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Housing Cooperatives, Housing Affordability, and Rent Control

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Housing Cooperatives, Housing Affordability, and Rent Control

Abstract

Housing cooperatives have a significant share in some countries, particularly in urban housing markets, and are supported by municipalities through tax breaks and preferential access to land. We examine the contribution of housing cooperatives to the provision of affordable housing and how they are affected by rent control. For Germany, we find that residents of cooperative housing pay lower rents than for-profit owners, but are still affected by rent control. In particular, we show that stricter limits on rent increases for existing residential leases in tight housing markets have the effect of lowering rents for housing cooperatives, while we find no such effect of rent regulation for for-profit landlords.

JEL-Codes: P130, R210, R310, R380.

Keywords: housing affordability, housing cooperatives, housing tenure, rent control.

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1 Introduction

Due to the high and rising real estate prices and rents, especially in economically booming cities and the associated housing affordability crisis, the provision of affordable housing is prominently placed on the political agenda worldwide. In 2022, the share of population in the bottom quintile of the income distribution spending more than 40% of disposable income to pay for rent at market price on the private rental market, was 48.6% in the UK, 49.2% in the US, and 16.1% in Germany; the share of social housing dwellings was 16.4% in the UK, 3.6% in the US, and 2.6% in Germany, and government spending on housing allowances as % of GDP, was 1.38 in the UK, 0.14 in the US, and 0.41 in Germany (OECD Affordable Housing Database). Various instruments are used at great expense to create living space and to make living space affordable for lower income groups in the vicinity of centers and workplaces. Preferred means of housing policy include state or state-sponsored provision of rent-capped housing for low-income earners (social housing), direct housing benefits and housing vouchers to poorer households, home-buying subsidies, and regulation of rent levels and increases (rent control). The effectiveness, incidence, and unplanned side effects of these interventions have been extensively studied in the theoretical and empirical literature.¹ Housing policy instruments may also interact in unintended ways.

Unlike social housing, rent regulation and vouchers, the impact of non-profit homeowners on rent levels has not been systematically quantitatively investigated. There are also no quantitative studies on how non-profit homeowners are affected by rent regulation, which actually aims to limit market power and profits from renting out apartments. In countries such as Germany, Austria, Switzerland, Sweden, Norway and Italy, housing cooperatives and other types of not-for-profit businesses play an important role in the provision of affordable housing beyond the traditional instruments of housing policy described above. Typical characteristics of housing cooperatives are joint ownership of the housing

¹See, e.g., on rent control Gyourko and Linneman (1990); Sims (2007); Autor et al. (2014); Diamond et al. (2019); Mense et al. (2019, 2023); Enström Öst and Johansson (2023); on housing assistance Jacob and Ludwig (2012); Carlson et al. (2012); Jacob et al. (2015); Borbely (2022); on public housing van Dijk (2019); Haltiwanger et al. (2020); Camacho et al. (2022); Dauth et al. (2024); on social housing versus vouchers Katz et al. (2001); Eriksen and Ross (2015); Chetty et al. (2016); Chyn (2018); Pollakowski et al. (2022); on home-buying subsidies Hilber and Turner (2014); Gruber et al. (2021); Krolage (2023).

units, lack of profit motive, equal voting rights for members and secured long-term rights of use. Federal and lower-level governments support housing cooperatives, for example by exempting them from corporation tax and by giving them preferential access to building land.

Even if there is a special legal form for cooperatives in countries like Germany (Münkner 2013), housing cooperatives offer services on the housing markets in competition with for-profit companies and private landlords and are subject to general legal regulations such as building law and in particular general tenancy law. In principle, the regulation of rents also affects housing cooperatives. For Germany, as a country with a large rental housing market, where 54.6% of households were renting in 2022 (OECD Affordable Housing Database), and a large market share of housing cooperatives equivalent to 9.44% of all rented dwellings in 2022 (Zensus 2022, Statistical Offices of German States and Federal Statistical Office of Germany), we want to examine whether the regulation of rents restricts housing cooperatives not only *de jure*, but also *de facto* in setting rents.

First, we demonstrate in a stylized housing market model that for-profit landlords and housing cooperatives can operate simultaneously in the market, with the lower rents of cooperatives leading to volume restrictions and queues for allocation. We then show, also within the model, that binding rent ceilings for cooperatives reduce the utility of cooperative members.

To empirically determine the impact of rent regulation on housing cooperatives, we first examine whether housing cooperatives actually charge lower rents than for-profit corporations, as is commonly claimed (Deschermeier et al. 2019). We then use a reform in German rental legislation in the mid-2010s, which, where the housing markets were tight, restricted the scope for rent increases in existing residential rental contracts to identify the causal effect of rent increase tightening on the average rents charged by housing cooperatives.

Unlike most studies on rent regulation, in our empirical analysis, we do not use advertised rents from real estate price portals as the data basis, but rather the actual rents given by respondents to a general representative longitudinal survey, the German Socio-Economic Panel (GSOEP). This database contains a lot of additional information about the rental properties, but for data privacy reasons no exact information about the location and only little information about the characteristics of the wider region. On the other

hand, real estate price portals only contain data on rents for the exact same property at larger and heterogeneous intervals, whereas we can use information that is updated annually. Objects are identified based on respondents' household affiliation and information about relocations. While only new and re-lettings are observed in the case of asking rents, we also and above all record existing rents with our database. Although we present descriptive statistics on rent regulation in general, our causal analysis of rent regulation focuses on existing rents.

Controlling for many time-invariant and time-varying characteristics, we find that residents of cooperative housing do indeed pay lower rents on average than residents of housing owned by for-profit corporations or private landlords. Furthermore, rents are positively correlated with rent regulation measures, but this positive correlation is weaker for cooperatives. In particular, using the time variation in the classification of local housing markets as tight, we show that in tight housing markets, the stricter limitation on rent increases in existing residential leases causally leads to lower rents in cooperative housing at the household level. Interestingly, we find no systematic rent-reducing effects for profit-seeking owners. We offer several explanations for this finding.

In particular, our paper contributes to two strands of the literature: On the one hand, our research expands the knowledge base on rent levels in housing cooperatives. On the other hand, our analysis complements the literature on rent regulation with an analysis of a housing type that has been largely neglected in housing market research in this context: cooperatives. By contrasting the effects of rent regulation on cooperatives and for-profit owners, we also address the relationship between tenure, pricing, and price regulation in housing markets.

The paper is organized as follows. The next section discusses the theoretical background. We then characterize the housing market institutions in Germany, in particular rent regulation. We describe the data and present descriptive results for rents and rent regulation. We then analyze the causal effect of rent regulation on the rents of housing cooperatives, non-profit owners in the broad sense, and for-profit owners, as well as private landlords as a subset of for-profit owners. Finally, we conclude.

2 Theoretical background

Housing cooperatives In the “Statement on the Co-operative Identity” the International Cooperative Alliance defines a cooperative in general as “an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise.” Accordingly, housing cooperatives provide living space for their members. Crucial cooperative principles are voluntary and open membership, democratic member control and economic participation of members (see International Cooperative Alliance 2015; Münkner 2015). Cooperative principles and cooperative values of mutual self-help, self-responsibility, democracy, equality, equity, and solidarity are mechanisms that aim to reduce the transaction costs of the members in their relationships with the cooperative organization (see, e.g., Nilsson 1996). Cooperative principles affect objectives and governance of housing cooperatives. From a theoretical point of view, in the interest of the members, housing cooperatives should provide housing security and quality, but also greater levels of social capital. Cost effectiveness and the absence of a profit motive imply lower housing costs for members than for the average tenant.

State support for housing cooperatives can be justified if housing cooperatives are willing and able, for example due to economies of scale compared to private landlords, to charge lower rents and thus provide affordable housing even in tight local housing. The obligation to support members, which is also enshrined in the German Cooperatives Act, and cooperative principles in general reduce or avoid the negative consequences for tenants of the hold-up problem associated with long-term leases and specific investments (Wrede 2023). On the other hand, a welfare economic assessment must also take into account the fact that membership in a housing cooperative without additional state funding for the truly poor is not an option due to the required deposit, and that state or municipal funding of housing cooperatives can displace wealthier owner-occupiers from attractive residential areas.

Segmented housing market Insofar as cooperatives offer cheap living space due to the lack of profit motives and due to additional state subsidies, cooperatives face excess

demand of would-be members. Housing would not be allocated via the price mechanism but via queues. Different rent levels for dwellings of comparable quality could coexist in the market if, on the one hand, missing profit motives and (implicit) subsidies allow cooperatives to charge lower rents, and, on the other hand, limited supply of affordable land prevent for-profit landlords from being crowded out.

To illustrate the coexistence of cooperatives and for-profit landlords and the potentially negative consequences of rent ceilings, we set up a simple static partial-equilibrium model. For simplicity, we assume that lot sizes for housing units are normalized to 1. With land L_i and capital K_i , housing $H_i = h_i L_i$, where h indicates housing quality, can be produced according to the linear-homogeneous production function $F(K_i, L_i) = f(k_i)L_i$, with $k_i = K_i/L_i$. The subscript $i = c, p$ indicates cooperative housing, c , and housing units, p , owned by for-profit landlords, respectively. The price for capital r is exogenously determined, and the price of the numéraire good, c , is 1. We denote the land price faced by housing provider i by q_i , and the respective rent p_i . Land supply is divided into the part that the housing cooperative receives, L_c , which is politically determined at the local level, at the price q_c , and the part, L_p , that the for-profit landlords receive at the price q_p , with $q'_p(L_p) > 0$. The number of members of the cooperative is implicitly determined by the amount of land that is available for the cooperative: $N_c = L_c$. The number of renters in the for-profit sector, $N_p = L_p$, is negatively correlated with the rent: $N'_p(p_p) < 0$.² Each individual living in a housing unit provided by owner type i has exogenous income y and derives utility from consumption, c_i , and housing quality, h_i , according to the strictly quasi-concave utility function, $U_i = U(c_i, h_i)$, with positive marginal utility for each good.

First, we consider the housing cooperative that has a certain number of lots L_c , each suitable for a single apartment with a fixed size normalized to 1. The representative member of the housing cooperative solves the following utility maximization problem:

$$\max_{c_c, h_c, k_c, p_c} U(c_c, h_c) \text{ s.t. } h_c = f(k_c), y = p_c h_c + c_c, \text{ and } (p_c h_c - r k_c - q_c)L_c = 0. \quad (1)$$

The constraints are the production technology, the household budget constraint, and the non-profit condition of the housing cooperative. Solving this optimization problem leads

²The inverse land supply function and the housing unit demand function are shorthand for full-fledged models of the land supply and household spatial mobility.

to the following first-order condition for an interior solution:³

$$\frac{U_c(c_c, h_c)}{U_h(c_c, h_c)} = \frac{f'(k_c)}{r}, \quad (2)$$

i.e., the marginal rate of substitution of housing quality and consumption is equal to the marginal rate of transformation. Equation (2) determines the optimal per-land-unit capital, k_c^* , which in turn gives optimal housing quality, $h_c^* = f(k_c^*)$, and optimal consumption, $c_c^* = y - rk_c^* - q_c$. Then the cooperative chooses the rent per housing quality, p_c^* , to fulfill the condition of zero profit at the cooperative level. Without rent regulation, rent has no allocative relevance.

Second, we analyze the profit-seeking landlord, which we assume to be the monopolist in the for-profit housing sector. In an oligopolistic market, the results would be qualitatively the same. The landlord fully takes the technology constraint, $h_p = f(k_p)$, the inverse land-supply function, $q_p(L_p)$, the housing unit demand function, $N_p(p_p)$, and the individual housing quality demand function, $h_p(p_p)$ into consideration, where the latter is derived from the individual household utility maximization problem, $\max_{c_p, h_p} U(c_p, h_p)$ s.t. $y = c_p + p_p h_p$. The landlord solves the profit-maximization problem:

$$\max_{p_p} \pi_p := \{p_p h_p(p_p) - rk_p(p_p) - q_p[N_p(p_p)]\} N_p(p_p) \quad (3)$$

The first-order condition for an interior solution is:

$$\begin{aligned} & \{h_p(p_p) + p_p h'_p(p_p) - rk'_p(p_p) - q'_p[N_p(p_p)]N'_p(p_p)\} N_p(p_p) \\ & + \{p_p h_p(p_p) - rk_p(p_p) - q_p[N_p(p_p)]\} N'_p(p_p) = 0, \end{aligned} \quad (4)$$

which determines the optimum p_p^* . Inserting backwards, yields $k_p^*, N_p^*, q_p^*, h_p^*$, and also the equilibrium profit π_p^* .

Together, the technological constraint and budget constraints, the inverse land supply function and the housing unit demand function in the for-profit sector, the first-order conditions of the cooperative, of tenants in the for-profit sector and of the for-profit landlord, and the equilibrium conditions in the land and housing markets determine capital, housing, land use, land prices, housing quality prices, and profits in an interior optimum

³Subscripts indicate partial derivatives.

$(k_c^*, k_p^*, h_c^*, h_p^*, c_c^*, c_p^*, q_p^*, p_c^*, p_p^*, N_p^*, \pi_p^*)$, which we assume to exist, whereas land use and land prices of housing cooperatives, L_c^* and q_c^* , are exogenously determined. Both segments of the housing market, cooperative housing with a waiting list for cooperative membership and for-profit housing with monopolistic pricing, will only coexist⁴ if the incentive compatibility conditions,

$$q_p^* \geq q_c^*, p_p^* \geq p_c^*, \text{ and } \pi_p^* \geq 0, \quad (5)$$

are satisfied. For-profit owners face higher land prices than cooperatives, charge higher housing quality prices, and do not make negative profits. Otherwise, the cooperative would switch to the unregulated land market, cooperative members would leave the cooperative, and the for-profit landlord would exit the housing market segment.

Rent control Uniform limits on rent levels and rent growth have different effects, at least in the short term, in a segmented market with low and high rents, given that the apartments are of comparable quality. If the maximum rent to be fixed is set at a uniform upper limit, rents in the low-priced housing market segment can continue to rise, rents in the expensive segment cannot. Neglecting supply responses, this policy instrument should tend to reduce the variance in rents. Uniform upper limits for the growth rates of rents – again neglecting supply effects – have a direct dampening effect on the development of rents for low-priced and high-priced apartments. The limited maximum rent increase in Germany should therefore reduce rent growth not only for high-priced but also for inexpensive apartments, at least in the first few years. All providers, including the cooperatives and other non-profit homeowners, would be affected.

Since the members of housing cooperatives are on the one hand residents or tenants and on the other hand owners of the apartments, the amount of the rent - if redistribution within the cooperative is neglected - initially appears as a transitory item and is therefore meaningless. However, the (implicit) ban on making profits at the corporate level and distributing profits in unlimited amounts to the members means that the level of rent has an impact on the utility of the members. Government regulation of rents can reduce members' utility.

⁴We checked numerically that the parameter space enabling coexistence is not empty.

In order to analyze the effects of rent regulation on a housing cooperative, we return to the model presented. We denote the solution of the housing cooperative's utility maximization problem $(c_c^*, h_c^*, k_c^*, p_c^*; U_c^*)$ and assume uniqueness. Figure 1 illustrates the optimization problem of the representative housing cooperative member. The North-East quadrant shows the non-profit constraint, $p_c h_c = r k_c + q_c$, and the housing quality function valued with the optimum price, $p_c^* f(k_c)$. The North-West quadrant depicts the individual budget constraint, $p_c h_c = y - c_c$, the South-East quadrant the housing quality production function, $f(k_c)$. The South-West quadrant shows the utility possibility curve (UPC), $h_c = f[(y - q_c - c_c)/r]$, and the indifference curve in the optimum, U^* , where $U(c_c, h_c) = U_c^*$. If the housing cooperative faces binding rent regulation, $p_c^+ \leq p_c^*$, to meet the non-profit requirement, it must react. $p_c f(k_c)$ in the North-East quadrant of Figure 1 shifts downwards, the cooperative reduces capital intensity, k_c , and housing quality, h_c . The member of the cooperative moves along the UPC to the left, increasing consumption, c_c , but lowering utility and, thus, implying that the indifference curve with regulation, U^+ , is below the indifference curve in the optimum. Analytically speaking, via the non-profit condition of the housing cooperative, the rent, p_c , determines the capital intensity, k_c , according to

$$\frac{dk_c}{dp_c} = -\frac{f(k_c)}{p_c f'(k_c) - r} \quad (6)$$

which is positive if $p_c f'(k_c) < r$, what is the case in Figure 1, and negative if $p_c f'(k_c) > r$.

If the feasible rent is strictly below the rent level, the member of the housing cooperative would choose if rent control were absent, i.e., $p_c^+ < p_c^*$, utility, $V(p_c) = U\{y - rk(p_c) - q_c, f[k(p_c)]\}$, depends on the rent according to

$$\frac{dV_c}{dp_c} = (U_h(c_c, h_c) f'(k_c) - U_c(c_c, h_c) r) \frac{dk_c}{dp_c}. \quad (7)$$

This term is positive if either $p_c f'(k_c) < r$ and $h_c < h_c^*$ or $p_c f'(k_c) > r$ and $h_c > h_c^*$. In case of Figure 1, $p_c < p_c^*$ implies $p_c f'(k_c) < r$ and $h_c < h_c^*$ (provided that p_c is not too low). Dotted lines show the curve $p_c^+ f(k_c)$ and the equilibrium values under regulation, $k_c^+, c_c^+, p_c^+ h_c^+$, and h_c^+ , with $k_c^+ < k_c^*$, $c_c^+ > c_c^*$, and $h_c^+ < h_c^*$. In any case, the cooperative would benefit from abolition of rent control.

To calculate the impact of rent control on the for-profit sector, we simply insert the regulated rent, p_p^+ into the technology constraint, the housing unit demand function, the inverse land-supply function, the individual housing quality demand function, and the profit

function, which yields k_p^+ , N_p^+ , q_p^+ , h_p^+ , and the profit under regulation π_p^+ . Since $k'_p(p_p) < 0$, $h'_p(p_p) < 0$, $N'_p(p_p) < 0$, $q'_p(N_p) > 0$, rent regulation increases capital intensity, increases housing quality, increases the number of housing units and tenants, and also increases the land price the for-profit house owner faces, whereas profits shrink. Also under regulation, coexistence of housing providers, cooperatives and for-profit owners requires incentive compatibility, i.e., Equation (5).⁵ Clearly, the effects of rent regulation on the for-profit sector are driven by the assumed monopolistic market structure, where price regulation benefits customers, and cannot be generalized to markets with different competitive conditions.

3 Institutions

The Cooperative Societies Act applies to all forms and types of cooperative societies, including housing cooperatives (see Münkner 2013). In response to a severe housing shortage, a special law for housing cooperatives in the public interest (Wohnungsgemeinnützigkeitsgesetz) was in force until 1990, which exempted housing cooperatives from corporate and other taxes under certain conditions. The law was repealed when the scarcity was considered to have been eliminated. Essential elements that distinguish cooperatives from other forms of business organizations are variable (open) membership, the primary objective of promoting the interests of members through service relationships with the jointly owned cooperative enterprise, self-help combined with mutual aid, and membership rights based on the person of the member, not on the capital share. However, transactions with non-members are possible, cooperatives may have social or cultural objectives, but there are no specific legal provisions for general interest cooperatives. Potential mechanisms to promote member interest in housing cooperatives are low rents, good living conditions and protection against eviction, which can lead to greater satisfaction and longer tenancies.

Although housing cooperatives are already required to promote the interests of members under the Cooperatives Act, they are also subject to general tenancy law and rent regulation. Most leases in Germany are perpetual. The landlord can only terminate the lease for good cause, such as personal use. Limited tenancies exist when the landlord needs to use

⁵Again, we checked numerically that the parameter space enabling coexistence is not empty.

the property him- or herself after a certain period of time or plans to sell it. In the case of an ongoing lease, the landlord may increase the rent up to the local comparative rent. The rent increase must remain unchanged for 12 months. The rent can only be increased by 20% over a period of three years (maximum rent increase). In 2013, the federal states were given the option to limit rent increases to 15% within three years in municipalities with tight housing markets (limited maximum rent increase). Apart from a general ban on usury, which for example prohibited rents 50% above the local comparative rent, there was no rent regulation for new contracts. In March 2015, however, a nationwide regulation on rent control for new contracts gave the federal states the legal authority to introduce rent control in municipalities with tight rental markets, which limits rent increases for new contracts in these municipalities to a maximum of 10% above the local comparative rent (rent cap). Dwellings built after 2014 are exempt from the cap. For both existing leases and new leases, there are also exceptions to the rent regulation for modernization projects. With a few exceptions, the rent cap applies in municipalities where the limited maximum rent increase applies, and vice versa. In most of these cases, the rent cap was introduced no earlier than the limited maximum rent increase.

On average, asking rents in Germany increased by more than 15% over three years in the top cities around 2013 and in all cities and counties in the years after 2016. However, existing rents, as measured by the consumer price index, increased much more slowly (see Figure 2). In this respect, it can be assumed that the limited maximum rent increase in the application areas is binding for some, but not all, rental properties. The maximum amount is binding if the rent is far below the local comparable rent. This is unlikely to be the case if the landlord is a professional profit-seeker or if the local comparable rent has increased only slightly in the recent past.

The introduction of the limited maximum rent increase can be classified as a quasi-experiment that allows for a staggered difference-in-differences design, since it is only implemented in local housing markets that are declared to be tight and is implemented by the federal states at different times. Combined with the fact that moving is very time-consuming and expensive, especially in tight housing markets, the introduction of the limited maximum rent increase by municipalities and states is an exogenous event for the affected households. At least the temporal variation can be interpreted as quasi-random.

The spatial and temporal variation as well as the exemption for new buildings has been used in the literature to identify a negative effect on rents in the regulated segments and a positive effect on rents in adjacent areas and land prices (Mense et al. 2019, 2023), where the rent dampening effect is shown to disappear rather quickly (Breidenbach et al. 2022). Most empirical studies on the effects of the rent cap on rents use asking rents from online real estate platforms, which cannot be used as a data basis for the rent effects of the limited maximum rent increase.

4 Data

The data basis for our analysis is the German Socio-Economic Panel (GSOEP)⁶, which represents Germany’s resident population. We use version 37 and include the years 2001-2019 in the analysis so that the years of the pandemic are excluded. Depending on the question, we choose individuals or households as observation units.

Answers to the question, who is the owner of the dwelling, are used to identify the owner of the dwelling occupied by the household that is not owned by a household member himself or herself. With regard to ownership, we consider three different categories: “cooperative housing” (housing cooperatives), the broader category “non-profit” including housing cooperatives, municipal companies and non-profit organizations and “for profit” including private landlords and private for-profit companies. Since 2013, the GSOEP has distinguished between private landlords and housing associations among for-profit landlords. We use this information from 2013 onwards and apply it as far back as possible for households that do not move and that do not report a change of location or ownership. Since the question about the owner is often not answered or the answer is obviously wrong, we impute the true ownership situation from answers in previous or subsequent surveys if necessary. We do this in the case of missing information if the answers from the previous and subsequent period(s) match and the household has not moved, and in the case of missing information immediately after a move in the first period if information is available from the following period. In regression analyses, we exclude individuals with an implausibly

⁶Data: doi:10.5684/soep-core.v37o; Reference: Goebel et al. (2018)

high number of changes of ownership (Top 5%) or inconsistencies between information on current ownership and information on changes of ownership.⁷

The moves measured with the variable “recently moved” play a central role, because in our analysis of rent regulation, we focus on the regulation of existing rental agreements and thus on households that do not move. In addition, the length of time spent in a housing cooperative is significantly longer than in other rental relationships. Furthermore, we take into account the size of the apartment measured in square meters, the number of household members, the year it was built, the categorically measured condition of the apartment, the federal state in which the apartment is located, and the city size. The dummy variable “reduced rent” indicates whether the dwelling is rented at a reduced rent or housing is government subsidized with the subsidies requiring a means test and a rent cap. Gender, nationality at birth, age, and self-rated health status are also taken into account.

We choose the logarithmized rent per square meter as the main dependent variable. The rent does not include the costs for heating and electricity, but it does include all other utility costs. Since misunderstandings often arise when asking about additional costs, information on additional costs is often missing and the wording of the questions has varied over time, the GSOEP contains a harmonized variable for rent, which in some cases is based entirely or partly on imputation. The existence and type of imputation are indicated by dummy variables, the imputation flags. In the empirical analysis carried out below, the associated measurement error problem is taken into account by either including the imputation flags as control variables or excluding imputed values. Furthermore, the wording of the GSOEP question on rent in 2014 and 2015 differed from earlier and later waves, which led to lower reported rents in these years. To account for these deviations, we include year dummies or exclude the years 2014 and 2015 from the analysis.

The municipality in which the apartment is located cannot be identified in the externally accessible version of the GSOP, so the status of the rent regulation is not known ex ante. In order to be able to add the status of rent regulation to the data, we first determined the status of rent regulation in the observation period for the municipalities in Germany and added it to the data with the help of the German Institute for Economic Research

⁷We also exclude rental periods in dormitories and all subsequent periods from the analysis.

(DIW). On the basis of the corresponding ordinances of the federal states, we recorded the status of rent regulation separately for the limited maximum rent increase and the rent cap as binary variables for each municipality for the desired reference date in each year. For the analysis, we select the municipalities whose area and municipality ID were not changed in the period of the rent regulation under consideration from 2013 to 2019. We are losing 548 predominantly small municipalities and keeping 10,850 municipalities. These municipality-year-regulation combinations were fed into the socio-economic panel data by the DIW using municipality ID, household identification number and year.⁸ Only 1.4% of the household-year combinations in the period 2013-2019 were not matched. Figure 4 in the Appendix shows the municipalities in which the limited maximum rent increase applied for at least one year during the entire period, the remaining municipalities and the municipalities not included in the sample.

Since the exact date of entry into force of the rent control does not match the survey data, we assign the regulation to the current calendar year for the months up to March and then to the following calendar year, and thus have to accept a certain measurement error. We have chosen March instead of the middle of the year as we assume delayed implementation.

The proportion of people subject to rent regulation in our sample rose from around 9% in 2014 to around 21% in the following year and then rose further to more than 30% in 2019 (see Table 1). Table 1 also shows that after the nationwide introduction of the rent cap in 2015, almost all households were either subject to both types of regulation or neither. Only a small proportion of households were only subject to the limited maximum rent increase, but not to the rent cap.

5 Cooperatives and rents

To demonstrate the relevance of living in a cooperative apartment for tenants and of rent control for housing cooperatives, we analyze correlations of owner type, rent control and rents, excluding homeowners. For this analysis, we consider individuals not households

⁸Many thanks to Jan Goebel for his support and the associated documentation.

as observational units. Basic descriptive statistics for 2019, shown in Table 2, reveal differences between owner types. Members of housing cooperatives and tenants from other non-profit owners are rather similar. However, tenants from for-profit owners are on average younger, rate their health as better, stay in the same apartment for less time, live in larger apartments, live less often in subsidized housing and pay higher rents.

For rents, we estimate a linear fixed-effect model with federal state fixed effects interacted with municipality size class fixed effects, year fixed effects, and individual fixed effects:

$$y_{it} = \beta \mathbf{x}_{it} + \gamma_t + \mu_s + \nu_m + \mu_s \times \nu_m + \alpha_i, \quad (8)$$

where \mathbf{x} is the vector of covariates that vary across individuals and time, β is the respective vector of coefficients, γ_t , μ_s , ν_m , and α_i indicate year, federal state, municipality size class, and individual fixed effects, respectively. The left-hand side variable, y_{it} , is logarithmized rent per square meter. Our main variable of interest on the right-hand side is a dummy indicating that the respondent lives in a cooperative apartment. To compare cooperatives with for-profit owners, we only include years where the respondents either live in a cooperative apartment or in an apartment owned by a private for-profit company or landlord. As already stated, we exclude homeowners and all respondents with inconsistent statements on ownership and more than one change of owner type during a rental period. We estimate four different models: Table 3 shows the results. In the baseline model, we add only size of housing unit, household size, year of construction, a binary variable indicating government subsidies, i.e., reduced rent, length of rental period, and a rent imputation flag. In Model (2), we also include conditions of the dwelling with good condition as reference category. Models (3) and (4) consider only those areas where information on rent regulation is available and include two dummy variables indicating whether regulation of rent increases in ongoing tenancies is in place. Model (4) also interacts these indicators with the housing cooperative dummy.

As Table 3 shows, living in a cooperative apartment reduces the rent per square meter by around 4%. Covariates show plausible effects. Rents are higher in newer buildings, but lower if the rent is reduced. The longer the rental period, the lower the rent. The log rent per square meter is lower in larger than in smaller units. Model (2) demonstrates that the

need for renovation goes hand in hand with a rent reduction. These effects do not change qualitatively or even significantly, when Models (3) and (4) control for rent regulation. On average, rents are higher in areas with rent control, but this is less the case for cooperative apartments. This result may indicate that the excess demand in tight housing markets is so great that rent control measures fail to reduce rents on average. Housing cooperatives, on the other hand, are apparently unable or unwilling to raise rents in tight housing markets in the same way as other companies.

Since the fixed-effect model can only identify the effects of the type of ownership based on changes of ownership or relocations, we also estimate a linear model without individual fixed effects, but with gender and nationality at birth as additional control variables. A comparison of the results from Table 8 in the Appendix with the results of the fixed-effect model in Table 3 shows no qualitative changes; the signs of the coefficients and the statistical significance remain. However, the estimated effects of living in a housing cooperative are about twice as large as with individual fixed effects suggesting that movers benefit less from housing cooperatives than stayers.

Another concern is the alternative design of the question on rents in 2014 and 2105. However, the change in design does not have a fundamental impact on the results of the two-way fixed effects model. Table 9 in the Appendix replicates the results of the basic model with interaction effects as Model (1), interacts rent regulation and housing cooperatives with a two-year dummy for 2014 and 2015 in Model (2), and excludes 2014 and 2015 in model (3). Comparison of Models (1) and (3) shows that excluding 2014 and 2015 only slightly reduces the price-reducing effect of housing cooperatives. But rents are significantly higher on average in regulated areas. Moreover, the exclusion of 2014 and 2015 has no significant effect on the effects of rent regulation. Rent control is associated with higher rents, but not when it comes to housing cooperatives.

6 Cooperatives and rent control

The descriptive analysis in the last section suggests that rent regulation prevented housing cooperatives from raising rents more than other landlords, especially for-profit housing corporations. However, these differences may be driven by unobserved differences between

dwelling in regulated and unregulated areas, as well as between dwellings and tenants of cooperative and for-profit landlords. In this section, we modify the study design to identify the causal relationship between the regulation of rent increases in existing leases and apartment rents, also differentiated by the legal form of the owner.

We focus our analysis on the limited maximum rent increase for existing leases and not on the rent cap for new leases because *de facto* cooperatives, which charge comparatively low rents for comparable quality housing, are primarily affected by the limited maximum rent increase. Furthermore, in tight housing markets, a household can hardly escape rent regulation for existing tenancies by moving, but it can escape regulation through the rent cap by not moving for at least a certain period of time.

We expect the two types of regulation to have partially different effects on rent levels. The limited maximum rent increase creates incentives to charge a higher rent when re-letting in order to be less constrained by the regulatory limit on rent increases in the future. The rent will be higher after the move, but progressively lower for longer tenancies. The rent cap permanently reduces the rent for affected apartments. In the case of existing tenancies, the rent cap does not have a direct effect on households at the time of its introduction, but only after the first move. Thus, the limited maximum rent increase reduces the incentives to move, while the rent cap increases them. Moreover, due to general equilibrium effects, we expect that the rent regulation initially lowers the local comparative rent, but increases it again due to an induced supply shortage.

In contrast to the previous descriptive analysis, we consider households rather than individuals as the unit of observation, since households as a whole are potentially affected by the introduction of stricter regulation of rent increases. This modeling is based on the assumption that the composition and size of the household are not affected by stricter rent regulation. The household is considered treated if it lives or has lived in a dwelling that is subject to a limited maximum rent increase. We choose an event study design for our analysis. Treatment begins when the municipality tightens rent regulation or the household moves to a municipality that already has tightened rent regulation. Since moving to a dwelling subject to stricter rent regulation obviously cannot be considered independent of this regulation, we exclude households that move to a regulated dwelling unless they have previously lived in a regulated dwelling. Thus, the treatment in question only starts

if the household was already living in the dwelling that then became subject to stricter regulation. The activation of rent regulation is not determined by landlords and tenants, but is related to the situation in the local housing market, which in turn is related to the characteristics of the contractors, the dwelling and the tenancy. However, the specific date of the beginning of rent regulation is not determined locally, but by the federal states, and can be accelerated or delayed by the balance of power in the federal state and by unforeseen events. We therefore consider the onset of rent regulation to be a quasi-random event.

6.1 Estimation strategy and baseline results

Since moving out of an apartment can obviously be the result of high or increased rents, we consider the entire period from the beginning of the treatment to the end of the observation period as the treatment period.⁹ Accordingly, we choose a staggered difference-in-difference design. As the housing markets differ greatly between treated and never-treated units, the assumption of parallel trends is not met for this comparison and never-treated units are not a suitable control group. We thus restrict the control group to the not-yet treated.

In order to analyze the influence of the legal form of the owner, we divide the sample according to the type of owner at the beginning of the treatment: Cooperatives, non-profit landlords in a broader sense, for-profit owners, and private landlords separately.¹⁰ If a household moves from a regulated dwelling to another dwelling, this household is still assigned to the owner type valid at the start of the treatment, regardless of the owner in the new dwelling. Only the observations for which the status of the rent regulation could be determined are taken into account.

The period of investigation is limited to 2006 to 2019, where 2010 saw the start of a boom on the housing market in Germany with sharply rising real estate prices and - to a lesser extent - of new contract rents.

More specifically, to identify the causal effect of rent regulation on the log rent per square meter, we use the difference-in-difference imputation estimator from Borusyak et al.

⁹Moreover, in our sample, there is no area in which rental price regulation ended during the observation period.

¹⁰The number of cases of for-profit housing companies is too small for an independent analysis.

(2024). In the first stage, we use only the non-treated observations to estimate the coefficients of the fixed effects and covariates, which are then used to predict the rents for the treated observations. The differences between the actual and predicted rents correspond to the treatment effects for treated observations whose means correspond to the respective average treatment effect on the treated (ATT). The estimator assumes parallel trends and absence of anticipation effects. We estimate both annual averages as part of an event study design and averages over the entire treatment period. In detail: the first-stage estimates β , γ_t , and α_i as $(\beta^*, \gamma_t^*, \alpha_i^*)$ by OLS within the not-yet treated observations

$$y_{it} = \beta \mathbf{x}_{it} + \gamma_t + \alpha_i + \epsilon_{it}, \quad (9)$$

where \mathbf{x} is the vector of covariates that vary across units, indicated by i , and time t , β is the vector of coefficients, γ_t and α_i indicate year and unit fixed effects, respectively. The left-hand side variable, y_{it} , is logarithmized rent per square meter. At the second stage, for each treated observation, the estimated and predicted coefficients of the first stage, $(\beta^*, \gamma_t^*, \alpha_i^*)$, are used to predict the outcome without treatment: $\hat{y}_{it}(0) = \beta^* \mathbf{x}_{it} + \gamma_t^* + \alpha_i^*$. This gives the imputed individual treatment effect: $\tau_{it} = y_{it} - \hat{y}_{it}(0)$. The averaging over each or all years since the start of rent regulation results in the respective ATT.

As recommended by Borusyak et al. (2024), we check pre-treatment trends by a separate regression - for not-yet-treated observations only - of our outcome variable on dummies, δ_k , for a certain number of periods K before treatment, in addition to all the fixed effects and controls we also accounted for in the first-stage regression:

$$y_{it} = \beta \mathbf{x}_{it} + \gamma_t + \alpha_i + \sum_{k=-K}^{-1} \delta_k + \epsilon_{it}. \quad (10)$$

This procedure compares the observed K pre-treatment periods to previous periods. We also test whether the K pre-treatment period effects are simultaneously zero. The reference to the periods of the past also means that the confidence bands in the pre-treatment period become wider and wider over time.

As mentioned, the owner is determined when the rent regulation is introduced and the household is assigned accordingly. We estimate separately for households then living in cooperative housing, in dwellings owned by nonprofit organizations, in dwellings owned

by for-profit owners, and in dwellings owned by the subgroup of private landlords. In all regression, we exclude reduced rent observations. By this procedure, we implicitly assume that the treatment does not affect whether the household is eligible for rent reduction.

In our baseline, we include dummies for rent imputation flags for two different imputation mechanism applied in the GSOEP and the length of stay as controls.

Table 4 shows clearly for household that the parallel trend assumption is violated. The coefficients of pre-treatment-period dummies are significantly positive and the Null that all pre-treatment-period dummies are jointly zero must be rejected. Rents rise more sharply directly before the treatment than for properties and households that are only affected by the treatment later. This is true for all sorts of owners, although, probably due to the large heterogeneity, the effects are not statistically significant for all periods for private landlords and, more generally, for profit-seeking owners.

To account for these trends, we add pre-treatment linear trends to our basic model as additional control variables. Since the short observation times do not allow us to include household specific trends, we use treatment-group specific trends (see, e.g., Duggan et al. 2016). To that end, we insert linear trends for cohorts that are formed by the calendar year of the introduction of rent regulation, interacted with a dummy for East Germany. As a result of the linear trends for cohorts of the rent regulation introduction, the residual developments are so similar that violations of the parallel trend assumption can no longer be determined. Table 5 showing the pre-treatment data conditional on cohort-east specific linear trends indicates clearly there is no evidence of divergent trends. The assumption of parallel trends seems to be fulfilled.

Table 6 shows the ATT for the treatment period and 4 subsequent periods and the ATT for the entire treatment period conditional on cohort-east specific linear trends at the household level. The limited maximum rent increase causes a decline in average rents for almost all periods for all sorts of owners. The ATT are largest with about 5.5% for the broader category of non-profit organizations (Model (1)) and with about 4.5% for the housing cooperatives (Model (2)). For the for-profit landlords in general and the private landlords in particular, the effects are smaller (less than 2%) and not statistically significant (Models (3) and (4)).

Figure 3 shows the calculated average annual deviation of the observed from the pre-

dicted logarithmized rents per square meter in cooperative housing, housing owned by non-profit corporations, housing owned by for-profit owners, and private landlords for rent control imposed in period 0 at the household level for cohort-east specific linear trends when reduced rents and households that moved in a already stricter regulated dwelling are excluded. For the treatment periods the coefficients coincide with the period specific ATT conditional on cohort-east specific linear trends; for pre-treatment periods, the reference point is the entire period before the specified pre-treatment period.

6.2 For-profit owners and rent control

The fact that it is not possible to identify a statistically significant treatment effect for profit-seeking landlords is not so surprising. The variance of the pre-trend effects is relatively large for these landlords. This group includes small private landlords as well as large housing corporations. Since the GSOEP only distinguishes between these two subtypes since 2013, when the rent regulation in question was first introduced, a fully differentiated analysis with pretrends is not possible. Therefore, we were only able to consider the cases from before 2013 for the subset of households living in dwellings owned by private landlords that did not move. This reduces the number of cases and limits generalizability.

It is also plausible that very small landlords, due to lack of knowledge, are more likely to violate the limited maximum rent increase than the comparatively large housing cooperatives and municipal housing corporations, whose behavior is much more closely monitored by the public. Professional for-profit landlords, on the other hand, will use the modernization exemptions to raise rents more extensively. Due to the higher average rents, for-profit landlords are already prevented from increasing rents more than housing cooperatives and municipal housing companies by the limit imposed by the local comparative rent, so that the limited maximum rent increase does not represent a major additional restriction.

After the rent increase limit is tightened, landlords will only be able to raise rents on existing leases through regular smaller rent increases, not through infrequent larger rent increases. Thus, for-profit landlords have an incentive to raise rents more frequently in order to at least partially circumvent the restriction on rent increases. However, we suspect that nonprofit landlords may not be able to impose such strategies on their members or

stakeholders in general. To test this hypothesis, we analyze whether the treatment is associated with an increase in the frequency of rent increases.

To do this, we define the dummy variable rent increase, which takes the value 1 if the rent was increased compared to the previous year, and the value 0 otherwise. In this analysis, we exclude both imputed rents and reduced rents and consider only the length of the tenancy as a time-varying control variable. Since the frequent rent increases are a response to the specific regulation, we do not expect the treatment group to have different trends from the control group. Therefore, and due to the small number of observations over two consecutive periods, we do not consider any event-specific linear trends.

Table 7 shows the coefficients for the pretreatment period and the ATTs. Over the entire reference period, we observe no pre-trends and positive ATTs only for the universe of for-profit landlords and the subset of private landlords. These results confirm the hypothesis that only for-profit landlords react to the additional restriction by increasing rents more frequently.

6.3 Ownership and rent control: robustness checks

We do several robustness checks. Firstly, we exclude the years 2014 and 2015, in which the questions on rents differ from those of the years before and after. Secondly, we undo the imputation of the dependent variable. Thirdly, we include moves into rent controlled units. The first two robustness tests significantly reduce the sample size, the third robustness test adds potentially endogenous moves, so that less significant effects can be expected. Nevertheless, the robustness checks confirm our baseline results qualitatively and almost quantitatively as shown in Figures 5, 6, and 7 in the Appendix.

The results of the estimates show that stricter regulation of rent increases in existing tenancies has a rent-reducing effect, especially for non-profit landlords. The robustness of the results to variations in the observation unit and the sample reinforces our conviction that we have identified a causal effect.

7 Conclusion

Although the public often takes it for granted that housing cooperatives contribute to affordable housing, and thus support for tax breaks and/or preferential access to land seems to be widespread, it is not obvious ex-ante that housing cooperatives can rent at lower rents. On the other hand, if housing cooperatives charge lower rents, they may not be affected by rent control.

To shed light on the triangle of market integration, lower rents and rent control, we examined housing cooperatives in the regulated housing market of Germany in terms of their contribution to affordable housing and the impact of rent control on them.

We found that general expectations are confirmed: residents of cooperative housing pay lower rents for comparable housing than tenants of for-profit housing. Despite lower rents, however, cooperatives and nonprofits in general are affected by rent control measures. Perhaps surprisingly, nonprofit landlords, including housing cooperatives, appear to be particularly affected by the regulation of rent increases for existing tenancies. We were able to show that, unlike housing cooperatives and other nonprofit landlords, for-profit landlords do not lower rents on average in response to rent regulation, but they do change rents more frequently.

Even though we were able to show that nonprofit providers of low-cost properties are affected by rent regulation, the interdependencies between for-profit and nonprofit landlords in their responses to rent regulation are unclear. Due to the lack of location information in our database, we were also unable to answer which group of landlords responded more strongly to rent control in the same housing market. Answering these questions is left to future research.

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Tables

Table 1: Expansion of rent control: shares of individuals subject to rent control measures

	2014	2015	2016	2017	2018	2019
limited maximum rent increase	0.093	0.207	0.255	0.266	0.284	0.293
rent cap	0.000	0.050	0.240	0.247	0.252	0.259
at least one of the two regulations	0.093	0.207	0.270	0.281	0.295	0.303
both regulations	0.000	0.005	0.220	0.228	0.238	0.246

Note: Unweighted shares of individuals in the sample who are subject to rent control measures at the time of the survey (in %) whereby residents of dormitories and individuals with obviously inconsistent information on housing tenure are excluded.

Table 2: Descriptive statistics 2019

	median	mean	sd	min	max
cooperative housing					
rent per square meter	7	7.21	2	2	17
satisfaction with dwelling	8	7.50	2	0	10
length of rental period	8	13.39	14	0	62
size of housing unit in sqm	67	68.35	19	15	180
current household size	2	2.18	1	1	9
estimated year of construction	1960	1966.46	20	1918	2018
reduced rent	0	0.15	0	0	1
age	49	50.40	18	18	91
current self-rated health status	3	2.72	1	1	5
non-profit owner					
rent per square meter	7	7.21	2	2	19
satisfaction with dwelling	8	7.45	2	0	10
length of rental period	8	13.13	14	0	62
size of housing unit in sqm	66	68.05	20	15	300
current household size	2	2.17	1	1	9
estimated year of construction	1960	1966.45	20	1918	2019
reduced rent	0	0.20	0	0	1
age	51	50.67	18	18	92
current self-rated health status	3	2.76	1	1	5
for-profit owner					
rent per square meter	7	7.86	3	0	28
satisfaction with dwelling	8	7.52	2	0	10
length of rental period	5	8.99	11	0	90
size of housing unit in sqm	77	82.67	32	11	400
current household size	2	2.16	1	1	12
estimated year of construction	1960	1962.10	28	1918	2019
reduced rent	0	0.09	0	0	1
age	42	45.26	18	18	96
current self-rated health status	2	2.54	1	1	5

Note: Only observations with consistent statements included; probability weighting.

Table 3: Fixed-effect regression models of rents

	(1)	(2)	(3)	(4)
dv: ln(rent per square meter)				
cooperative housing	−0.0449*** (0.0120)	−0.0421*** (0.0140)	−0.0410*** (0.0141)	−0.0387*** (0.0141)
size of housing unit in sqm	−0.00416*** (0.000217)	−0.00407*** (0.000245)	−0.00401*** (0.000246)	−0.00401*** (0.000246)
current household size	0.0414*** (0.00374)	0.0428*** (0.00410)	0.0420*** (0.00410)	0.0420*** (0.00410)
estimated year of construction	0.00204*** (0.000200)	0.00195*** (0.000219)	0.00192*** (0.000220)	0.00192*** (0.000220)
reduced rent	−0.0883*** (0.00932)	−0.0802*** (0.0101)	−0.0802*** (0.0102)	−0.0802*** (0.0102)
length of rental period	−0.00552*** (0.000747)	−0.00477*** (0.000772)	−0.00477*** (0.000776)	−0.00474*** (0.000775)
rent not imputed	−0.0254*** (0.00307)	−0.0291*** (0.00320)	−0.0279*** (0.00321)	−0.0280*** (0.00321)
minor renovation required		−0.0136*** (0.00403)	−0.0137*** (0.00407)	−0.0138*** (0.00407)
complete renovation required		−0.0402*** (0.0106)	−0.0395*** (0.0106)	−0.0396*** (0.0106)
dilapidated		−0.120** (0.0510)	−0.0881** (0.0413)	−0.0884** (0.0413)
limited max. rent increase			0.0335*** (0.00631)	0.0398*** (0.00700)
limited max. rent increase x coop				−0.0301*** (0.0112)
N	99936	81720	80582	80582
F	118.5	82.14	77.87	74.91
R^2	0.777	0.778	0.778	0.778
R^2_a	0.726	0.725	0.725	0.725
R^2_w	0.146	0.135	0.135	0.135

Note: Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01; federal-state \times municipality-size, year, and individual fixed effects included; (1): basic, (2): w dwelling conditions, (3)/(4): areas with information on rent regulation, (4): also interaction terms.

Table 4: Pretrend analysis of rents w/o linear trend controls

	(1) cooperative	(2) nonprofit	(3) for profit	(4) private landlords
period -5	0.0475** (0.0241)	0.0355* (0.0204)	0.0192* (0.0105)	0.0264** (0.0111)
period -4	0.0533* (0.0295)	0.0416* (0.0235)	0.0395** (0.0171)	0.0382** (0.0186)
period -3	0.113*** (0.0346)	0.0925*** (0.0273)	0.0374 (0.0239)	0.0405 (0.0259)
period -2	0.117*** (0.0434)	0.102*** (0.0338)	0.0394 (0.0308)	0.0434 (0.0343)
period -1	0.156*** (0.0528)	0.149*** (0.0409)	0.0536 (0.0386)	0.0635 (0.0431)
p	0.00840	0.000435	0.185	0.157
χ^2	15.51	22.42	7.512	7.979

Note: The table shows coefficients from period dummies for 5 periods before treatment at the household level and the result of a Wald test whether all 5 pre-treatment period coefficients are jointly zero. Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01; reduced rents and moves into stricter regulation are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: rent imputation flags, length of stay; control group: not-yet treated.

Table 5: Pretrend analysis of rents with linear trend controls

	(1) cooperative	(2) nonprofit	(3) for profit	(4) private landlords
period -5	0.0367 (0.0440)	0.0366 (0.0355)	−0.00262 (0.0166)	0.00334 (0.0192)
period -4	0.0319 (0.0688)	0.0421 (0.0522)	−0.00755 (0.0332)	−0.0114 (0.0386)
period -3	0.0803 (0.0950)	0.0928 (0.0719)	−0.0420 (0.0557)	−0.0427 (0.0635)
period -2	0.0691 (0.134)	0.101 (0.101)	−0.0799 (0.0830)	−0.0814 (0.0936)
period -1	0.0922 (0.178)	0.148 (0.134)	−0.113 (0.114)	−0.110 (0.129)
p	0.145	0.248	0.241	0.240
χ^2	8.211	6.649	6.731	6.745

Note: The table shows coefficients from period dummies for 5 periods before treatment at the household level and the result of a Wald test whether all 5 pre-treatment period coefficients are jointly zero. Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01; reduced rents and moves into stricter regulation are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: rent imputation flags, length of stay, cohort-east specific linear trends; control group: not-yet treated.

Table 6: ATT for rents with linear trend controls

	(1) cooperative	(2) nonprofit	(3) for profit	(4) private landlords
ATT period 0	−0.0132 (0.0150)	−0.0176 (0.0144)	0.00662 (0.0135)	0.00655 (0.0142)
ATT period 1	−0.0445* (0.0267)	−0.0461** (0.0230)	−0.00451 (0.0219)	−0.00202 (0.0249)
ATT period 2	−0.0384 (0.0361)	−0.0579* (0.0321)	−0.0224 (0.0397)	−0.0259 (0.0426)
ATT period 3	−0.0843* (0.0455)	−0.0990** (0.0393)	−0.0629 (0.0743)	−0.0707 (0.0760)
ATT period 4	−0.112** (0.0571)	−0.138*** (0.0462)	−0.0493 (0.128)	−0.0624 (0.128)
ATT	−0.0449* (0.0254)	−0.0551** (0.0224)	−0.0175 (0.0370)	−0.0197 (0.0386)

Note: The table shows annual ATT for the first periods after treatment starts and for the entire treatment period at the household level.

Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01; reduced rents and moves into stricter regulation are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: rent imputation flags, length of stay, cohort-east specific linear trends; control group: not-yet treated.

Table 7: Pretrend analysis and ATT for annual rent increases

	(1) cooperative	(2) nonprofit	(3) for profit	(4) private landlords
period -5	0.0612 (0.105)	0.0921 (0.0933)	0.0252 (0.0700)	0.00488 (0.0857)
period -4	0.226** (0.111)	0.225** (0.0956)	0.0235 (0.0789)	-0.0270 (0.100)
period -3	0.0191 (0.138)	0.0680 (0.108)	0.00634 (0.0967)	0.0221 (0.116)
period -2	-0.000426 (0.166)	0.00488 (0.123)	0.0685 (0.125)	0.103 (0.142)
period -1	-0.0974 (0.227)	-0.0243 (0.157)	0.0117 (0.152)	0.0666 (0.163)
p	0.186	0.121	0.883	0.728
χ^2	7.499	8.722	1.746	2.816
ATT period 0	0.112 (0.228)	-0.165 (0.174)	0.174 (0.152)	0.172 (0.152)
ATT period 1	0.0114 (0.162)	-0.102 (0.157)	0.286** (0.134)	0.292** (0.144)
ATT period 2	-0.0376 (0.178)	-0.232* (0.134)	0.161 (0.124)	0.173 (0.133)
ATT period 3	0.0865 (0.152)	-0.160 (0.109)	0.197 (0.130)	0.179 (0.137)
ATT period 4	-0.00439 (0.259)	-0.247 (0.170)	0.376* (0.207)	0.395* (0.211)
ATT	0.0390 (0.156)	-0.185* (0.103)	0.231* (0.132)	0.232* (0.139)

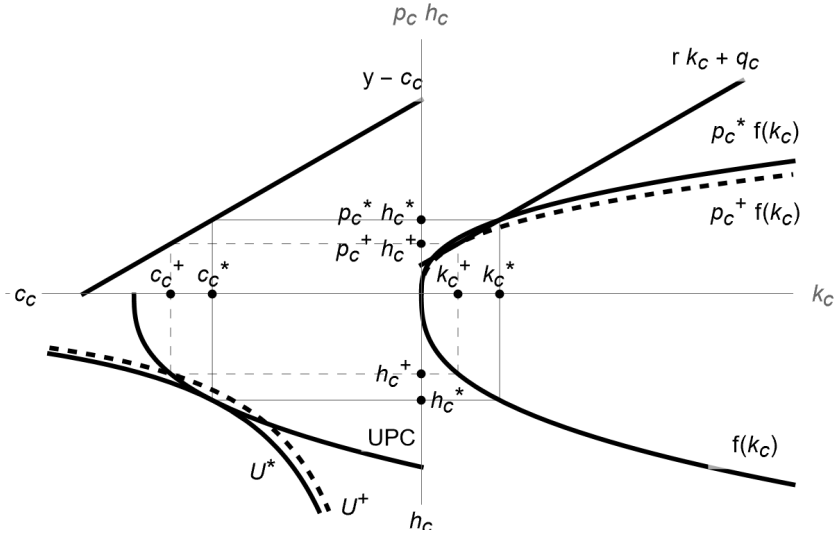
Note: The table shows in the upper part coefficients from period dummies for 5 periods before treatment at the household level and the result of a Wald test whether all 5 pre-treatment period coefficients are jointly zero. In the lower part, it shows annual ATT for the first periods after treatment starts and for the entire treatment period at the household level.

Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01.

Imputed rents, reduced rents and moves into stricter regulation are excluded; dependent variable: annual rent increase; control variables: length of stay; control group: not-yet treated.

Figures

Figure 1: Cooperative housing in equilibrium without and with rent control



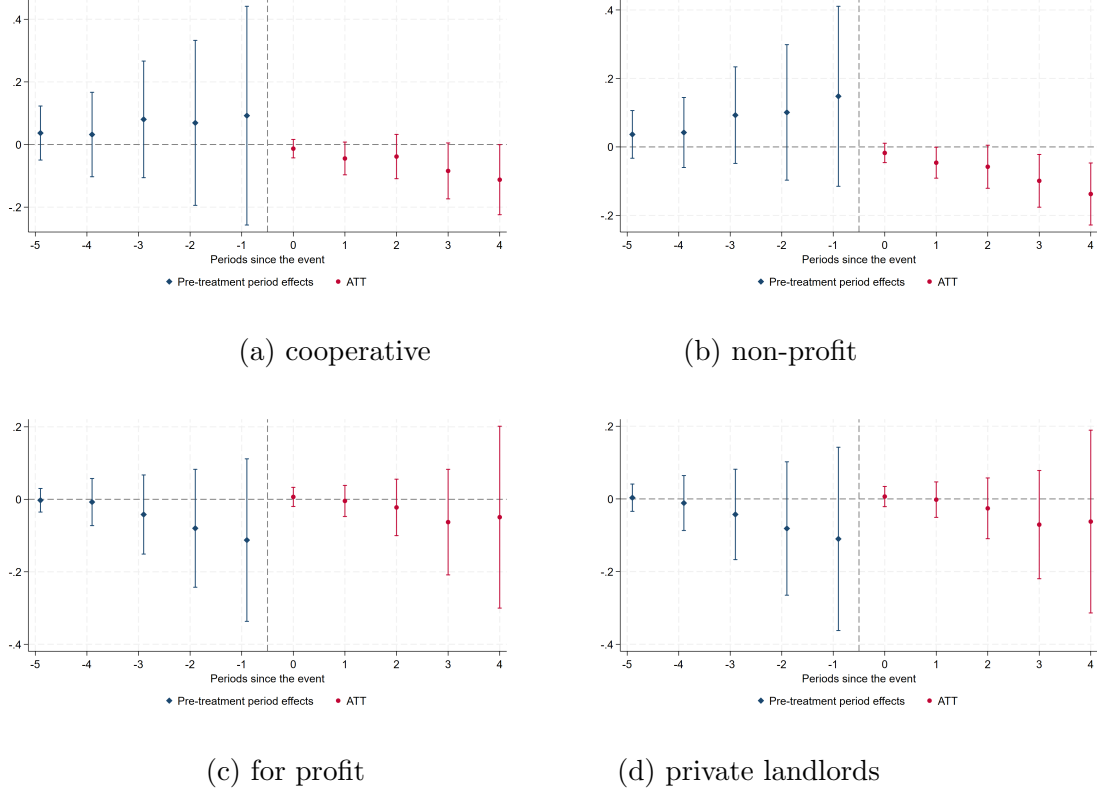
Note: The figure illustrates the optimization problem of the representative housing cooperative member. The North-East quadrant shows the non-profit constraint, the North-West quadrant the individual budget constraint. The South-East quadrant depicts the housing quality production function, the South-West quadrant shows the utility possibility curve (UPC) and the indifference curve in the optimum, U^* . The optimum is $(c^*, h^*, k^*, p^*; U^*)$. Dashed lines indicate the outcome under rent control. The equilibrium with rent control is $(c^+, h^+, k^+, p^+; U^+)$

Figure 2: Three-year-rent-growth rates



Note: The figure shows the three-year-growth rates for asking rents in all German counties, in cities, and in 7 major cities, and the rent index from the consumer price index. The data comes from the system of indicators for the German residential property market provided by the Deutsche Bundesbank: <https://www.bundesbank.de/en/statistics/sets-of-indicators/system-of-indicators-for-the-german-residential-property-market>

Figure 3: Effects of rent control on rents with cohort-east specific linear trends

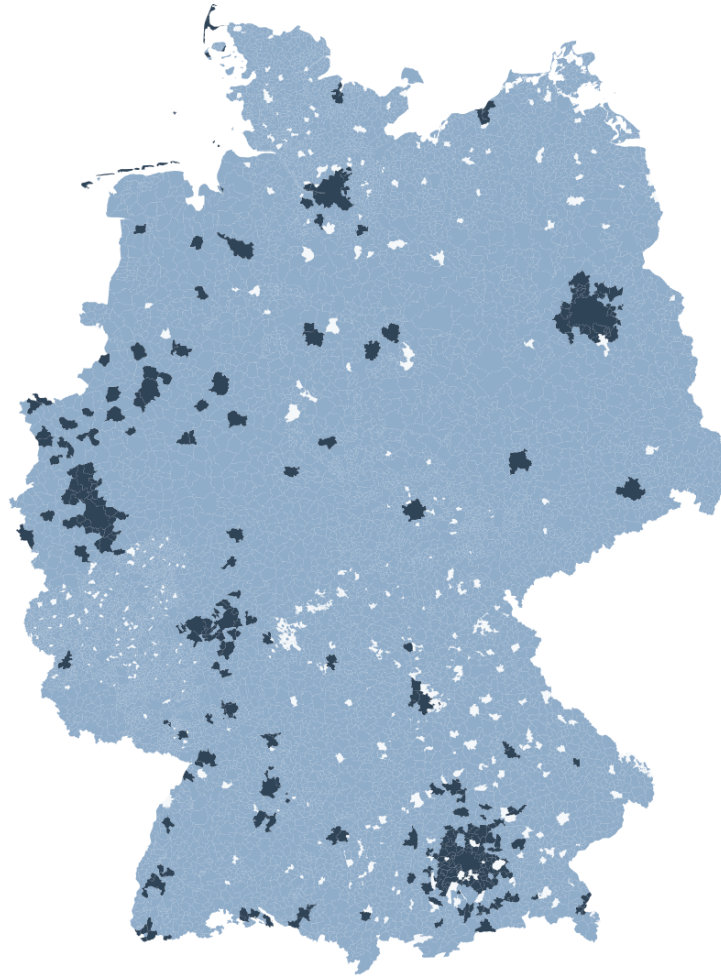


Note: The figure shows at the household level point estimates and 95% confidence bands for cooperative housing, housing owned by non-profit organizations, housing owned by for-profit owners, and housing owned by private landlords. For the treatment period the coefficients are ATT when rent control is imposed in period 0, i.e., average calculated deviations of the observed from the predicted logarithmized rents per square meter. For the pre-treatment period the coefficients compare the observed 5 pre-treatment periods to previous periods. The event plot is based on the difference-in-difference imputation estimator developed by Borusyak et al. (2024). Reduced rents and moves into stricter regulation are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: rent imputation flags, length of stay, cohort-east specific linear trends; control group: not-yet treated.

Appendix

Spatial distribution of rent control

Figure 4: Map of rent control



Note: The figure shows in dark blue the municipalities in Germany with limited maximum rent increase in at least one year in the period 2013–March 2019, in light blue the municipalities without this kind of rent regulation in this period and in white the municipalities we excluded from the analysis.

Robustness checks

Table 8: Linear regression models of rents w/o individual fixed effects

	(1)	(2)	(3)	(4)
dv: ln(rent per square meter)				
cooperative housing	−0.0728*** (0.00623)	−0.0734*** (0.00672)	−0.0727*** (0.00667)	−0.0542*** (0.00657)
size of housing unit in sqm	−0.00238*** (0.000193)	−0.00229*** (0.000212)	−0.00228*** (0.000213)	−0.00227*** (0.000212)
current household size	0.0122*** (0.00296)	0.0129*** (0.00323)	0.0118*** (0.00320)	0.0119*** (0.00318)
estimated year of construction	0.00262*** (0.000107)	0.00246*** (0.000113)	0.00243*** (0.000112)	0.00243*** (0.000111)
reduced rent	−0.266*** (0.0103)	−0.268*** (0.0113)	−0.267*** (0.0112)	−0.267*** (0.0112)
length of rental period	−0.00396*** (0.000247)	−0.00374*** (0.000257)	−0.00378*** (0.000256)	−0.00378*** (0.000254)
rent not imputed	−0.0198*** (0.00403)	−0.0211*** (0.00415)	−0.0181*** (0.00414)	−0.0189*** (0.00412)
female	−0.000914 (0.00247)	−0.000358 (0.00259)	0.000159 (0.00259)	0.000104 (0.00258)
born in Germany	−0.00379 (0.00575)	0.000872 (0.00613)	0.00234 (0.00605)	0.00338 (0.00600)
minor renovation required		−0.0363*** (0.00470)	−0.0364*** (0.00467)	−0.0370*** (0.00466)
complete renovation required		−0.102*** (0.0109)	−0.0988*** (0.0109)	−0.0987*** (0.0109)
dilapidated		−0.0834* (0.0432)	−0.0563 (0.0371)	−0.0573 (0.0368)
limited max. rent increase			0.116*** (0.00770)	0.146*** (0.00843)
limited max. rent increase x coop				−0.154*** (0.0142)
N	107125	90531	89292	89292
F	177.1	140.0	141.6	139.7
R^2	0.358	0.351	0.356	0.359
R^2_{-w}	0.203	0.196	0.204	0.207

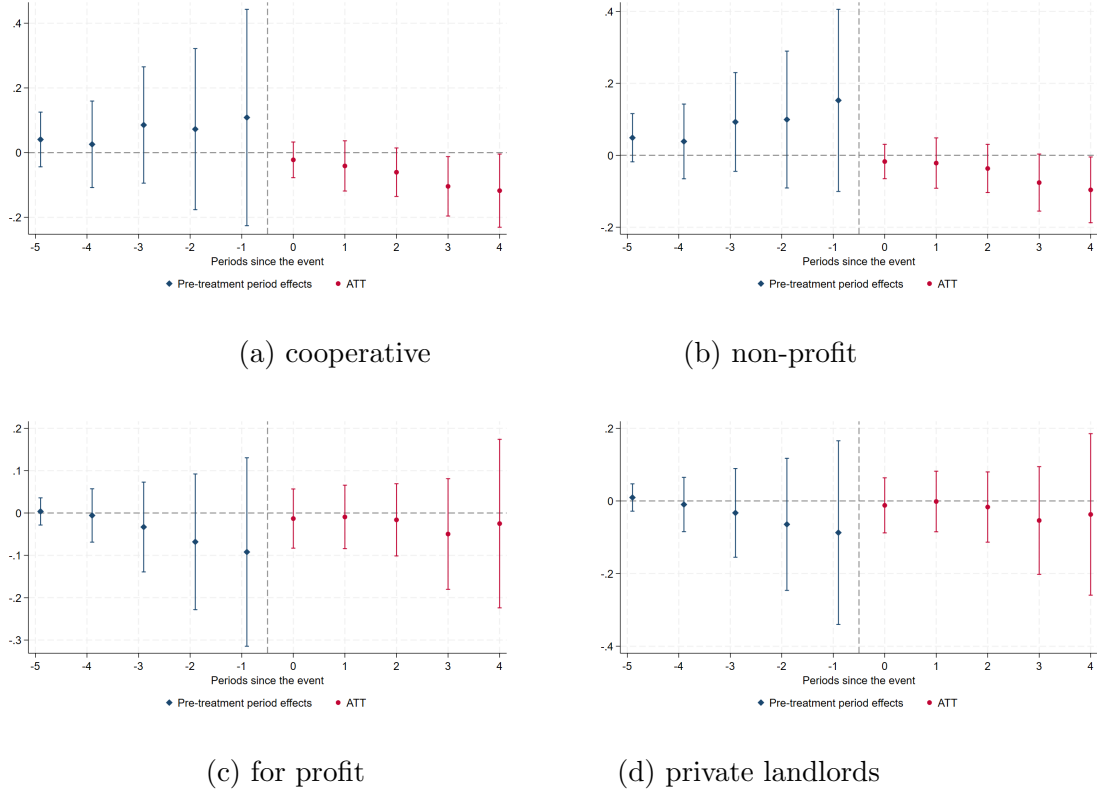
Note: Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01; federal-state \times municipality-size, and year fixed effects included; (1): basic, (2): w dwelling conditions, (3)/(4): areas with information on rent regulation, (4): also interaction terms.

Table 9: Fixed-effect regression models of rents addressing 2014 and 2015

	(1)	(2)	(3)
dv: ln(rent per square meter)			
cooperative housing	−0.0387*** (0.0141)	−0.0365** (0.0142)	−0.0352** (0.0152)
size of housing unit in sqm	−0.00401*** (0.000246)	−0.00401*** (0.000247)	−0.00414*** (0.000263)
current household size	0.0420*** (0.00410)	0.0421*** (0.00410)	0.0463*** (0.00435)
estimated year of construction	0.00192*** (0.000220)	0.00192*** (0.000220)	0.00195*** (0.000229)
reduced rent	−0.0802*** (0.0102)	−0.0808*** (0.0102)	−0.0748*** (0.00978)
minor renovation required	−0.0138*** (0.00407)	−0.0140*** (0.00406)	−0.0123*** (0.00417)
complete renovation required	−0.0396*** (0.0106)	−0.0394*** (0.0106)	−0.0289*** (0.00942)
dilapidated	−0.0884** (0.0413)	−0.0902** (0.0411)	−0.0818* (0.0484)
length of rental period	−0.00474*** (0.000775)	−0.00471*** (0.000776)	−0.00423*** (0.000708)
rent not imputed	−0.0280*** (0.00321)	−0.0282*** (0.00320)	−0.0262*** (0.00312)
limited max. rent increase	0.0398*** (0.00700)	0.0140 (0.00891)	0.0297*** (0.00954)
limited max. rent increase x coop	−0.0301*** (0.0112)	−0.0290** (0.0133)	−0.0302** (0.0134)
limited max. rent increase x 2014/15		0.0486*** (0.0113)	
limited max. rent increase x coop x 2014/15		0.00987 (0.0212)	
coop x 2014/15		−0.0163 (0.0112)	
N	80582	80582	64292
F	74.91	68.01	60.88
R^2	0.778	0.778	0.817
R^2_{-w}	0.135	0.136	0.153

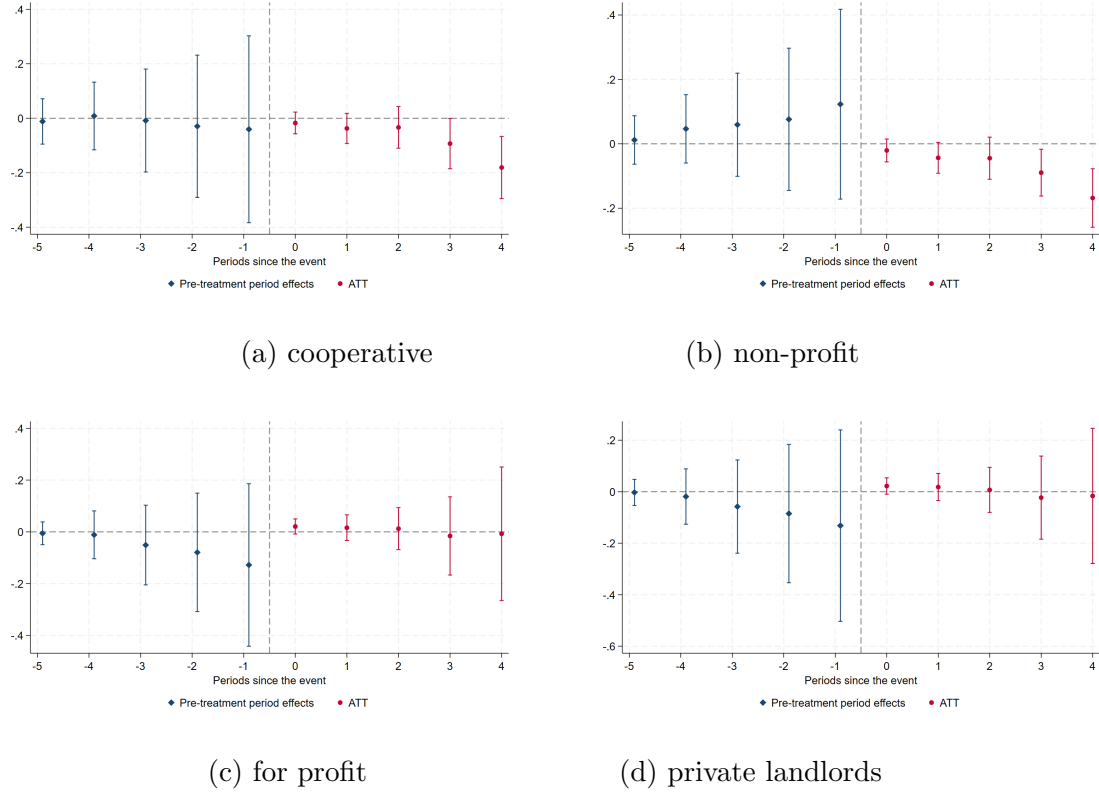
Note: Standard errors clustered at the household level are in parentheses, * 0.1 ** 0.05 *** 0.01; federal-state \times municipality-size, year, and individual fixed effects included; (1): areas with information on rent regulation and interactions all sample years, (2): also interacted with rent question design, (3): without sample years 2014 and 2015.

Figure 5: Effects of rent control on rents with cohort-east specific linear trends w/o 2014/15



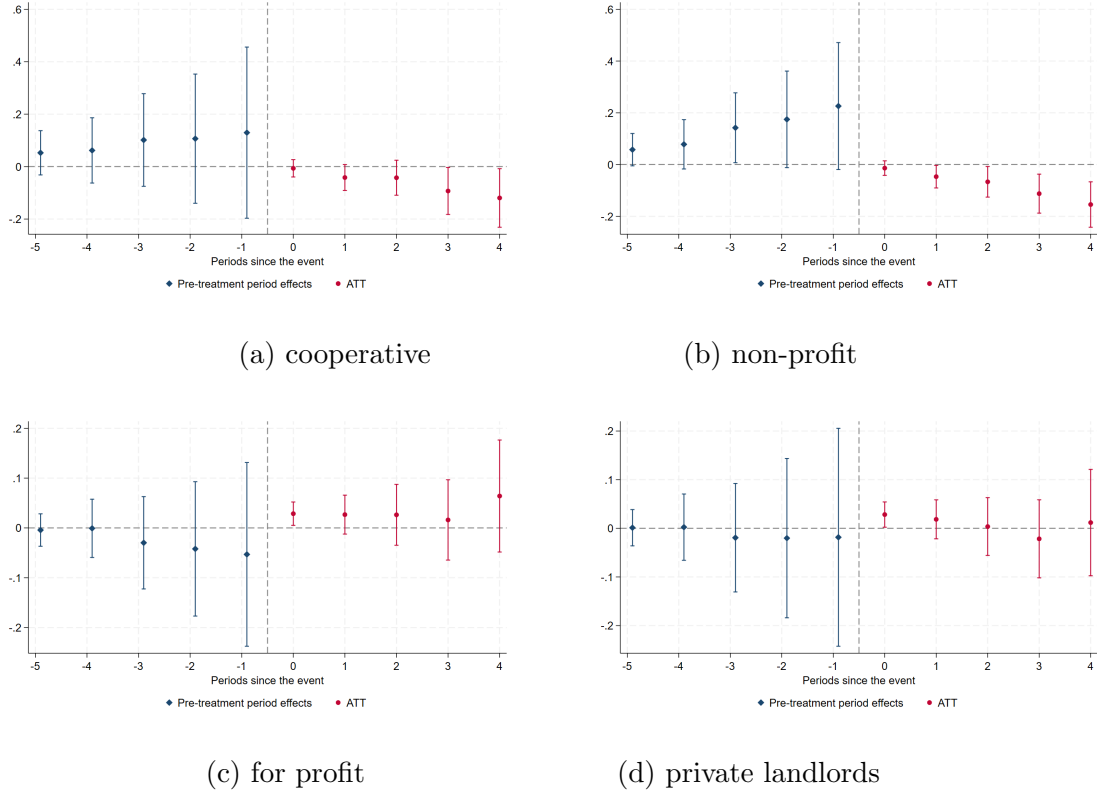
Note: The figure shows at the household level point estimates and 95% confidence bands for cooperative housing, housing owned by non-profit organizations, housing owned by for-profit owners, and housing owned by private landlords. For the treatment period the coefficients are ATT when rent control is imposed in period 0, i.e., average calculated deviations of the observed from the predicted logarithmized rents per square meter. For the pre-treatment period the coefficients compare the observed 5 pre-treatment periods to previous periods. The event plot is based on the difference-in-difference imputation estimator developed by Borusyak et al. (2024). Observations from 2014 and 2015, reduced rents and moves into stricter regulation are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: rent imputation flags, length of stay, cohort-east specific linear trends; control group: not-yet treated.

Figure 6: Effects of rent control on non-imputed rents with cohort-east specific linear trends



Note: The figure shows at the household level point estimates and 95% confidence bands for cooperative housing, housing owned by non-profit organizations, housing owned by for-profit owners, and housing owned by private landlords. For the treatment period the coefficients are ATT when rent control is imposed in period 0, i.e., average calculated deviations of the observed from the predicted logarithmized rents per square meter. For the pre-treatment period the coefficients compare the observed 5 pre-treatment periods to previous periods. The event plot is based on the difference-in-difference imputation estimator developed by Borusyak et al. (2024). Imputed rents, reduced rents and moves into stricter regulation are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: length of stay, cohort-east specific linear trends; control group: not-yet treated.

Figure 7: Effects of rent control on rents with cohort-east specific linear trends (recently moved households included)



Note: The figure shows at the household level point estimates and 95% confidence bands for cooperative housing, housing owned by non-profit organizations, housing owned by for-profit owners, and housing owned by private landlords. For the treatment period the coefficients are ATT when rent control is imposed in period 0, i.e., average calculated deviations of the observed from the predicted logarithmized rents per square meter. For the pre-treatment period the coefficients compare the observed 5 pre-treatment periods to previous periods. The event plot is based on the difference-in-difference imputation estimator developed by Borusyak et al. (2024). Reduced rents are excluded; dependent variable: $\ln(\text{rent per square meter})$; control variables: rent imputation flags, length of stay, cohort-east specific linear trends; control group: not-yet treated.