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Abstract: Most countries show a residency discount in rents for sitting tenants. In the wake of strong rent increases and housing shortages, Germany implemented a reform in 2001 to curtail rent increases. Based on linked housing-tenant data for Germany, this paper estimates panel OLS and quantile regressions of rents within tenancies. The results show that rents deflated by the CPI increase strongly from 1984 until the reform in 2001, and there is a reversal in the trend afterwards. Before the reform, there is a significant residence discount which decreases in absolute value with tenure. The reform reduces rents, in particular for expensive apartments and for new leases. There is no residency discount after the reform.

Keywords: linked housing-tenant data, rent regression, length of residency discount, rent control, quantile regression

JEL: R 31, C 21, C 23

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1 Introduction

In comparison to other European countries, a fairly large share of the population in Germany lives in rental housing (Eurostat 2013). At the same time, the large private rental housing market in Germany shows a higher level of regulation through rent control and tenant protection against eviction than the OECD average (Johannsson 2011). In contrast to the current situation, Germany was characterized until the 1990s by fairly liberal rent laws (Börsch-Supan 1994; Hubert 1998).[1] In the wake of housing shortages and strong rent increases in the 1990s, there was a change towards more regulation in order to protect sitting tenants. There are less restrictions on rent increases for new leases and these restrictions remained basically unchanged during the 1990s and 2000s.

The rental housing market in most countries shows a residency discount for sitting tenants. With stronger rent control for sitting tenants and tenant protection against eviction, one would expect a stronger residency discount for sitting tenants if rents for new leases can adjust to market conditions (Börsch-Supan 1994; Hubert 1995, 1998). Thus, rent control is likely to protect sitting tenants more than tenants in new leases. This paper analyzes the impact of the Tenancy Law Reform Act implemented in 2001 on both the level of rents and the residency discount. Based on linked housing-tenant data from 1984 to 2011, we estimate panel OLS and quantile regressions of rents within tenancies.

As an application of hedonic price models (Court 1939, Rosen 1974), a large body of empirical research examines the relationship between characteristics of rental units and average rents (see e.g. Barnett 1979, Follain and Malpezzi 1980, Guasch and Marshal 1987 for the U.S. or Hoffmann and Kurz 2002 or Bischoff and Maennig 2011 for Germany). Rents are regressed on characteristics of rental units and the coefficients are interpreted as the marginal prices for these characteristics. In an unregulated rental market, the price effects reflect market conditions which are the result of supply and demand. In a regulated market, which is the case in our paper, the estimated price effects are also affected by the institutional constraints. Furthermore, not all price relevant characteristics are observed in rent data and the

[1] Currently (in 2015), the regulation of the private rental housing market in Germany is further strengthened through stronger rent control ('Mietpreisbremse') both for new leases and for sitting tenants and through the requirement that the person, who engages a real estate agent to find a tenant/an apartment, has to pay for the service her-/himself. Thus, landlords cannot add the service fee for an agent they engaged to the rents the tenants have to pay.

distribution of unobserved characteristics may change with observed characteristics. Thus, observed characteristics may have different implicit prices along the rent distribution. The latter aspects motivate the estimation of quantile regressions which go beyond the estimation of the effects on average rents.

Hedonic price regressions are often augmented by covariates which are not per se characteristics of the rental units and which may reflect frictions in the rental market. Regulations such as rent control and tenant protection against eviction have an impact on rents and the effects may differ by the level of rents. For instance, one would expect that rent control should reduce the rents for expensive apartments more strongly than for cheap apartments. Similarly, rent control for sitting tenants should increase the length of residency discount, i.e. the reduction in rents as elapsed tenure of the tenant grows, when rents for new leases are less regulated (as it is the case in Germany). This effect may be strongest for expensive rental units, which further motivates the estimation of quantile regressions for rents.

The rent control and the protection of tenants against eviction were strengthened in light of the rent increases observed in West Germany during the 1990s. The Tenancy Law Reform Act, implemented since September 1, 2001, covers all tenancies starting on this date or later. Its most substantial changes involve a cap on the maximum rent increases by landlords for sitting tenants and a reduction of the minimum notice time until termination of a tenancy by the tenant to three months, while keeping the protection of the tenant against eviction unchanged. Before the reform, landlords could increase rents by 30% within three years. After the reform, the maximum is reduced to 20%.[2] Our empirical analysis investigates the impact of the reform on rents. Specifically, we investigate the observed change in the length of residency discount because the reform did not change regulations of the rents for new leases.

Our empirical analysis uses linked housing-tenant data from the German Socio-Economic Panel (SOEP) for the time period 1984 to 2011. These data offer the unique advantage of a large and representative panel data set of tenancies. The panel structure allows us to control for unobservable time-invariant characteristics of a tenancy. We restrict the analysis to West German households and to observations with elapsed tenure up to 10 years.

[2]The actual upper limit of rent increases, however, was and still is given by the average local rent index (published by local authorities) reflecting the average rent of comparable rental units in the neighborhood ('ortsübliche Vergleichsmiete'). A higher rent increase is possible to compensate for the costs of modernizing the rental unit or for an increase in the running costs.

Our empirical results show that rents deflated by the CPI increase strongly from 1984 until the reform in 2001, and there is a reversal in the trend afterwards. Before the reform, we find a significant residence discount in the rent level which decreases in absolute value with tenure and which is stronger at the top than at the bottom of the rent distribution. The reform reduces rents, in particular for expensive apartments and for new leases. The reform eliminates the residency discount and the fixed effects estimates reveal that after the reform rents in fact grow with tenure, especially for more expensive apartments. The evidence is consistent with expensive tenancies being likely to end earlier and tenants in new leases benefitting strongly from a reduction in rents induced by the reform. Our evidence suggests that the reform was successful in curtailing rent increases for new leases and for expensive apartments early in a tenancy.

The remainder of this paper is organized as follows. Section 2 discusses the background of the analysis and reviews the existing literature. Section 3 describes the data used. Section 4 introduces the econometric approach. Section 5 provides descriptive statistics and discusses the regression results. The final section involves our concluding remarks. An additional online appendix contains all the results, which in this paper are referred to as being available upon request.[3]

2 Background

We first discuss economic and institutional aspects of rental housing in Germany. Then, we provide a selective literature review and develop some hypotheses as the basis of our empirical analysis.

2.1 Private Rental Housing in Germany

Evidence provided by Eurostat (2013)[4] shows that in 2013 about 47% of the German population live in rental housing, which is a high share in international comparison. Only in Switzerland, this share is even higher while especially in Eastern and Southern Europe owner-occupied housing is much more common. The causes for this difference are manifold. Differences in attitudes towards home-ownership may play a role. While in Germany home ownership is rather viewed as a long-term invest-

[3]See `www.wiwi.hu-berlin.de/de/professuren/quantitativ/oe/research/publications`.

[4]Online data code: ilc_lvho02.

ment and rental housing seems better suited for temporary housing needs, it is more common in Anglo-Saxon countries to buy and sell residential houses depending on the own current economic situation and needs (Börsch-Supan 1994). In addition to differences in the flexibility to buy and sell residential houses, preferential tax treatment may shape housing demand. In contrast to a number of other European countries, there is no preferential tax treatment of owner-occupied housing in Germany regarding the difference between the after-tax and the pre-tax interest rate of mortgage loans, which is a likely reason for the high share of rental housing in Germany (CESifo 2005).[5]

While Germany is characterized by rather liberal rental laws up to the early 1990s, a shift takes place since then towards much more "tenant friendly" rental laws (Hubert 1998, Börsch-Supan 1994). In comparison to other OECD countries, the private rented housing sector in Germany is strongly regulated curtailing the flexibility of landlords. Figures 1 and 2, as taken from Johansson (2011), show that Germany as of 2010 shows a very high level of rent control and an above average level of tenant protection in international comparison. Despite the tighter regulations, rents increase strongly during the 1990s in most parts of Germany, especially in the metropolitan areas. Hubert (1998) views the rising regulation in the 1990s as a response to an acute housing shortage after German unification in order to avoid strong rent increases for incumbent tenants. Because rent increases for new leases are less regulated (Börsch-Supan 1994), strong rent control for sitting tenants is complemented by tenant protection against eviction by the landlord motivated by the goal of increasing the rent (henceforth denoted as economic eviction).

— Insert figure 1 here. —

— Insert figure 2 here. —

As a further policy response to protect tenants, the Tenancy Law Reform Act[6] in 2001 reduces the maximum rent increases for sitting tenants from 30% to 20% over the course of three years. The new cap applies only, if the planned increase in rents does not exceed the average rent of comparable units in the neighborhood

[5]The current situation differs strongly from the rather favorable taxation of owner-occupied housing during the 1970s and 1980s in West Germany, see Hubert (1998) and Börsch-Supan (2004).

[6]Gesetz zur Neugliederung, Vereinfachung und Reform des Mietrechts (Mietrechtsreform), see Bundestag (2000) for a discussion of the objectives of the reform.

(ortsübliche Vergleichsmiete) as measured by the local rent index excluding rent increases due to modernization or growing running costs included in rents (see §558(3), §559, and §560 German Civil Code [BGB] for further details). The local rent index is intended to provide both tenants and landlords an indication of market conditions and to allow tenants to identify particularly high rents.[7] A local rent index typically provides for comparable apartments the average rent and the interval around the average, covering the two-third span ranging from the one sixth (17%) quantile to the five sixth (83%) quantile. The local rent index serves as a monitoring instrument for rent control in Germany.

Furthermore, the reform involves a reduction of the minimum notice time until termination of a tenancy by the tenant to three months, while it keeps the protection of the tenant against eviction by the landlord unchanged. Before the reform, the notice time depends upon the length of the tenancy, with a minimum of three and a maximum of twelve months. The reform initially only applies to tenancies that started on September 1, 2001 or later. As an extension of the reform in 2005, the notice time of three months also applies to tenancies which has started before September 1, 2001.[8] One objective of our paper is to estimate the statistical association between the 2001 reform and the length of residency discount over the distribution of rents.

2.2 Literature Review and Hypotheses

There exists a sizeable literature in economics on the effect of rent control on the rental market. Eekhoff (1981), Börsch-Supan (1986), and Schwager (1994) provide a theoretical discussion of the welfare implications of a reform in Germany in 1975, which strengthens the protection of tenants against economic eviction and which regulates maximum rent increases for sitting tenants.[9] There is stronger rent control for sitting tenants compared to rent setting for new leases in order to protect sitting tenants. The predicted welfare effects are ambiguous. On the one hand, there are negative welfare effects because rent control reduces efficiency and flexibility in the rental market, thus resulting in deviations from market equilibrium and from

[7]Based on a sample from the local rental market, the local rent index (Mietspiegel) reports the average rents and the dispersion of rents for comparable apartments/housing units.

[8]See Klarstellungsgesetz 2005 and Art. 229 §3 Abs. 10 EGBGB - Einführungsgesetz BGB - for further information.

[9]"Law for the Protection of Tenants from Arbitrary Eviction" [Zweites Wohnraumkündigungsschutzgesetz (2. WKSchG)] The law is a predecessor of the 2001 Tenancy Law Reform Act.

the law-of-one-price for a good with the same characteristics. It may reduce the supply of rental units. On the other hand, there could be positive welfare effects if landlords value the curtailment of their property rights less than tenants value the benefits of a cap on rent increases in a dynamic perspective (Börsch-Supan 1994, Hubert 1995). Furthermore, rent control for sitting tenants is likely to imply a front loaded rent payment schedule, where landlords would ask for higher rents at the beginning of a tenancy to compensate for the stronger rent control during tenancy. This could result in rental payments that decrease with the length of residency for sitting tenants relative to rents for new leases of comparable apartments. Further implications of these considerations are that the rent for a given apartment increases more strongly than the market rents for comparable apartments when a new lease starts, and therefore landlords have an incentive to evict sitting tenants in order to realize a rent increase with a new lease. Because of the latter incentive, a stronger rent control for sitting tenants is typically complemented with a stronger protection of sitting tenants against economic eviction.

Before reviewing some empirical results on the length of residency discount, let us discuss some pertinent theoretical aspects in a bit more detail. A large part of the U.S. literature (e.g. Guasch and Marshall 1987) argues that the length of residency discount can be explained by the survival of good matches of landlords and tenants in the presence of turnover costs for both sides. Providing a somewhat different perspective, Barker (2003) considers the relationship between turnover costs and the level of price discrimination between new leases and long-term tenancies. Landlords of apartments with low turnover costs are more likely to raise rents for sitting tenants. Furthermore, tenants in new leases could obtain a discount because of a lower demand elasticity of long-term tenants or because of the higher mobility costs of the latter. Thus, it is an open empirical question as to whether a length of residency discount exists.

Relating the length of residency discount to regulation, Hubert (1995) discusses a possible justification for a regulation, which protects tenants against arbitrary eviction, based on efficiency grounds. The argument relies on adverse selection operating in the presence of asymmetric information about tenants. If tenants differ in the 'service costs' to be paid for by the landlords and landlords offer rental contracts with different lengths, then tenants with low service costs would select into shorter tenancies because they can show after a while that they are good ($\equiv$ low service cost) tenants. Furthermore, longer tenancies would rather involve tenants with high ser-

vice costs. Increasing tenant protection may overcome an inefficient segmentation of good (bad) tenants in short-term (long-term) tenancies in market equilibrium. Hubert (1995) discusses the combination of rent control and tenant protection to prevent economic eviction. The analysis implies that the length of residency discount increases with the strength of rent control. However, the lower the rent the stronger is the incentive for economic eviction, possibly using one of the legal routes (e.g. modernization of apartment). Altogether it is an open empirical question as to whether tenancies with low rents are more likely to survive because of the higher interest of tenants to keep a cheap apartment or less likely to survive because of the higher interest of landlords in economic evictions. Furthermore, rent control may be binding more for the rent increases for new leases of more expensive apartments. Thus, it is an open empirical question as to how the length of residency discount varies across the distribution of rents.

Hoffmann and Kurz (2002) find a length of residency discount for Germany which could be a kind of compensation for the diminishing quality of an apartment over time. Schlicht (1983) interprets the discount as a landlord's concession trying to keep good tenants, especially when tenants' preferences change over time and landlords want to avoid turnover costs, e.g. forgone rents and search costs for new tenants. The existing empirical literature for the U.S. mostly finds evidence for a length of residency discount in average real rents for rental housing when regulation is lower than in Germany, see e.g. Barnett (1979), Börsch-Supan (1994), Follain and Malpezzi (1980), Noland (1979), Goodman and Kawai (1985), Basu and Emerson (2000), or Guasch and Marshall (1987). Guasch and Marshall (1987) decompose the discount into a *pure sit discount* and a *length of residency discount*. While the former discount is offered by landlords when contracts are renegotiated, the latter discount is given for each additional year tenants spend in the same rental unit. Using the Annual Housing Survey (AHS) data from 1974 to 1977, they estimate multiple specifications and find a sit discount between 6% and 13% and an annual residency discount between 0.2% and 0.8%.[10] Using data of 102 apartment complexes in US-American metropolitan areas, Barker (2003) finds that discounts for short-term tenants are more common. Since rental payments rise faster than turnover costs, he predicts

[10]Guasch and Marshall (1987) also implement a selection correction for the termination of a tenancy accounting for selection on unobservables. Correcting for selection on unobservables in our quantile regression estimates is beyond the scope of this paper for two reasons. First, how to account for selection when estimating quantile regression is still subject of an intensive debate (Huber and Melly 2012). Second, finding a credible instrument with sufficient bite is difficult.

that discounts for new leases become more frequent. Sims (2007) analyzes the effect of rent control in various cities in Massachusetts that ended in 1995. The rent increase was adjusted to a specific annual rate, condominium conversions was made harder for landlords to avoid a reduction of the rental stock, and a prohibition to evict tenants without permission was imposed. Altogether, only 20% of rental housing was under active control because vacancy decontrol was possible. Based on difference-in-differences estimates, Sims (2007) finds that rent control leads to a significant rent decline. Furthermore, tenants' mobility falls as measured by significantly longer tenancies and the stock of rental housing declines because of the reduced attractiveness of rental apartments as investments for landlords.

Summing up and providing an outlook on our empirical analysis, our reading of the literature implies that the empirical studies so far have been restricted to an empirical analysis of how average rents vary by length of residency and other characteristics of the apartment and the tenant. We provide an analysis of the change in rents for new leases and of the effect of the length of residency (elapsed tenure) depending on the level of rents using quantile regression. The theoretical considerations above suggest that the length of residency discount depends upon tenants' characteristics such that tenants with lower mobility costs experience a higher discount. The discount should be larger when rents for new leases show a strong upward trend. It is an open empirical question as to how the length of residence discount varies with the level of rents because, on the one hand, tenants are more interested to keep a cheaper apartment and rent control may be binding more for the rent increases for new leases of more expensive apartments. On the other hand, landlords of cheaper apartments have a stronger incentive for economic evictions and there may be a stronger need for a modernization of the apartment justifying a rent increase. Furthermore, the above considerations imply that a reform strengthening the protection of sitting tenants against eviction and against rent increase should increase the length of residency discount. However, it is a priori unclear as to how the increase varies with the rent level. Because the theoretical considerations suggest that the rent level and the length of residency discount depend both upon tenants' characteristics and characteristics of the apartment, we use a panel of linked housing-tenant data.

3 Data

The empirical analysis uses the German Socio-Economic Panel Study (SOEP), a representative annual household panel survey.[11] Because of a lack of information on East German rental units before German unification and the ongoing transition process as well as the strong regulation of rents in East Germany during the 1990s, our analysis is restricted to West Germany.

The SOEP offers detailed information on rental housing from the perspective of tenants, thus providing *linked housing-tenant data*.[12] Because these are panel data on tenancies, we can study the length of residency discount within tenancies. The available variables include the size of an apartment (or house) in square meters (sqm), its equipment like the existence of a basement, balcony or terrace, and a garden, the type of building regarding the number of rental units and the year of construction, information as to whether the apartment is subsidized by the government and as to whether there is a private or a public landlord. We exclude outliers with a reported apartment size of less than 20 sqm and of more than 200 sqm as well as observations with a reported rent of less than 50 Euros (in current prices).

To account for variation in regional housing markets, we account for the state ("Bundesland") and we use detailed information on the location available in the SOEP, such as city size (number of inhabitants), region, type of residential area, and information on amenities in the local neighborhood.[13] In addition, one observes the length of residence so far (elapsed tenure $\equiv$ elapsed tenancy duration). Our panel data allow to control for unobserved time-invariant tenancy-specific characteristics, which can account for biases induced by the selective termination of tenancies (Guasch and Marshall 1987). Our dependent variable of interest is the real gross rent actually paid (without costs for heating) - henceforth referred to as rent. We deflate rents to 2005 prices using the consumer price index.

The final data set consists of 11,328 households and 18,601 tenancies, which means

[11] We use the version of the data set for the time period 1984-2011, `http://dx.doi.org/10.5684/soep.v28.1` (see Wagner et al. (2007), Wagner et al. (2008) and Schupp (2009) for further information).

[12] We coin this term in analogy to linked employer-employee data used in labor market research. Up to our knowledge, the term *linked housing-tenant data* (or another term conveying the same idea) has not been used so far in the literature.

[13] The information on the amenities is available for the years 1986, 1994, 1999, 2004, and 2009. To impute the values in between, we assume that within a tenancy the distance to amenities measured by the time needed by foot to reach the amenity does not change over time.

that we observe on average 1.6 tenancies per household. To account for the 2001 Tenancy Law Reform Act, we define a dummy variable that indicates whether the tenancy started on September 1, 2001 or later. To make the samples before and after the reform comparable, we restrict the panel data set to those observations with elapsed tenure up to 10 years because we can not observe a longer tenure after the reform.

4 Econometric Approach

We estimate a standard hedonic price regression which we augment with variables observed for tenants.[14] The estimated coefficients of the apartment characteristics are interpreted as implicit prices, which may be interpreted as the consumer's marginal willingness to pay, if he or she is able to choose between a sufficiently large number of units that vary in their characteristics.

Based on the limited set of characteristics of the apartment observed and because of likely frictions in the rental housing market, prices for apartments with the same observed characteristics do vary.[15] Consumers may differ in their willingness to pay and the limited mobility of tenants may prevent relative prices to equal the willingness to pay for certain characteristics. These issues motivate the estimation of quantile regressions. In addition, it is likely that the distribution of unobservables, as measured by the dispersion of prices within cells defined by observed apartment characteristics, may differ across cells.

4.1 Specification and Identification

We specify the rent for rental unit i in year t by

$$(1)\ \ log(rent_{it}) = \sum_{j=1}^{k} \beta_j \cdot X_{j,i,t} + f(Ten_{it})'\gamma + \delta_0 RD_{it} + [RD_{it} f(Ten_{it})]'\delta_1 + \mu_t + \varepsilon_{it}$$

[14] Waugh (1929) and Court (1939) were the first to use this approach. Griliches (1961 and 1971), Lancaster (1966 and 1971), and Rosen (1974) introduced the hedonic price model to a wider audience of economists.

[15] Sirmans, Macpherson, and Zietz (2005), Zietz, Zietz, and Sirmans (2007) and Zietz, Sirmans, and Smersh (2008) address the heterogeneity of implicit prices in housing markets. Decomposing the unconditional rental price distribution of advertised apartments in Berlin, Thomschke (2015) finds that the increase in rental prices are due to a changing demand structure regarding quality and quantity rather than a change in apartment characteristics, especially in the high-price segment.

where $log(rent_{it})$ denotes the log deflated rental payment, $X_{j,i,t}$ for $j = 1, \ldots, k$ are the apartment characteristics and β_j the corresponding implicit price. Ten_{it} is the elapsed tenure of unit i in year t and our specification will use linear splines in elapsed tenure. $f(Ten_{it})$ involves the specific terms of the separate spline segments and γ and δ_1 are the corresponding coefficient vectors, respectively. μ_t are year fixed effects. RD_{it} is a reform dummy which is zero for tenancies starting before the 2001 reform and one for tenancies starting after the 2001 reform. ε_{it} is the idiosyncratic error term. For our fixed effects estimates, tenancy specific fixed effects are added to equation (1).

The identification of the reform effects in equation (1) relies on the differences between tenancies starting before 2001 and still continuing after 2001 and tenancies starting after 2001. The reform only applies for those tenancies starting after 2001. Thus, the year effects starting from 2001 onwards can be separated from the reform dummy because the reform effect does not apply for tenancies starting before 2001 and continuing at least until 2001. Analogously, we can identify the coefficients of the reform dummy and its interactions with the linear tenancy splines. For the OLS fixed effects estimator, the reform dummy cannot be identified. We also do not include a reform dummy in the panel fixed effects quantile regressions as described in the following. However, the coefficients of the interactions of the linear tenancy splines with the reform dummy are identified because, over time, tenancies do change from one spline segment to the next.

To identify the nonlinear effect of elapsed tenure on rental payment, we construct linear splines. After a preliminary cross-validation of models with equally positioned but varying number of knots, the preferred specification has one knot at three years of elapsed tenure.

4.2 Quantile Regression

Quantile regressions allow to estimate how the market valuation of characteristics of apartments varies with the level of rents across the conditional rent distribution (see Koenker and Hallock 2001 and Koenker 2005 for details). A further advantage is that quantile regressions are more robust than OLS to outliers in the dependent variable. Estimating quantile regressions for panel data within a tenancy can reveal the net effect of rent setting for new leases and sorting effects due to termination of tenancies if the ranking of rents across tenancies does not change over time. For

instance, if the length of residency discount is generally higher (lower) at the top of the rent distribution than at the bottom, then tenancies for cheaper apartments may be more (less) likely to end early. Furthermore, if the discount between the first and the second year of a tenancy is higher (lower) at the top of the rent distribution than at the bottom, then rents for new leases grow more (less) for more expensive apartments compared to less expensive apartments.

Using the same specification as for OLS, we estimate quantile regressions at the median, at the 17%- (one sixth) and at the 83%- (five sixth) quantile of the conditional rent distribution. This way we cover the two-third span of conditional rents as it is customary for an official local rent index in Germany. For our baseline model, we also provide quantile regression estimates at each decile to investigate whether the results at the three quantiles we focus upon are representative for the entire distribution. We obtain clustered standard errors for our estimated coefficients through bootstrapping based on 200 resamples. We resample entire tenancies to account for heteroscedasticity and serial correlation of the error term within a tenancy.

As robustness check, we estimate panel regressions accounting for mean tenancy fixed effects as suggested for quantile regression by Canay (2011).[16] We first estimate the fixed effects OLS regression and obtain the mean tenancy fixed effects. Then, to implement the quantile regressions with fixed effects, we substract the mean tenancy fixed effects from the rents within a tenancy and estimate the panel quantile regressions for these adjusted rents based on an intercept and the time-varying covariates. Note that the approach does not allow the fixed effects to differ across quantiles. Accounting for quantile specific fixed effect would result in an estimator which is not easy to interpret because then the conditional distribution for a given tenancy modeled by the quantile regression estimates would change by quantile. In contrast to fixed effects OLS estimation, our fixed effects quantile regression still suffers from the incidental parameter problem even though the estimated fixed effect is part of the dependent variable.[17] It is likely that our fixed effects quantile

[16]We prefer this simple estimator compared to more involved alternatives proposed in the literature. Koenker (2004) was the first to suggest a fixed effects quantile regression by adding a dummy for each cross-sectional unit and by including an L_1-penalization to shrink the individual fixed effects to zero (see also Koenker 2005, chapter 8.7, and Lamarche 2010). This estimator involves the choice of a shrinkage (tuning) parameter. Consistency of this estimator requires that both the number of cross-sectional units and the number of time periods converge to infinity. As an alternative approach, among others, Galvao and Kato (2015) suggest to estimate the asymptotic bias of the fixed effects quantile regression without penalization in order to correct for this bias.

[17]Note that the number of panel observations in our application is unlikely to be large enough to render the bias in the fixed effects estimator negligible. The average number of panel observations

regression estimator is smoothed across quantiles, because the estimation error in the fixed effects may attenuate the differences in coefficients across quantiles.[18]

5 Empirical Results

5.1 Descriptive Statistics

Table 1 shows means and standard deviations of apartment characteristics for the full sample as well as for subsamples with tenancies starting before September 1, 2001, or afterwards [before and after the reform - here and henceforth, *after September 1, 2001* also includes tenancies that start on September 1, 2001]. Recall that to make the samples before and after the reform comparable, the samples are restricted to those observations with the elapsed tenure up to 10 years. 25% (75%) of the tenancies are observed to have started after (before) September 1, 2001. The column labeled "Difference" displays results of t-tests of equality of means for each variable in both subsamples. The average rent for tenancies starting after the reform is € 461 and the average rent for tenancies starting before the reform is € 420.

Both subsamples differ significantly in further apartment characteristics. Tenancies starting after the reform are on average 2.4 sqm larger, can rather be found in more recently built tenancy-occupied houses (especially in houses built after 1990), and are on average better equipped (more likely to include a balcony, a terrace or a garden, and central heating). Mechanically, the elapsed tenure in tenancies starting after the reform is 1.5 years shorter. Also, the households in the two subsamples differ slightly in their assessment (assess) of the rental payment and the apartment size.[19,20] Tenants in the before-reform subsample are 6.5 percentage points (ppoints) more likely to assess their rent to be inexpensive and they are 1.8 ppoints more likely

per tenancy in our sample (elapsed tenure up to 10 years) is 5.6. The lower quartile is 3 and the upper quartile is 8. Still, if the fixed effects quantile regression estimates differ from the standard panel quantile regression estimates, the direction of the change is likely to be informative, especially if it corresponds to the OLS fixed effects estimator.

[18] We are extremely grateful to a referee to point this out and to refer us to an unpublished study. Unfortunately, this study is very preliminary and at this point we are not supposed to provide the reference.

[19] The variables displayed in Table 1 under "Further Characteristics" are only used for descriptive comparisons. They are not part of the specification of the final regressions.

[20] The differences in assessment we observe are larger when adding observations with tenure above 10 years to the before-reform sample. The evidence is consistent with a tenancy being more likely to last if the renter is more satisfied, i.e. better matches are more likely to last. These results are available upon request. We are grateful to a referee for suggesting this point.

to assess their apartment to be too small. At the same time, the rent-to-income ratio increases by 2.7 ppoints for the after-reform sample.[21] Overall, the descriptive evidence suggests that the demand for larger (and better equipped) apartments is rising over time and households are willing to spend a higher share of their income on rents. However, the difference could also reflect the remaining difference in elapsed tenure in combination with better matches being more likely to last.

— Insert Table 1 here. —

Table 2 shows mean differences in some key variables between the first tertile (low-price segment) and the third tertile (high-price segment) of the unconditional rent distribution (recall that rents are deflated by the CPI to 2005 prices). Apartments in the high-price segment are 34 sqm larger than in the low-price segment. High-price apartments are rather located in recently built houses/buildings, in new residential areas, in larger cities, and in city centers (evidence on these variables is available upon request). As to be expected, high-price apartments are on average better equipped. Furthermore, apartments in the high-price segment are rather located next to stores, parks, sports complexes or public transport, and the apartment size per person is larger. Households in the high-price segment tend to assess the rent as being too high and the size of the apartment as being too large compared to the assessments in the low-price segment. Consistent with the subjective assessments, there is a 7 ppoints higher rent-to-income ratio in the high-price segment. The evidence suggests that tenants in the high-price segment demand higher quality apartments, but they tend to think that their apartments are over-priced and possibly too well equipped relative to their needs. These findings may rationalize the political momentum towards stronger rent control in the wake of the large rent increases during the 1990s.

— Insert Table 2 here. —

5.2 Estimation Results

Table 3 provides the estimation results for our baseline panel OLS and quantile regressions. We estimate quantile regressions at the median (QR 50%), at the one

[21] The rent-to-income ratio is calculated as the share of the household net income that is spent on the gross rent without heating.

sixth (QR 17%), and at the five sixth (QR 83%) quantile. The column '83%-17%' involves t-statistics for the significance of the difference of the coefficients between QR 83% and QR 17%.[22]

Quite uniformly, the covariates apartment size, city size, and central location show the expected positive effects on rents. The differences between the two tail quantiles are mostly not significant, but there are some notable exceptions. The average partial effect (APE) of apartment size increases between the two quantiles by 4.1 log points, thus implying a higher dispersion of rents for larger apartments. Regarding the type of house, rents for nondetached houses and apartments in multiunit buildings are ceteris paribus higher than in detached houses. A priori, one would expect a higher rent for detached houses and our estimates should not be viewed as being causal. Most likely, detached houses and multiunit buildings differ on average in some unmeasured characteristics. Furthermore, in multiunit buildings, the rents are less dispersed than in detached houses (the quantile differences are significantly negative). It is likely that unobserved characteristics among detached houses are more dispersed than in more standardized multiunit buildings. Rents are higher in new residential areas compared to old residential areas, typically in apartments with more amenities in walking distance, and in better equipped apartments (the results for the latter three variables are available upon request). Rents are higher and more dispersed for private landlords and for non-subsidized housing. A housing subsidy may imply a particular restriction on rent increases for higher rents. Private landlords, who tend to focus more on higher revenues, are more likely to raise rents compared to non-private landlords.

— Insert Table 3 here. —

Let us now turn to our estimates of the length of residency discount. We estimate flexible linear splines and our regressions report the slope (the annual discount) for each linear segment of our splines. For the first three years of a tenancy, we find a significant annual reduction of rents which amounts to 1.2 log points per year and the decline is significantly stronger for higher rents. At the 83% quantile the

[22]We also estimate unconditional quantile (RIF) regressions (Firpo et al. 2009) to investigate the effects on the unconditional rent distribution. The reform effect and the length of residency discounts are quite similar to those estimated by the conditional quantile regressions reported in this paper. However, the estimated coefficients are in some instances more heterogeneous across quantiles. The results for the RIF regressions are available upon request. Because the level of rents changes strongly over time, our study focuses on conditional quantile regression estimates.

annual discount amounts to 1.7 log points while at the 17% quantile the annual discount is only 0.7 log points. From the fourth year of a tenancy onwards, the residency discounts become more uniform. While at the 17% quantile the annual discount increases slightly to 0.8 log point, it falls to 0.9 log points at the 83% quantile. Figure 3 provides the estimated annual discounts at each decile confirming that the results at the three quantiles reported in the table are representative for the entire distribution. We find that the dispersion of rents falls during the first years of a tenancy while there is no evidence for a significant further reduction of the dispersion after the fourth year.

The baseline rent regressions control for year dummies, states, and the year of construction (the corresponding coefficients and further details are available upon request). As to be expected, rents increase with the year of construction and the increase is significantly stronger at the bottom of the rent distribution compared to the top. There are also significant differences in rents across states.

Next we turn to the time effects and the reform effects. The estimated time effects reflect a uniform growth of average and median rents (deflated by the CPI) between 1984 and 2001 by 26 log points. The increase is significantly higher by about seven log points at the 17% quantile compared to the 83% quantile. The stronger increase at the bottom of the distribution may rationalize the strong political demands for further rent control in the 1990s and 2000s. Incidentally, rents do not increase further after 2001 and rents at the 17% quantile (83% quantile) are six (two) log points lower in 2011 compared to 2001. Apparently, rent growth has stopped after 2001 but it has to be kept in mind that the regression also includes a dummy variable 'After Reform' which corresponds to tenancies starting after the reform in 2001. The OLS reform effect is minus four log points and the decline is about three log points stronger at the top of the distribution compared to the bottom. Figure 4 shows that the estimates by decile confirm a uniformly growing reform effect (in absolute value) along the distribution. These findings suggest a stronger effect of the reform in curtailing higher rents. However, the difference between the two tail quantiles is not significant. Altogether we find a general decline in rents after 2001 and a further decline of rents for new tenancies after the reform. While the general decline is stronger for lower rents, the specific (partial) reform effect is stronger for higher rents. Prima facie, our findings suggest that in times of generally falling rents the reform did in fact result both in reducing rent growth for new leases, especially for expensive new leases. The latter implies that households living in

expensive apartments tend to benefit more from the reform than households living in cheaper apartments. Thus, one may be concerned that the reform may not have been sufficiently targeted, if the goal was to curtail rents for low-income tenants who tend to pay lower rents.

Now, we investigate the impact of the reform on the residency discount. One could expect that the reform increases the discount, and the reduction should be particularly strong for higher rents. We keep the reform dummy and we add interactions of the reform dummy with the splines in elapsed tenure. Table 4 provides the annual discounts estimated separately before and after the reform (all other covariates are as in the baseline regressions reported in Table 3 and results for the other covariates are available upon request). The level effect of the after reform dummy now shows a particularly strong negative reform effect on rents for new leases of about ten log points on average. The effect is significantly larger in absolute value at the top compared to the bottom of the distribution. Before the reform, during the first three years of a tenancy, the annual discount is 2.5 log points at the 83% quantile, being 1.2 log points (significantly) larger than at the 17% quantile. From the fourth year onwards, the annual discount is more uniform and lies between 0.8 and 0.9 log points. After the reform, the annual discount becomes insignificant and the point estimates are mostly positive. The difference (after minus before) is significantly positive and the reduction in the discount is higher at the bottom compared to the top of the distribution. Basically, after the reform there is no residency discount any more. In addition to the changes in the coefficients, we also calculate the APE of the reform effect during the two tenure intervals which table 4 reports as 'After Reform (APE)'.[23] We find a significantly negative average reform effect during the first three years of a tenancy which increases along the distribution. However, there is no significant average reform effect after the third year of a tenancy. Our overall findings may be related to the fact that in general real rents are falling after the reform and CPI inflation is generally low. Somewhat in contrast to our prior expectation, the rent gap between new leases and sitting tenants does not increase after the reform. The reform effect on new leases is particularly strong and rent increases fall in general after the reform, which eliminates the length of residency discount because nominal rents are unlikely to fall. These are surprising findings because the reform attempted to curtail rent increase for sitting tenants and it did not change regulations of the rents for new leases.

[23]The APEs add the level effect of the reform dummy and the effect on the cumulative discount.

— Insert table 4 here. —

5.3 Tenancy Fixed Effects

To examine the sensitivity of our results to potential unobserved confounders that are constant within tenancies, we reestimate the model in Table 4 also accounting for tenancy fixed effects. To do so, we first exclude 5,870 tenancies with only one observation and estimate the tenancy fixed effects regression based on this restricted sample. Table 5 provides the fixed effects estimates for the residency discount before and after the reform. Note that we can not estimate the level effect of the reform, when accounting for tenancy fixed effects when accounting for tenancy fixed effects.

The estimated annual discounts differ from the results reported in Table 4. They are reduced before the reform and they even become significantly positive after the reform. Before the reform, the annual discount during the first three years of tenure is only 0.4 log points for OLS, 0.2 log points at the 17% quantile, and 0.6 log points at the 83% quantile. However, before the reform for elapsed tenure above three years and after the reform the discount turns significantly positive for OLS for all levels of elapsed tenure as well as for the median and the upper part of the distribution after three years of elapsed tenure. These changes between the estimates in Tables 4 and 5 are compatible with sorting effects such that high price tenancies are more likely to end early, thus enhancing the 'observed' discount as reported in Table 4. The finding is consistent with tenants in high-price rental units searching more strongly for cheaper alternatives, partly because rents in these tenancies are being increased over time. In contrast, tenancies with a low rent tend to last longer. These findings are not consistent with the hypothesis that tenants in the low-price segment are more likely to experience economic evictions or to search for better quality alternatives. After the reform, landlords seem to increase rents within a tenancy in a low-inflation environment, which is still consistent with the allowed maximum rent increases for sitting tenants and which may be a compensation for the drop in rents for new leases. Landlords may be using their market power arising from the cost of moving to a new apartment. Considering the differences in the residency discount induced by the reform, we find a similar direction of the effects in Tables 4 and 5, but the size of the estimated changes is reduced when accounting for fixed effects.

— Insert table 5 here. —

Summing up, controlling for tenancy fixed effects changes the estimates for the residency discounts, effectively revealing that the discount is smaller before the reform, and we even find significantly positive tenure effects on rents after the reform. The evidence is consistent with expensive tenancies being likely to end earlier and new leases benefitting strongly from a reduction in rents induced by the reform. It is a robust finding that the reform reduces the residency discount and that there is no evidence for a residency discount after the reform.

6 Conclusions

The large private rental housing market in Germany shows a higher level of regulation through rent control and tenant protection against eviction than the OECD average. In contrast to the current situation, Germany was characterized by fairly liberal rent laws until the 1990s. In the wake of housing shortages and strong rent increases in the 1990s, there was a change towards more regulation in order to protect sitting tenants. For instance, the German government passed the Tenancy Law Reform Act in 2001 to restrict rent increases and to strengthen the protection of tenants against eviction. Based on linked housing-tenant data from the Socioeconomic Panel, this paper estimates panel OLS and quantile regressions of rents within tenancies during the time period 1984 to 2011. Specifically, we analyze the impact of the Tenancy Law Reform Act implemented in 2001 (the reform) on the level of rents and on the residency discount.

Our findings can be summarized as follows. Rents deflated by the CPI increase strongly from 1984 until the reform in 2001, and there is a reversal in the trend afterwards. Households whose tenancy started after the reform rather live in newer, better equipped, and larger rental units. Both the level of rents and the rent-to-income ratio grow after the reform. This suggests that demand for better equipped housing increases over time.

Before the reform, we find a significant residence discount in the rent level which decreases in absolute value with tenure and which is stronger at the top than at the bottom of the rent distribution. The reform reduces rents, in particular for expensive apartments and for new leases. The reform eliminates the residency discount and the fixed effects estimates reveal that after the reform rents in fact grow with tenure, especially for more expensive apartments. These are surprising findings because

the reform attempted to curtail rent increase for sitting tenants and it did not change regulations of the rents for new leases. The evidence is consistent with expensive tenancies being likely to end earlier and tenants in new leases benefitting strongly from a reduction in rents induced by the reform. After the reform, in a low-inflation environment, landlords seem to increase rents within a tenancy which is still consistent with the allowed maximum rent increases for sitting tenants and which may be a compensation for the drop in rents for new leases. Landlords may be using their market power arising from the cost of moving to a new apartment. Altogether, households living in expensive apartments tend to benefit more from the reform than households living in cheaper apartments.

Our evidence suggests that the reform was successful in curtailing rent increases for new leases and for expensive apartments early in a tenancy. It remains an open question as to whether this led to fewer houses being built, which may imply detrimental long-run effects for renters.

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Figures

Figure 1: Rent control in the private rental market,[1] 2009

Scale 0-6: Increasing in degree of control

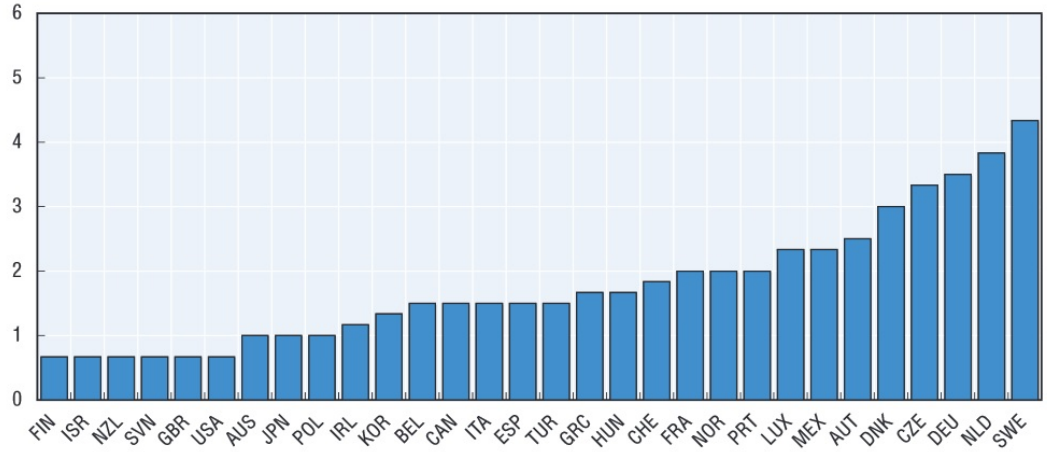
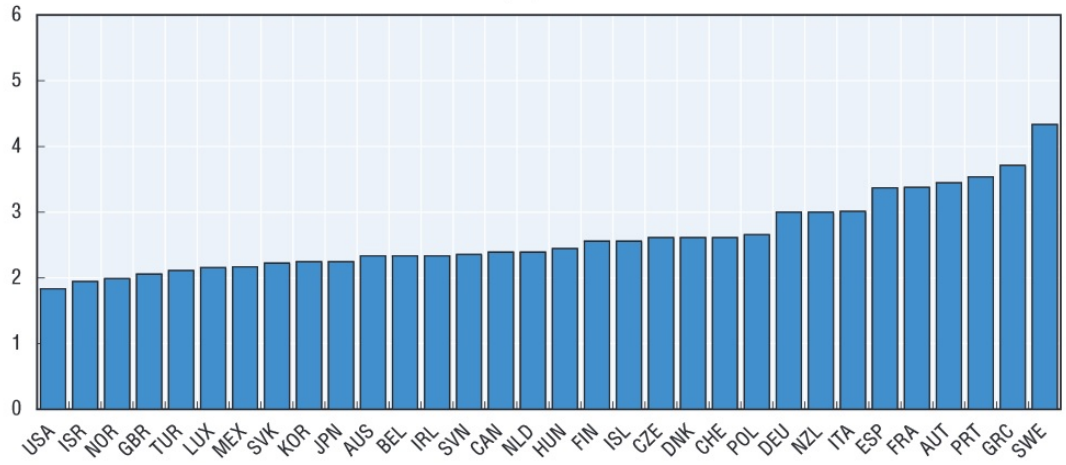


Figure 2: Tenant-landlord regulations in the private rental market,[2] 2009

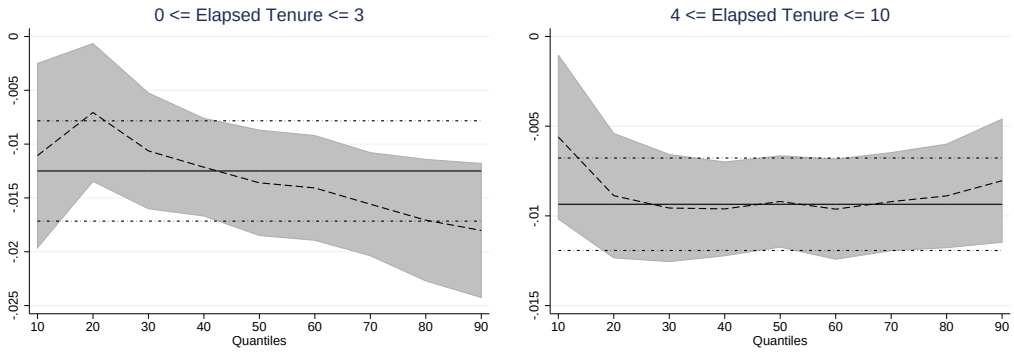
Scale 0-6: Increasing in protection for tenants



1. This indicator is a composite indicator of the extent of controls of rents, how increases in rents are determined and the permitted cost pass-through onto rents in each country. Control of rent levels includes information on whether rent levels can be freely negotiated between the landlord and the tenant, coverage of controls on rent levels and the criteria for setting rent levels (market based, utility/cost based, negotiation based or income based). Controls of rent increases includes information on whether rent increases can be freely agreed by the landlord/tenant, whether rent increases are regularly indexed to some cost/price index or if increases are capped or determined through some other administrative procedure, including negotiation between tenant/landlord associations. The pass-through of costs onto rents includes information on whether landlords are allowed to pass on increases in costs onto rents (cost pass-through) and the extent of such pass-through i.e. the types of cost that can be passed on.
2. The indicator measures the extent of tenant-landlord regulation within a tenancy. It includes the ease of evicting a tenant, degree of tenure security and deposit requirements.

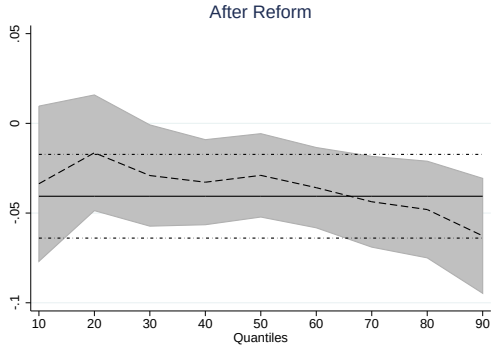
   Source: Johansson (2011)

Figure 3: Annual Residency Discount - Coefficient Estimate by Quantile



Note: Quantile regression estimates for baseline model 1 as specified in Table 3.

Figure 4: After Reform - Coefficient Estimate by Quantile



Note: Quantile regression estimates for baseline model 1 as specified in Table 3.

Tables

Table 1: Descriptive Statistics (Means and Standard Deviations/Standard Errors)

Variable	Full	Before Reform	After Reform	Difference
Rent (Deflated to 2005 €)	429.786	419.522	460.864	41.342***
	(208.231)	(201.072)	(225.720)	(1.902)
Apartment Size (in m^2)	72.530	71.933	74.338	2.404***
	(26.613)	(26.220)	(27.690)	(0.244)
Elapsed Tenure (in years)	3.802	4.165	2.705	−1.460***
	(2.790)	(2.903)	(2.060)	(0.025)
Private Landlord	0.789	0.789	0.789	0.000
	(0.408)	(0.408)	(0.408)	(0.004)
Subsidized Housing	0.110	0.131	0.047	−0.084***
	(0.313)	(0.338)	(0.211)	(0.003)
Year of Construction				
Before 1918	0.104	0.106	0.096	−0.011***
	(0.305)	(0.308)	(0.294)	(0.003)
1918 to 1948	0.165	0.168	0.154	−0.014***
	(0.371)	(0.374)	(0.361)	(0.004)
1949 to 1971	0.372	0.380	0.345	−0.035***
	(0.483)	(0.485)	(0.475)	(0.005)
1972 to 1980	0.198	0.209	0.164	−0.044***
	(0.399)	(0.406)	(0.370)	(0.004)
1981 to 1990	0.069	0.066	0.078	0.012***
	(0.253)	(0.248)	(0.268)	(0.002)
Since 1991	0.093	0.071	0.163	0.092***
	(0.290)	(0.257)	(0.370)	(0.003)
City Size (Number of Inhabitants, k $\hat{=}$ 1000 inhabitants)				
≥ 500k (Center)	0.372	0.382	0.342	−0.041***
	(0.483)	(0.486)	(0.474)	(0.004)
≥ 500k (Suburb)	0.102	0.111	0.076	−0.034***
	(0.303)	(0.314)	(0.266)	(0.003)
100k to 500k (Center)	0.153	0.134	0.211	0.077***
	(0.360)	(0.341)	(0.408)	(0.003)
100k to 500k (Suburb)	0.070	0.056	0.113	0.057***
	(0.255)	(0.229)	(0.317)	(0.002)
50k to 100k (Center)	0.030	0.032	0.025	−0.007***
	(0.171)	(0.176)	(0.155)	(0.002)
50k to 100k (Suburb)	0.026	0.019	0.048	0.028***
	(0.161)	(0.138)	(0.213)	(0.001)
20k to 50k	0.083	0.081	0.089	0.008***
	(0.276)	(0.273)	(0.284)	(0.003)
5k to 20k	0.105	0.117	0.067	−0.050***
	(0.306)	(0.321)	(0.250)	(0.003)

<continued on next page>

Table 1: Descriptive Statistics <continued>

Variable	Full	Before Reform	After Reform	Difference
< 5k	0.058	0.068	0.029	−0.039***
	(0.235)	(0.252)	(0.169)	(0.002)
Equipment				
Central Heating	0.924	0.912	0.963	0.051***
	(0.264)	(0.284)	(0.190)	(0.002)
Balcony or Terrace	0.675	0.659	0.725	0.066***
	(0.468)	(0.474)	(0.446)	(0.004)
Basement	0.919	0.919	0.919	0.000
	(0.272)	(0.272)	(0.273)	(0.003)
Garden	0.343	0.338	0.360	0.022***
	(0.475)	(0.473)	(0.480)	(0.004)
Further Characteristics				
Rent-to-Income Ratio	0.270	0.263	0.290	0.027***
	(0.171)	(0.176)	(0.155)	(0.002)
Apt. Size per	43.321	42.450	45.957	3.508***
Person (sqm/person)	(21.242)	(21.077)	(21.520)	(0.194)
Rent Inexpensive	0.336	0.351	0.287	−0.065***
(Assessment)	(0.472)	(0.477)	(0.452)	(0.005)
Rent Reasonable	0.445	0.432	0.490	0.058***
(Assessment)	(0.497)	(0.495)	(0.500)	(0.005)
Rent Expensive	0.218	0.217	0.224	0.007
(Assessment)	(0.413)	(0.412)	(0.417)	(0.004)
Apt. Size Too Small	0.246	0.250	0.233	−0.018***
(Assessment)	(0.431)	(0.433)	(0.423)	(0.004)
Apt. Size Appropriate	0.700	0.697	0.707	0.010**
(Assessment)	(0.458)	(0.459)	(0.455)	(0.004)
Apt. Size Too Large	0.055	0.053	0.060	0.008***
(Assessment)	(0.227)	(0.223)	(0.238)	(0.002)
Apt. Condition Good	0.626	0.622	0.637	0.015***
(Assessment)	(0.484)	(0.485)	(0.481)	(0.004)
Share of Observations	100%	75.2%	24.8%	–

Note: The samples are restricted to observations with elapsed tenure up to 10 years. Calculations use the SOEP sample weights. The table reports means (and standard deviations/standard errors in parentheses). The column labeled "Full" refers to the full sample. The columns labeled "Before Reform" and "After Reform" refer to the subsamples with tenancies starting before and after September 1, 2001, respectively. The column labeled "Difference" reports the mean difference between the two subsamples and its standard error. "Apt." denotes apartment, "Bldg." building, *,** and *** significance at the 10%-, 5%- and 1%-level, respectively. For sets of dummy variables the reference category is printed in bold. Variables reported under "Further Characteristics" are not used for the final regressions. Source: SOEP V28.1 and authors' calculations.

Table 2: Further Descriptive Statistics: Means by Tertiles of Rents

Variable	Overall	1st Tertile	3rd Tertile	Difference
Rent (Deflated to 2005 €)	429.786	245.422	651.916	406.494***
	(208.231)	(54.982)	(201.564)	(1.433)
Apartment Size (in m^2)	72.530	56.760	90.568	33.808***
	(26.613)	(21.142)	(26.249)	(0.231)
Elapsed Tenure (in years)	3.802	3.967	3.561	−0.405***
	(2.790)	(2.843)	(2.693)	(0.027)
Private Landlord	0.789	0.707	0.873	0.165***
	(0.408)	(0.455)	(0.333)	(0.005)
Subsidized Housing	0.110	0.164	0.054	−0.111***
	(0.313)	(0.371)	(0.225)	(0.003)
Tenancy Starting	0.248	0.198	0.283	0.085***
After Reform	(0.432)	(0.398)	(0.450)	(0.004)
Equipment				
Central Heating	0.924	0.843	0.978	0.135***
	(0.264)	(0.364)	(0.147)	(0.003)
Balcony or Terrace	0.675	0.488	0.840	0.352***
	(0.468)	(0.500)	(0.367)	(0.004)
Basement	0.919	0.876	0.957	0.082***
	(0.272)	(0.330)	(0.202)	(0.003)
Garden	0.343	0.302	0.409	0.107***
	(0.475)	(0.459)	(0.492)	(0.005)
Further Characteristics				
Rent-to-Income Ratio	0.270	0.233	0.304	0.071***
	(0.171)	(0.160)	(0.201)	(0.002)
Apt. Size per	43.321	41.919	44.874	2.955***
Person (sqm/person)	(21.242)	(19.584)	(23.328)	(0.209)
Rent Inexpensive	0.336	0.477	0.200	−0.276***
(Assessment)	(0.472)	(0.499)	(0.400)	(0.005)
Rent Reasonable	0.445	0.385	0.489	0.104***
(Assessment)	(0.497)	(0.487)	(0.500)	(0.005)
Rent Expensive	0.218	0.139	0.311	0.172***
(Assessment)	(0.413)	(0.346)	(0.463)	(0.004)
Apt. Size: Too Small	0.246	0.294	0.202	−0.091***
(Assessment)	(0.431)	(0.455)	(0.402)	(0.004)
Apt. Size: Appropriate	0.700	0.679	0.710	0.032***
(Assessment)	(0.458)	(0.467)	(0.454)	(0.004)
Apt. Size: Too Large	0.055	0.028	0.087	0.059***
(Assessment)	(0.227)	(0.165)	(0.282)	(0.002)
Good Apt. Condition	0.626	0.555	0.691	0.136***
(Assessment)	(0.484)	(0.497)	(0.462)	(0.005)

Note: The samples are restricted to observations with elapsed tenure up to 10 years. Calculations use the SOEP sample weights. The table reports the overall mean, the mean in the first tertile (one third quantile), the mean in the third tertile (two third quantile) of the unconditional rent distribution, and the difference between the tertile-specific means. See Table 1 for further details.

Table 3: Baseline Rent Regressions

Variable	QR 17%	QR 50%	QR 83%	83% - 17%	OLS
Annual Residency Discount					
$0 \leq$ Elapsed Tenure ≤ 3	-0.007^{*}	-0.014^{***}	-0.017^{***}	-0.010^{**}	-0.012^{***}
	(0.004)	(0.002)	(0.003)	(0.004)	(0.002)
$4 \leq$ Elapsed Tenure ≤ 10	-0.008^{***}	-0.009^{***}	-0.009^{***}	-0.001	-0.009^{***}
	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Reform Effect					
After Reform	-0.020	-0.029^{**}	-0.049^{***}	-0.029	-0.041^{***}
	(0.018)	(0.012)	(0.014)	(0.020)	(0.012)
Apartment Size					
Ln(Size)	0.498^{***}	0.570^{***}	0.558^{***}	0.060	0.509^{***}
	(0.051)	(0.025)	(0.027)	(0.050)	(0.028)
Ln(Size) $\times$ Balcony	0.098^{***}	0.103^{***}	0.106^{***}	0.007	0.119^{***}
	(0.025)	(0.020)	(0.020)	(0.028)	(0.018)
Ln(Size) $\times$ Basement	0.198^{***}	0.152^{***}	0.172^{***}	-0.026	0.175^{***}
	(0.049)	(0.029)	(0.029)	(0.051)	(0.028)
Ln(Size) (APE)	0.741^{***}	0.775^{***}	0.782^{***}	0.041^{**}	0.745^{***}
	(0.016)	(0.011)	(0.012)	(0.018)	(0.011)
City Size by Population (Ref.cat: $<$ 5k)					
$\geq$ 500k (Center)	0.258^{***}	0.262^{***}	0.271^{***}	0.013	0.263^{***}
	(0.023)	(0.018)	(0.018)	(0.026)	(0.017)
$\geq$ 500k (Suburb)	0.208^{***}	0.202^{***}	0.198^{***}	-0.010	0.200^{***}
	(0.024)	(0.018)	(0.020)	(0.026)	(0.018)
100k to 500k (Center)	0.155^{***}	0.134^{***}	0.114^{***}	-0.041	0.127^{***}
	(0.023)	(0.018)	(0.019)	(0.026)	(0.017)
100k to 500k (Suburb)	0.108^{***}	0.072^{***}	0.049^{**}	-0.059^{**}	0.071^{***}
	(0.023)	(0.018)	(0.020)	(0.026)	(0.017)
50k to 100k (Center)	0.123^{***}	0.089^{***}	0.113^{***}	-0.010	0.085^{***}
	(0.030)	(0.023)	(0.023)	(0.033)	(0.022)
50k to 100k (Suburb)	0.059^{*}	0.066^{***}	0.038^{*}	-0.021	0.060^{***}
	(0.032)	(0.023)	(0.022)	(0.036)	(0.021)
20k to 50k	0.081^{***}	0.048^{**}	0.032	-0.049^{*}	0.050^{***}
	(0.026)	(0.019)	(0.021)	(0.028)	(0.019)
5k to 20k	0.027	0.010	0.002	-0.025	0.011
	(0.025)	(0.019)	(0.021)	(0.028)	(0.018)
Missing Dummy	0.287	0.275	0.142	-0.144	0.188
	(0.477)	(0.171)	(0.154)	(0.497)	(0.175)
Type of House (Ref.cat.: Detached House, 1-2 Family)					
Other Bldg.	-0.039	-0.002	0.021	0.060	0.000
	(0.061)	(0.039)	(0.033)	(0.062)	(0.031)
Nondetached House (1-2 Family)	0.077^{***}	0.092^{***}	0.093^{***}	0.017	0.088^{***}

<continued on next page>

Table 3: Baseline Rent Regressions <continued>

Variable	QR 17%	QR 50%	QR 83%	83% - 17%	OLS
	(0.026)	(0.016)	(0.016)	(0.026)	(0.015)
Apt. in 3-4 Unit Bldg.	0.097***	0.056***	0.035***	−0.062***	0.073***
	(0.017)	(0.013)	(0.012)	(0.018)	(0.011)
Apt. in 5-8 Unit Bldg.	0.125***	0.079***	0.066***	−0.060***	0.098***
	(0.019)	(0.012)	(0.013)	(0.020)	(0.012)
Apt. in 9+ Unit Bldg.	0.140***	0.111***	0.097***	−0.043**	0.128***
	(0.020)	(0.013)	(0.014)	(0.022)	(0.013)
High-Rise Apt. Bldg.	0.131***	0.113***	0.097***	−0.034	0.122***
	(0.036)	(0.024)	(0.027)	(0.038)	(0.025)
Missing Dummy	0.018	0.026	0.080**	0.063	0.046
	(0.049)	(0.033)	(0.034)	(0.055)	(0.030)
Further Characteristics					
Private Landlord	0.059***	0.075***	0.099***	0.040***	0.078***
	(0.011)	(0.008)	(0.009)	(0.012)	(0.008)
Private Landlord, Missing	0.074***	0.058***	0.081***	0.007	0.070***
	(0.018)	(0.012)	(0.015)	(0.021)	(0.012)
Subsidized Housing	−0.097***	−0.131***	−0.159***	−0.062***	−0.132***
	(0.011)	(0.009)	(0.010)	(0.013)	(0.008)
Subsidized Housing, Missing	0.008	0.018	0.020	0.012	0.009
	(0.044)	(0.024)	(0.030)	(0.046)	(0.025)
Selected Year Dummies (Ref.cat.: 1984)					
2001	0.256***	0.225***	0.191***	−0.065**	0.221***
	(0.024)	(0.015)	(0.021)	(0.029)	(0.014)
2011	0.198***	0.169***	0.171***	−0.027	0.179***
	(0.025)	(0.020)	(0.025)	(0.033)	(0.018)
Year Dummies 1985-2011	x	x	x		x
Year of Construction	x	x	x		x
State	x	x	x		x
Equipment	x	x	x		x
Residential Area	x	x	x		x
Amenities	x	x	x		x

Note: QR 17%, 50%, 83% denote quantile regressions at the three quantiles. 83% - 17% denotes the difference between the two quantiles 83% and 17%. Ref.cat. denotes the reference category. Calculations use the SOEP sample weights. Standard errors are in parentheses estimated by bootstrap with 200 replications, clustered at tenancy level. *,** and *** denote significance at the 10%-, 5%- and 1%-level, respectively. Average partial effects (APE) are partial effects at the mean of the covariates used for the interactions. Source: SOEP V28.1 and authors' calculations.

Table 4: Annual Residency Discount Before and After Reform

	QR 17%	QR 50%	QR 83%	83% - 17%	OLS
After Reform Effect					
After Reform	−0.065***	−0.071***	−0.109***	−0.044*	−0.096***
	(0.022)	(0.014)	(0.016)	(0.024)	(0.014)
After Reform (APE)	−0.035**	−0.043***	−0.066***	−0.030	−0.058***
(0 ≤ Elapsed Tenure ≤ 3)	(0.018)	(0.011)	(0.014)	(0.020)	(0.012)
After Reform (APE)	0.032	0.006	0.001	−0.031	0.013
(4 ≤ Elapsed Tenure ≤ 10)	(0.020)	(0.015)	(0.022)	(0.026)	(0.016)
Annual Residency Discount					
(a) Before Reform					
0 ≤ Elapsed Tenure ≤ 3	−0.014***	−0.020***	−0.025***	−0.012**	−0.021***
	(0.004)	(0.003)	(0.004)	(0.005)	(0.003)
4 ≤ Elapsed Tenure ≤ 10	−0.008***	−0.009***	−0.009***	−0.001	−0.009***
	(0.002)	(0.001)	(0.002)	(0.003)	(0.001)
(b) After Reform					
0 ≤ Elapsed Tenure ≤ 3	0.004	−0.003	0.001	−0.003	0.003
	(0.006)	(0.005)	(0.005)	(0.007)	(0.004)
4 ≤ Elapsed Tenure ≤ 10	0.005	−0.002	0.000	−0.005	0.003
	(0.004)	(0.004)	(0.005)	(0.006)	(0.004)
(c) Difference (After minus Before)					
0 ≤ Elapsed Tenure ≤ 3	0.018***	0.017***	0.026***	0.009	0.023***
	(0.007)	(0.005)	(0.006)	(0.008)	(0.005)
4 ≤ Elapsed Tenure ≤ 10	0.013***	0.007**	0.009*	−0.004	0.012***
	(0.005)	(0.004)	(0.005)	(0.006)	(0.004)

Note: Pooled panel OLS and quantile regressions. Calculations use the SOEP sample weights. Standard errors are in parentheses and bootstrapped with 200 replications, clustered at tenancy level. *,** and *** denote significance at the 10%-, 5%- and 1%-level, respectively. Panel (a) shows annual discounts for tenancies where the old legal situation apply while panel (b) provides information on annual discounts for tenancies affected by the reform in 2001. Panel (c) shows the difference. Source: SOEP V28.1 and authors' calculations.

Table 5: Annual Residency Discount Before and After Reform (Tenancy Fixed Effects)

	QR 17%	QR 50%	QR 83%	83% - 17%	OLS
Annual Residency Discount					
(a) Before Reform					
$0 \leq$ Elapsed Tenure ≤ 3	-0.002	-0.006^{***}	-0.006^{***}	-0.004^{*}	-0.004^{**}
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$4 \leq$ Elapsed Tenure ≤ 10	0.001	0.003^{***}	0.005^{***}	0.004^{***}	0.004^{***}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
(b) After Reform					
$0 \leq$ Elapsed Tenure ≤ 3	0.006	0.003	0.004	-0.003	0.007^{**}
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)
$4 \leq$ Elapsed Tenure ≤ 10	0.005	0.008^{***}	0.010^{***}	0.005	0.007^{**}
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
(c) Difference (After minus Before)					
$0 \leq$ Elapsed Tenure ≤ 3	0.008^{*}	0.009^{**}	0.010^{**}	0.001	0.011^{***}
	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)
$4 \leq$ Elapsed Tenure ≤ 10	0.004	0.005^{*}	0.004	0.000	0.003
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)

Note: Panel OLS and quantile regressions. The estimates account for tenancy mean fixed effects. Calculations use the SOEP sample weights. Standard errors are in parentheses and bootstrapped with 200 replications, clustered at tenancy level. *,** and *** denote significance at the 10%-, 5%- and 1%-level, respectively. Panel (a) shows annual discounts for tenancies where the old legal situation apply while panel (b) provides information on annual discounts for tenancies affected by the reform in 2001. Panel (c) shows the difference. Source: SOEP V28.1 and authors' calculations.