ross (2015) who analyze the impact of changes in the US housing choice voucher program by exploiting two reforms which increased the supply of vouchers to a varying degree in different metropolitan areas. Their results indicate that increased supply of vouchers did not affect the overall rental rate but shifted demand from lower quality units towards higher quality units. This finding is in contrast with earlier results by Susin (2002) who finds that that rents paid by non-recipient low-income households increased faster in metropolitan areas with more vouchers. For the UK, Gibbons and Manning (2006) use the differences in the share of housing subsidy recipients in different regions in order to assess the general equilibrium effects, but do not find evidence of strong effects on the overall rent level.

[2] The US housing choice voucher system is very different form the Finnish HA system. A household is eligible for a voucher if its income is low enough relative to the local income level. Not all eligible households receive a voucher. If it does, it needs to find an apartment which satisfies the requirements of the program. The size of the subsidy is determined by local rent ceilings which the housing authorities set based on the local fair market rent determined by the US Department of Housing and Urban Development.

[3] For most recipients, the rent was below the rent ceiling before the reform. This means that their out-of-pocket rent is a fixed share of their income and not affected by rent increases.

2 The institutional setting

2.1 The housing allowance system

The Finnish housing allowance program consists of three parts: general HA, HA for pensioners and housing supplement for students. The program is financed by the government through the Social Insurance Institution of Finland (Kela). We focus on the general HA, which is intended for working age low-income households and is the most important tenant-based housing subsidy system in terms of the number of recipients and total outlays.

Our data cover the years 2008 to 2013.[4] In 2013, general HA expenditures were roughly 670 million euros (Kela, 2014) which amounts to 0.34% of GDP. In December 2013, roughly eight percent of population under the age of 65 years received the general HA. The average monthly allowance was about 280 euros.

Eligibility for the HA is based on pre-tax income, financial wealth and household size but does not depend on whether the tenant lives in private rental housing or social housing. The allowance is determined by the following formula:[5]

(1)

$$HA = 0.8 * [\mathrm{Min}(rent/m^2, rent\_ceiling) * \mathrm{Min}(area, area\_ceiling) - deductible]$$

The formula contains three different elements. First, the allowance covers rents up to a maximum rent per square meter (rent ceiling). If the rent per square meter exceeds the rent ceiling, the excess rent is neglected when calculating the HA. The rent ceiling depends on the floor area of the unit, the construction (or major renovation) year and location of the building. Table 1 below shows an example.

Second, the allowance covers rents up to a maximum floor area of the unit (floor area ceiling). Again, the excess floor area is neglected when calculating the HA. The area ceiling depends on the household size only. For example, the ceiling is 37m^2 for a single and 57m^2 for a couple.

[4] The general HA (*yleinen asumistuki*) was reformed in the beginning of 2015. As our data cover the time period between 2008 and 2013, in what follows we will describe the system as it existed before this recent reform.

[5] Lyytikäinen (2008) provides a more detailed description of the system.

Third, the allowance is means-tested and involves a deductible if household income exceeds an income limit which depends on the household size and location of the building. The deductible increases with pre-tax income and is lower for larger households. The allowance covers 80% of the difference between the actual rent (or the rent up to the ceilings) and the deductible.

Similar households will receive different HA depending on the region where they live. Finnish municipalities are divided into four regions according to housing affordability. The rent ceilings and income limits vary from one region to another. Region 1 is the capital city Helsinki. Region 2 consists of the rest of the Helsinki Metropolitan Area (HMA). Region 3 includes 30 medium sized towns, and region 4 is the rest of Finland.[6]

The tenant applies for the HA from Kela and typically the HA is paid to the tenant. When applying for the HA, the household can also authorize Kela to pay the subsidy directly to the landlord. In our estimation sample, about 26% of the recipients choose this alternative. In these cases, the landlord knows not only the recipient status of the tenant but also the amount of subsidy received.

Our estimation strategy exploits the feature that the rent ceiling is a step function of the unit size and the construction year of the building. As an example, Table 1 shows the rent ceilings in medium-sized towns (region 3) in 2012. The floor area and construction year cut-offs shown in the table are the same for all affordability regions. The rent ceilings and as a result also the size of the jumps at the cut-offs vary slightly from one affordability region to another.

As the table shows, the discontinuities in the schedule are quite large. For instance, for a housing unit of 35 square meters, the rent ceiling is 9.72 euros per square meter if the building is constructed in 1985, but is 13% higher (11 euros) if the building is constructed in 1986. That is, the maximum monthly rent taken into account when determining the HA is 340.5 euros in a building constructed in 1985 and 385.0 euros in a building constructed in 1986. In the same manner, the rent ceiling is 10.56 euros per square meter for a housing unit of size 30.5 square meters built in 1985, but is 8% lower if the floor area is 31 square meters. Translated into rent levels, this means that for a 30.5 square meter dwelling the maximum

[6] The discontinuities in the rent ceilings at the region borders are not suitable for studying the effects of the HA on rents as the borders are determined based on municipality borders and many other things affecting the rents also change these borders.

monthly rent taken into account when determining the HA is 322.1 euros while for a 31m^2 dwelling, it is 301.3 euros.

For larger units, the maximum monthly rent taken into account when determining the HA depends not only on the rent ceiling but also on the size of the household through the floor area ceiling. For instance, if a single household was renting a 45 square meters dwelling built in 1985, it faces a rent ceiling of 9.27 euros but the area exceeding 37 square meters is excluded when calculating the HA.

2.2 Social housing and social assistance

The second major housing-related subsidy program in Finland is social rental housing intended mostly for low-income households. In 2008, roughly half of all rental housing was social housing, but the share of the social rental housing has been decreasing slightly over the last ten years.

The social housing units are mainly owned by municipalities but also by various non-profit organizations. The owners receive subsidies from the municipality and the central government and commit to different types of regulation. For instance, the rents cannot be freely set but must be based on the capital and maintenance costs of the building. Also, because in many social rental housing units tenant selection is based on household income and housing needs, the households in the social housing rental units tend to have on average lower incomes than those is private rental market.

The HA is determined in the same manner in both rental market sectors. However, because of the restrictions in rent setting in the social housing sector, one would not expect the HA to affect rents of the social housing tenants.

Finally, HA recipients in both private and social rental sector are entitled to social assistance if their income and assets do not cover their necessary daily expenses, including housing. For these households, social assistance can cover up to 100% of the housing costs. As a result, the incentives generated by the HA system may be not relevant for these households.

There exist no comprehensive data on housing costs covered by social assistance for the time period of our study. But as eligibility for social assistance is based on income, we can address this issue by splitting the sample by income and studying separately those with high enough income not to be eligible for social assistance.

3 Potential mechanisms behind rent effects

Housing subsidy programs may influence households and the housing markets in various ways. The programs directly affect recipient households' housing costs and disposable income. In addition, the programs affect all households through the taxes required to finance the programs. They may also influence the allocation of households into rental housing units and the rents paid by recipient and non-recipient households. At least in principle, programs may also affect the size and distribution of the overall stock of rental housing. This means that the short run effects of the programs may differ from those observed in a longer run. All these effects are likely to depend on the share of recipient households in the rental market, on the elasticity of rental housing demand and supply, on the competitiveness of the rental market, as well as the details of the program. Therefore, the results of different empirical studies are not necessarily directly comparable.

This paper focuses on the rents paid by the recipient households. There are several potential reasons for why the amount of HA received by the tenant might affect the rent of the dwelling. First, if the rental housing market is characterized by substantial frictions and the rents are negotiated between the tenant and the landlord, the rent of any given unit may depend on the characteristics of the tenant, including the amount of housing allowance received. Second, the tenant and the landlord may jointly agree on a higher rent so as to maximize the HA received.[7] Third, if landlords perceive HA recipients to be more costly than other tenants due to, say, a higher risk of damage to the unit, HA recipients may face a rent premium.[8] The first two mechanisms are potentially relevant in our context.

Several papers (e.g. Laferrère and Le Blanc, 2004; Gibbons and Manning, 2006; Fack, 2006; Kangasharju, 2011; Viren, 2013;[9] Collinson and Ganong, 2016, and Brewer et al., 2016) have

[7] The incentives for this type of collusion obviously depend on the design of the system. In the Finnish system, the HA covers up to 80% of the rent. Therefore, the incentive to collude is not as high powered as, for instance, in the US voucher system where, below the rent ceiling, any increase in rent is entirely paid by the housing authority.

[8] On the other hand, if the tenant has authorized KELA to pay HA directly to the landlord, the landlord may also view the recipient households as less risky because of guaranteed stream of rental payments,.

[9] Viren's (2013) period of analysis includes a HA reform but his empirical analysis is not focused on the variation generated by the reform. Viren (2013) finds that higher HA is related to higher rent using register data

studied the effect of HA on the rents of recipient households by exploiting reforms which affected the subsidy received by different households in different ways. Brewer et al. (2016) find that on average the incidence is largely on the tenant. Most other studies tend to conclude that the subsidy is to a large extent passed on to the landlords in the form of higher rents although they are typically not able to discriminate between the three mechanisms discussed above.

Instead of relying on a reform in generating identifying variation, our empirical strategy exploits the stepwise dependence of the HA on the floor area of the unit and the construction year of the building (see Figure 1). Because of these discontinuities in the amount of HA, recipient households' willingness to pay for two similar units could change at the cut-off. As a result, rents paid by recipient households could be higher on the generous side of the cut-offs. The discontinuities also create incentives to choose dwellings on the generous side of the cut-offs. If the recipients respond to these incentives, we would expect HA recipients to be over-represented just below the floor area cut-offs and above the construction year cut-offs.

The strength of these demand responses may depend on the institutional details. For instance, optimizing housing choices precisely might be difficult if the rental market is thin with respect to the relevant unit characteristics (floor area and construction year). Also, the difference in the willingness to pay between two alternative, otherwise similar dwellings but with different levels of HA should depend on expected benefit duration. Finally, at least in the Finnish system, the incentives may also be muted because of the social assistance system covering housing costs for HA recipients with very low incomes. Our data will allow us to partly address these concerns. We can study whether the results are sensitive to differences in benefit duration and analyze separately a subsample of recipient households with income levels high enough not to be eligible for social assistance.

Two additional margins of adjustment are potentially important especially over the long run if the share of HA recipients is large. First, if the HA system directs housing demand towards certain types of units, rental housing supply can be expected to respond to the demand. This type of supply response should reinforce discontinuities in the floor area and construction year distributions. We do not have data on the characteristics of the overall rental stock, but

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on HA recipients. Using another data set, which includes also non-recipients, he finds no difference in rents paid by recipients and non-recipients. Based on these two findings, he argues that the law-of-one-price holds and HA affects the overall rent level.

we can analyze the distribution of recipient households in the proximity of the cut-offs. As we do not observe discontinuities in this distribution, we conjecture that the effects on the overall rental stock are likely to be modest at most.

Second, the landlords' incentive to maintain and renovate units changes at the cut-offs as recipient households' willingness to pay for the units changes. As a result, it is possible that discontinuities in the HA translate into discontinuities in quality-adjusted rents even if the observed rent level develops smoothly when crossing the cut-offs. This is an issue to be kept in mind when interpreting the results as we do not have data on the quality of units.

Like most previous studies, our strategy is based on the comparison of rents paid by different groups of tenants. If there are no frictions in the rental market, a subsidy program that affects a subset of households will affect the rents paid by all households.[10] If so, an empirical strategy based on the comparison of the rent changes in different subgroups fails to detect the effect of the subsidy program on the overall rent development. Two different approaches exist in the literature to address this issue. One study (Gibbons and Manning, 2006) uses variation in the share of housing subsidy recipients in the UK in the different housing market areas but does not find evidence of strong general equilibrium effects. Two studies exploit geographic variation in the size of the US housing voucher system (Susin, 2002, and Eriksen and Ross, 2015). While Susin finds that non-recipient low-income households pay higher rents in areas with more vouchers, Eriksen and Ross conclude that increased supply of vouchers did not affect the overall rental rate.

4 Empirical analysis

4.1 Data

We use data on all HA recipients and their dwellings provided by Kela for the years 2008–2013. The data are originally monthly payment data. We keep only regular payments[11] and collapse the data by address, recipient, monthly rent, monthly HA and year. We define cases where any of these five variables changes as new observations.[12] It can be argued that this

[10] Of course, the fact that rent contracts feature a certain degree of rigidity could lead to delayed responses.

[11] We drop claw-backs and retrospective payments.

[12] The average number of observations per dwelling per year is 1.49.

leads to overweighing of dwellings with frequent changes in rent or high turnover, and dwellings occupied by recipients whose circumstances change so that the amount of HA is reviewed. We test for the robustness of our findings to keeping only one randomly drawn observation for each dwelling each year.

We limit the analysis to dwellings with a floor area below 41 square meters because the discontinuities in HA are stronger for small flats than for larger flats. In addition, for small flats, the floor area ceilings are not binding and the whole floor area of the flat is typically taken into account when determining the HA. For larger flats, the floor area ceiling often becomes binding. In addition, because the floor area ceilings depend on the household size, they cause noise for bigger flats.

As discussed in Section 2, rents in the social housing sector are set administratively and the rent ceilings are typically not binding. Therefore, we restrict our attention to the private rental market only, but report the results concerning the social housing sector in Appendix A.

Figure 2 shows that there are clear discontinuities in the rent ceiling at all floor area cut-offs in our main estimation sample. For instance, on average the rent ceiling used to calculate the HA for flats with a floor area of 26m^2 is slightly less than 12 euros and roughly 12.8 euros for flats with a floor area of 25.5m^2. As the figure shows, there is also some variation in the rent ceiling away from the cut-offs. This is because the rent ceiling varies from one affordability region to another and also depends on the construction year of the building. The rent ceilings are also typically adjusted upwards each year.

The rent ceilings and income limits used in calculating the HA vary from one affordability region to another. Nevertheless, the rent ceiling is binding relatively infrequently in affordability region 4, which consists of small municipalities. In addition, rental market conditions may be quite different in rural areas than in large cities and towns. Therefore, we leave out affordability region 4 from the analysis.[13]

In regions 1–3, the rent ceilings are binding for over 80% of small flats. This is important for the analysis. If the actual rents per square meter were substantially lower than the rent ceilings used to calculate the HA, changes in the rent ceilings should not be expected to influence

[13] A series of municipal mergers took place in Finland during the time period of the study. Most importantly, in the beginning of 2009, some 70 small municipalities merged with larger ones and, as a result, are likely to have been reclassified from affordability region 4 to region 3.

rents. Figure 3 shows the distribution of the proportionate differences between actual rents and the rent ceiling in our main estimation sample.

Figure 1 in the introduction showed that the discontinuities in rent ceiling cause clear discontinuities in actual HA. The discontinuities in the rent ceiling shown in Figure 2 are somewhat stronger. There are three main reasons for this. First, as Figure 3 shows, the rent ceiling is not always binding and hence the HA does not change at the cut-off. Second, the HA also depends on the income of the household through the deductible. In addition, even when the deductible is zero, the HA only covers 80% of the rent up to the rent ceiling. Nevertheless, individual jumps are clearly visible and economically significant for low-income households.

Our data cannot be used to assess the importance of HA for the entire private rental market because they only include information on HA recipients. Based on additional calculations using the Income Distribution Survey data (IDS)[14] for the same time period, the share of HA recipients was slightly below 20% in the kind of flats included in our main estimation sample. The share varies by affordability region and the type of dwelling.

Table 2 shows summary statistics for the main variables for our main estimation sample. With the above restrictions, there are some 273,000 observations in the data (83,620 recipients and 73,819 flats). The mean rent is roughly 434 euros/month and the mean floor area 32 square meters. On average, the HA is some 226 euros/month which implies that the average net rent (or out-of-pocket rent) is roughly 208 euros/month.

[14] The IDS data are a representative sample of Finnish households with an annual sample size of about 10,000 households.

As discussed in Section 3, the expected benefits of adjusting housing choices according to the HA scheme depend on how persistent the recipient status is expected to be. Table 3 reports observed lengths of HA spells starting in 2009.[15] Approximately 28% do not continue as HA recipients in 2010 and for another 29% the spell discontinues before 2011. Thus for the majority of HA recipients, the subsidy appears to serve as temporary assistance. On the other hand, some 23% continue as recipients for five or more years.

4.2 Empirical strategy

Estimating the effect of housing allowance on rents is challenging because typically, other things equal, the housing allowance is bigger if the rent is higher. This reverse causality implies that simple OLS regression gives biased results. In addition, housing allowance is likely to be correlated with other factors that affect rent.

However, the fact that the rent ceiling jumps at certain cut-off points can be used to identify the impact of the HA on rent. The idea is to compare rents below and above the cut-off points where the HA changes sharply. These discontinuities generate variation in the generosity of the housing allowance. The variation is plausibly exogenous because there is no reason, other than the HA, to expect the relationship between rents and floor space (or construction year) to be stepwise, when we control for smooth but flexible functions of these attributes.

Our empirical strategy has the features of a regression discontinuity design (RDD) discussed in e.g. Lee and Lemieux (2010). However, the setting differs from an ideal RDD in that HA recipients can sort into flats with different attributes. The discontinuities may also affect selection into the sample.[16] Sorting of HA recipients to flats with more generous HA is one of the channels through which rents could be affected because such sorting would increase the demand for flats where the HA is higher. The standard RDD tests (balancing tests and McCrary test) are useful in studying potential sorting.

The main focus of our empirical analysis is on the floor area discontinuities, because visual examination of the data shows that the relationship between rent and floor area is smoother

[15] The sample used to produce Table 3 includes recipients who were in our estimation sample in 2009 but did not receive HA in 2008. The length of spell is calculated so that it is not affected by attrition from the estimation sample (e.g. through moving to another area or to a larger dwelling).

[16] A household with a relatively large deductible may be eligible on the generous side of the cut-off but not on the other side. Similarly, the discontinuity in the size of the HA may affect take-up.

than the relationship between rent and construction year. Thus, the floor area cut-offs likely provide a cleaner source of variation and give more precise estimates. The same methodology can be used for the construction year discontinuities. We present the results for the construction year discontinuities in Appendix A and discuss the findings briefly after analyzing the floor area cut-offs.

Our sample consists of units with floor area varying from 21m^2 to 40.9m^2. The sample therefore includes the first three floor area cut-offs shown in Table 1 (26m^2, 31m^2 and 36m^2). 98% of the observations of floor area are concentrated on multiples of 0.5m^2 (76% integers). We round the observations not divisible by 0.5m^2 down to the closest 0.5m^2. Thus we have 40 floor area clusters. Heaping of the observations to integer values may bias our estimation results if the likelihood of an integer floor area is correlated with some determinants of rent (Barreca et al. 2016). We address this concern by controlling for integer values and testing for the robustness of our results for dropping non-integers.

Our empirical analysis has three steps. First, in order to visualize the discontinuities at the floor area cut-offs, we calculate bin averages for rent ceiling, HA, rent, and net rent in our sample for the discrete values of floor areas and plot these averages at the floor area values. The graphical analysis is presented in Figures 1–3. In each figure, the dots show bin averages of these variables and the vertical red lines show the location of the cut-offs where the rent ceiling changes. The figures include the fits of second order polynomials estimated separately for each group separated by the cut-offs.[17]

Second, we estimate the effect of each cut-off on the HA and the rent separately[18] using the model

$$(2) \qquad Y_i = \alpha + \sum_{\mathrm{j}} \beta_j D_j(Floor\ area_i > cutoff_j) + f(Floor\ area_i) + \delta' X_i + u_i.$$

The dependent variable Y_i is HA per square meter or rent per square meter in unit i. The explanatory variables of interest are the dummy variables D for values above the various floor area cut-offs. Using floor area group dummies defined in an overlapping way implies that the β coefficients can be interpreted as the impact of crossing the cut-off on Y_i. We control for the direct impact of floor area by including a smooth function f of floor area in the model. The

[17] The regression is weighted by the number of observations in the bin.

[18] Alternatively, we could pool the discontinuities and normalize the floor area to zero at each discontinuity to estimate a pooled RD treatment effect. Our strategy is preferable because it fully exploits the information available in our multi-cut-off setup (See Cattaneo et al., 2016).

function is allowed to vary between the cut-offs. In order to allow for a straightforward interpretation of the β coefficients, the function f is in practice modeled through an overlapping sequence of floor area variables normalized to zero at the cut-offs. These normalized floor area variables are interacted with the respective floor area group dummies:

(3) $$f(Floor\ area_i) = g_0(Floor\ area_i) + \sum_{\mathrm{j}}[D_j(Floor\ area_i > cutoff_j) * g_j(Floor\ area_i - cutoff_j)].$$

Other control variables in X_i include municipality-specific year fixed effects, postcode fixed effects and affordability group-specific dummies for construction year dummies, type of land lord (an individual or a firm) and integer value of floor area. We include these control variables in all specifications to gain precision. In addition, some specifications include characteristics of recipient households (income, household size and age of household head).

Finally, we quantify the impact of HA on rent through instrumental variables regression where we use the discontinuities as exogenous instruments for HA. The first stage of the IV regression is model (2) with HA as the dependent variable. The floor area group dummies are the excluded instruments. In the second stage, we estimate the model:

(4) $$R_i = \beta_1 + \beta_2 \widehat{HA}_i + f(Floor\ area_i) + \gamma X_i + u_i,$$

where R_i is the rent per square meter and the regressors are the predicted HA from the first stage together with polynomials of floor area and other controls.

This kind of IV regression arguably solves the reverse causality and omitted variables issues and gives an estimate of the impact of HA on rent isolated from other determinants of rent.

The identifying assumption is that the floor area cut-off dummies are orthogonal to the error term. This should be the case if other determinants of HA develop smoothly with respect to floor area and are therefore captured by the f function. The main worry here is that sorting and sample selection might lead to discontinuities in the background characteristics. This can be examined through balance of covariates tests where we use characteristics of the dwellings and HA recipients as dependent variables in model (2).

As discussed above, our assignment variable is discrete. This means that we cannot compare the means of the dependent variable just below and above the cut-offs. The conditions for non-parametric or semi-parametric methods are not satisfied (Lee and Card, 2008). Thus we are forced to perform simple parametric RDD analysis, where we choose a functional form for the relationship between the assignment variable and the outcome variable. We use 1st and 2nd order polynomials which are allowed to vary between the cut-offs in our main tables. The use of higher order polynomials would likely lead to overfitting, but we report specifications with all (in total 81) combinations of 1st–3rd order polynomials for the four intervals separated by the cut-offs as a robustness check.

The discreteness of the assignment variable also has implications for statistical inference. As pointed out by Lee and Card (2008), specification errors in the fitted regression line imply that at each discrete value there is an error component positively correlated within observations at that particular point. As a result, conventional standard errors are downward-biased. Therefore, we cluster standard errors at discrete values of floor area.

4.3 Results

Our graphical analysis (Figures 1 and 2) shows that there are clear discontinuities in the rent ceilings and actual HA received at the floor area cut-offs. It also suggests that these differences in the generosity of the HA system do not translate into differences in relative rents.

We now turn to regression analysis where we estimate the size of the discontinuities in HA and rents at the cut-offs, and estimate the impact of HA on rents utilizing the three discontinuities as instruments for HA.

Table 4 shows the estimation results for model (2). The coefficients are changes in HA, in rent or in net rent in euros (per square meter per month) when crossing the floor area cut-offs. Columns 1–4 report the effect of crossing the cut-offs on monthly HA per square meter and columns 5–8 show the effect on monthly rent per square meter. For both outcomes, we consider four different specifications. To gain precision, all the specifications include construction year dummies interacted with affordability group, a dummy for integer values of floor area interacted with affordability group, municipality-year fixed effects (34 municipalities and 6 years) and postcode fixed effects (799 postcodes). The first specification is a naïve regression where we do not control for floor area of the unit. In the second and the third specifications, we add 1st and 2nd order polynomials of floor area. The last specification includes household characteristics as additional controls. For the third outcome, the monthly net rent per square meter in column 9, we report only the third specification without the household characteristics.

The first four columns show that there are clear and statistically significant jumps in HA per square meter at all three cut-offs. Comparisons of the jumps in HA with the mean income and HA reported in Table 2 indicates that the jumps are not large but not negligible either. For example, crossing the first cut-off implies on average a 15 euro reduction in the monthly HA ($26m^2$ * 0.576 euros/m^2) which corresponds to a 6.7% decrease in HA or 1.9% decrease in income.

Turning to the monthly rent per square meter in columns 5–8, all the coefficients are negative and significant in the naïve regression of column 5 where we do not control for floor area. In column 6, where this effect is controlled for using the 1st order polynomials, there is one significant coefficient with a counterintuitive sign. With the 2nd order polynomials in column 7, all the coefficients are close to zero and statistically insignificant and have reasonably narrow confidence intervals. Adding household characteristics in column 8 has little effect on the results.

Column 9 shows that crossing the floor area cut-offs has a statistically significant effect on the net rent (the difference between the actual rent and the HA) of the recipient households. At all the cut-offs, households just to the right of the cut-off have higher housing expenses after the housing allowance has been taken into account than those just to the left of the cut-off.

Table 5 shows the result of the IV regression of model (4). The specifications used are the same as in Table 4. The first stage F-statistics are high indicating that the instruments are strong enough for reliable estimation. The first stage regressions are reported in Table 4. Table A5 in Appendix A shows the results with all possible combinations of 1st–3rd order polynomials of floor area for the intervals between the cut-offs.

In the first column of Table 5 without the 1st or 2nd order polynomial of the floor area, the housing allowance coefficient is positive and significant. Adding the 1st and 2nd order polynomials first turns the estimate negative and significant and then brings it close to zero.

In column 5, the dependent variable is the net rent per square meter. The results indicate that a higher HA translates roughly one-to-one into a lower net rent.

Results for sub-groups

As discussed in Section 3, there are reasons to expect that the effects of HA on rents are heterogeneous and depend on the circumstances of the household. In Table 6, we repeat the analysis discussed above for various sub-samples based on recipient and unit characteristics. The first panel shows the IV estimates for the effects of HA on rents (corresponding to column 3 in Table 5) and the second panel the reduced form of IV regressions (corresponding to column 7 in Table 4).

In the first column, we limit the sample to those 26% of the HA recipients whose HA is paid directly to the landlord. In the second and the third columns, we divide the sample into two groups based on income: those with incomes lower and higher than the mean income. This is because the details of the HA system might be less important for those with very low incomes as they are eligible for social assistance covering their housing costs. In the fourth and fifth columns, we focus on those flats and recipient households that appear regularly (in at least five out of six years) in our data. The rationale is that one might not expect HA to influence willingness to pay for different types of units or housing consumption choices if the household's reliance on the HA is very short term. While we cannot know what the expectations of the recipient households are when they make their housing consumption choices, we can examine whether the effects are different for those who end up receiving HA for extended durations. Finally, in columns 6 and 7 we consider the effects separately for those with a private individual and a corporation as their landlord. The effects could be different as institutional landlords are more likely to use posted rents as opposed to bargaining while private landlords might be more willing to negotiate with potential tenants.

Starting from the reduced form of IV estimates in the lower panel, there is some evidence of rent effects for long-term HA recipients and flats inhabited by HA recipients for longer periods. In these groups, there is a statistically significant (at the 5% level) downward shift in rent at the first cut-off, and also at the third cut-off for the long term HA flat group. In the other groups, none of the coefficients for crossing the floor area cut-offs are significant, apart from one with a counterintuitive sign in column 7. Despite some significant coefficients in the reduced form regressions, all the IV estimates in the upper panel are insignificant. The results are not entirely conclusive for some sub-groups because the standard errors are rather large.

All the results above concern tenants in the private rental market. Table A4 in Appendix A reports estimates for municipality owned housing and for privately-owned subsidized housing. The reduced form of IV estimates might suggest some impact on rents in the privately-owned subsidized housing at one of the cut-offs, but the IV estimates are insignificant for both sectors. In both cases, the first stage F values are low which is not surprising as the rent ceiling is much less frequently binding in the social housing sector than in the private rental market. Also the share of very small flats is smaller than the private rental market. Accordingly, the standard errors are large especially at the first floor area cut-off.

Construction year cut-offs

The analysis above utilizes variation due to discontinuities in HA at floor area cut-offs. The effects might differ for other types of variation in HA. For example, the dependence of HA on other characteristics might trigger rent responses if the demand for these characteristics is more price elastic than the demand for housing space. Collison and Ganong (2016), for instance, study a reform which made the US housing voucher system more generous in expensive neighborhoods and less generous in low-cost neighborhoods, and find evidence of demand and price responses. Brewer et al. (2016) argue that variation in the incidence is explained by differences in demand elasticities across recipient groups.

The stepwise dependence of HA on construction year of the dwelling offers an additional source of variation in HA[19]. We repeat the analysis presented and discussed above using the cut-offs for the year of construction or major renovation (henceforth construction year) in Appendix A. There are two construction year cut-offs in the scheme, in 1986 and 1996. For the analysis, we restrict the sample to a +/- 10 year band around these cut-offs (flats built between 1975 and 2006) which reduces the sample size from roughly 273,000 to 132,086.

Figures A1 and A2 in Appendix A show that the discontinuity in HA is particularly strong at the 1986 cut-off. In Figure A3, there is some indication of an upward shift in rents at the first cut-off, but no sign of a jump in rents at the second cut-off. The figure also reveals that there is substantial variation in rents and the relationship between rents and construction year does not appear to be very smooth. Thus the analysis utilizing the floor area discontinuities is likely to be more reliable. Table A1 shows estimates of the discontinuities in HA and rent and Table

[19] Variation in HA generosity across the borders of the four affordability regions is probably not exogenous in Finland because the borders coincide with municipality borders where other determinants of rents, such as local taxes and public services, change at the same time. Moreover, RDD type analysis might not be feasible because the rental market is often thin in border areas which are typically outside urban areas.

A2 reports the IV estimates. According to columns 7 and 8 in Table A1, there is a jump in the rent at the second cut-off but not at the first cut-off where the discontinuity in HA is larger. The IV estimates are close to zero and insignificant. Overall, the results are in line with the findings of the analysis based on the floor area cut-offs.

Relationship with previous Finnish studies

The finding that differences in the level of HA do not affect rents is in contrast with two previous Finnish studies (Viren, 2013, and Kangasharju, 2010). Viren (2013) uses similar (but smaller) register data on HA recipients as we do for an earlier time period. The analysis exploits the whole range of variation embedded in the rent ceiling differences.[20] He estimates reduced form models of rent on maximum achievable HA and various controls. As regards floor area and construction year, his controls include only the first order terms fitted over the whole support of the distribution of floor area and construction year. In the light of our analysis, this is clearly insufficient to capture the underlying relationship between these attributes and rents. We, on the other hand, focus on data close to cut-offs where rent ceilings have an important impact on actual HA and generate plausibly exogenous variation in the allowance. We also control for the running variables in a more flexible way and perform extensive robustness and validity checks. Therefore, we argue that the internal validity of the analysis is higher here than in Viren (2013).

Kangasharju (2010) in turn studies a reform which increased the rent ceilings in 2002 using the Income Distribution Statistics data which combines register data and survey elements. The IDS is a representative sample of Finish households and contains both HA recipient and non-recipient households. The study presents differences-in-differences results based on the comparison of rental rates of recipient and non-recipient households before and after the reform as well as an instrumental variable estimation exploiting the variation in the changes in the rent ceiling. The main result is that one additional euro in HA led to a 60–70 cent increase in the rents paid by the recipient household. In Appendix B, we repeat the analysis of the 2002 reform using the same data and the methods described in Kangasharju (2010) but find different results. In particular, we do not find evidence of large rent effects. All in all, the comparison of our analysis to the previous Finnish studies highlights the importance of a credible research design and transparent empirical analysis.

[20] The discussion presenting the empirical strategy in Viren (2013) is not very detailed and hence it is not entirely clear what the sources of identifying variation are.

4.4 Robustness and validity

In this section, we report the results of the robustness checks. We also discuss the internal validity (in particular, the possible manipulation of the assignment variable close to the cut-offs and the balance of the covariates by treatment status) and the external validity of the results.

Internal validity

The existence of the floor area cut-offs at which the rent ceiling changes may, at least in principle, induce behavioral responses both on the demand and supply side. When thinking about supply, two issues should be discussed. First, the ability of landlords or tenants to manipulate floor area (reported to Kela) could invalidate our RD analysis. The concern would be that units with a floor area just above the cut-offs are reported to have floor area below the cut-off for the unit to qualify for a higher HA. Second, if the construction of new units responds to this incentive, over time, the whole rental housing stock could start to reflect these cut-offs in the system. The rental housing stock could adjust by conversion of owner-occupied units to rental units and vice versa.

In addition, it is possible that the cut-offs also lead to sorting by inducing changes in the level of the HA and thereby in net rents. Because non-recipients and recipients face different incentives, recipients could be expected to be over-represented just below the floor area cut-offs.

All these different ways of manipulating the assignment variable should show up as discontinuities in the distribution of floor area at the cut-offs. We examine the distribution in Figure 4 and in Table 7.

Figure 4 shows that there are spikes in the distribution at the round values 25, 30 and 35 just below the cut-offs, but there is a similar spike at 40 square meters with no floor area cut-off (and also at 20 square meters, which is not shown in the figure). The figure also shows that integers are in general much more common than half-integers. In general, based on the figure, it seems that there are no abnormal jumps in the distribution at the cut-offs.

Table 7 shows the change in the number of observations (and log of number of observations) when crossing the cut-offs when we control for 2nd order polynomials of floor area. A dummy for integer values is included as a control (not included in Figure 4), because otherwise the presence of integers just to the right of the cut-offs could bias the test. The table confirms that there are no statistically significant jumps in the density of floor area at the cut-offs.

We then turn to the characteristics of the dwellings and households. Figure 5 and Table 8 report the balance of covariates tests for some household characteristics (household age, size and income). They also show the construction year, share of units located in Helsinki and share of private owners at different floor areas. The construction year and Helsinki dummy are of particular interest because the rent ceiling depends not only on the floor area but also on the construction year and affordability group.

Figure 5 shows that in general larger units tend to be located in newer buildings and are less likely to be located in Helsinki and more likely to have a private owner. Also, households in larger units are older, larger and have higher incomes.

Table 8 shows that the year of construction, dummy for Helsinki and dummy for private owner are balanced at the cut-offs but for household characteristics there are statistically significant jumps at some of the cut-offs, indicating that there may be sorting based on household characteristics into different floor area groups. The fact that the sign of the jumps varies between cut-offs, however, suggests that an alternative reason is that the standard errors are downward biased for household characteristics because the errors are correlated within household and the same households are observed many times. Table A3 in Appendix A shows that only one coefficient is significant at the 5% level when we cluster standard errors at the household level. Using household level clustering in our main analysis leads to lower standard errors, and thus, we hold to the more conservative floor area clustering.

Table 9 addresses the concern that non-random heaping of the data to integer values of floor area might bias our results. We control for integer values through a dummy variable in all regressions but this might not be sufficient. As suggested by Barreca et al. (2016), we report the IV and reduced form of IV estimates for a sample limited to integers of floor area in Table 9. The results are very similar to the corresponding specification in Tables 4 and 5. Note that the standard errors in Table 9 are likely to be downward biased due to the low number of clusters (20 instead of 40).

The way we have constructed the estimation sample from the original payment level data implies that dwellings with more frequent changes in rent, high turnover or tenants with frequent changes in HA get higher weight than dwellings where these key variables are more stable. In Table A5, we test for the robustness of our IV estimates to drawing a sample which includes only one (randomly drawn) observation per year for each dwelling. The sample size reduces from 272,941 to 182,217, but the results are very similar to our main IV estimates in Table 5.

Finally, we analyze the robustness of the IV estimates to the functional form of floor area by reporting specifications with all the combinations of 1st–3rd order polynomials for the four intervals separated by the three floor area cut-offs as a robustness check (81 specifications altogether). The findings are reported in Table A6. We do not find positive point estimates in any of the specifications. There are some counterintuitive negative and significant estimates when we use a 1st order polynomial for the first interval. With intermediate degrees of flexibility we find small and insignificant estimates similar to our main specifications. With higher order polynomials the point estimates tend to move further away from zero but remain statistically insignificant.

External validity

Our results suggest that the incidence of differences in HA due to discontinuities in the Finnish HA scheme is on the tenant. The results may be generalizable to other settings where HA depends on characteristics of the dwelling or characteristics of the household, such as household size and income. The findings are not informative as to whether the demand increase due to the existence of the HA scheme affects the overall rent level or whether HA recipients pay a premium relative to non-recipients.

5 Conclusions

We study the effect of housing demand subsidies on rents exploiting the stepwise nature of the Finnish HA scheme. During the time period of the study, the HA system featured discontinuities in the rent ceiling per square meter as a function of the floor area of the unit. These discontinuities are informative of whether the HA affects rents because there is no other reason to expect the relationship between rents and unit size to be stepwise.

The discontinuities in the amount of HA at the cut-offs studied are economically and statistically significant. However, we do not find evidence of discontinuities in rents at these cut-offs when focusing on HA recipient households in the private rental housing market. Instead, it seems that differences in the size of the housing allowance are translated into differences in the out-of-pocket rent of the recipient households.

More generally, while our results are not informative about the effects of the overall size of the housing allowance system, they do suggest that the incidence of small changes in the parameters of the system is largely on the tenants.

Tables

Table 1. Rent ceilings (euro/m^2 per month) as a function of floor area and construction year, affordability region 3, year 2012.

	Construction year		
Floor area (m^2)	–1985	1986–1995	1996–
< 26	11.4	12.68	13.18
26 – 30.9	10.56	11.84	12.34
31 – 35.9	9.72	11	11.5
36 – 45.9	9.27	10.64	11.15
46 – 60.9	8.96	10.26	10.76
61 – 80.9	8.76	9.82	10.33
> 81	8.68	9.74	10.24

Table 2. Summary statistics for the main estimation sample (N = 272,941).

Variable	Mean	Std. Dev.	Min	Max
Rent ceiling/m2	11.07	1.48	7.73	15.35
Rent (EUR per month)	433.96	107.22	61.74	1580.00
Rent/m2	14.07	4.10	2.00	39.74
HA (EUR per month)	225.70	73.11	16.83	481.60
HA/m2	7.27	2.40	0.42	17.17
Net rent (EUR per month)	208.26	112.52	12.35	1354.40
Net rent/m2	6.80	3.92	0.40	34.44
Floor area	31.53	4.87	21.00	40.50
Floor area>25.9	0.87	0.34	0.00	1.00
Floor area>30.9	0.57	0.50	0.00	1.00
Floor area>35.9	0.22	0.42	0.00	1.00
Construction year	1985.10	21.83	1620.00	2013.00
Age of recipient	32.98	12.28	16.00	66.00
Household size	1.04	0.23	1.00	8.00
Deductible (EUR per month)	46.63	83.19	0.00	468.00
Hh income excluding HA (EUR per month)	561.03	349.35	0.00	2156.00
Rent ceiling binding	0.83	0.38	0.00	1.00
HA paid to landlord	0.26	0.44	0.00	1.00
Private owner	0.74	0.44	0.00	1.00
Integer floor area	0.76	0.43	0.00	1.00
Affordability region 1	0.21	0.41	0.00	1.00
Affordability region 2	0.05	0.23	0.00	1.00
Affordability region 3	0.74	0.44	0.00	1.00

Table 3. Length of HA spells starting in 2009.

Length of HA spell	Percent	Cumulative percentage
1 year	28.19	28.19
2 years	29.4	57.58
3 years	12.58	70.17
4 years	6.81	76.97
5 or more years	23.03	100

Table 4. Discontinuities in monthly HA, rent and net rent (1st stage and reduced form of IV regression).

Dep var	(1) HA/m2	(2) HA/m2	(3) HA/m2	(4) HA/m2	(5) Rent/m2	(6) Rent/m2	(7) Rent/m2	(8) Rent/m2	(9) Net Rent/m2
Floor area>25.9	-0.786***	-0.527***	-0.497***	-0.576***	-2.232***	0.263***	-0.134	-0.152	0.363**
	[0.042]	[0.033]	[0.062]	[0.038]	[0.390]	[0.093]	[0.159]	[0.167]	[0.156]
Floor area>30.9	-0.662***	-0.409***	-0.455***	-0.575***	-1.331***	0.118	0.193	0.165	0.648***
	[0.042]	[0.037]	[0.066]	[0.043]	[0.223]	[0.073]	[0.122]	[0.130]	[0.079]
Floor area>35.9	-0.644***	-0.118*	-0.224***	-0.245***	-0.853***	0.127*	-0.008	0.024	0.216***
	[0.104]	[0.068]	[0.076]	[0.042]	[0.144]	[0.070]	[0.084]	[0.081]	[0.057]
1st stage F	463.7	96.2	50.4	183.8					
Order of polynomials of floor area	No	1st	2nd	2nd	No	1st	2nd	2nd	2nd
Dwelling and area characteristics	X	X	X	X	X	X	X	X	X
Household characteristics				X				X	

Notes: N=272,941. Table shows coefficients on the dummies for crossing floor area cut-offs. Dwelling and area characteristics include construction year dummies interacted with affordability group, dummy for integer values of floor area interacted with affordability group, municipality-year fixed effects and postcode fixed effects. Household characteristics include age of recipient, age squared, household income (pre-allowance), income squared and household size dummies. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table 5. IV results on the effect of housing allowance on rents.

Dep var	(1) Rent/m2	(2) Rent/m2	(3) Rent/m2	(4) Rent/m2	(5) Net Rent/m2
HA/m2	2.043***	-0.395**	-0.14	-0.1	-1.140***
	[0.122]	[0.170]	[0.178]	[0.151]	[0.178]
1st stage F	463.7	96.2	50.4	183.8	50.4
Order of polynomials of floor area	No	1st	2nd	2nd	2nd
Dwelling and area characteristics	X	X	X	X	X
Household characteristics				X	

Notes: N=272,941. Table shows IV regression results on the effect of HA/m2 on rent/m2 and net rent/m2. The excluded instruments are the three dummies for floor area cut-offs. 1st stage regressions are shown in Table 4. Dwelling and area characteristics include construction year dummies interacted with affordability group, dummy for integer values of floor area interacted with affordability group, municipality-year fixed effects and postcode fixed effects. Household characteristics include age of recipient, age squared, household income (pre-allowance), income squared and household size dummies. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table 6. Estimated effect of HA on rent in sub-groups.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sub-sample	HA paid to landlord	Below mean income	Above mean income	Flat in data in 5 or more years	Recipient in data in 5 or more years	Private landlord	Firm landlord
Dep var	Rent/m2	Rent/m2	Rent/m2	Rent/m2	Rent/m2	Rent/m2	Rent/m2
Panel A: IV results							
HA/m2	0.024	-0.096	-0.195	0.27	0.164	-0.057	-0.775
	[0.330]	[0.121]	[0.277]	[0.250]	[0.270]	[0.104]	[0.499]
1st stage F	45.2	403.4	44.4	17.6	23.1	82.3	4.7
N	71514	125758	147183	101484	114173	200709	72232
Panel B: Reduced form of IV							
Floor area>25.9	-0.295	-0.01	-0.268	-0.638**	-0.468**	0.031	-0.387
	[0.292]	[0.135]	[0.225]	[0.259]	[0.207]	[0.084]	[0.486]
Floor area>30.9	0.187	0.083	0.278	0.369*	0.316	0.011	0.605***
	[0.256]	[0.088]	[0.171]	[0.217]	[0.241]	[0.086]	[0.217]
Floor area>35.9	0.106	0.037	-0.025	-0.257*	-0.218**	0.044	0.072
	[0.134]	[0.115]	[0.078]	[0.138]	[0.098]	[0.087]	[0.141]
N	71514	125758	147183	101484	114173	200709	72232
Order of polynomials of floor area	2nd	2nd	2nd	2nd	2nd	2nd	2nd
Dwelling and area characteristics	X	X	X	X	X	X	X

Notes: Panel A shows IV regression results on the effect of HA/m2 on rent/m2 and net rent/m2. The excluded instruments are the three dummies for floor area cut-offs. Panel B shows coefficients on the dummies for crossing floor area cut-offs from a regression of Rent/m2 on floor area group dummies and controls. Dwelling and area characteristics include construction year dummies interacted with affordability group, dummy for integer values of floor area interacted with affordability group, municipality-year fixed effects and postcode fixed effects. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table 7. Tests for discontinuities in the density of floor area.

	(1)	(2)
Dep var	Number of observations	Ln(Number of observations)
Floor area>25.9	-388.017	0.132
	[1492.702]	[0.294]
Floor area>30.9	-2485.19	-0.202
	[5996.131]	[0.348]
Floor area>35.9	-520.999	-0.178
	[1187.473]	[0.158]
N	40	40
Order of polynomial of floor area	2nd	2nd

Notes: Table shows coefficients on the dummies for crossing floor area cut-offs. Dummy for integer values of floor area included as a control. Heteroskedasticity robust standard errors are in brackets * p<0.1, ** p<0.05, *** p<0.01.

Table 8. Balance of covariates tests.

	(1)	(2)	(3)	(4)	(5)	(6)
Dep var	Year of construction	Helsinki	Private owner	Age	hh size	hh income
Floor area>25.9	0.377	0.052	-0.002	-0.293	0.009***	14.5
	[2.821]	[0.103]	[0.039]	[0.619]	[0.003]	[11.503]
Floor area>30.9	1.039	0.000	0.069	-2.270***	0.005	-17.281**
	[1.393]	[0.035]	[0.046]	[0.510]	[0.003]	[6.866]
Floor area>35.9	0.235	-0.029	0.029	0.409	-0.012**	0.205
	[1.829]	[0.024]	[0.034]	[0.534]	[0.006]	[5.008]
Order of polynomial of floor area	2nd	2nd	2nd	2nd	2nd	2nd

Notes: N=272,941. Table shows coefficients on the dummies for crossing floor area cut-offs. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table 9. Integers only sample.

	(1)
	Integer values of floor area only
Dep var	Rent/m2
Panel A: IV results	
HA/m2	-0.063
	[0.080]
1st stage F	130.5
Panel B: Reduced form of IV	
Floor area>25.9	-0.009
	[0.115]
Floor area>30.9	0.031
	[0.050]
Floor area>35.9	0.088
	[0.083]
Order of polynomials of floor area	2nd
Dwelling characteristics	X

Notes: N=204,432. Panel A shows IV regression results on the effect of HA/m2 on rent/m2 and net rent/m2. The excluded instruments are the three dummies for floor area cut-offs. Panel B shows coefficients on the dummies for crossing floor area cut-offs from a regression of Rent/m2 on floor area group dummies and controls. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Figures

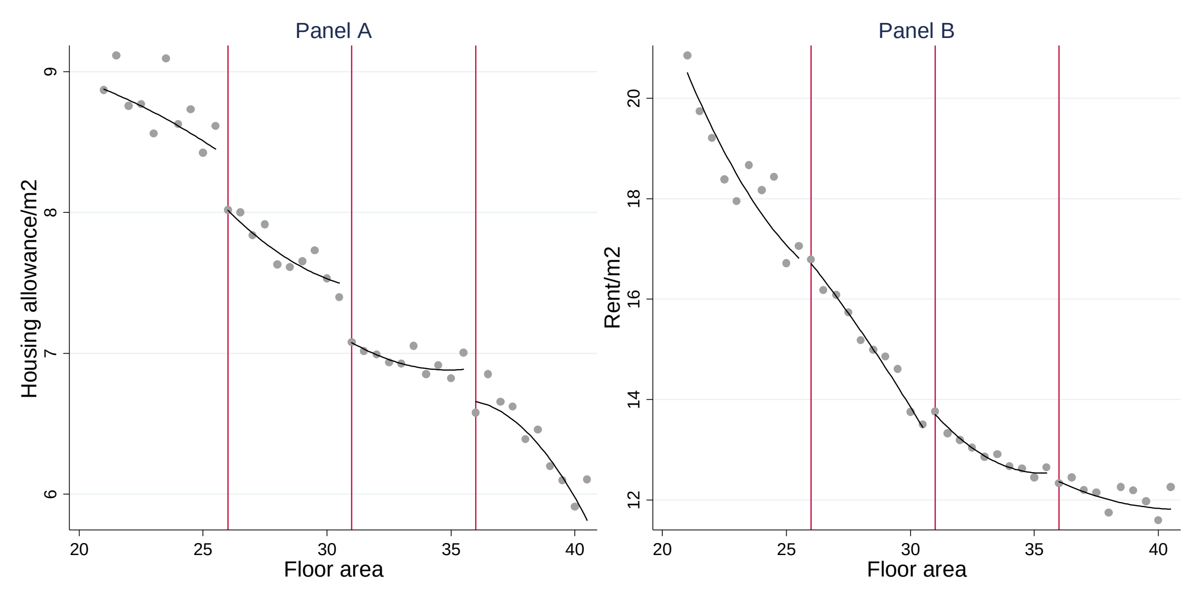

Figure 1. Floor area, monthly HA per square meter (panel A) and monthly rent per square meter (panel B).

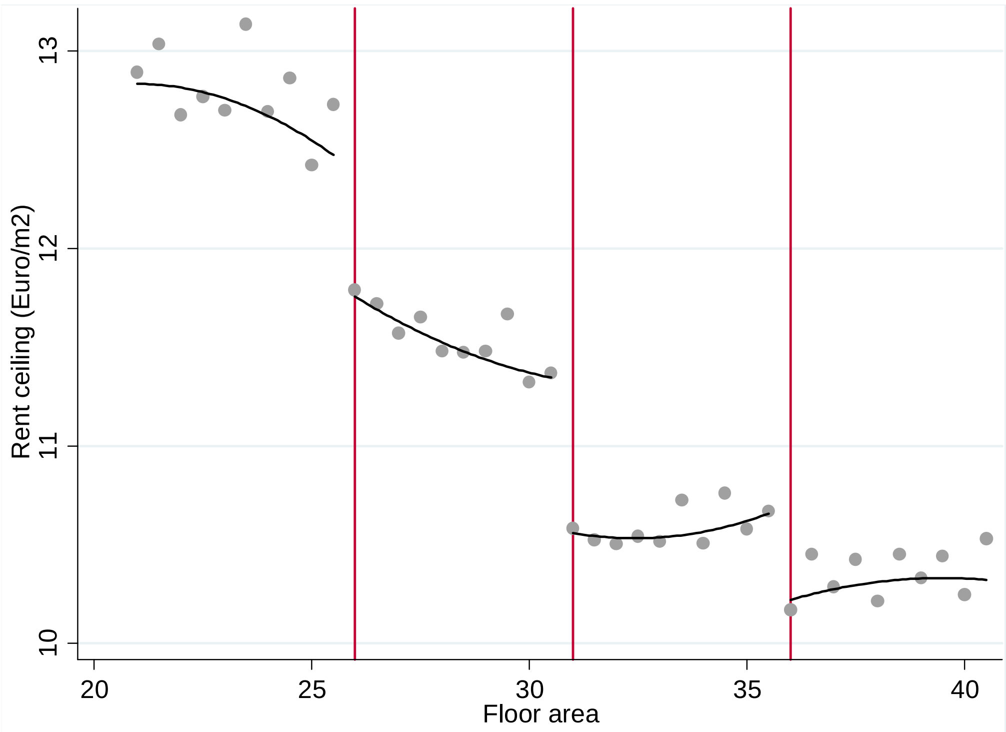

Figure 2. Floor area and monthly rent ceiling.

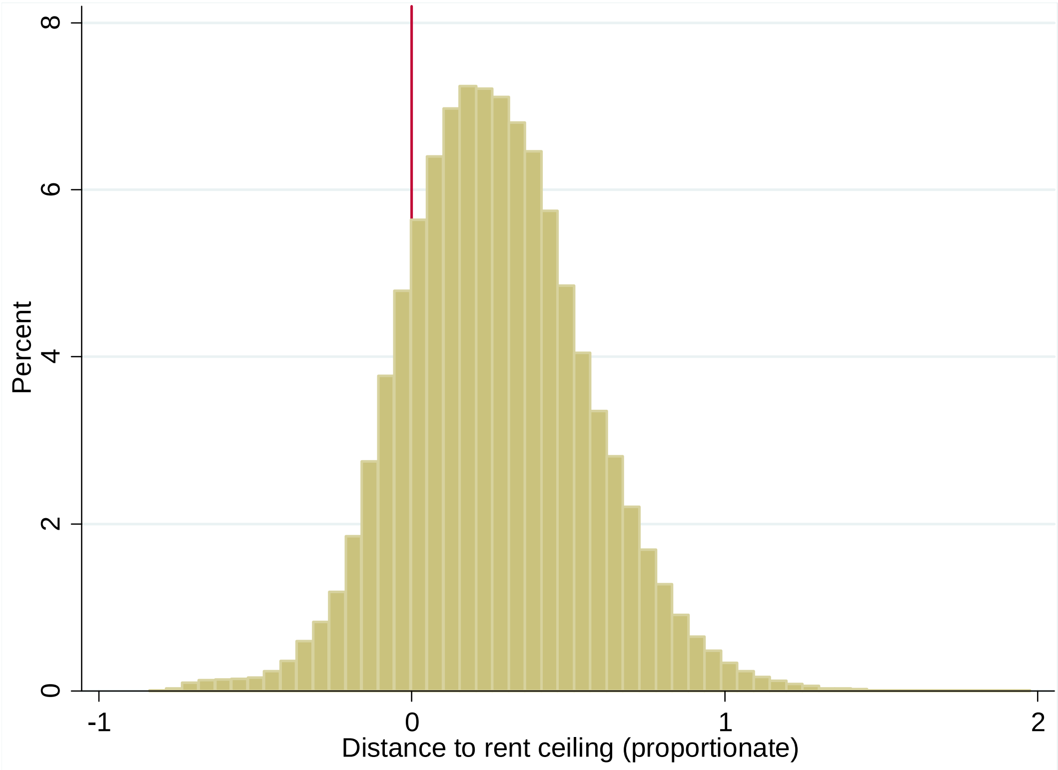

Figure 3. Actual rents relative to the rent ceiling.

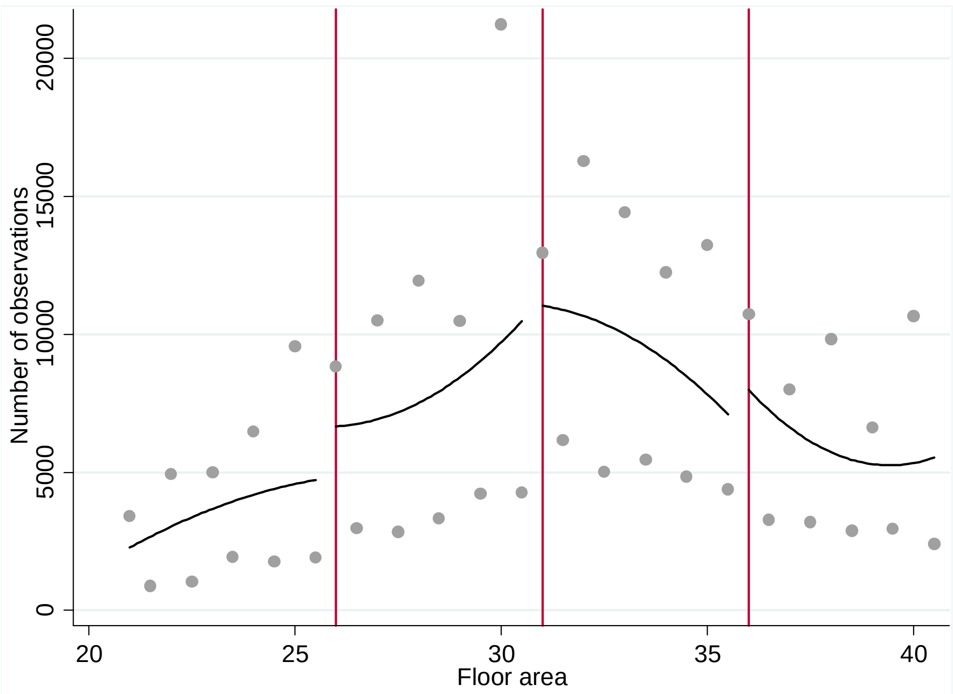

Figure 4. Distribution of floor area of HA recipient households.

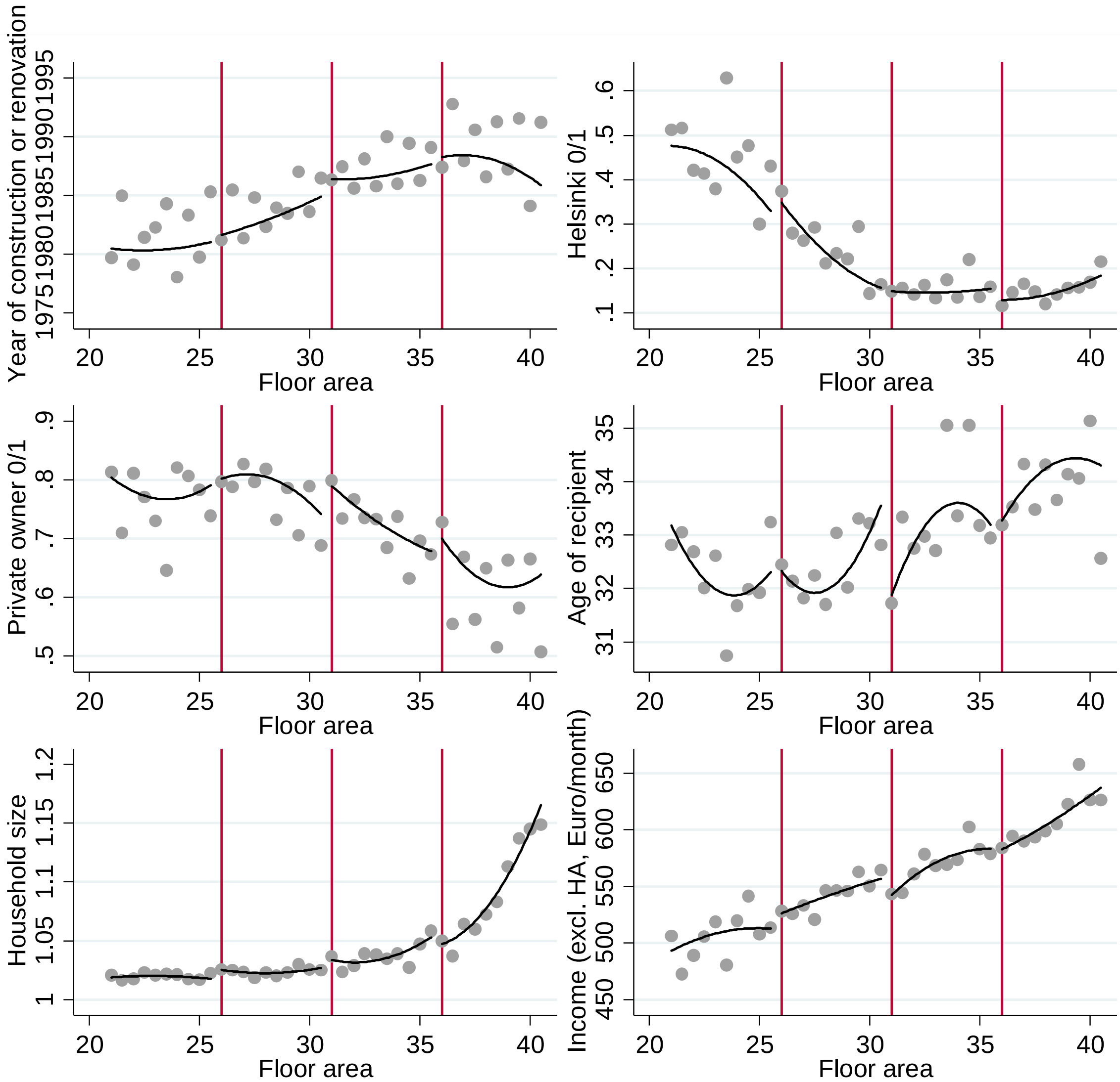

Figure 5. Discontinuities in dwelling and household characteristics.

Appendix A: Additional figures and tables

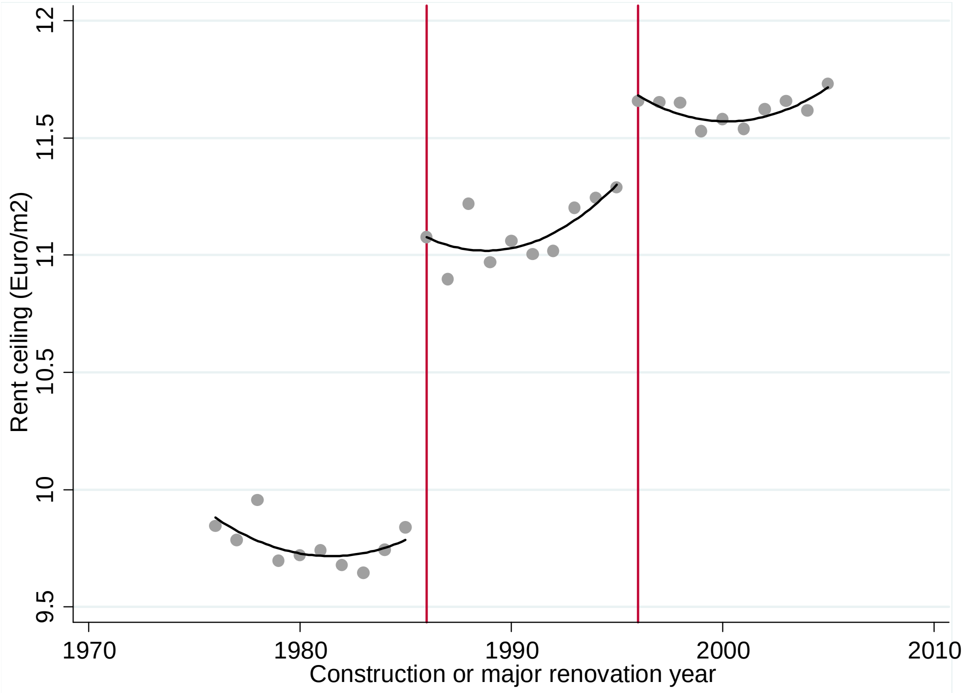

Figure A1. Construction year and rent ceiling.

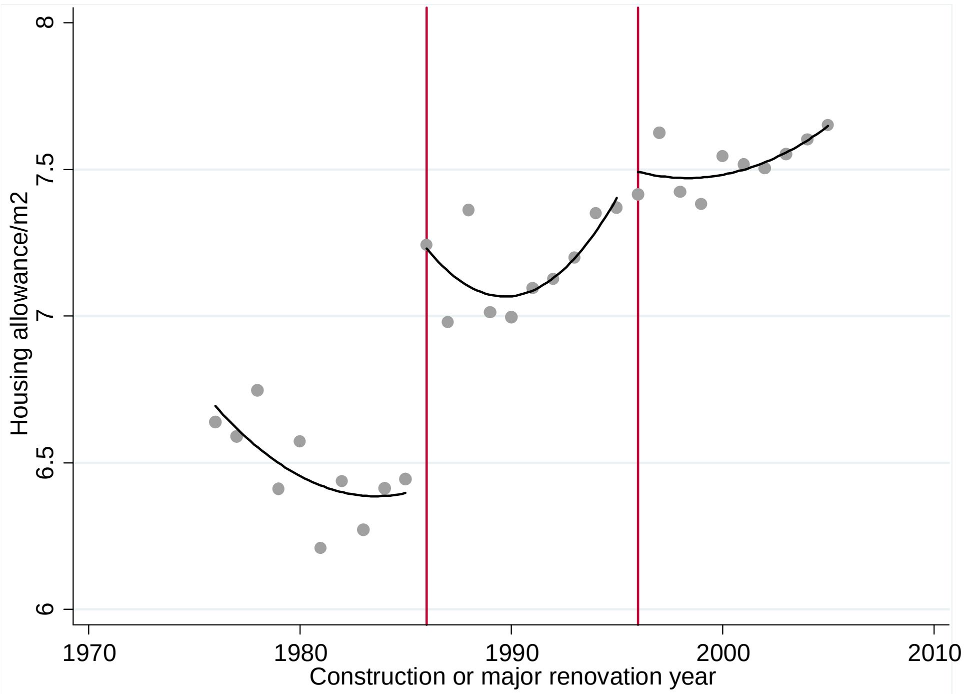

Figure A2. Construction year and HA per square meter.

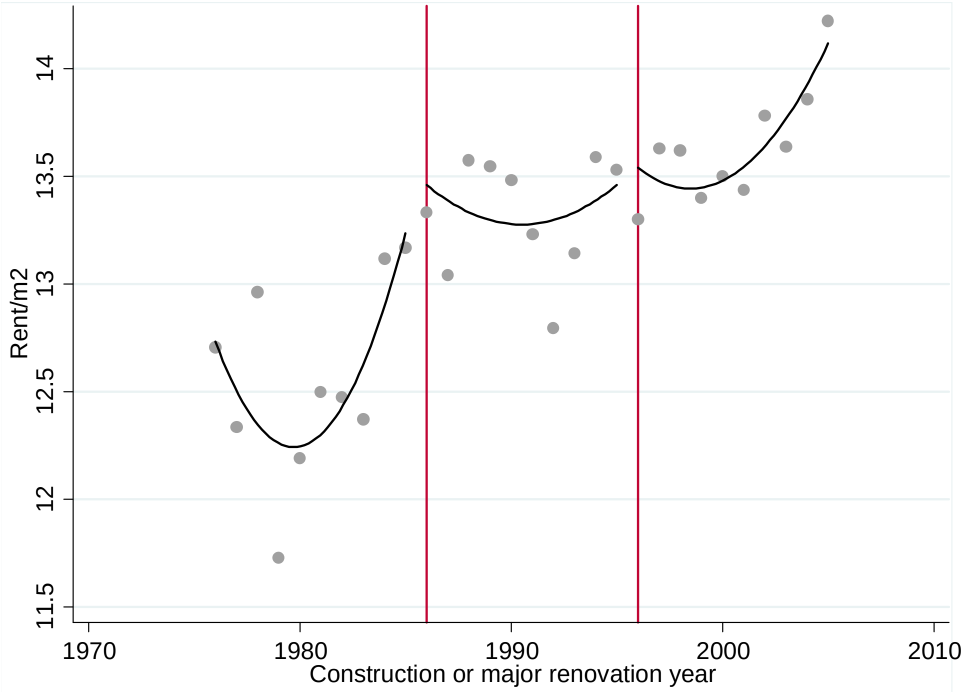

Figure A3. Construction year and rent per square meter

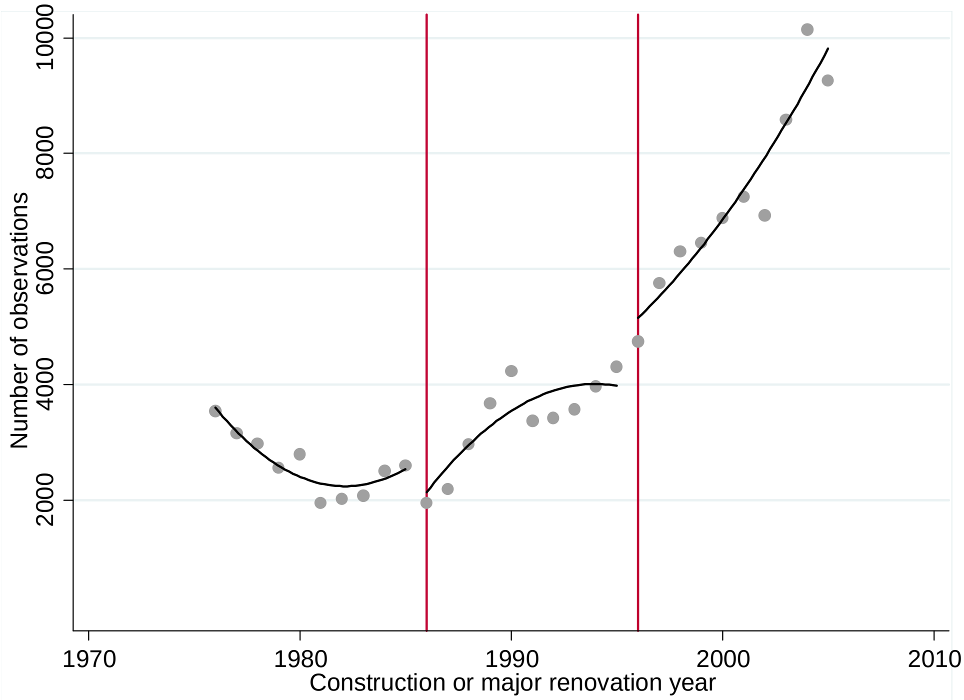

Figure A4. Distribution of construction year.

Table A1. Discontinuities in HA, rent and net rent (1st stage and reduced form of IV regression, construction year cut-offs).

Dep var	(1) HA/m2	(2) HA/m2	(3) HA/m2	(4) HA/m2	(5) Rent/m2	(6) Rent/m2	(7) Rent/m2	(8) Rent/m2	(9) Net Rent/m2
Construction or renovation year>1986	0.652***	0.770***	0.799***	0.731***	0.161	0.464***	-0.143	-0.089	-0.942***
	[0.045]	[0.067]	[0.081]	[0.042]	[0.104]	[0.159]	[0.177]	[0.177]	[0.179]
Construction or renovation year>1996	0.281***	0.247***	0.152**	0.409***	0.218**	0.204**	0.373**	0.332**	0.221
	[0.032]	[0.049]	[0.072]	[0.039]	[0.086]	[0.084]	[0.146]	[0.144]	[0.144]
1st stage F	242.6	68.5	52.5	307.3					
Order of polynomials of floor area	No	1st	2nd	2nd	No	1st	2nd	2nd	2nd
Dwelling and area characteristics	X	X	X	X	X	X	X	X	X
Household characteristics				X				X	

Notes: N=132,086. Table shows coefficients on the dummies for crossing floor area cut-offs. Dwelling and area characteristics include floor area dummies interacted with affordability group, municipality-year fixed effects and postcode fixed effects. Household characteristics include age of recipient, age squared, household income (pre-allowance), income squared and household size dummies. Standard errors clustered at discrete values of construction year are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table A2. IV results on the effect of housing allowance on rents (construction year cut-offs).

Dep var	(1) Rent/m2	(2) Rent/m2	(3) Rent/m2	(4) Rent/m2	(5) Net Rent/m2
HA/m2	0.415***	0.618***	0.071	0.229	-0.929***
	[0.095]	[0.213]	[0.221]	[0.173]	[0.221]
1st stage F	242.6	68.5	52.5	307.3	52.5
Order of polynomials of floor area	No	1st	2nd	2nd	2nd
Dwelling and area characteristics	X	X	X	X	X
Household characteristics				X	

Notes: N=132,086. Table shows IV regression results on the effect of HA/m2 on rent/m2 and net rent/m2. The excluded instruments are the two dummies for construction year cut-offs. 1st stage regressions are shown in Table 3. Dwelling and area characteristics include floor area dummies interacted with affordability group, municipality-year fixed effects and postcode fixed effects. Household characteristics include age of recipient, age squared, household income (pre-allowance), income squared and household size dummies. Standard errors clustered at discrete values of construction year are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table A3. Balance of covariates tests, clustering at household level.

	(1)	(2)	(3)
Dep var	Age	hh size	hh income
Floor area>25.9	-0.293	0.009	14.5
	[0.619]	[0.006]	[13.764]
Floor area>30.9	-2.270***	0.005	-17.281*
	[0.447]	[0.005]	[9.372]
Floor area>35.9	0.409	-0.012*	0.205
	[0.484]	[0.007]	[10.938]
Order of polynomial of floor area	2nd	2nd	2nd

Notes: N=272,941. Table shows coefficients on the dummies for crossing floor area cut-offs. Standard errors clustered at household level are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table A4. Estimated effect of HA on rent in the social housing sector.

Dep var	(1) Municipalities Rent/m2	(2) Non-profit organisations Rent/m2
Panel A: IV results		
HA/m2	0.581	0.445*
	[0.516]	[0.258]
1^{st} stage F	2.6	9.2
N	93369	65110
Panel B: Reduced form of IV		
Floor area>25.9	0.128	0.854
	[0.437]	[0.599]
Floor area>30.9	-0.165	0.550*
	[0.193]	[0.305]
Floor area>35.9	-0.012	-0.450***
	[0.057]	[0.175]
Order of polynomials of floor area	2nd	2nd
Dwelling and area characteristics	X	X

Notes: Panel A shows IV regression results on the effect of HA/m2 on rent/m2 and net rent/m2. The excluded instruments are the three dummies for floor area cut-offs. Panel B shows coefficients on the dummies for crossing floor area cut-offs from a regression of Rent/m2 on floor area group dummies and controls. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table A5. Robustness of IV estimates to alternative sample construction (one observation per dwelling per year)

Dep var	(1) Rent/m2	(2) Rent/m2	(3) Rent/m2	(4) Rent/m2	(5) Net Rent/m2
HA/m2	2.022***	-0.439***	-0.195	-0.156	-1.195***
	[0.120]	[0.165]	[0.161]	[0.138]	[0.161]
1st stage F	2047.2	62.7	37.7	203.8	37.7
N	182217	182217	182217	182217	182217
Order of polynomials of floor area	No	1st	2nd	2nd	2nd
Dwelling characteristics	X	X	X	X	X
Household characteristics				X	

Notes: N=182,217. Table shows IV regression results on the effect of HA/m2 on rent/m2 and net rent/m2. Sample includes only one randomly drawn observation per dwelling per year. The excluded instruments are the three dummies for floor area cut-offs. 1st stage regressions are shown in Table 3. Household characteristics include age of recipient, age squared, household income (pre-allowance), income squared and household size dummies. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table A6. Robustness of IV estimates to functional form. (Model title indicates the order of polynomial used for each interval around the cut-offs.)

IV1111	**IV1112**	**IV1113**	**IV1121**	**IV1122**	**IV1123**	**IV1131**	**IV1132**	**IV1133**
-0.395**	-0.414**	-0.412**	-0.463***	-0.450***	-0.434***	-0.464***	-0.428***	-0.462***
[0.170]	[0.168]	[0.163]	[0.140]	[0.136]	[0.133]	[0.138]	[0.136]	[0.136]
IV1211	**IV1212**	**IV1213**	**IV1221**	**IV1222**	**IV1223**	**IV1231**	**IV1232**	**IV1233**
-0.379**	-0.372**	-0.369**	-0.458***	-0.442***	-0.427***	-0.455***	-0.420***	-0.453***
[0.172]	[0.172]	[0.168]	[0.155]	[0.150]	[0.147]	[0.152]	[0.147]	[0.147]
IV1311	**IV1312**	**IV1313**	**IV1321**	**IV1322**	**IV1323**	**IV1331**	**IV1332**	**IV1333**
-0.390**	-0.405***	-0.393***	-0.468***	-0.470***	-0.535***	-0.549***	-0.475***	-0.524***
[0.163]	[0.151]	[0.149]	[0.154]	[0.163]	[0.161]	[0.172]	[0.174]	[0.174]
IV2111	**IV2112**	**IV2113**	**IV2121**	**IV2122**	**IV2123**	**IV2131**	**IV2132**	**IV2133**
-0.242	-0.225	-0.223	-0.285	-0.269	-0.255	-0.283	-0.252	-0.283
[0.170]	[0.164]	[0.162]	[0.186]	[0.177]	[0.174]	[0.179]	[0.174]	[0.174]
IV2211	**IV2212**	**IV2213**	**IV2221**	**IV2222**	**IV2223**	**IV2231**	**IV2232**	**IV2233**
-0.08	-0.091	-0.09	-0.156	-0.14	-0.129	-0.149	-0.108	-0.124
[0.157]	[0.156]	[0.154]	[0.188]	[0.178]	[0.172]	[0.184]	[0.176]	[0.183]
IV2311	**IV2312**	**IV2313**	**IV2321**	**IV2322**	**IV2323**	**IV2331**	**IV2332**	**IV2333**
-0.12	-0.124	-0.118	-0.15	-0.088	-0.089	-0.085	-0.029	-0.044
[0.169]	[0.167]	[0.162]	[0.189]	[0.237]	[0.261]	[0.285]	[0.249]	[0.270]
IV3111	**IV3112**	**IV3113**	**IV3121**	**IV3122**	**IV3123**	**IV3131**	**IV3132**	**IV3133**
-0.146	-0.155	-0.146	-0.218	-0.233	-0.213	-0.207	-0.167	-0.184
[0.190]	[0.193]	[0.187]	[0.165]	[0.165]	[0.158]	[0.168]	[0.162]	[0.167]
IV3211	**IV3212**	**IV3213**	**IV3221**	**IV3222**	**IV3223**	**IV3231**	**IV3232**	**IV3233**
-0.114	-0.114	-0.109	-0.163	-0.264	-0.373	-0.521	-0.357	-0.441
[0.168]	[0.165]	[0.161]	[0.195]	[0.278]	[0.330]	[0.394]	[0.340]	[0.388]
IV3311	**IV3312**	**IV3313**	**IV3321**	**IV3322**	**IV3323**	**IV3331**	**IV3332**	**IV3333**
-0.264	-0.309	-0.291	-0.398	-0.377	-0.476	-0.498	-0.345	-0.441
[0.220]	[0.211]	[0.198]	[0.301]	[0.300]	[0.357]	[0.483]	[0.320]	[0.399]

Notes: N=272,941. Table shows IV regression results on the effect of HA/m2 on Rent/m2. Model titles indicate the polynomials used for each interval of floor area separated by the cut-offs. For example IV2222 means that we use a second order polynomial for all four intervals. Controls include dwelling and area characteristics: construction year dummies interacted with affordability group, dummy for integer values of floor area interacted with affordability group, municipality-year fixed effects and postcode fixed effects. Standard errors clustered at discrete values of floor area are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Appendix B: Robustness analysis of Kangasharju (2010)

In this appendix, we study the robustness of the findings of Kangasharju (2010) (henceforth K2010) by analyzing the 2002 reform using the same data. The program code used in K2010 was not available to us but we follow the methodology as reported in the paper. We focus on Tables 8 and 9 of the original paper presenting the key differences-in-differences and instrumental variables result.

We end up with a substantially larger estimation sample than K2010. Thus, using the terminology suggested by Clemens (2017) our analysis is perhaps better interpreted as a robustness check by reanalyzing the data than as a replication. The reason for the difference in sample size is not known to us but probably reflects differences in choices made when constructing the estimation sample (not all choices are reported in K2010).

The 2002 reform

The reform divided the HMA into two regions: the city of Helsinki (affordability region 1) and the rest of the metropolitan area (affordability region 2). In addition, the reform reduced the number of construction year cut-offs from three to two and divided the first floor area group (flats smaller than 36m^2) into three different groups (smaller than 25.9m^2, 26–30.9m^2 and 31–35.9m^2). But most importantly for the identification of the effects of HA on rents, the reform increased the rent ceilings with varying degrees for all HA recipients. The increases were largest for small flats in the city of Helsinki. For instance, for a 25m^2 flat located in Helsinki and built before 1985, the rent ceiling increased from 7.74 euros to 11.25 euros per square meter.

Data

We use the Income Distribution Statistics data from Statistics Finland for the years 2000–2003. The data contain roughly 10,000 households and 28,000 individuals each year and combines register data with a survey. Each household is present in the data for two consecutive years. Information on rents is based on the housing allowance register and the survey.

The data include information on the number of months HA was received, the total annual amount of HA and the amount of HA received in December by each member of the household. We collapse the data to the household level and sum up the HA variables within the household. We define HA recipients as households that, according to the IDS records, have received HA within the survey year and have at least one HA month. We drop households with negative HA (due to claw back of excessive HA paid previously), households with positive HA but zero HA months, and households with zero HA but positive HA months. In addition we drop out households with zero or missing rent.

Methods

The main method of K2010 is an instrumental variables regression of rent/m^2 on HA/m^2 where the change in the rent ceiling due to the reform of 2002 is used as an instrument for housing allowance. Before the instrumental variables estimation he runs a differences-in-differences (DiD) regression of ln(rent/m^2) on a dummy for HA recipient status (*Allowance*), dummy for years 2002 and 2003 after the reform (*After*), interaction term (*Allowance*After*) and a set of control variables (see K2010, Table A1) interacted with dummies for Helsinki and the rest of the HMA. He runs the DiD regression separately for the private rental market and social housing units owned by municipalities, and for two time windows around the reform (2001–2002 and 2000–2003). In addition, he reports two placebo tests using a two-year period before the reform (2000–2001) and after the reform (2002–2003). He finds a weakly significant positive effect on rents for the two-year window (2001–2002) and a significant positive effect for the wider time window (2000–2003) in the private rental markets but no impact in the placebo tests or in the municipal social housing sector.

Table B1 shows our results from a similar DiD analysis. Our estimation sample (N=3641) is larger than in K2010 (N=2660).[21] For the private rental market in the upper panel, we find smaller DiD coefficients than K2010. With the 2–year window (2001–2002) our point estimate is 0.03 and insignificant (compared with 0.048 with t-value 1.7 in K2010) and with the 4–year window our point estimate is 0.035 and significant at the 10% level (K2010's estimate is 0.051 with t-value 2.4). The placebo estimates are similar to K2010.

Turning to the municipal housing sector in the lower panel, we find positive and significant DiD estimates. The results are unexpected since in the municipal rental sector rents should be based on maintenance and capital costs and should not be affected by the amount of HA. They are also in contrast with K2010's finding of small and insignificant coefficients. On the

[21] Apparently, there is an error in the 'free markets' 2000–2001 sample size (Column (a) of Table 8 in K2010), because the 2000–2001 and 2002–2003 sample sizes should sum up to the 'All' sample size.

other hand, as Table B3 below indicates, the changes in the rent ceilings caused by the reform are not correlated with the HA variable. This would suggest that the differences in changes in the rental rates of recipient and non-recipient households in the municipal rental sector are not driven by the reform.

Table B1. Reanalysis of the 2002 reform – DiD estimates (cf. K2010 Table 8)

Period	Placebo 2000–01	2-year window 2001–02	Placebo 2002–03	4-year window 2000–03
Free markets				
Allowance*After	0.016	0.03	-0.024	0.035*
	[0.031]	[0.033]	[0.028]	[0.021]
R^2	0.63	0.613	0.622	0.615
Sample size	1769	1786	1872	3641
Number of assisted households	408	323	345	753
Municipal sector				
Allowance*After	-0.03	0.055**	-0.011	0.036**
	[0.026]	[0.026]	[0.027]	[0.017]
R^2	0.463	0.509	0.491	0.454
Sample size	1154	1152	1216	2370
Number of assisted households	392	375	401	793

Notes: Table shows DiD estimates of the HA reform of 2002. All specifications include control variables listed in Kangasharju (2010). Robust standard errors are in brackets. * p<0.1, ** p<0.05, *** p<0.01

Table B2 reports the IV estimates for the effect of HA on rent. For the ‘Assisted only’ sample HA/m^2 is instrumented with *After*Change*, where *Change* is the change in the rent ceiling in the 2002 reform for the type of flat inhabited by the household. The main effects of *After* and *Change* are included in the controls along with the same controls as in the DiD estimation of Table B1. For the ‘All’ sample including both HA recipients and non-recipients, the excluded instrument is *Allowance*After*Change.* The main effects and pairwise interactions of *Allowance*, *After* and *Change* are controlled for.

The two first columns of Table B2 show the results for the free market sector (logarithmic model in the upper panel and linear model in the lower panel). K2010 reported elasticities of 0.24 (for assisted only) and 0.31 (for all households) and euro-on-euro effects of roughly 0.7. Starting from the ‘assisted only’ sample in the first column of Table B2, our IV estimates are smaller than in K2010 and statistically insignificant. Turning to the ‘All’ sample in column 2, a notable difference between our analysis and K2010 is that we find low first stage F values indicating severe weak instrument problems, whereas he reported very strong first stage F values for the 'All' sample. The 3rd and 4th column show the results for the municipal social housing sector. Similarly to K2010, the first stage F-statistics are too low for meaningful IV estimation. Table B3 reports the first stage results for all IV specifications.

Table B2. Reanalysis of the 2002 reform – IV estimates (cf. K2010 Table 9)

	Dep. var. Ln(rent/m2)			
	Free markets		**Municipal sector**	
	Assisted only	All	Assisted only	All
ln(HA/m2)	0.100	0.463	-1.979	0.017
	[0.096]	[0.324]	[4.696]	[0.020]
Sample size	753	3641	793	2370
First stage F (Kleibergen-Paap)	12.89	3.293	0.167	0.258
	Dep. var. rent/m2			
	Free markets		**Municipal sector**	
	Assisted only	All	Assisted only	All
HA/m^2	0.321	1.25	3.76	-0.013
	[0.212]	[1.511]	[9.282]	[0.065]
Sample size	753	3641	793	2370
First stage F (Kleibergen-Paap)	8.344	0.949	0.14	0.044

Notes: Table shows IV estimates of the effect of HA on rents. The excluded instrument is *After*Change* (or *After*Ln(Change)* for the 'Assisted only' sample, and *Allowance*After*Change* (or *Allowance*After*Ln(Change)*) for the 'All' sample. All specifications include control variables listed in Kangasharju (2010), and main effects and pairwise interactions of *After*, *Allowance* and *Change*. First stage estimates are shown in Table B3. Robust standard errors are in brackets. * p<0.1, ** p<0.05, *** p<0.01.

Table B3. Reanalysis of the 2002 reform – first stage of IV estimates (cf. K2010 Table A3)

	Dep. var. Ln(HA/m2)			
	Free markets		**Municipal sector**	
	Assisted only	All	Assisted only	All
ln(Change)*After	2.336***		-0.25	
	[0.651]		[0.605]	
ln(Change)*After*Allowance		1.170*		-0.296
		[0.645]		[0.583]
Sample size	753	3641	793	2370
First stage F (Kleibergen-Paap)	12.89	3.293	0.167	0.258
	Dep. var. HA/m2			
	Free markets		**Municipal sector**	
	Assisted only	All	Assisted only	All
Change*After	1.559***		0.13	
	[0.539]		[0.353]	
Change*After*Allowance		0.435		-0.062
		[0.446]		[0.296]
Sample size	753	3641	793	2370
First stage F (Kleibergen-Paap)	8.344	0.949	0.14	0.044

Notes: Table shows the first stage of the IV estimates reported in Table B2. Robust standard errors are in brackets. * p<0.1, ** p<0.05, *** p<0.01.

The conclusion is that the results indicating large effects of HA on rents found in K2010 are not robust to reanalysis of the same data following the methods as reported in the paper. The results of our reanalysis are consistent with the other findings of this paper suggesting that the incidence of differences in HA for different types of dwellings is on the tenant.

References

Barreca, A.I., J.M. Lindo, and G.R. Waddell (2016): "Heaping-Induced Bias in Regression-Discontinuity Designs", *Economic Inquiry* 54(1), 268-293.

Brewer, M., J. Browne, C. Emmerson, A. Hood and R. Joyce (2016): "The curious incidence of rent subsidies: evidence from administrative data", Paper presented in the 2016 LAGV Conference.

Cattaneo, M.D., R. Titiunik, G. Vazquez-Bare and L. Keele (2016): "Interpreting regression discontinuity designs with multiple cutoffs", *The Journal of Politics* 78(4), 1229-1248.

Clemens, M.A. (2017): "The meaning of failed replications: A review and proposal", *Journal of Economic Surveys* 31(1), 326–342.

Collinson, R. and P. Ganong (2016): "The Incidence of Housing Voucher Generosity" mimeo.

Eriksen, M. D. and A. Ross (2015): "Housing Vouchers and the Price of Rental Housing", *American Economic Journal: Economic Policy* 7(3), 154-176.

Fack, G. (2006): "Are housing benefits an effective way to redistribute income? Evidence from a natural experiment in France", *Labour Economics* 13, 747-771.

Gibbons, S. and A. Manning (2006): "The incidence of UK housing benefit: Evidence from the 1990s reforms", *Journal of Public Economics* 90, 799-822.

Kangasharju, A. (2010): "Housing Allowance and the Rent of Low-income Households", *The Scandinavian Journal of Economics* 112(3), 595–617.

Kela (2014): "Kela housing allowance Statistics 2013" (in Finnish).

Laferrère, A. and D. Le Blanc (2004): "How do housing allowances affect rents? An empirical analysis of the French case", *Journal of Housing Economics* 13, 36–67.

Lee, D.S. and T. Lemieux (2010): "Regression discontinuity design in economics", *Journal of Economic Literature* 48, 281-355.

Lee, D.S. and D. Card (2008): "Regression Discontinuity Inference with Specification Error", *Journal of Econometrics* 142(2), 655-674.

Lyytikäinen, T. (2008): "Studies on the Effects Property Taxation, Rent Control and Housing Allowances" VATT Research Reports 140.

Susin, S. (2002): "Rent vouchers and the price of low-income housing" *Journal of Public Economics* 83, 109–152.

Viren, M. (2013): "Is the housing allowance shifted to rental prices?" *Empirical Economics*, 44(3), 1497–1518.

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