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Inflation and Rental Markets: Theory and Evidence
from a Rent-Controlled System

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How do rental markets shape inflation? In many countries, new leases follow the market, while ongoing rents rise only with inflation. Long-term tenants therefore pay less than newcomers – a “tenure discount.” This paper builds a simple model of this two-tier system and tests it with Austrian data (2005–2024). It shows how contract length and indexation rules make rent inflation persistent and how they drive inflation in both the short and long run.

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Rental institutions drive inflation

A tractable model shows how rental markets shape inflation: new rents track current conditions, while continuing contracts adjust via indexation rules. The model implies that institutional details (e.g. contract length, turnover, indexation) matter for aggregate inflation.



Tenure discounts, equal growth

The model yields a closed-form tenure discount – the rent gap between ongoing and new leases. Despite sluggish indexation, average continuing and new rents grow at the same steady-state rate via a composition effect, even as continuing rents stay permanently lower in level.



Austrian evidence, 2005–2024

Austrian rental data (2005–2024) – a setting of widespread indexation and long tenures – confirm the model: geometric contract-duration distribution, sizable tenure discounts, similar long-run growth of continuing and new rents, sluggish adjustment and effects of structural shifts.

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Abstract

This paper studies how rental market institutions shape inflation dynamics. I develop a tractable model in which newly signed rents reflect current market conditions, while continuing contracts adjust only through predetermined indexation rules. The model gives rise to a closed-form expression for tenure discounts—the gap between rents in ongoing and new leases. Despite sluggish indexation, the model implies that average continuing and new rents grow at the same rate in steady state due to a composition effect (replacement of old leases by new), even as continuing rents stay permanently lower in level. The framework highlights three channels through which rents affect aggregate inflation: steady-state contributions driven by real income growth, persistent effects of structural shifts that alter contract durations, and slow adjustment to short-run shocks arising from the stock of continuing contracts. The empirical analysis uses data from the Austrian rental market for 2005–2024, a setting with widespread inflation indexation and long tenures, to test the model’s predictions. The data confirm a geometric distribution of contract durations, sizable tenure discounts, similar long-run growth rates of continuing and new rents, housing inflation in excess of aggregate inflation, the influence of structural shifts and tenure-specific shock adjustments, supporting the model’s implications for inflation dynamics.

Keywords: Rental market, Tenure discounts, Inflation, Indexation, Rent control

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Non-Technical Summary

Motivation. Rents in aggregate price indices combine two distinct objects: rents on newly signed leases, which reflect current market conditions, and rents on continuing contracts, which were set earlier and adjust only through predetermined indexation rules. This gap shapes how quickly inflation responds to shocks and how rent indices should be read—a first-order concern for policy, given shelter’s weight in consumer price indices.

Framework. The paper develops a tractable model of a rental market with identical units occupied either by new tenants, whose rents track current market conditions and grow with nominal income, or by continuing tenants, whose contracts are indexed with a fixed rate—often the rate of inflation. Because this adjustment typically lags the evolution of market rents, the rents of continuing tenants fall below those of new entrants, giving rise to “tenure discounts”: rents that decline with the duration of a tenancy.

Central result. One might expect continuing and new rents to diverge steadily. They do not: in steady state their averages grow at the same rate. The mechanism is compositional—when few tenancies dissolve, most continuing rents rise slowly, but the few that reset jump to the higher market level, and these forces exactly offset.

Implications. The framework identifies three channels through which rental markets shape aggregate inflation. First, rent inflation can raise measured aggregate inflation even absent pressure elsewhere. Second, structural shifts have persistent inflationary effects: higher turnover, e.g., erodes tenure discounts and generates a prolonged phase of above-normal rent inflation. Third, the speed of adjustment to short-run shocks is governed by the weight of continuing contracts.

Evidence. Austria offers a clean testing ground for the framework: high share of renters, long tenancies, wide-spread inflation indexation. Microcensus data for 2005–2024 confirm the model’s predictions: contract durations are roughly geometric; average tenure is long (10.8 years) and turnover low (15.2%); rents decline by about 1.33% per year of tenancy; and continuing and new rents grow at similar long-run rates (3.3% vs. 3.0%). Austria also offers a natural experiment. Since the 1990s, fixed-term leases have spread rapidly, shortening tenancies in parts of the market. Exactly as the model implies, the segments where contracts shortened the most saw continuing rents grow fastest.

Policy relevance. Divergences between new-tenant and all-tenant indices need not signal conflicting trends; they can reflect predictable transitional dynamics, and ignoring these mechanisms may distort the assessment of inflation persistence. More broadly, the institutional details (indexation rules, turnover patterns) deserve close attention in inflation analyses. The Austrian case highlights these mechanisms clearly, but the underlying logic applies to any rental market with a mix of old and new contracts.

1 Introduction

At any point in time, the rents recorded in aggregate price indices are a weighted average of two very different objects: rents on newly signed leases, which respond to current market conditions, and rents on continuing contracts, which were set months or years earlier and often evolve according to predetermined adjustment rules. This gap between new and continuing rents shapes how monetary policy transmits through the economy, how quickly inflation responds to shocks, and how aggregate rent indices should be interpreted. This paper develops a framework to analyze the mechanics of this two-tier structure and quantifies its consequences for inflation dynamics.

Rental inflation is of direct relevance for macroeconomic policy. In the United States, shelter accounts for 33.1% of the Consumer Price Index, with 7.9% attributable to actual rents and 25.2% to owners' imputed rents (Bureau of Labor Statistics 2025). In the euro area, the direct weight is considerably smaller—about 6% (Eurostat 2025)—because the Harmonized Index of Consumer Prices excludes owner-occupied housing, although indirect effects and the role of rents in perceived inflation remain substantial (European Central Bank 2022). The importance of the new-versus-continuing rent distinction for aggregate inflation dynamics has become particularly evident during the recent inflation surge from 2021 to 2023 (Kmetz et al. 2023). The topic has fueled an active policy debate—most prominently in the United States—about whether monetary policymakers should pay greater attention to more informative new-lease rents¹, and has motivated a growing body of empirical work on the dynamics of continuing-tenant rents and their role in aggregate inflation (Adams et al. 2024, Gallin et al. 2024, Ball & Koh 2025, Cotton 2026).

In this paper, I contribute to the literature along two dimensions. The first contribution is theoretical. I develop a tractable model that provides a useful benchmark for understanding the interaction between newly signed and continuing leases. This theoretical perspective complements a largely empirical literature. Specifically, I model a rental market as a continuum of identical units whose stock grows at rate n . Each unit is occupied either by a new tenant or by a continuing tenant, and every contract dissolves randomly with probability s each period. New-lease rents grow at the rate of nominal income η , while continuing contracts are indexed at a potentially different rate ω , in practice often set equal to the rate of inflation. This simple structure yields several closed-form results for the steady state. (i) A constant separation probability implies

¹See, for example, the argument by Paul Krugman, “Wonking Out: Inflation and the Imputation Game,” *New York Times*, January 27, 2023.

geometrically distributed contract durations. (ii) As long as $\omega < \eta$, the model generates “tenure discounts”, i.e. rents decline with contract duration. One can also derive a closed-form expression for the average tenure discount—the ratio of average old rents to average new rents—which is a useful summary measure of the extent of inertia in aggregate rent inflation. (iii) In steady state, average continuing rents grow at the same rate as new-lease rents, namely η . At first glance, this result may seem surprising because an individual continuing contract does not respond to nominal income growth η but follows an indexation rule at the potentially lower rate ω . The key mechanism is a composition effect: with a low separation rate s , few leases reset, but because the average continuing contract has drifted further below the market rent, each reset produces a larger upward jump. In steady state these two forces exactly offset each other. (iv) The model delivers a closed-form expression for the speed-of-adjustment parameter of continuing contracts introduced by Ball & Koh (2025), expressing it as a function of structural primitives—most importantly, the average tenure discount.

These analytical results allow me to characterize three channels through which rental markets shape aggregate inflation. First, in steady state, rent inflation can exceed inflation elsewhere in the economy, so that measured aggregate inflation lies permanently above core inflation even in the absence of inflationary pressure outside the rental market. This happens whenever real income grows faster than the size and quality of the average dwelling, as in the case of a fixed or only imperfectly elastic supply of housing services. I discuss the rationale for this mechanism and how it is related to the quality-change bias identified by the Boskin Commission (Boskin et al. 1996). Second, structural shifts in the rental market can have persistent effects on rent dynamics and, through the housing weight, on aggregate inflation. For example, an increase in the separation probability erodes average tenure discounts over time, generating a prolonged period of above-normal rent inflation—even though new-lease rents grow at an unchanged rate. Third, the persistence of rent inflation after short-run shocks is shaped by the weight of continuing contracts: longer average contract durations and a larger gap between market rent growth and indexation imply larger tenure discounts and hence a more sluggish adjustment.

The second contribution of the paper is empirical. The existing literature on rent dynamics has focused predominantly on the United States. Extending the analysis to other institutional settings is valuable because cross-country variation in rental regulations and market structure provides a natural laboratory for studying the mechanics of rent inflation. I exploit data from the Austrian Microcensus for 2005–2024, which provides

quarterly information on approximately 22,500 households to test the model’s predictions.

Austria is a particularly informative setting for three reasons. First, it is one of the few advanced economies—along with Germany and Switzerland—that maintains a large rental sector, with around 50% of households renting (OECD 2023). Second, continuing rents are adjusted by near-universal and largely mechanical indexation to the consumer price index. This holds in the private market—where, depending on the segment, initial rents are either set freely or capped, while ongoing rents follow statutory or contractual indexation rules resembling second- or third-generation rent controls (Arnott 1995, Kettunen & Ruonavaara 2021)—as well as in the sizable municipal and cooperative segments, which feature subsidized initial rents but similar indexation of continuing contracts. Because these rules are broad in scope and stable over time, Austria offers a near-textbook setting for testing the model’s steady-state predictions. Third, a major regulatory change—the introduction of fixed-term leases from 1994 onwards—generated substantial and uneven increases in separation rates across market segments, making it possible to study the transitional dynamics emphasized by the model as well.

The empirical results support the model along several dimensions. Contract durations are well approximated by a geometric distribution, especially within more homogeneous submarkets. Average tenures are long (10.8 years) and annual turnover is low (15.2%), in sharp contrast to the United States where turnover rates of 25–50% are common. Tenure discounts are sizable: rents decline by roughly 1.33% per additional year of tenancy, implying an average discount of about 15% for continuing contracts. Quality-adjusted rent growth is similar for continuing and newly signed contracts, as confirmed by an Engle–Granger cointegration test. Both clearly exceed aggregate inflation (2.3% per year), in line with the model’s prediction that real income growth pushes housing inflation above overall inflation in steady state. Continuing rents, however, grow somewhat faster than new rents (3.3% vs. 3.0% per year). According to the model, this pattern could be attributed to the structural increase in tenant turnover caused by the spread of fixed-term leases. Cross-segment comparisons corroborate this interpretation: segments with a larger reduction in average contract duration show a higher difference in growth rates between continuing and new rents. Finally, adjustment to short-run shocks was slower in segments with longer contract durations, again consistent with the model.

Related literature. The paper builds on and connects several strands of the literature. Most directly, it relates to the recent work on the delayed pass-through from market rents to aggregate shelter inflation. Bolhuis et al. (2022) and Cotton (2026) study the lag

structure between rent inflation and CPI shelter in the United States. In related work, Adams et al. (2024) construct a new-tenant rent index based solely on recent market transactions and show that it leads conventional measures. Ball & Koh (2025) develop a reduced-form model that incorporates three sources of lag—contract vintages, measurement details and smoothing procedures—and show that it captures the delayed response of CPI shelter inflation quite accurately. My framework complements their approach by providing structural microfoundations for the key adjustment parameter. Additional research in this area has also studied the impact of other factors like house prices or monetary policy on housing rents (Dias & Duarte 2019, Muellbauer 2022).

The paper also connects to a longer tradition of research on rent stickiness. Early empirical contributions document patterns of rent rigidity across countries using household survey data (Genesove 2003, Hoffmann & Kurz-Kim 2006, Shimizu et al. 2010, Gallin & Verbrugge 2019). Building on this work, Gallin et al. (2024) assemble a comprehensive set of stylized facts for the U.S. rental market over 1999–2024, including evidence on renter mobility, the dynamics of continuing-tenant rents, and the determinants and consequences of rent gaps. Baker & Wroblewski (2025) use administrative data from Berkeley to document additional regularities, including downward nominal rigidity, business-cycle sensitivity, and heterogeneity in rent-setting behavior across landlord types. A number of papers also study the effects of tenure discounts on tenant mobility and the income distribution (Kattenberg & Hassink 2017, Munch & Svarer 2002, Suzuki et al. 2021, Fitzenberger & Fuchs 2017, Dustmann et al. 2022). On the theoretical side, tenure discounts have been explained through turnover costs and informational frictions: landlords may offer below-market renewals to avoid vacancy costs (Guasch & Marshall 1987, Barker 2003) or because they learn tenant quality over time (Hubert 1995). Gallin & Verbrugge (2019) show that risk-averse landlords may keep rents stable as implicit insurance against turnover. My model offers a complementary, purely compositional explanation: tenure discounts arise mechanically from the differential adjustment of new and continuing contracts, even in the absence of strategic landlord behavior.

Finally, the paper relates to the literature on the effects of rent regulation. The Austrian setting exemplifies second- and third-generation controls (Arnott 1995, Kettunen & Ruonavaara 2021), in which regulatory constraints apply primarily (though not exclusively) to the adjustment of ongoing contracts rather than to initial rent setting. A prominent set of contributions studies how such regulations affect tenant mobility and sorting (Diamond et al. 2019, Autor et al. 2014, Asquith 2019, Chen et al. 2023); see Kholodilin (2024) for a comprehensive review. In this context, tenure discounts capture

one important dimension of the costs and benefits associated with continuing tenancies under regulated rents. By providing a tractable model of how these discounts arise and interact with aggregate inflation, the paper contributes a structural perspective to this predominantly empirical literature.

The remainder of the paper is organized as follows. Section 2 presents the benchmark model. Section 3 analyzes the implications for long-run and short-run inflation dynamics. Section 4 describes the Austrian rental market, documents the main stylized facts, and compares the empirical evidence to the model’s predictions. Section 5 concludes.

2 Benchmark model

In this section I present a simple model of the rental market that will prove useful to interpret and organize empirical patterns and to make predictions about future developments. I focus first on the steady state and derive a number of implications that should be visible in a stationary situation. In the following Section 3 I emphasize the implications of the model for inflationary developments. There I also move beyond the stationary situation when discussing the effects of structural shifts and short-term shocks.

2.1 Setup

The rental market is divided into a number of segments. It is assumed that in each market segment j there exists a continuum of identical flats $H_{j,t}$ whose mass increases at a constant rate n_j , i.e. $H_{j,t} = H_{j,t-1}(1 + n_j)$ with $H_{j,0} > 0$ given. Appendix A describes the general case of the model with time-varying exit and entry rates while in this section I focus on the situation with constant parameter values. Each flat is inhabited by a renter who can be either a “continuing” renter with an ongoing contract (which I call “old”) or a renter that just moved in (which I call “new”).

Ongoing rental contracts are assumed to be dissolved each period with a constant probability s_j .² In the appendix I show that this set-up implies that the steady-state distribution of contract durations $\mathcal{K}$ follows a (memoryless) geometric distribution with the probability density function:

$$\Pr(\mathcal{K} = k) \equiv \Psi_{jk} = \lambda_j(1 - \lambda_j)^{k-1} \quad \text{for } k \geq 1, \quad (1)$$

²The same assumption is also used in Ball & Koh (2025).

with $\lambda_j = \frac{s_j + n_j}{1 + n_j}$ and where “new contracts” are defined as the ones with $k = 1$.

Turning to the level and the change of rents, I assume that nominal income grows at rate η_j and that the “fundamental” rent (or “market rent”, see Ball & Koh 2025) R_{jt}^* increases in line with this rate, i.e.:

$$R_{jt}^* = R_{j0} (1 + \eta_j)^t, \quad (2)$$

where R_{j0} stands for the rent in the starting period $t = 0$ in which all rents are “new” per assumption. The growth rate of nominal incomes can be written as $\eta_j = (1 + g_j)(1 + \pi) - 1$, where g_j stands for the growth rate of real incomes in segment j and where I assume that the measured aggregate inflation rate π is used in all sectors alike to compensate for the erosion of purchasing power. Note that R_{jt}^* refers to the *total* nominal market rent of the flat (“rent per dwelling”). In Section 3.1 I discuss how this total rent is related to the rent per square meter and to the rent per quality-adjusted square meter, the latter being not directly observable but recoverable only through hedonic methods.

As stated above, rental contracts are dissolved at random. This implies that the (otherwise identical) flats only differ with respect to the duration k of their occupancy. If $k = 1$ a flat is inhabited by a “new” tenant who has just moved in while for $k > 1$ it is inhabited by an “old” (i.e. sitting) renter with an existing contract. The rent of a new contract is given by the current fundamental value, i.e.:

$$R_{jt}^{new} = R_{jt}^* = R_{j0} (1 + \eta_j)^t. \quad (3)$$

This assumption implies that the expenditure share on *new* rental contracts stays constant over time which looks plausible and is in line with the empirical data for many countries over longer time periods.³

Old contracts, on the other hand, are assumed to be indexed by rate ω_j . First-generation rent controls typically implemented rent freezes with $\omega_j = 0$ while at the other extreme one could assume that the indexation follows the market rents with $\omega_j = \eta_j$. A middle ground that is often followed in second- or third-generation rent control regimes is an indexation with the rate of inflation, i.e. $\omega_j = \pi$. In general terms it holds that for

³In Appendix A.6 I present a model with Cobb-Douglas preferences that implies constant housing expenditures shares. The benchmark model is similar to Davis & Ortalo-Magné (2011) who also document the constancy of expenditures for the U.S. from 1980–2000 which is corroborated by Piazzesi & Schneider (2016) for an even longer time span. For other countries (and a shorter time period) see also OECD (2023). In Appendix C.1.4 I show that this also holds for the Austrian data where the average net expenditure share for new contracts is remarkably stable around 25% without a pronounced trend between 2011–2023.

$k \geq 2$:

$$\begin{aligned} R_{jkt}^{old} &= R_{j,t-k+1}^* (1 + \omega_j)^{k-1} = R_{j0} (1 + \eta_j)^{t-k+1} (1 + \omega_j)^{k-1} \\ &= R_{j0} (1 + \eta_j)^t \left(\frac{1 + \omega_j}{1 + \eta_j} \right)^{k-1} = R_{jt}^* \left(\frac{1 + \omega_j}{1 + \eta_j} \right)^{k-1}. \end{aligned} \quad (4)$$

2.2 Results

In a stationary situation the relative frequencies of contract durations correspond to the probability density function in equation (1). This expression then also implies that the logarithms of the relative frequencies $\ln(\Psi_{jk})$ are proportional to the duration k . This property can be compared to the empirical data and I summarize them for later reference as follows.

Result 1: Geometric distribution of contract durations

The logarithms of the relative frequencies in segment j are a linear function of the contract duration k , i.e. $\ln(\Psi_{jk}) = \ln \lambda_j + (k - 1) \ln(1 - \lambda_j)$.

It is straightforward to use equation (1) to calculate the average contract duration $\overline{Dur}_j = \sum_{k=1}^{\infty} k \lambda_j (1 - \lambda_j)^{k-1} = 1/\lambda_j$. This is summarized as follows:

Result 2: Average duration

In the long-run equilibrium the average contract duration in segment j is given by $\overline{Dur}_j = \frac{1}{\lambda_j} = \frac{1+n_j}{s_j+n_j}$. The share of new rental contracts is: $\Psi_{j1} = \lambda_j = 1/\overline{Dur}_j$.

For $n_j = 0$ one gets the well-known result for a geometric distribution that the share of new contracts is equal to the constant separation rate s_j and the average duration is given by $1/s_j$.

The tenure discount is defined as the rent of a contract that is $k \geq 2$ periods old relative to a new contract ($k = 1$), i.e.:

$$\frac{R_{jkt}^{old}}{R_{jt}^{new}} = \frac{R_{jt}^* \left(\frac{1+\omega_j}{1+\eta_j} \right)^{k-1}}{R_{jt}^*} = \left(\frac{1 + \omega_j}{1 + \eta_j} \right)^{k-1}. \quad (5)$$

From equation (5) one can derive a third important result of the model.

Result 3: Annual tenure discounts

The logarithm of the tenure discount in segment j is linear in the contract duration k and given by: $\ln\left(\frac{R_{jkt}^{old}}{R_{jkt}^{new}}\right) = \ln(R_{jkt}^{old}) - \ln(R_{jkt}^{new}) = -(k-1)(\ln(1+\eta_j) - \ln(1+\omega_j)) \approx -(k-1)(\eta_j - \omega_j)$.

For $\omega_j = \pi$ this further simplifies to $\ln(R_{jkt}^{old}) - \ln(R_{jkt}^{new}) = -(k-1)\ln(1+g_j) \approx -(k-1)g_j$. In this case the logarithm of the tenure discount is proportional to the duration of the contract with the proportionality factor approximately equal to the real growth rate of rents.

The average rent per dwelling of old and new contracts and the overall average rent can be derived from (1), (3) and (4) as:

$$\bar{R}_{jt}^{new} = R_{jt}^* = R_{j0}(1+\eta_j)^t, \quad (6)$$

$$\begin{aligned} \bar{R}_{jt}^{old} &= \frac{\sum_{k=2}^{\infty} \Psi_{jk} R_{jkt}^{old}}{\sum_{k=2}^{\infty} \Psi_{jk}} = \frac{1}{1-\lambda_j} R_{jt}^* \sum_{k=2}^{\infty} \left[\left(\frac{1+\omega_j}{1+\eta_j} \right)^{k-1} \lambda_j (1-\lambda_j)^{k-1} \right] \\ &= R_{jt}^* \frac{\lambda_j(1+\omega_j)}{\lambda_j(1+\omega_j) + \eta_j - \omega_j}, \end{aligned} \quad (7)$$

$$\bar{R}_{jt} = \lambda_j \bar{R}_{jt}^{new} + (1-\lambda_j) \bar{R}_{jt}^{old} = \lambda_j R_{jt}^* \left(1 + \frac{(1-\lambda_j)(1+\omega_j)}{\lambda_j(1+\omega_j) + \eta_j - \omega_j} \right). \quad (8)$$

Note that for $\omega_j = \eta_j$ this implies $\bar{R}_{jt} = R_{jt}^*$.

Using these expressions one can calculate the average “rent gap” (Gallin et al. 2024)—the ratio of the average new rent to the average old rent—in the long-run equilibrium as:

$$\frac{\bar{R}_{jt}^{new}}{\bar{R}_{jt}^{old}} \equiv \varphi_j^n = 1 + \frac{\eta_j - \omega_j}{\lambda_j(1+\omega_j)} = 1 + \frac{\eta_j - \omega_j}{1+\omega_j} \overline{Dur}_j. \quad (9)$$

Note that the average rent gap depends on all structural parameters of the model since $\overline{Dur}_j = \frac{1+n_j}{n_j+s_j}$. For the special case where rents are indexed with the rate of inflation ($\omega_j = \pi$) one has that $\frac{\eta_j - \omega_j}{1+\omega_j} = g_j$ and thus: $\varphi_j^n = 1 + g_j \overline{Dur}_j$. The average tenure discount φ_j^o is just the inverse of the rent gap φ_j^n .

Result 4: Average tenure discount

In the long-run equilibrium, the average tenure discount—the rent of the average old contract to the average new contract—in segment j is given by:

$$\varphi_j^o = \frac{\bar{R}_{jt}^{old}}{\bar{R}_{jt}^{new}} = \frac{1}{1 + \frac{\eta_j - \omega_j}{1 + \omega_j} Dur_j}.$$

Denoting the steady-state growth rates of *average* total rental payments for old and new contracts by $\pi_j^{v,old}$ and $\pi_j^{v,new}$, respectively, one can derive the final crucial result of the model.

Result 5: Growth rate of average rents for old and new contracts

In the long-run equilibrium, average new, average old and average overall rents grow at the same rate $\pi_j^{v,old} = \pi_j^{v,new} = \pi_j^v = \eta_j = (1 + g_j)(1 + \pi) - 1 \approx g_j + \pi$.

Note that this result does *not* hold at the level of an individual contract: the rent of a given continuing contract grows only at the regulated rate ω_j . That *average* old rents nevertheless grow at η_j follows directly from the expressions in (6) and (7), since both old and new contracts depend on time only via the fundamental rent R_{jt}^* . The economic mechanism behind this is a composition effect: expiring low-rent contracts are continuously replaced by new contracts signed at the current market rent. It is noteworthy—and perhaps at first sight surprising—that the growth rate of average old rents is independent of both the adjustment rate ω_j and the separation probability s_j . The composition effect explains why. If the separation probability s_j is low, then only a few old contracts are dissolved each period in market j , and the majority of old rents grow merely at the adjustment rate ω_j . The few contracts that *are* dissolved, however, have on average drifted further below the level of new rents R_{jt}^* , so that each replacement generates a larger upward jump. The frequency of replacements and the size of these jumps exactly counterbalance each other, and the growth rate of the average old rent is therefore given by η_j , independently of s_j and ω_j .

3 Implications for inflation

In this section I focus on the implications of the model for inflationary developments. I start with a summary of the situation around a steady state (Section 3.1) before dealing with the inflationary consequences of structural shifts (Section 3.2) and short-term shocks

(Section 3.3). In the latter cases the tenure discounts—both their level and their change—will turn out to play a crucial role. I close with some comments on the role of indexation rules and on the distinction between new-tenant and all-tenant indices (Section 3.4).

3.1 Long-run development

So far I have only considered the steady-state growth rate of average rental payments per dwelling, $\pi^v = \eta \approx g + \pi$ (Result 5, now written for the entire economy, dropping the index j). This rate ignores changes in the size or quality of the average flat and thus differs from the measure of rental inflation employed by statistical offices, denoted by π^h . Measured aggregate inflation π combines π^h with the inflation rate of non-housing goods π^c :

$$\pi = (1 - \theta)\pi^c + \theta\pi^h, \quad (10)$$

where θ is the housing expenditure share. Appendix A.6 derives (10) in a simple general-equilibrium framework in which households value housing *services* $v = zq$ —the product of dwelling size z and quality q —with Cobb–Douglas preferences $U = c^{1-\theta}v^\theta$, and in which average size and quality grow at rates g^z and g^q .

Besides the price per dwelling P^v (denoted R before), there is now a price per square meter $P^z = P^v/z$ and a price per quality-adjusted square meter $P^q = P^z/q$. Statistical offices typically report P^z , whereas the fully hedonic index P^q underlies a true cost-of-living index (Appendix A.6). To capture such differences I assume that the statistical office adjusts observed rents for fractions $\xi^z, \xi^q \in [0, 1]$ of size and quality growth, so that $\pi^h = \pi^v - \xi^z g^z - \xi^q g^q$; common practice corresponds to $\xi^z = 1$ and $\xi^q = 0$. Using $\pi^v = \pi + g$ from Result 5, measured rental inflation can be written as

$$\pi^h = \pi + \chi + \mu, \quad \chi = g - g^z - g^q, \quad \mu = (1 - \xi^z)g^z + (1 - \xi^q)g^q. \quad (11)$$

The *fundamental component* χ is the true excess of rental over aggregate inflation: it is positive whenever real income growth g outpaces the growth of housing services per dwelling. The *measurement bias* $\mu \geq 0$ is the part of that growth which the price index fails to capture.

The two components have different origins. The fundamental component is a matter of quantities: it is large when construction lags household formation and vanishes when dwellings grow or improve in step with income ($g^z + g^q = g$). Empirically, constant rental dwelling size ($g^z = 0$) is a reasonable benchmark; in Austria, it has fluctuated narrowly

around 68.5 m² over the entire period 2005–2024 (Appendix C.1.4). The measurement bias, by contrast, is a matter of the index concept. An index of total rents per dwelling ($\xi^z = \xi^q = 0$) records even pure size growth as rent inflation; rents per square meter ($\xi^z = 1, \xi^q = 0$) remove size but leave quality, implying $\mu = g^q$. Only a fully hedonic index ($\xi^z = \xi^q = 1$) recovers the ideal concept, but such indices are rare, not least because many quality improvements are hard to observe.

Substituting (11) into (10) yields

$$\pi = \pi^c + \zeta, \quad \zeta = \frac{\theta}{1 - \theta} (\chi + \mu). \quad (12)$$

The wedge ζ between headline and core inflation is a *structural rent-growth component*: it depends on χ and μ but is independent of monetary conditions and of inflationary pressures outside the rental sector. It explains why headline inflation exceeds core inflation ($\pi > \pi^c$) and, equivalently, why measured rental inflation may lie permanently above aggregate inflation ($\pi^h > \pi$).

The published series cannot tell the two components apart. Suppose dwelling size is constant and recorded rents outpace inflation by income growth, $\pi^h = \pi + g$. This is consistent with a genuine price effect ($\chi = g, \mu = 0$: fixed housing services confront demand rising with income) and equally with a pure quality-change bias ($\chi = 0, \mu = g$: dwellings improve in step with income, invisibly to the index). In either case, $\zeta = \frac{\theta}{1 - \theta} g$. With $g = 2\%$ and a shelter weight of $\theta = 33.1\%$, as in the U.S. CPI, this yields

$$\frac{\theta}{1 - \theta} g = \frac{0.331}{0.669} \times 2\% = 0.99\%,$$

a contribution of nearly one percentage point to annual aggregate inflation.⁴

While the magnitude of ζ in this example does not depend on its composition, the interpretation and the policy implications do. If the component is largely measurement bias, the remedy is statistical: better quality adjustment, i.e. a higher ξ^q . The Boskin Commission (Boskin et al. 1996), e.g., estimated that the U.S. CPI overstated the true cost of living by roughly 1.1 percentage points per year, attributing 0.25 percentage points to a quality-change bias in the rental component.⁵ If the component is instead a genuine rela-

⁴In other countries the measured component is smaller because shelter carries a lower weight. In the euro-area HICP the weight is only 6%, mainly because only actual rents paid by tenants are included. Gros (2021) argues that including owner-occupied housing would raise the weight to about 30%, close to the U.S. figure.

⁵The Commission concluded: “The CPI accurately measures rent per square foot of apartment space,

tive price change, it concerns monetary policy: a central bank targeting headline inflation has to accommodate a persistent wedge between housing and non-housing inflation. From a positive perspective, however, the key result stands either way: rental markets introduce a structural rent-growth component $\zeta > 0$ into measured aggregate inflation, whether it reflects genuine rent dynamics, imperfect measurement, or—most plausibly—both.

3.2 Reaction to structural shifts

The preceding analysis has focused on stationary environments. In practice, however, rental markets are also affected by both permanent structural shifts and by short-run shocks that can generate prolonged deviations of aggregate inflation from its long-run path. Any shift in rental inflation feeds into aggregate inflation proportionally through the housing weight: $\Delta\pi = \theta \Delta\pi^h$ (see equation (10)). Because rents typically adjust more slowly than other prices, such disruptions can produce persistent transitional dynamics. In this section I examine the response of average rents to permanent shifts in two key structural parameters: the separation probability s and the net inflow rate n . The focus on these changes is motivated by the fact that they correspond to developments that could actually be observed in segments of the rental markets in the U.S. and in Austria.

Changes in the separation probability. Part (i) of Figure 1 illustrates the transition dynamics following a permanent increase in the separation probability from $s = 0.05$ to $s = 0.33$, which lowers the steady-state average contract duration from $\overline{Dur} = 16.8$ to $\overline{Dur} = 3$ years. The magnitude of this shift is consistent with changes documented for subsegments of the Austrian rental market (see Section 4), although in practice these changes unfolded more gradually than the one-time jump imposed here for expositional clarity.

The mechanism operates through a compositional channel. The increase in s raises the share of new contracts from 6% to 34%. Since new contracts grow at rate $g + \pi = 3\%$ while individual continuing contracts are indexed at $\omega = \pi = 2\%$, the compositional shift toward newer, higher-priced leases pushes average rent inflation to nearly 8% on impact (see right graph in part (i)). This effect is then transmitted, with a one-period lag, to the group of continuing contracts. In subsequent periods the compositional effect gradually diminishes and the system converges back to the steady-state rent inflation

but its measure of shelter rent is upward biased by neglecting the increase in the quality of apartments per square foot” (Boskin et al. 1996, p. 30). In the model, measured inflation overstates the exact cost-of-living index by exactly $\theta\mu = \theta g^q$.

rate of 3%. Economically, the temporary burst of inflation reflects the erosion of average tenure discounts caused by the reduction in mean contract duration.

Part (ii) of Figure 1 examines the reverse case: a permanent decrease in the separation probability from $s = 0.33$ to $s = 0.18$. This scenario corresponds to the development in the U.S. rental market documented by Gallin et al. (2024), who show that the share of tenants with new contracts (not more than one year old) fell from 33% in 2005 to approximately 18% in 2020. As shown in the right graph of part (ii), this structural shift generates a prolonged period of below-normal rental inflation, with the deviation reaching up to 0.5 percentage points.

Changes in the net inflow rate. Parts (iii) and (iv) of Figure 1 illustrate an analogous mechanism operating through changes in the growth rate of the rental market. A sudden increase in the net inflow rate from $n = 1\%$ to $n = 5\%$ has qualitatively similar effects to an increase in s : in each period, a larger fraction of the market consists of new contracts. This compositional shift reduces average contract duration (to approximately 10.5 years) and generates a temporary rise in rent inflation of up to 0.5 percentage points. Again it is important to note that this is purely due to a compositional change, without any increase in new rents. In a contracting market the reverse obtains (see part (iv)). For a decline from $n = 1\%$ to $n = -3\%$, rent inflation undershoots its equilibrium value during the transition and average duration only slowly approaches the new steady state value of 48.5 years.

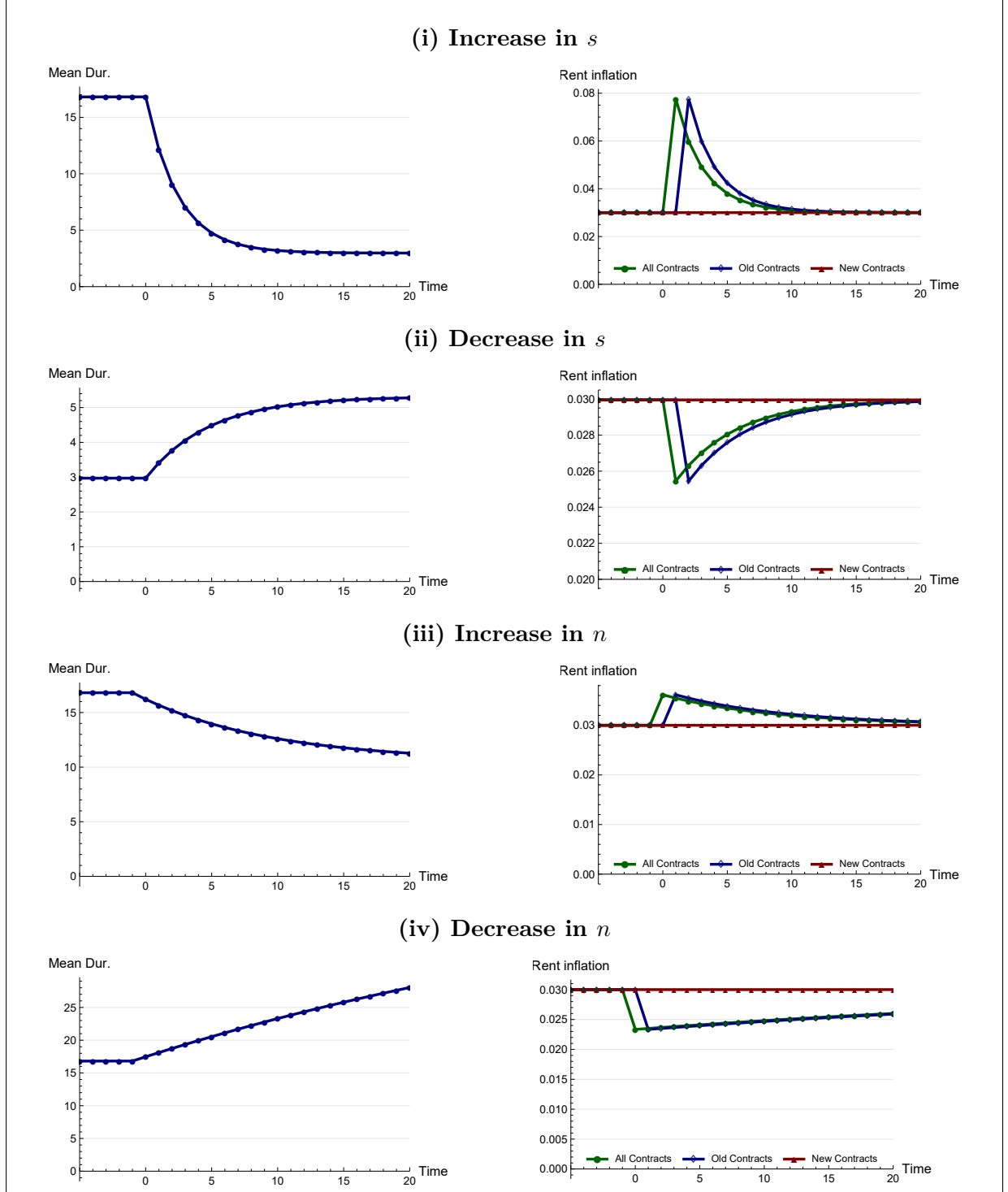
3.3 Reaction to short-run shocks

Rent dynamics are not only affected by structural shifts within the rental market but also by exogenous shocks—such as sudden increases in the price of imported goods—that are fed through the system only slowly and that have an impact of their own on aggregate inflation. The tenure discounts that drive the transitional dynamics in Figure 1 also play a central role in the speed at which rents adjust to short-run shocks. To formalize this link, I build on the framework developed in Ball & Koh (2025).

Ball & Koh (2025) model the rent of continuing tenants as a weighted average of the current market rent and the average rent paid in the previous period. Adapted to the notation of my model, this can be written as

$$\overline{R}_t^{old} = \kappa \overline{R}_t^{new} + (1 - \kappa) \overline{R}_{t-1}, \quad (13)$$

Figure 1: Reaction to structural shifts in s and n



Note: The picture shows the reaction of average contract duration and rent inflation to a sudden increase in s from 0.05 to 0.33, a sudden decrease in s from 0.33 to 0.18, a sudden increase in n from 1% to 5% and a sudden decrease in n from 1% to -3%. The other parameter values are assumed as $g = 1\%$, $n = 1\%$, $\pi = \omega = 2\%$, $s = 5\%$.

where κ governs the speed of adjustment: it measures the fraction of the gap between the current market rent $\bar{R}_t^{new}$ and average past rents $\bar{R}_{t-1}$ that is closed in each period. The average rent $\bar{R}_t$ is defined as before:

$$\bar{R}_t = \lambda \bar{R}_t^{new} + (1 - \lambda) \bar{R}_t^{old},$$

where λ denotes the share of new contracts (see Result 2).⁶ Ball & Koh (2025) treat κ as a free parameter, calibrated to best fit U.S. CPI shelter inflation over 2015–2025, and obtain an estimate of $\kappa = 0.213$ at the annual frequency.⁷

A contribution of the present framework is that, to a first-order approximation around the steady state, κ can be derived in closed form from the model’s structural parameters, most importantly the average rent gap φ^n . To see this, substitute $\bar{R}_{t-1} = \lambda \bar{R}_{t-1}^{new} + (1 - \lambda) \bar{R}_{t-1}^{old}$ together with $\bar{R}_{t-1}^{new} = \bar{R}_t^{new} / (1 + \eta)$, $\bar{R}_{t-1}^{old} = \bar{R}_t^{old} / (1 + \eta)$ (both from Result 5) and $\bar{R}_t^{new} = \bar{R}_t^{old} \varphi^n$ (equation (9)) into equation (13) and solve for κ :

$$\kappa = \frac{\eta - \lambda(\varphi^n - 1)}{\eta\varphi^n + (1 - \lambda)(\varphi^n - 1)}. \quad (14)$$

The comparative statics are intuitive: the speed of adjustment decreases in φ^n (a larger rent gap implies greater inertia). In the limiting case of no tenure discounts ($\varphi^n = 1$), expression (14) reduces to $\kappa = 1$ —continuing rents track market rents immediately.

Substituting $\varphi^n = 1 + \frac{\eta - \omega}{1 + \omega} \overline{Dur}$ (equation (9)) and $\lambda = 1 / \overline{Dur}$ (Result 2) yields an equivalent representation in terms of average contract duration:

$$\kappa = \frac{1}{1 + \left(\frac{\eta}{\omega} - 1\right) \overline{Dur}}. \quad (15)$$

Expression (15) shows that the adjustment parameter decreases in average contract duration and in the new-contract rent growth rate η , while it increases in the indexation rate ω . For $\overline{Dur} \rightarrow 0$ or $\omega = \eta$ it again collapses to $\kappa = 1$.

For realistic parameter values, the model delivers estimates of κ in the range reported by Ball & Koh (2025). Between 2015 and 2020, average U.S. CPI shelter inflation was 3.4% while overall inflation averaged 1.5%. Setting $\pi = 1.5\%$ and $g = \eta - \pi = 1.9\%$ together with $\omega = \pi$ and $\overline{Dur} = 3$ (Adams et al. 2024) yields $\kappa = 0.208$, almost identical

⁶This equation and equation (13) correspond to equations (3) and (5) in Ball & Koh (2025), with my $\bar{R}_t$, $\bar{R}_t^{old}$, $\bar{R}_t^{new}$, κ , λ written there as s_t , s_t^n , m_t , λ , α . Note that their λ is my κ .

⁷The authors conclude: “Over a year, the rents of continuing tenants adjust about 21.3 percent of the way from their past levels to current market rents” (Ball & Koh 2025, p. 21).

to the empirical estimate of 0.213.

3.4 Discussion

Two additional aspects of the framework deserve comment.

New-tenant versus all-tenant rent indices. Away from the long-run equilibrium the inflation rates experienced by new and by continuing tenants can differ markedly, as the transition dynamics of Figure 1 illustrate. It implies that the choice between a new-tenant rent index and the conventional all-tenant index—discussed, e.g., in Adams et al. (2024)—involves a substantive trade-off: the former provides a more timely signal of market conditions, while the latter better captures the rental costs actually incurred by the majority of tenants. I return to this trade-off in Section 4.

Institutional determinants of rent adjustment. The magnitude and persistence of rent-driven inflation also depend critically on the institutional details of rent setting. Centralized versus decentralized indexation schemes, threshold-based adjustment rules, and legally mandated adjustment intervals all shape the timing and size of rental adjustments, and hence the short-run behavior of π^h . These institutional features are the focus of recent work by Ball & Koh (2025) and Baker & Wroblewski (2025), and their interaction with the tenure-discount mechanism studied here is a natural direction for future research.

4 Empirical analysis

As argued in the introduction, Austria combines near-universal, mechanical indexation of continuing rents with substantial structural change in specific segments, which makes it well suited for testing both the steady-state and the transitional implications of the model presented in Sections 2 and 3. This section is organized as follows. I begin by outlining the key institutional features of the Austrian rental market. I then describe the data and empirical methodology. Next, I present the main results and stylized facts and compare them to the model’s predictions, with particular emphasis on the implications for inflation.

4.1 The rental market in Austria

General description. Austria has one of the highest rental shares in Europe, with around 50% of households renting their homes (see Table 1). This high share is driven

by a combination of historical factors, strong tenant protections, and a well-developed social housing sector. Unlike in many other countries, renting is not just a temporary phase but a long-term housing choice for many Austrians. The rental market is highly regulated, with elements such as rent controls, indefinite lease contracts, and indexed rent adjustments playing a key role (for details, see Baumgartner 2013, Klien et al. 2023). Additionally, Austria’s large social housing sector, particularly in cities like Vienna, further supports affordability and market stability. In particular, rental agreements fall into three main categories: private rentals (“Hauptmietverträge”), cooperative rentals (“Genossenschaftswohnungen”), and municipal rentals (“Gemeindewohnungen”).

Private rents. Private rentals are agreements between individual landlords and tenants, with rental prices and conditions varying based on factors such as location, building type, and whether rent regulation applies. Contracts can be either unlimited or fixed-term, with Austrian tenancy laws providing strong protections, particularly in older buildings. In particular, the Austrian rental law distinguishes between four types of private rents: free rents (“freie Mieten”), adequate rents (“angemessene Mieten”), reference rents (“Richtwertmieten”), and category rents (“Kategoriemieten”). The applicable type depends on factors such as the year of construction, renovations, condition, and size of the flat. Two central criteria for distinguishing between regimes are the year of construction of the building and the timing of contract conclusion. For rental units in buildings completed before 1945, the category rent (reference rent) applies, if the lease was concluded before (after) 1994. In Table 1 I refer to these two types as “regulated (≤ 1994)” and “regulated (> 1994)” and I refer to all other private rents as “free market rents”.⁸

Cooperative and municipal rents. Cooperative rentals are managed by housing cooperatives, where tenants typically pay an initial financial contribution (“Genossenschaftsbeitrag”) to help fund housing projects. Monthly rents are generally lower than in the private market, and although tenants contribute financially, they do not own the property. Municipal rentals consist of publicly owned apartments provided by local governments (most prominently in Vienna). These apartments are meant for low- and middle-income residents, offering subsidized and affordable rents. Access to both types of social housing often involves certain waiting periods and specific eligibility criteria based on income and residency status.

⁸In fact, the regulation is somewhat more complex: the reference rent does not apply for apartments smaller than 30 m² or larger than 130 m² which I also take into account in the classification. For regulatory details, see again Baumgartner (2013), Klien et al. (2023).

Rent control and indexation. The private rental market segment in Austria is close to a prototypical regime of second- or third-generation rent control (Arnott 1995, Kettunen & Ruonavaara 2021). Under second-generation rent control, rent increases within an ongoing tenancy are allowed, but initial rents remain controlled between tenancies (“vacancy control”). This maps well to Austria’s reference-rent system, where initial rents are regulated and continuing rents are typically updated through a statutory adjustment mechanism that applies every two years in April in line with CPI inflation.⁹ By contrast, third-generation rent control permits initial rents to be set freely (“vacancy decontrol”) but limits rent increases during the tenancy, often by linking them to an index. This describes the segment of free rents in Austria, where unregulated private contracts typically include an “indexation clause” (“Wertsicherungsklausel”) that contractually ties rent adjustments to the CPI. Rents in the cooperative and municipal sectors follow a procedure similar to the regulated private market, with continuing rents adjusted regularly in line with inflation.

Fixed-term rents. An important regulatory element concerns fixed-term rents (“Befristung”) which have been substantially expanded in the Austrian tenancy law since the mid-1990s. In particular, a key turning point was 1994, when the use of fixed-term residential leases became broadly feasible under the modern regime. Two elements are particularly important: first, fixed terms for apartments were tied to a minimum duration of three years (otherwise the lease is treated as open-ended); second, fixed-term leases in the regulated segments were made subject to a standardized rent discount (“Befristungsabschlag”) of 25% relative to the maximum legally permissible rent. Subsequent reforms further refined these regulations.

Regional differences. In addition to contract-type heterogeneity, the Austrian housing market also exhibits pronounced regional differences, which I discuss in more detail in Appendix C.2. For some of the subsequent analyses, I therefore differentiate the data by four regional groups (Vienna, Center/East, West, and South) and, where appropriate, by both contract type and region.

Structural shifts. Over the last decades there have been some important structural shifts in the Austrian rental markets. First, as shown in Table 1, this concerns the composition of the market. While the share of municipal housing has declined, cooperative rentals have expanded disproportionately. Within the private segment, the share of cat-

⁹Since 2020, however, this regular adjustment has been repeatedly modified by various temporary “brakes” and special (non-)adjustments, leading to deviations from the standard indexation schedule.

egory rents falls (largely mechanically), whereas reference rents and free-market rents increase almost in lockstep. Second, as documented in Table C2, the incidence of fixed-term leases has risen sharply in all segments of the private market (from 34% to 60% in the postwar free-rent segment and from 19% to 37% in the prewar reference-rent segment).

Table 1: Housing in Austria (2005–2024)

Type	Share (overall) 2020–24	Share (of rentals) 2020–24	Annual Growth 2005–24
Owners	46.9%		0.6%
Houses	35.4%		0.3%
Flats	11.5%		1.6%
Renters	53.1%		1.3%
Private	20.8%	46.6%	1.6%
– Free Market	12.7%	28.4%	2.5%
– Regulated (≤ 1994)	1.3%	2.8%	–5.4%
– Regulated (> 1994)	6.8%	15.3%	2.6%
<i>Memo: Regulated</i>	<i>8.1%</i>	<i>18.1%</i>	<i>0.4%</i>
Municipal	6.9%	15.6%	0.0%
Cooperative	16.9%	37.9%	2.1%
Other	8.5%		0.5%

Note: The table shows main characteristics of the Austrian housing market from 2005 to 2024. Overall, the number of private households increased from 3.47 to 4.16 million (with an average annual growth rate of 0.95%). The growth rates in the table refer to the average of the early period (2005–2009) to the late period (2020–2024). The category “regulated” corresponds to flats in houses built before 1945 where contracts signed before and after 1994 are termed “category rents” (“Kategoriemieten”) and “reference rents” (“Richtwertmieten”), respectively. The group “other” subsumes rent-free housing arrangements and subleases and is excluded in the shares of rentals. *Source:* Statistics Austria (2024), Statistics Austria (2025); own calculations.

4.2 Data

The data used in this paper come from the 2005–2024 Austrian Microcensus, conducted by Statistics Austria (Statistics Austria 2025). It is a rotating panel survey in which approximately 22,500 randomly selected private households across Austria participate each quarter. For the selected households participation is mandatory, ensuring high response rates and robust data quality. A selected household remains in the survey for a total of five consecutive quarters (“waves”). In each survey round, those households that have

completed their five waves are rotated out, and approximately 4,500 new households are introduced into the sample. Households are selected and identified by address, and individuals who move out of the household are not further tracked. The same applies if the household itself relocates. Since it is likely that moving households do not constitute a random sample of the total population, I focus my analysis on the first time a household responds.¹⁰

The data source on housing is the housing submodule of the Microcensus, which collects detailed information on housing costs, housing conditions, tenure status, and related aspects. The data also include information that can be used to derive a variable for the rental contract duration. In particular, the duration is calculated as the time elapsed between the week of the survey and the month and year in which the rental contract was signed. A crucial distinction in this study is between old and new contracts. I define a “new contract” as one with a contract duration of not more than one year.

While the Microcensus is a comprehensive survey, it nevertheless only contains a subset of the variables relevant to the quality and attractiveness of a rental apartment. For example, while it does provide information on the year of construction, it lacks data on the condition of the property or the year of the last renovation. Similarly, there is no information on the floor level or noise pollution. Most importantly, location cannot be differentiated more finely than at the state level (plus a rough classification of the degree of urbanization).

4.3 Methodology

The model in Section 2 was based on the concept of total rental payments P^v (called R in Section 2). As discussed in Section 3.1 it is, however, important to also look at different measures like the rent per square meter (P^z) or the rent per quality unit (P^q) in order to assess the extent and the implications of rental inflation. To this end I employ hedonic regressions.¹¹ In particular, I employ a semi-log regression model, in which the dependent variable is the logarithm of the monthly rent (net of operating costs) per square meter ($Rentsqm_i$), while the key explanatory variables include a time

¹⁰In most cases, this corresponds to the first of the five waves. However, for a small subset of households, the dataset does not include information for the first wave but only for a later wave. In these cases, I use the earliest wave in which the household responds.

¹¹The foundation of hedonic pricing models can be traced back to Lancaster (1966), who proposed that consumers derive utility not from goods themselves but from the characteristics they possess. This idea was later formalized by Rosen (1974) providing a concise framework for estimating the implicit value of these characteristics through regression analysis.

trend t , the contract duration (Dur_i), and a vector of additional controls ($\mathbf{X}_i$). These characteristics are intended to capture the quality of the flat and include dummy variables for the building’s construction period, total size, type of heating, quality category, and urbanization level. For some specifications, I also include additional explanatory variables such as the type of contract (private, cooperative, or municipal) or the geographical region. In these cases, it is debatable whether these variables capture quality characteristics of the flats or should instead be regarded as non-hedonic explanatory factors. Formally, the model is specified as follows:

$$\ln(Rentsqm_i) = \alpha + \mathbf{X}_i' \beta + \gamma Dur_i + \delta t + \varepsilon_i, \quad (16)$$

where the error term ε_i captures unobserved factors affecting rental prices. The coefficients β represent the marginal contributions of each characteristic to the rent, while γ specifically measures the tenure discount per year of contract duration and δ the basic growth rate of quality-adjusted rents.¹² For the reasons stated in the previous section, the regressions use exclusively observations from the first survey wave in which each household responded.

In Appendix A.6.10 I show in detail how the regression equation (16) relates to the theoretical model. In particular, the specification nests the central cases: without the controls $\mathbf{X}_i$, the regression simply tracks (duration-adjusted) rents per square meter, i.e. the concept P^z , while the controls move the estimate toward the quality-adjusted concept P^q . The “richness” of $\mathbf{X}_i$ thus determines the fraction ξ^q of quality differences for which the analysis accounts (see Section 3.1). If the dependent variable refers to the total rent then the specification without the controls $\mathbf{X}_i$ corresponds to the measure P^v (or R).

I come back to this issue in Section 4.4.2.

¹²Depending on the context I will also sometimes employ a set of $k = 1, \dots, K$ contract duration dummies $Dur_{1i}, \dots, Dur_{Ki}$ with corresponding coefficients $\gamma_1, \dots, \gamma_K$ instead of the continuous variable Dur_i . Similarly, I sometimes use a vector of quarterly time dummies TD_t with corresponding coefficients δ_t instead of the time trend t with the coefficient δ . When dealing with the developments in subsegments of the rental market I mostly use an interaction model as described in Appendix D.2. In Appendix D.3 I report the results of various alternative specifications.

4.4 Empirical results

4.4.1 Main stylized facts

Figure 2 uses three panels to characterize the Austrian rental market. Panel (a) illustrates the distribution of the duration of rental contracts both for the entire period 2005–2024 and for the most recent interval 2020–2024. Focusing on the latter period one can establish the following two stylized facts.

Fact 1: Average duration
The average duration of rental contracts is 10.8 years.

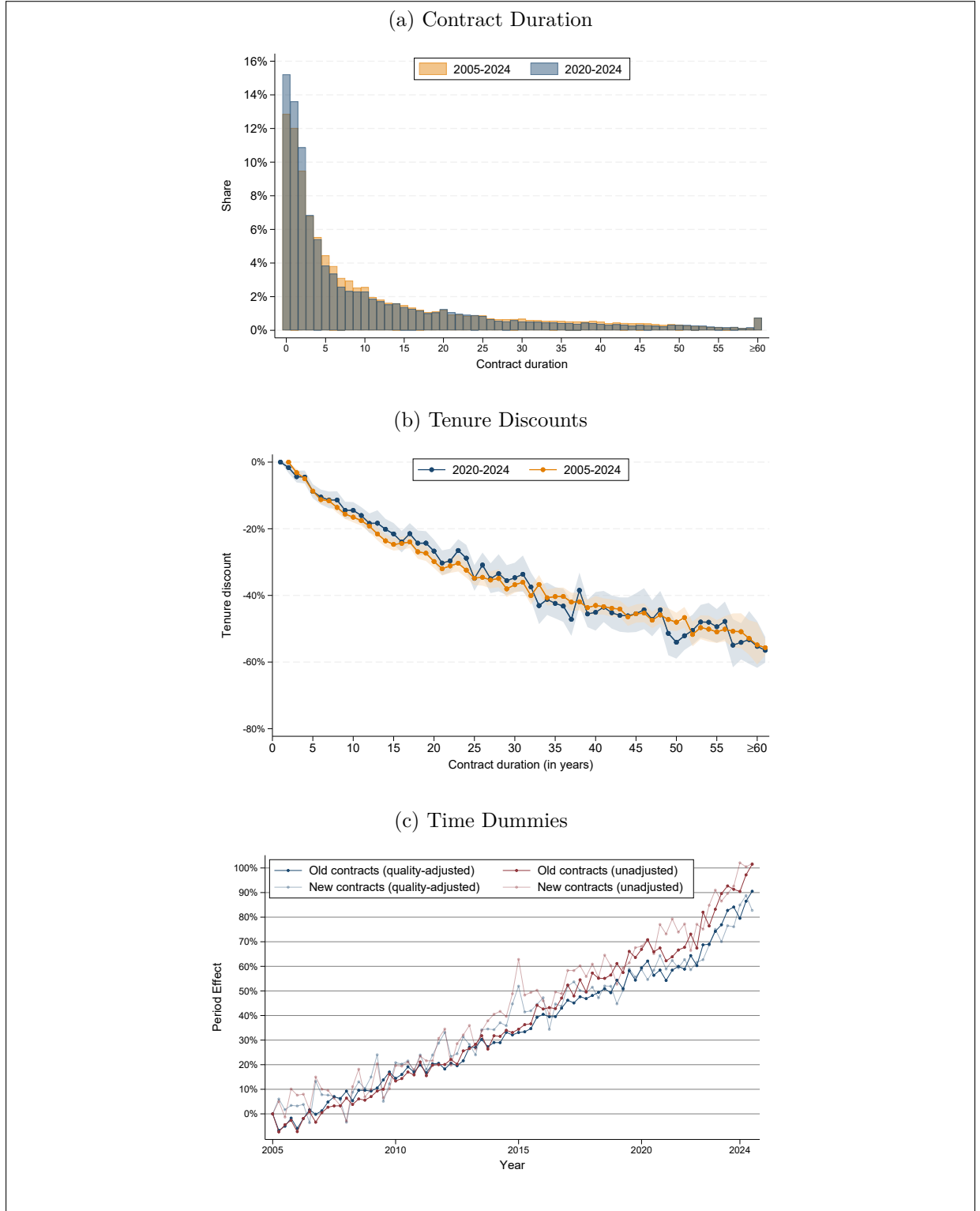
Fact 2: Share of new contracts
15.2% of contracts are one year old or younger.

Around 52% of all contracts are less than 5 years old and 75% less than 15 years. Old (> 30 years) or very old contracts (> 50 years) are less common (10.5% and 3.0%, respectively). Facts 1 and 2 refer to the most recent period 2020–2024. Comparing these numbers to the entire period 2005–2024 (average duration of 11.8 years and a share of new contracts of 12.9%) suggests that there has been a trend to shorter contracts. I come back to this issue below.

These summary statistics can be compared to the data of other countries. Adams et al. (2024), e.g., indicate that in the U.S. between 25 and 50 percent of tenants are newly moving in each year and that the average tenure duration is around 3 years. For Germany, the data in Destatis (2024) suggest a similar situation as in Austria with an average contract duration of around 12 years.

Panel (b) of Figure 2 shows the “tenure discounts,” i.e. the reduction in the average rent per square meter that is associated with different contract durations. For these results, as well as for those in panel (c), the exact specification of the hedonic regressions matters. As stated above, it is not clear a priori whether variables such as region or contract type should be included as quality characteristics (or proxies thereof). In the following, I will mostly report results from regressions that include these additional variables, while occasionally also presenting results from regressions with no or minimal

Figure 2: Stylized facts of the Austrian rental market



Note: Panels (a) and (b) show the distribution of contract durations and the tenure discounts, both for the full period (2005–2024) and for the most recent interval (2020–2024). Panel (c) shows the estimated time profiles of rents per m^2 for old and new contracts (with and without quality controls). New contracts are defined as not older than one year. *Source:* Statistics Austria (2025); own calculations.

controls in order to illustrate the range of possible estimates.^{13,14} Panel (b) shows the pattern of tenure discounts for the latest subperiod (2020–2024) together with the pattern based on all periods (2005–2024). The two lines are almost identical indicating that tenure discounts were remarkably stable over time. The result can be summarized as follows.

Fact 3: Annual tenure discounts

There exist sizable tenure discounts that increase steadily with contract duration: in the quality-adjusted (hedonic) specification, each additional year of contract duration is associated with an average reduction of the rent by 1.33%.

The latter number corresponds to the coefficient γ in the hedonic regression (16), estimated on continuing contracts (duration above one year), which form the benchmark sample throughout. In Table 2 I report the main results for the tenure discount γ and the time trend δ for a number of different samples—always transformed into percentage points. The complete results can be found in Tables D1 to Tables D4. Note that Figure 2b illustrates the results of a regression that includes 60 dummy variables of the various contract durations. The picture supports the assumption of a linear relation between the logarithm of the rent per square meter and the duration.

One can also calculate the average tenure discount by multiplying (the antilog of) each of the 60 categorical contract duration variables with their relative frequencies and summing them up. The result is stated in the next box.

Fact 4: Average tenure discounts

On average, old contracts are 15.1% cheaper than new contracts, holding observable quality differences constant.

In order to understand the reason behind the existence and the pattern of tenure discounts it is necessary to take the determination of rent increases into account, in particular the differential development of old (continuing) and new contracts. This is illustrated in panel (c) of Figure 2. The bold blue line documents the development of the

¹³In this paper I am mainly interested in the size and relations of the tenure discounts and the growth effects. In Appendix D I briefly discuss the estimated coefficients of the other explanatory variables.

¹⁴Note that Figure 2b is based on a slightly adapted version of equation (16). In particular, for the purpose of illustration I have used a specification that includes a set of (sixty) categorical variables Dur_{ki} with coefficients γ_k for the contract duration instead of one continuous variable Dur_i with a corresponding coefficient γ .

Table 2: Trend growth and tenure discount: benchmark regressions

	Old contracts			New contracts			All contracts		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Trend growth δ	3.82*** (0.36)	3.62*** (0.27)	3.27*** (0.24)	3.57*** (0.17)	3.57*** (0.17)	3.02*** (0.08)	3.86*** (0.37)	3.63*** (0.26)	3.26*** (0.23)
Tenure discount γ		-1.77*** (0.29)	-1.33*** (0.29)					-1.85*** (0.30)	-1.37*** (0.30)
$\gamma + \delta$		1.78*** (0.15)	1.90*** (0.10)					1.72*** (0.17)	1.84*** (0.12)
Duration	No	Yes	Yes	No	No	No	No	Yes	Yes
Quality controls	No	No	Yes	No	No	Yes	No	No	Yes
Type/region/urban.	No	No	Yes	No	No	Yes	No	No	Yes
N	108,723	108,723	108,723	16,715	16,715	16,715	125,569	125,569	125,569
Adj. R^2	0.128	0.311	0.441	0.160	0.160	0.424	0.131	0.321	0.456

Note: Dependent variable: log rent per m² (net of operating costs), 2005–2024. The time trend is measured in years. Coefficients are transformed as $(e^\beta - 1) \times 100$ and thus give the annual growth rate and the annual tenure discount in percent; standard errors by the delta method, significance stars based on the untransformed coefficients; the third line is computed as $e^{\gamma+\delta} - 1$. Old (new) contracts are those older than (up to) one year; for new contracts the duration variable is omitted. Quality controls: construction period, size, category, heating, number of flats in the building. Standard errors clustered by region $\times$ contract type in parentheses; *** p<0.001, ** p<0.01, * p<0.05. Population weighted. *Source:* Statistics Austria (2025); own calculations.

time dummies δ_t in a hedonic regression of the continuing contracts (i.e. of all contracts that are older than one year), while the light blue line does the same for new contracts. The time dummies thus represent the movement in the average rent per square meter that is not explained by the independent variables.

Fact 5: Growth of old and new contracts

Over the whole sample period, quality-adjusted rents in old and new contracts grow at similar but not identical annual rates (3.3% and 3.0%, respectively).

The numbers of Fact 5 are based on the linear time-trend in the hedonic regression (16) (including all available explanatory variables) as reported in columns (3) and (6) of Table 2. The figure indicates that the estimated time profile of quality-adjusted rents of old contracts increased by around 85% between 2005 and 2024 which was similar to the increase for new contracts.¹⁵ One can also see, however, that for the new contracts the fluctuations around the long-run trend are much larger (which is mainly due to the smaller number of observations). Panel (c) also shows the corresponding evolution of old and new rents per square meter for the specification without any quality controls. In this case rents increase by around 100% between 2005 and 2024, corresponding to average annual

¹⁵I am taking the average of the dummies in 2024 in order to reduce the influence of quarterly fluctuations.

growth rates of 3.8% for old and 3.6% for new contracts. The two series nevertheless track each other quite closely.

4.4.2 Comparison of theoretical and empirical results

Contract duration. In a steady state the model implies that contract durations follow a geometric distribution—log relative frequencies linear in duration, $\ln(\Psi_{jk}) = \ln \lambda_j + (k - 1) \ln(1 - \lambda_j)$ —and that the average duration equals the inverse of the share of new contracts, $\overline{Dur}_j = 1/\Psi_{j1}$ (Result 2). For the aggregate market both predictions hold only imperfectly: the log frequencies deviate from linearity at short durations (blue line in Figure 3, panel (a)), and the aggregate share of new contracts (15.2%, Fact 2) implies $\overline{Dur}^{model} = 6.6$ years, far below the observed $\overline{Dur}^{data} = 10.8$.

Table 3: Characteristics of submarkets (2020–2024)

Sub-market	Size (%)	Dur. (data) (yrs)	New (%)	Dur. (model) (yrs)
All	100.0	10.8	15.2	6.6
Private – Unlimited Leases				
Built $\geq$ 1945	10.6	7.8	14.0	7.2
Built<1945	12.4	16.3	9.0	11.1
Private – Fixed-Term Leases				
Built $\geq$ 1945	15.9	1.8	37.0	2.7
Built<1945	7.2	2.1	35.4	2.8
Municipal	15.7	17.0	5.6	17.8
Cooperative	38.2	12.7	8.7	11.6
Weighted Average	—	10.8	15.2	10.0

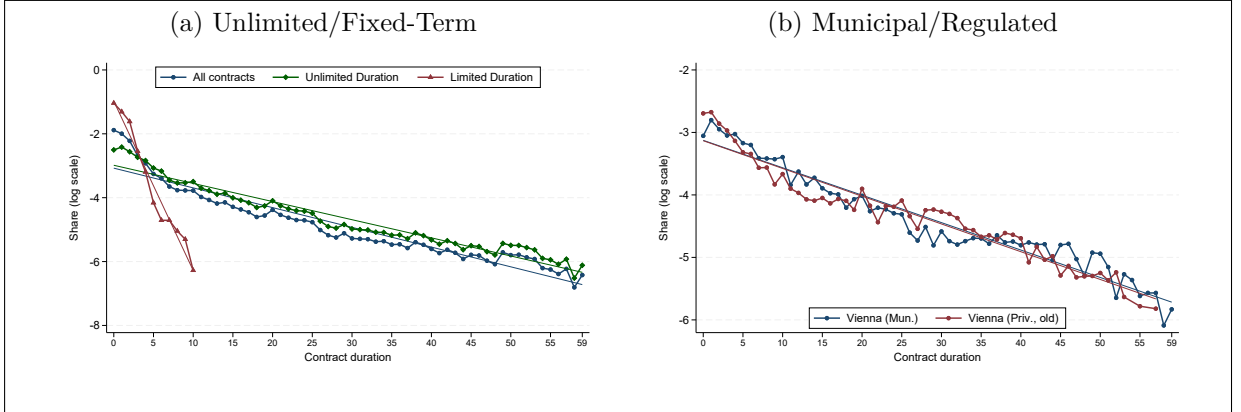
Note: The table reports for each of the stated submarkets j the relative size, the observed average contract duration, the percentage of new contracts (≤ 1 year) and the theoretical duration in a steady state ($\overline{Dur}_j^{model} = 1/New_j$). *Source:* Statistics Austria (2025); own calculations.

These deviations reflect the heterogeneity of the Austrian rental market rather than a failure of the mechanism. The market combines segments with very different turnover: fixed-term private leases with average durations around 2 years and shares of new contracts above 35%, and unlimited private, municipal and cooperative segments with durations of 8 to 17 years (Table 3). *Within* these submarkets the prediction $\overline{Dur}_j = 1/New_j$ is much more closely met (last column), and the weighted average of the submarket

predictions, $\overline{Dur}^{model} = 10.0$, comes close to the observed $\overline{Dur}^{data} = 10.8$. The improved fit within segments is also visible in the duration distributions themselves. Panel (a) of Figure 3 shows the log relative frequencies separately for unlimited and fixed-term contracts, together with the distribution for the aggregate market: both subsamples are considerably closer to the linear fit than the aggregate. Panel (b) shows the relative frequencies for two of the largest submarkets—municipal flats and unlimited regulated flats in Vienna—which exhibit an almost perfect linear fit. The remaining deviations at short durations plausibly reflect separation rates that are higher at the beginning of a tenancy than later on ($s_j(k) \neq s_j$).

For the purposes of this paper this suggests that within reasonably homogeneous submarkets, the stationary model with a constant separation rate provides a good description of the duration data. The steady-state results of Section 2 thus provide a useful benchmark for the analysis.

Figure 3: Logarithm of the relative frequencies in submarkets



Note: The graphs show the relative frequencies of contract duration in log scale. Panel (a) for a split with respect to fixed-term/unlimited and panel (b) for municipal flats and unlimited private flats built before 1945 in Vienna. *Source:* Statistics Austria (2025); own calculations.

Tenure discounts. The model predicts a linear relationship between the logarithmic discounts and the contract duration, as stated in Result 3. In Appendix C.1 I show that one can redraw Figure 2b in logarithmic form and observe an almost perfect linear relation between the logarithmic tenure discounts and the contract duration. Furthermore, equation (4) implies the following steady-state relationship for the aggregate market:

$$\ln(R_{kt}^{old}) = \alpha + \delta t + \gamma(k - 1), \quad (17)$$

with $\alpha \equiv \ln(R_0)$, $\delta \approx \pi^h$ and $\gamma \approx -(\pi^h - \omega)$. This is exactly the structure of the hedonic regression (16) (where I use $Dur = k - 1$).¹⁶ Depending on the rent concept underlying the dependent variable and the included controls, the time coefficient δ estimates π^v , π^z or π^q , and the duration coefficient γ the corresponding tenure discount—but in *every* specification the two must satisfy

$$\gamma + \delta = \omega. \quad (18)$$

Intuitively, over one year a given contract advances by one unit in t and in k simultaneously, and its rent grows at the regulated rate ω .

This invariance allows one to recover the indexation rate of continuing contracts from the estimates. The benchmark hedonic regression (see Table 2) yields $\gamma = -1.33\%$ and $\delta = 3.27\%$, implying $\omega = 1.90\%$ (where I use $e^{\gamma+\delta}$ for the calculation). The specification without quality controls yields a larger discount ($\gamma \approx -1.77\%$) together with a larger trend ($\delta \approx 3.62\%$)—individually different, as the mapping predicts, but with a similar implied $\omega = 1.78\%$. The value of ω between 1.8% and 1.9% can be compared with the average rate of inflation: 2.28% over the full period 2005–2024, and 1.8% up to the first quarter of 2022, i.e. excluding the recent inflation surge. The implied adjustment rate therefore appears compatible with the conjecture that indexation is broadly in line with inflation, with remaining differences possibly reflecting that not all contracts include indexation clauses, or that landlords sometimes refrain from implementing contractual adjustments.

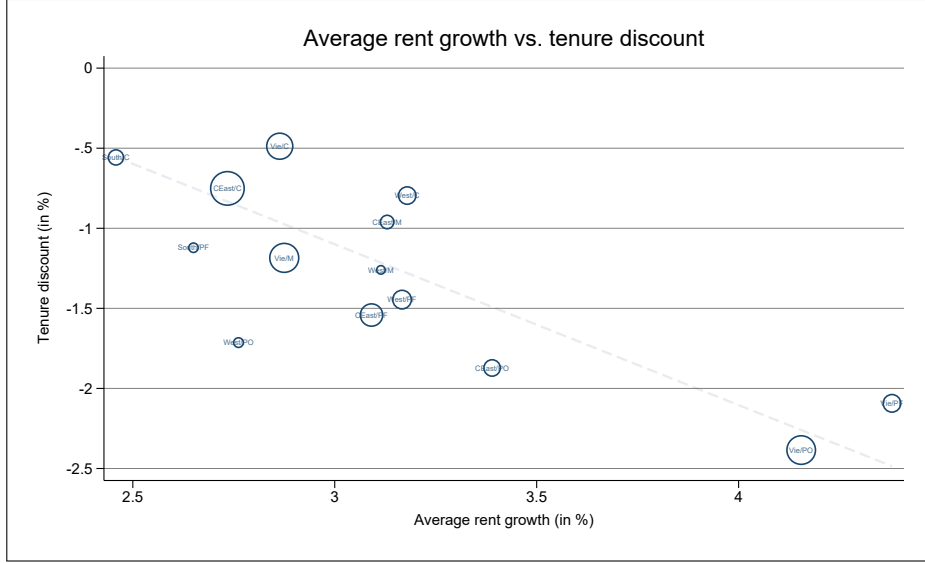
The relation (18) should also hold in a cross-section of heterogeneous submarkets: in the steady state $\gamma_j = \omega_j - \delta_j$, so that a plot of tenure discounts against rent growth should have a slope of -1 and an intercept equal to the average indexation rate. Figure 4 performs this test for 14 submarkets. The tenure discount is largest for private rents in Vienna (both regulated and free), which also experienced the highest rent growth. The estimated slope is -0.98 (not significantly different from the theoretical value of -1) with an intercept of 1.83, an estimate of the average indexation rate $\bar{\omega}$ that is again close to 2%.

Finally, the model also predicts the steady-state *average* tenure discount—the ratio of the average old to the average new contract: $\varphi^o = 1/(1 + (\delta - \omega) \overline{Dur})$ (see (9)), where $\delta - \omega$ is the annual discount of the rent concept under consideration. Since Fact 4 (15.1%) refers to the quality-adjusted comparison, the matching rate is the estimated $|\gamma| = \delta - \omega = 1.33\%$ from the same specification. Together with $\overline{Dur} = 10.8$ this implies

¹⁶Appendix A.6.10 derives the correspondence in detail.

$\varphi^o = 0.873$: old contracts should on average be around 12.7% cheaper than comparable new contracts, somewhat below the observed 15.1%. As with the duration distribution, the discrepancy shrinks when the calculation is carried out at the level of submarkets.

Figure 4: Tenure discounts and average rent growth



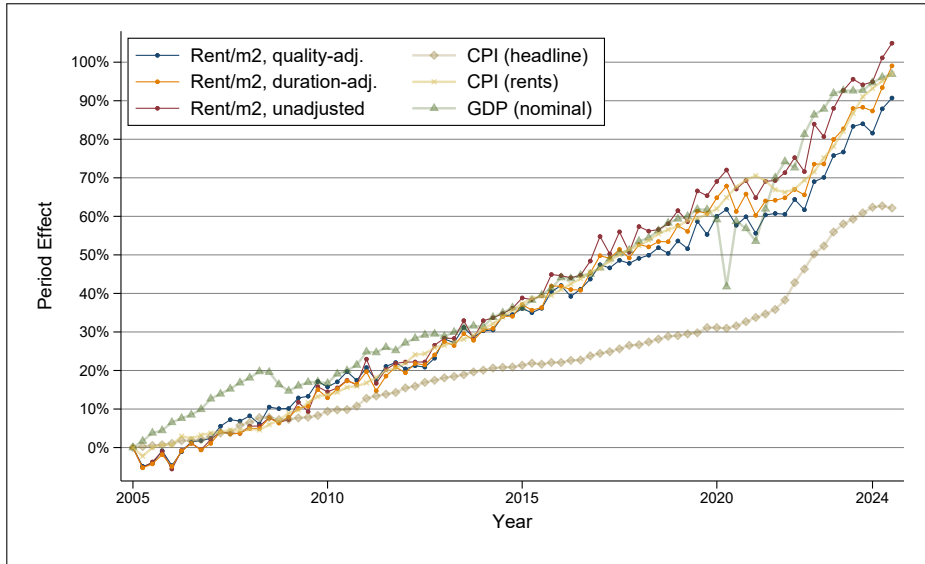
Note: The figure contrasts the tenure discounts γ_j and the average annual trend growth δ_j where submarkets with too few observations are dropped. This leaves 14 submarkets (type and region). PO/PF/C/M=Private (Regulated)/Private (Free)/Cooperative/Municipal rents; CEast=Center/East. *Source:* Statistics Austria (2025); own calculations.

Parallel growth rate of old and new rents. The model suggests that in a long-run steady state the growth rates of old and new contracts should be equal. In the data the growth rates come out as 3.27% (old) and 3.02% (new) in the specification with all control variables, and as 3.82% and 3.57% in the specification without controls (see Table 2). Although the point estimates differ by about 0.25 percentage points, the difference is not statistically significant. Furthermore, an Engle–Granger test rejects the null of no cointegration ($Z(t) = -3.48$, $p < 0.05$) between the two time-dummy series, suggesting that, the growth rates of old and new contracts share a stable long-run equilibrium relationship. The observed deviations from this long-run trend are likely due to structural shifts and short-run economic shocks, as discussed in Sections 3.2 and 3.3.

The structural component of inflation in Austria. The estimates also make it possible to quantify the structural rent-growth component of Section 3.1. In Figure 5 I compare the time pattern of different rent measurements (now for old and new rents taken together), as discussed in Section 3.1, with macroeconomic time series. The pattern of

quality-adjusted rents per square meter P^q and of unadjusted rents per square meter is similar to the line for old contracts in panel (c) of Figure 2. The picture also shows the pattern of rents per square meter when correcting for contract duration. Arguably this is the best equivalent to the theoretical concept P^z . Over the period until 2024, this rent measure increased by about 100%, close to the development of nominal GDP (+97%), although with at times sizeable deviations, which are likely attributable to cyclical fluctuations or adjustment processes in the housing market. This parallel development is in line with the model's implication that, with constant average flat size, square-meter rents track nominal incomes. In contrast, the consumer price index has shown a smaller increase (+63%) over the same time period.

Figure 5: Rents, Consumer Prices and Nominal GDP, 2005–2024



Note: The figure shows three different measures of average rents per m² across all rental contracts: unadjusted, adjusted for contract duration only, and adjusted for the full set of quality controls. For comparison, the figure also reports the consumer price index, its rent component, and nominal GDP. *Source:* Statistics Austria (2025); own calculations.

Instead of focusing on the development of the time dummies, one can again calculate the underlying average growth rates over the period. Using the notation above, they come out (see Table 2) as $\pi^q = 3.26\%$ (hedonic specification), $\pi^z = 3.63\%$ (rents per square meter, controlling for contract duration) and $\pi^{z'} = 3.86\%$ (rents per square meter without any controls), compared with aggregate inflation of $\pi = 2.28\%$.¹⁷ Measured rental

¹⁷It is not entirely clear which of the two square-meter concepts is used by the statistical office in the construction of the rental component of the CPI. Figure 5 suggests the measure π^z that controls for contract duration, while the verbal description is more in line with $\pi^{z'}$.

inflation thus exceeds aggregate inflation by $\pi^z - \pi = 1.35$ percentage points. Following Section 3.1, this excess is the sum of the fundamental component χ and the measurement bias μ . As emphasized above, the two are observationally equivalent in the published series, and no regression can separate them, since the unobserved part of quality growth is missing by construction.

It is, however, possible to be more specific about the measurement bias. The rental component of the CPI is based on rents per square meter and thus $\xi^z = 1$ and $\mu = (1 - \xi^q) g^q$. This implies that the gap between the square-meter and the hedonic growth rate ($\pi^z - \pi^q = \xi^q g^q = 0.37$ percentage points) equals the portion of quality growth that the observable characteristics can account for. Adjusting for observable quality would thus reduce the excess of rental over aggregate inflation by about 27% ($0.37/1.35$); the remaining 0.98 percentage points are due to the fundamental component $\chi = g - g^q$ and the unrecorded quality improvements $\mu = (1 - \xi^q) g^q$.

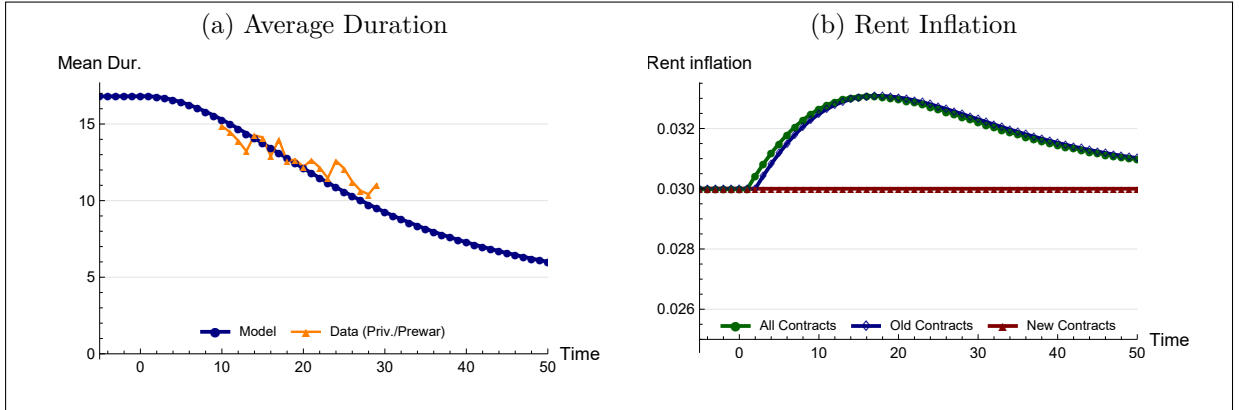
The implied structural component of measured aggregate inflation, $\zeta = \frac{\theta}{1-\theta}(\chi + \mu)$, depends on the shelter weight. With the weight of actual rents in the Austrian CPI, $\theta = 5.38\%$, the rental excess translates into a modest $\zeta \approx 0.08$ percentage points per year. This small number, however, reflects the low weight rather than tame rental dynamics: with a comprehensive shelter weight of $\theta = 33.1\%$, as in the U.S. CPI, the *same* rental market would contribute $\zeta \approx 0.67$ percentage points to measured aggregate inflation.¹⁸ The persistent excess of rental over aggregate inflation of well above one percentage point per year is thus a quantitatively relevant magnitude and it is only due to the specific design of the Austrian index that the effect on headline inflation appears weak.

Reaction to structural shifts. The results discussed so far all refer to a steady state with $\pi_t^{v,old} = \pi_t^{v,new} = \pi^v$. I now turn to the transitional dynamics. A change in the growth rate of real incomes g , in the growth rate of the housing stock n or in the separation rate s triggers a transition during which old and new rents grow at different rates for an extended period (see Section 3.2 and Figure 1). This scenario is in fact an accurate description of the rental market in Austria, which has experienced a number of continuous structural shifts over the past decades. As documented, e.g., in Table 1 there have been compositional changes with a stagnant development for municipal housing and an upward trajectory for private (+1.6%) and cooperative rents (+2.1%). Even more importantly, there has been a continuous increase in fixed-term contracts, especially in the private sector which has

¹⁸The Austrian weight covers actual rents paid by tenants only; costs of owner-occupied housing are not included. As discussed in Section 3.1, including the latter would bring the weight closer to the U.S. figure.

led to a parallel reduction in average duration. This is visible in Figure 2a and further discussed in Appendix C.2. As documented there, the contract duration in the private segment fell from 10.7 to 7.1 years over a 15-year span, with a parallel increase in the share of fixed-term contracts from 27% to 50% (or from 54% to 75% among new contracts).

Figure 6: Reaction to a slow change in the separation rate



Note: The graphs show the development of rent inflation and average duration for a situation where the separation rate increases from $s = 0.05$ in $t = 0$ towards $s = 0.25$ by annual increments of 0.0025. The other parameter values are $g = 1\%$, $\pi = 2\%$ and $n = 1\%$. Panel (a) also shows the observed annual duration for private rents in prewar buildings. *Source:* Statistics Austria (2025); own calculations.

I illustrate this situation in Figure 6 in a stylized fashion. In particular, the example is meant to resemble the development of private contracts in prewar buildings in Austria since the reform of fixed-term tenancy regulations in 1994. I assume that at the start of this process the separation rate and average duration in this segment was the same as in the municipal segment today (where fixed-term contracts are still the exception) which implies $s = 0.05$ and $\overline{Dur} = 16.8$ (for $n = 0.01$). Furthermore, I assume that from 1995 onward the separation rate increases slowly (with annual increments of 0.0025) due to an ever-increasing proportion of fixed-term contracts as can be observed in the data. Panel (a) of Figure 6 indicates that the average duration in this segment slowly approaches the new equilibrium value of 3.9 years. What is more, the orange line shows the average contract duration in this market segment from 2005 to 2024 where the observation in $t = 10$ corresponds to the year 2005, the first observation in my dataset. In the simulation it comes out as 15.2 years which is close to the empirical value of 14.8. The fit seems also acceptable for the rest of the time span. The new equilibrium value could be interpreted as a situation in which only 10% of contracts are unlimited ($10\% \times 16.83 + 90\% \times 2.5 = 3.9$).

Panel (b) shows that this adjustment process is associated with an increase in rent inflation in this segment up to 3.3%. It is important to note that this increase in tran-

sitional rent inflation happens despite the fact that the growth rate of new contracts is always the same and given by $\pi^{v,new} = 3\%$. What might look at first sight as a situation with increasingly expensive new rents is in fact only the consequence of the structural change. The increase in the separation probability implies that there is a lower fraction of old contracts and the renting population is losing their tenure discounts. The transitional increase in rent inflation is just a reflection of the phasing-out of these tenure discounts.

The cross-segment pattern is in line with this observation. In particular, the difference between $\pi^{v,old}$ and $\pi^{v,new}$ is exceptionally large in the private market of pre-war buildings (1 percentage point) where also the reduction in contract duration was most pronounced (around 3 years). By contrast, for municipal contracts both the growth differential (0.04 percentage points) and the change in duration (plus 0.2 years) were negligible. The connection is illustrated in Figure C3 in Appendix C.1.3 which indicates that the rent growth differential was higher in submarkets that have shown the largest decrease in contract duration; the relation is statistically significant once municipal rents are excluded. The steady increase in the separation probability may therefore explain why the average growth rate of continuing-contract rents was slightly higher than that of newly signed rents. At first sight even the magnitude seems right: the simulated differential of about 0.3 percentage points matches the one observed for the entire market (3.3% vs. 3.0%). However, the structural shift is confined to the private segment, where the observed differential is considerably larger (about 1 percentage point). The mechanism thus accounts for only part of the difference.

Reaction to short-run shocks. In Section 3.3, I have shown that the parameter κ , which captures the adjustment speed of continuing contracts to developments in new contracts, can be expressed in closed form as a function of structural parameters. The key relationship is that longer contract durations—and thus larger tenure discounts—are associated with more sluggish adjustment. One can estimate an adjustment equation analogous to (13) and compare the empirical estimate $\hat{\kappa}$ with the theoretical value κ^{model} implied by equation (15). When calibrating the latter, caution is required, since the expression in (15) relies on a steady-state assumption which does not hold for all submarkets in practice.

For the entire rental market, estimating (13) yields $\hat{\kappa} = 0.098$.¹⁹ This is considerably

¹⁹To estimate κ , I first obtain quarterly time-dummy series from the benchmark hedonic regression (16), estimated separately for continuing contracts ($P_t^{z,old}$), new contracts ($P_t^{z,new}$) and all contracts ($\bar{P}_t^z$). I then estimate the annual version of (13), $P_t^{z,old} - \bar{P}_{t-4}^z = c + \kappa (P_t^{z,new} - \bar{P}_{t-4}^z) + u_t$, so that $\hat{\kappa}$ is an annual adjustment rate comparable with Ball & Koh (2025) and with (15). Submarket estimates use submarket-specific time dummies. It should be noted that the $\hat{\kappa}$ are estimated rather imprecisely with

below the estimate for the U.S. rental market in 2015–2020, $\hat{\kappa} = 0.21$, reported by Ball & Koh (2025). This difference is consistent with the general impression of a more flexible U.S. rental market. Inserting $\overline{Dur} = 10.8$, $\eta = 3.27\%$ and $\omega = 2\%$ into (15) gives a value of $\kappa^{model} = 0.12$, which is above the estimated value of $\hat{\kappa} = 0.098$ but still considerably below the US value. One can repeat this comparison across market segments. Splitting the market into four submarkets (free private, regulated private, municipal, and cooperative) yields estimates $\hat{\kappa}$ of 0.199, 0.134, 0.126, and 0.096, respectively, and theory-based values κ^{model} of 0.243, 0.085, 0.111, and 0.152. Within the private market the model performs well: it matches the faster adjustment in the free segment and the slower adjustment in the regulated segment and the municipal sector, where contracts last longer and tenure discounts are larger.

All-tenant vs. new-tenant indices. When the rental market is hit by structural shifts or short-term shocks, a new-tenant index (as proposed by Adams et al. 2024) can differ markedly from the traditional all-tenant index. This is further discussed in Appendix C.3. I show there that a new-tenant index for Austria would be based on a considerably different sample than the conventional index: it would include fewer municipal (6% vs. 16%) and cooperative rents (22% vs. 38%), fewer observations from Vienna (32% vs. 41%), more observations from the western regions (23% vs. 16%), and a substantially higher share of fixed-term contracts (60% vs. 26%). It is therefore crucial to choose the appropriate index when informing or motivating policy decisions.

5 Conclusion

Rental markets transmit shocks to aggregate inflation through the interaction of contract durations and indexation rules. This paper has developed a tractable framework to analyze these mechanisms and provided empirical evidence from the Austrian rental market.

The analysis yields three main insights. First, rent inflation can raise measured aggregate inflation above core inflation even in steady state. When real income grows faster than the size and quality of the average dwelling, the shelter component generates a persistent wedge that does not require additional inflationary pressure elsewhere in the economy. The magnitude of this effect depends on measurement conventions—particularly the extent to which quality improvements in housing are controlled for—an issue closely

standard errors between 0.06 and 0.09.

related to the findings of the Boskin Commission. Second, structural shifts in the rental market—such as changes in average contract duration—are central for medium-run inflation dynamics. In particular, a period of above-normal rental inflation need not reflect a surge in newly signed contracts. Instead, it can arise from compositional changes that deplete tenure discounts: as lower-rent, long-tenure contracts are replaced by higher-rent vintages, measured rent inflation rises persistently, even if the growth rate of new-lease rents remains unchanged. Third, the speed at which continuing rents adjust to short-run shocks can be derived from structural primitives: longer contract durations and larger tenure discounts imply more sluggish adjustment. Together with the second insight, this implies that divergences between new-tenant and all-tenant rent indices do not necessarily signal conflicting inflation trends. Such divergences can reflect predictable transitional dynamics implied by contract composition, and ignoring them can lead to misreadings of inflation persistence and the timing of disinflation.

The empirical analysis of the Austrian rental market supports these mechanisms. Microcensus data for 2005–2024 reveal contract durations that are well approximated by a geometric distribution within homogeneous submarkets, sizable tenure discounts, and similar long-run growth rates of continuing and newly signed rents. The rise in fixed-term leases is associated with faster growth of continuing than of new rents, in line with the model’s transitional dynamics, and the estimated speed of adjustment is of the magnitude implied by the model and considerably lower than in the United States. Austria’s institutional setting—characterized by widespread indexation and long contract durations—offers a particularly transparent environment in which to observe these forces, but the underlying logic extends to any rental market with heterogeneous contract structures.

More broadly, the results suggest that institutional details of rental markets deserve closer attention in the analysis of aggregate inflation. This paper has focused on Austria, whose regulatory environment makes the mechanisms particularly visible, but extending the empirical analysis to countries with different regulatory regimes and indexation conventions would be useful.

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Appendices

A Model

A.1 Supply of flats

I focus in the following on the development of one market segment and leave out the subscript j in order to simplify notation. Time is discrete, $t \in \mathbb{N}$. Let H_t denote the number of active rental contracts at the *end* of period t and $\mathfrak{h}_t$ the inflow of new contracts signed at the *beginning* of period t . Since every active contract corresponds to exactly one occupied flat, H_t is at the same time the number of (occupied) flats. The economy starts at $t = 0$ with an initial stock $H_0 > 0$. Entry occurs already in the first period, so that for $t \geq 1$

$$\mathfrak{h}_t = \phi_t H_{t-1}, \quad (19)$$

where $\phi_t \geq 0$ is the (possibly time-varying) *entry rate*. Each contract that is active at the beginning of period t (including the new contracts $\mathfrak{h}_t$) survives period t with the deterministic survival share $\rho_t \in (0, 1]$; the separation rate during period t is $s_t = 1 - \rho_t$. The stock of active contracts thus evolves according to

$$H_t = \rho_t (H_{t-1} + \mathfrak{h}_t) = (1 + \phi_t) \rho_t H_{t-1}. \quad (20)$$

I specify the entry rate such that the stock grows at rate n_t :

$$\phi_t = \frac{1 - \rho_t + n_t}{\rho_t} = \frac{s_t + n_t}{\rho_t}, \quad (21)$$

which implies $H_t = (1 + n_t)H_{t-1}$ for all $t \geq 1$. For $n_t = 0$ (i.e. $\phi_t = s_t/\rho_t$) the stock stays constant at $H_t = H_0$. This corresponds to a useful benchmark case in which all contracts that are dissolved in one period are replaced by new contracts in the next period. Iterating (20) forward yields

$$H_t = H_0 \left(\prod_{\tau=1}^t (1 + \phi_\tau) \right) \left(\prod_{\tau=1}^t \rho_\tau \right). \quad (22)$$

A.2 Age structure of flats

Let $H_t(a)$ denote the number of contracts of age a at time t , that is, those which entered in period $t - a + 1$ and survived until t . Because the model is deterministic,

$$H_t(a) = \mathfrak{h}_{t-a+1} \prod_{\tau=t-a+1}^t \rho_\tau, \quad 1 \leq a < t, \quad (23)$$

while the oldest age group with $a = t$ consists of the remaining flats from the initial stock together with the first-period entrants: $H_t(t) = (H_0 + \mathfrak{h}_1) \prod_{\tau=1}^t \rho_\tau$. Substituting $\mathfrak{h}_{t-a+1} = \phi_{t-a+1} H_{t-a}$ and (22) (with time index $t - a$) into (23) leads to:²⁰

$$H_t(a) = \begin{cases} \phi_{t-a+1} H_0 \left(\prod_{\tau=1}^{t-a} (1 + \phi_\tau) \right) \left(\prod_{\tau=1}^t \rho_\tau \right), & 1 \leq a < t, \\ (1 + \phi_1) H_0 \left(\prod_{\tau=1}^t \rho_\tau \right), & a = t. \end{cases} \quad (24)$$

Summing (24) over a and telescoping recovers (22), i.e. $\sum_{a=1}^t H_t(a) = H_t$.

A.3 Relative age frequencies

The relative frequency of age a at time t is given by $f_t(a) = H_t(a)/H_t$. The common factor $H_0 \prod_{\tau=1}^t \rho_\tau$ in (24) and (22) cancels, so that

$$f_t(a) = \begin{cases} \frac{\phi_{t-a+1}}{\prod_{\tau=t-a+1}^t (1 + \phi_\tau)}, & 1 \leq a < t, \\ \frac{1 + \phi_1}{\prod_{\tau=1}^t (1 + \phi_\tau)} = \frac{1}{\prod_{\tau=2}^t (1 + \phi_\tau)}, & a = t, \end{cases} \quad (25)$$

where I use the fact that $\frac{\phi_{t-a+1} \prod_{\tau=1}^{t-a} (1 + \phi_\tau)}{\prod_{\tau=1}^t (1 + \phi_\tau)} = \frac{\phi_{t-a+1}}{\prod_{\tau=t-a+1}^t (1 + \phi_\tau)}$.

²⁰This follows from $H_t(a) = \phi_{t-a+1} H_{t-a} \prod_{\tau=t-a+1}^t \rho_\tau = \phi_{t-a+1} H_0 \left(\prod_{\tau=1}^{t-a} (1 + \phi_\tau) \right) \left(\prod_{\tau=1}^{t-a} \rho_\tau \right) \left(\prod_{\tau=t-a+1}^t \rho_\tau \right)$. The expression in (24) follows by combining the two products that involve ρ_τ .

A.4 Steady state

If the growth rate and the survival share are constant, $n_t \equiv n$ and $\rho_t \equiv \rho$ (with $s = 1 - \rho$), then $\phi_t \equiv \phi = \frac{s+n}{\rho}$ and $1 + \phi = \frac{1+n}{\rho}$. Equation (20) implies $H_t = (1 + n)^t H_0$, and (24) and (25) simplify to

$$H_t(a) = \begin{cases} \phi (1 + \phi)^{t-a} \rho^t H_0, & 1 \leq a < t, \\ (1 + \phi) \rho^t H_0, & a = t, \end{cases} \quad (26)$$

$$f_t(a) = \begin{cases} \frac{\phi}{(1+\phi)^a}, & 1 \leq a < t, \\ \frac{1}{(1+\phi)^{t-1}}, & a = t. \end{cases} \quad (27)$$

A.5 Asymptotic age distribution and contract duration

In the limit $t \rightarrow \infty$ the term for $f_t(t)$ vanishes and the age distribution converges to

$$f(a) = \frac{\phi}{(1 + \phi)^a} = \frac{\phi}{1 + \phi} \left(\frac{1}{1 + \phi} \right)^{a-1} = \lambda (1 - \lambda)^{a-1}, \quad \lambda \equiv \frac{\phi}{1 + \phi} = \frac{s + n}{1 + n}, \quad (28)$$

i.e. the age of active contracts follows a geometric distribution.²¹ For $n = 0$ it holds that $f(a) = s(1 - s)^{a-1}$. The mean age of active contracts is

$$\overline{Dur} = \mathbb{E}(a) = \sum_{a=1}^{\infty} a f(a) = \frac{1}{\lambda} = \frac{1 + n}{s + n}, \quad (29)$$

which also equals the inverse of the share of new contracts, $1/f(1)$. The median is $Dur^{\text{med}} = \lceil \ln(1/2)/\ln(1 - \lambda) \rceil$. Two duration concepts should be distinguished here: (29) is the average *elapsed* duration of the contracts active at a point in time (the concept measured by cross-sectional tenure surveys), while the expected *completed* duration of a newly signed contract is $1/s$, independently of n . The two coincide only for $n = 0$; for $n > 0$ the growing inflow makes the cross-section younger, $\overline{Dur} < 1/s$. In the main text the age variable a is denoted by k , and I write $\Psi_k \equiv f(k)$ for the asymptotic distribution (28).

²¹To be precise, (28) is the distribution of the number of independent trials needed for a first success with success probability λ , where “success” is understood as the dissolution of the contract. Note that $1 - \lambda = \rho/(1 + n)$: growth tilts the cross-section towards young contracts, so that $\lambda > s$ whenever $n > 0$.

A.6 Demand for rental housing

A.6.1 Introduction and Overview

Housing is unusual among consumption goods since a dwelling is not a homogeneous commodity but rather a bundle of floor space and structural characteristics that is unique for every specific object and might also change over time. This creates two challenges: (i) how to theoretically capture this specific characteristic and (ii) how to build an appropriate index of rental prices and how to measure it in official statistics. The total *cost of dwellings* typically develops differently from the *cost of space* or the *cost of housing services*.

In the rest of this section I develop a minimal general-equilibrium framework in which this distinction can be made precise. Following the structure of Sections A.1–A.5 it is assumed that only newly matched renters choose their dwelling, while continuing tenants stay in the flat chosen at signing and pay rents that adjust according to the existing regulation.

Roadmap. The subsections support the main text as follows.

- A.6.2–A.6.3 (environment, demand): constant expenditure share of new renters and declining rent burden of continuing renters; underpin the assumption that new rents grow with nominal income (Section 2) and Appendix C.1.4.
- A.6.4–A.6.5 (three rental prices, equilibrium rent, Proposition 1): growth rates of rents per dwelling, per square meter and per quality unit; underpin Result 5 and the price concepts of Section 3.1.
- A.6.6 (true cost-of-living index, Proposition 2): the hedonic price is the ideal housing deflator (Section 3.1).
- A.6.7–A.6.8 (true vs. measured inflation): decomposition into fundamental component and measurement bias; derive equations (10)–(12).
- A.6.9 (cash-in-advance constraint): pins down the level of inflation; no direct counterpart in the main text.
- A.6.10 (hedonic regression): maps the model into regression (16) and derives equations (17) and (18) used in Section 4.4.2.

Notation. I follow a consistent convention.

- **Time is discrete**, as in Sections A.1–A.5, and I focus throughout on steady-state (balanced-growth) paths.
- **Price growth rates** are denoted by π with the corresponding superscript: π^v , π^z , π^q for the three housing prices introduced below, π^h for the measured rental inflation rate used by statistical offices and π^c for the non-housing good; π^{true} denotes the growth rate of the true cost-of-living index while π without a superscript stands for the measured rate of aggregate inflation.
- **Real growth rates** are denoted by g^z and g^q for average dwelling size and average quality, while households and contracts grow at the rate g^n , real incomes at rate g^y and nominal incomes at rate $g^\eta = (1 + g^y)(1 + \pi) - 1 \approx g^y + \pi$ (using measured inflation). Growth-rate identities are typically stated in the exact gross (factor) form and, where convenient, in the additive first-order-approximation.
- In the main text of the paper I use for some of the growth rates more **compact symbols**. In particular, $\eta \equiv g^\eta$, $n \equiv g^n$, $g \equiv g^y$ and $R \equiv P^v$.
- **Aggregation over tenure classes** repeatedly uses the geometric sum

$$G(x) \equiv \sum_{k=1}^{\infty} \Psi_k x^{k-1} = \frac{\lambda}{1 - (1 - \lambda)x}, \quad x(1 - \lambda) < 1, \quad (30)$$

with $\Psi_k = \lambda(1 - \lambda)^{k-1}$ and $\lambda = \frac{s+g^n}{1+g^n}$ from Section A.5 (written there as $\lambda = \frac{s+n}{1+n}$).

A.6.2 Environment

I start by focusing on a single local housing market j (suppressing again the index to simplify notation). A region is inhabited at date t by N_t identical households, each occupying one dwelling under a rental contract, so that $N_t = H_t$ counts households, dwellings, and active contracts alike, and grows at rate g^n (called n in the main text). Households differ only in the duration k of their tenure; the steady-state tenure distribution is the geometric distribution Ψ_k of Section A.5. A household whose contract is dissolved (probability s per period, the same event as the termination of the contract in Section A.1) re-enters the search pool in the following period. I abstract from the moving decision and model the transition into rental search as an exogenous event. New contracts are signed by re-entering and by newly formed households.

Preferences over a non-housing consumption good c and housing services v are Cobb–Douglas, i.e.:

$$U_{k,t} = c_{k,t}^{1-\theta} v_{k,t}^\theta, \quad \theta \in (0, 1). \quad (31)$$

Housing services $v_{k,t}$ are assumed to be a function of both floor space $z_{k,t}$ (measured in square meters) and the quality $q_{k,t}$ which is conceptualized as a scalar index that captures features like heating and insulation, layout and floor plan, outdoor spaces, building age, and local amenities. It is assumed that households do not value the two dimensions separately but rather their product:²²

$$v_{k,t} = z_{k,t} q_{k,t}. \quad (32)$$

Both dimensions of housing services are fixed at the signing of the contract. In particular, a flat let for the first time in period t has size $z_{1,t}$ which is chosen by the new renter as derived below and which remains unchanged over the course of the rent. Furthermore, each square meter of the newly let flat is assumed to “embody” the current quality standard q_t that is assumed to grow at rate g^q :

$$q_t = q_0 (1 + g^q)^t, \quad (33)$$

which is driven by building technology and renovation and taken as exogenous. For simplicity I assume that the quality does not deteriorate over time but stays constant at its vintage level. A flat that is re-let after the dissolution of a contract is refurbished to the current quality standard. Note that although quality improvements apply only to the most recent vintage of flats, average quality across the stock, $\bar{q}_t = \sum_k \Psi_k q_{t-k+1} = q_t G(\frac{1}{1+g^q})$, also increases at rate g^q due to a composition effect—the same mechanism as for the growth rate of average rents discussed in the main text. A household with tenure k at date t therefore consumes the frozen vintage bundle

$$v_{k,t} = z_{1,t-k+1} q_{t-k+1}. \quad (34)$$

Let P_t^c denote the price of non-housing consumption, $P_{k,t}^z$ the price of one square meter of space for a renter in the k -th period of the rent, y_t^L the real expenditures each household devotes to purchases in period t (which are assumed to be identical across all renters),

²²It should be noted that the multiplicative specification embodies a substantive assumption: a small excellent dwelling and a large mediocre one are equivalent if they deliver the same v . This is restrictive, but it is the specification implicit in the standard semi-log hedonic regression.

and P_t the aggregate price index. For simplicity I use the terms *expenditures* and *income* interchangeably (thus abstracting from savings behavior). The budget constraint is thus given by:

$$P_t^c c_{k,t} + P_{k,t}^z z_{k,t} = P_t y_t^L. \quad (35)$$

Real per-household expenditures y_t^L are assumed to grow at the rate g^y (called g in the main text):

$$y_{t+1}^L = (1 + g^y) y_t^L. \quad (36)$$

Note that the use of P_t in (35) indicates that nominal incomes are assumed to be indexed to *measured* inflation π which corresponds to the empirically relevant case in which wage settlements track the published CPI. In Footnote 25 I discuss alternative conventions (e.g. when income is adjusted in line with non-housing consumption or an ideal price index). The growth rate of nominal income is denoted by $g^\eta = (1 + g^y)(1 + \pi) - 1$. Also note that quality appears in the utility function but not in the budget constraint, because quality is not something the household purchases separately. It is embodied in the stock and enters the household's opportunity set only through what must be paid per unit of space. A household cannot rent insulation without renting the wall it is attached to.

A.6.3 Demand, the constant expenditure share, and continuing renters

The Cobb–Douglas structure implies constant expenditure shares for new renters. In particular, for $k = 1$ the optimization of (31) with respect to (35) leads to:

$$c_{1,t} = (1 - \theta) \frac{P_t}{P_t^c} y_t^L, \quad z_{1,t} = \theta \frac{P_t}{P_{1,t}^z} y_t^L. \quad (37)$$

Thus, newly renting households allocate a fraction $(1 - \theta)$ of expenditures to non-housing consumption and a fraction θ to housing services: $\frac{P_t^c c_{1,t}}{P_t y_t^L} = (1 - \theta)$ and $\frac{P_{1,t}^z z_{1,t}}{P_t y_t^L} = \theta$. Total rental payments for new renters are given by $P_{1,t}^z z_{1,t}$. As mentioned above, quality has disappeared from the demand system entirely since q multiplies the housing sub-utility, but leaves the marginal rate of substitution between c and z untouched at any given (c, z) .

Continuing renters ($k \geq 2$) simply stay in their flat and pay the rent that adjusts according to the existing regulation. In particular, it is assumed that:

$$P_{k,t+1}^z = (1 + \omega) P_{k-1,t}^z \text{ for } k \geq 2. \quad (38)$$

The level of non-housing consumption for continuing renters is then simply given by the

rest of their period budget that is left after their rental payments. In other words:

$$z_{k,t} = z_{1,t-k+1} = \theta \frac{P_{t-k+1}}{P_{1,t-k+1}^z} y_{t-k+1}^L, \quad c_{k,t} = \frac{P_t}{P_t^c} y_t^L - \frac{P_{k,t}^z}{P_t^c} z_{k,t}. \quad (39)$$

These expressions can be further transformed by noting that

$$P_{k,t}^z z_{k,t} = (1 + \omega)^{k-1} \theta P_{t-k+1} y_{t-k+1}^L = \theta P_t y_t^L x_\omega^{k-1}, \quad x_\omega \equiv \frac{1 + \omega}{1 + g^\eta}, \quad (40)$$

indicating that the rent burden declines with tenure whenever $\omega < g^\eta$. Non-housing consumption of a tenure- k household and its aggregate follow as

$$c_{k,t} = \frac{P_t y_t^L}{P_t^c} (1 - \theta x_\omega^{k-1}), \quad C_t = \sum_{k=1}^{\infty} \Psi_k N_t c_{k,t} = \frac{N_t P_t y_t^L}{P_t^c} (1 - \theta G(x_\omega)), \quad (41)$$

using the definition of $G(\cdot)$ in (30).

A.6.4 Three prices for one dwelling

There exist three distinct definitions of rental prices for new-let flats that differ in the unit in which the price is expressed. Each successive definition strips out one further dimension of the object being priced:

$$\underbrace{P_{1,t}^v = P_{1,t}^z z_{1,t}}_{\text{per dwelling}}, \quad \underbrace{P_{1,t}^z}_{\text{per square meter}}, \quad \underbrace{P_{1,t}^q = \frac{P_{1,t}^z}{q_t} = \frac{P_{1,t}^v}{z_{1,t} q_t}}_{\text{per quality-adjusted square meter}}. \quad (42)$$

These correspond directly to observable data. $P_{1,t}^v$ is what a newly matched household actually pays and is what rent surveys record. In the main text this rental payment is denoted by $R_{1,t}$ (in order to simplify notation). $P_{1,t}^z$ is the headline euro-per-square-meter series published by statistical offices (and often also by listing platforms), and is the figure that dominates public discussion. $P_{1,t}^q$ is the hedonic price, recoverable only from a regression that controls for characteristics. The corresponding definitions for continuing contracts follow from (38). For instance, the per-square-meter rent of a tenure- k contract is $P_{k,t}^z = (1 + \omega)^{k-1} P_{1,t-k+1}^z$ and similarly $P_{k,t}^v = (1 + \omega)^{k-1} P_{1,t-k+1}^z z_{1,t-k+1}$ and $P_{k,t}^q = (1 + \omega)^{k-1} \frac{P_{1,t-k+1}^z}{q_{t-k+1}}$. For fixed tenure k , each of these prices grows at the same steady-state rate as its new-contract counterpart— π^z , π^v , and π^q , respectively. Note that since the factor $(1 + \omega)^{k-1}$ is constant over time the adjustment rate ω shapes the level profile across

tenure classes, but no steady-state growth rate. Across the three concepts, of course, the growth rates differ, as specified in Proposition 1 below.

A.6.5 Equilibrium rent

The demand for floor space of new renters is given by (37), i.e. $z_{1,t} = \theta \frac{P_t}{P_{1,t}^z} y_t^L$. Total demand is thus given by $\Psi_1 N_t \theta \frac{P_t}{P_{1,t}^z} y_t^L = \lambda N_t \theta \frac{P_t}{P_{1,t}^z} y_t^L$ and the equilibrium rent follows by equating it with the total supply of floor space available for new rents. I assume that the floor space supplied to the new-let market per contract, $z_{1,t}^s$, grows at g^z .

In equilibrium it has to hold that $z_{1,t} = z_{1,t}^s$ and the equilibrium price can thus be calculated as

$$P_{1,t}^z = \theta \frac{P_t y_t^L}{z_{1,t}^s}. \quad (43)$$

Note that although only newly let flats embody the current standard, every cohort's bundle is a lagged copy of the new-let bundle, so the cross-sectional averages

$$\bar{z}_t = \sum_{k=1}^{\infty} \Psi_k z_{1,t-k+1} = z_{1,t} G\left(\frac{1}{1+g^z}\right), \quad \bar{v}_t = v_{1,t} G\left(\frac{1}{(1+g^z)(1+g^q)}\right), \quad (44)$$

grow at the same rates g^z and $(1+g^z)(1+g^q) - 1$ as the new-let margin: the whole vintage profile shifts up uniformly, and the size and quality of continuing lets and of the average dwelling increase at the same steady-state rates as those of new lets.²³

Combining (43) with (42) yields the three price paths in closed form; their growth rates are collected in the following proposition.

Proposition 1 *The three rental prices on the new-let market grow at*

$$1 + \pi^v = 1 + g^\eta, \quad 1 + \pi^z = \frac{1 + g^\eta}{1 + g^z}, \quad 1 + \pi^q = \frac{1 + g^\eta}{(1 + g^z)(1 + g^q)},$$

i.e., to first order, $\pi^v = g^\eta$, $\pi^z = g^\eta - g^z$ and $\pi^q = g^\eta - g^z - g^q$ where $g^\eta = g^y + \pi$.

Note that the wedges between successive definitions are exactly the growth rates of the two physical dimensions, i.e. $\frac{1+\pi^v}{1+\pi^z} = 1 + g^z$ and $\frac{1+\pi^z}{1+\pi^q} = 1 + g^q$. The same rates apply to continuing contracts: for fixed tenure k , $P_{k,t}^z$ grows at π^z and the total $P_{k,t}^v$ at g^η .

²³ In fact, behind g^z lies an accounting identity: aggregate floor space equals households times average dwelling size, $Z_t = N_t \bar{z}_t$, so that $(1 + g^Z) = (1 + g^\eta)(1 + g^z)$ —only two of the three rates (household growth, construction, average size growth) can be set independently. If construction lags household formation, $g^Z < g^\eta$, average floor size shrinks, $g^z < 0$. Convergence of the averages in (44) requires $1 - \lambda < 1 + g^z$; analogous conditions $(1 - \lambda)x_\omega < 1$ and $(1 - \lambda)x_q < 1$ apply to (41) and (49).

Three implications follow immediately. First, expenditure per newly let dwelling tracks nominal income one-for-one, a direct consequence of unit elasticity: whatever happens to construction, demography, or building technology, the newly matched household spends the share θ of a growing income on its home. The square-meter price grows more slowly by g^z , because part of the rising outlay might buy additional space rather than dearer space. The quality-adjusted price grows more slowly still by g^q , because a further part buys better dwellings. Second, population growth alone is not a price driver. In the steady state growth rates of Proposition 1 g^n never appears directly, although it is indirectly captured by g^z (see Footnote 23). If there is a high rate of household formation it is likely that construction lags behind (at least for some time) thus implying a temporary shrinkage of average floor space with $g^z < 0$. It should also be noted that a demographically stagnant region that stops building entirely still sees prices rise with income. Third, rising prices are compatible with falling real costs. Whenever $g^n > g^z$, headline square-meter prices climb, which is the familiar stylized fact across nearly all developed economies. Yet this is entirely silent about P^q . If quality improves rapidly, the quality-adjusted price may be flat or falling even as the headline series rises. Only if $g^y > g^z + g^q$ —i.e. only if income growth outpaces the combined growth of space and quality—does the price of housing services rise relative to the general price level.

A.6.6 The true cost-of-living index

So far I have left the aggregate price index P_t (see equation (35)) unspecified. It is, however, needed to close the model and also for a complete macroeconomic and welfare analysis. In this section I first show how the set-up above can be used to derive a true cost-of-living index $\mathcal{P}_t$. The measured index P_t is then obtained in the next subsection by combining π^c with measures of rental inflation typically employed by statistical offices. The true index $\mathcal{P}_t$ derived here serves as the benchmark.

For the derivation of the true index one can use the unit-expenditure approach in terms of housing services $v_{k,t} = z_{k,t}q_{k,t}$ where the unit-expenditure function is defined as the minimum expenditure required to achieve a given utility level $\bar{u}$:

$$e(P_t^c, P_{k,t}^q; \bar{u}) = \min_{c_{k,t}, v_{k,t}} P_t^c c_{k,t} + P_{k,t}^q v_{k,t} \quad \text{s.t.} \quad c_{k,t}^{1-\theta} v_{k,t}^\theta \geq \bar{u}. \quad (45)$$

For Cobb–Douglas utility, the expenditure function is linear in the utility target,

$$e(P_t^c, P_{k,t}^q; \bar{u}) = \bar{u} \mathcal{P}_{k,t}, \quad (46)$$

where the unit-expenditure price index is

$$\mathcal{P}_{k,t} = \frac{(P_t^c)^{1-\theta} (P_{k,t}^q)^\theta}{(1-\theta)^{1-\theta} \theta^\theta}. \quad (47)$$

Because housing prices differ across renter types, the price index $\mathcal{P}_{k,t}$ is also type-specific.

Using equation (38) to write $P_{k,t}^q = P_{1,t-k+1}^q (1+\omega)^{k-1}$ and the definition $P_{1,t}^q = P_{1,t-k+1}^q (1+\pi^q)^{k-1}$ one can substitute for $P_{k,t}^q$ in (47) and write:

$$\mathcal{P}_{k,t} = \frac{(P_t^c)^{1-\theta} (P_{1,t}^q)^\theta}{(1-\theta)^{1-\theta} \theta^\theta} \left(\frac{1+\omega}{1+\pi^q} \right)^{\theta(k-1)} = \mathcal{P}_{1,t} \left(\frac{1+\omega}{1+\pi^q} \right)^{\theta(k-1)}. \quad (48)$$

Note that the square-meter price and quality appear in (47) only through the ratio $P^q = P^z/q$; neither enters separately. Two regions with different square-meter prices and different quality levels but the same P^q confront the household with identical costs of attaining a given level of utility, and are for welfare purposes the same region. Also note that these price indices $\mathcal{P}_{k,t}$ are meaningful even if the observed values for $c_{k,t}$ and $z_{k,t}$ are not optimally chosen (as is the case for the continuing renters with $k \geq 2$) since $e(\cdot)$ is a counterfactual—the minimum spending needed to achieve the given utility level $\bar{u}$ at the prices the household faces.

I define the overall index as the tenure-weighted average

$$\mathcal{P}_t = \sum_{k=1}^{\infty} \Psi_k \mathcal{P}_{k,t} = \mathcal{P}_{1,t} G(x_q), \quad x_q \equiv \left(\frac{1+\omega}{1+\pi^q} \right)^\theta, \quad (49)$$

where I use the definition of $G(\cdot)$ in (30). Since $G(x_q)$ is constant in the steady state, the “true” (i.e. theory-based) aggregate inflation is

$$\begin{aligned} 1 + \pi^{true} &\equiv \frac{\mathcal{P}_{t+1}}{\mathcal{P}_t} = \frac{\mathcal{P}_{1,t+1}}{\mathcal{P}_{1,t}} = (1 + \pi^c)^{1-\theta} (1 + \pi^q)^\theta \implies \\ \pi^{true} &\approx (1 - \theta) \pi^c + \theta \pi^q. \end{aligned} \quad (50)$$

Proposition 2 *The housing component of the true cost-of-living index is the growth rate of the quality-adjusted price P^q , weighted by the expenditure share θ . The square-meter price P^z and the price per dwelling P^v do not enter the ideal index.*

The ideal housing deflator is thus given by P^q and not by the typically used measure P^z . Space and quality are perfect substitutes at the margin in welfare terms (a one per

cent increase in either z or q raises v by one per cent). The former is captured by the conventional indices, while the latter is omitted and mistaken for inflation.

Note that the staggering of contracts affects the level of the index through $G(x_q)$ but not its steady-state growth rate: the rent-regulation parameter ω shapes the profile of prices across tenure classes, while inflation is only governed by the new-contract margin.

A.6.7 True and measured rental inflation

Proposition 2 identifies the growth rate of the quality-adjusted price π^q as the *true* rate of rental inflation, i.e. the growth rate of the price of one unit of housing services. The true rate of inflation is thus given by (50) as $\pi^{true} = (1 - \theta) \pi^c + \theta \pi^q$ where core inflation π^c is determined by monetary policy (see below). In practice, however, statistical offices work with measures that are not fully in line with this theoretical concept. In order to discuss the topic of measurement error in a concise way I assume that the statistical office adjusts observed rents only for fractions $\xi^z \in [0, 1]$ and $\xi^q \in [0, 1]$ of the two components of housing services—size and quality. Measured rental inflation, denoted in the following by π^h , thus is equal to the rental payment per dwelling adjusted by these factors.²⁴

$$\begin{aligned}\pi^h &= \pi + g^y - \xi^z g^z - \xi^q g^q = \pi^q + (1 - \xi^z)g^z + (1 - \xi^q)g^q \text{ i.e.} \\ \pi^h &= \pi + \chi + \mu,\end{aligned}\tag{51}$$

where

$$\chi = g^y - g^z - g^q \quad \text{and} \quad \mu \equiv (1 - \xi^z)g^z + (1 - \xi^q)g^q.\tag{52}$$

The measured excess of rental inflation over aggregate inflation thus consists of two conceptually distinct parts: the *fundamental component* $\chi = \pi^q - \pi$ reflects whether rent increases have been due to genuine improvements of housing conditions or whether they correspond to pure price effects, and the *measurement bias* $\mu \geq 0$ reflects the part of the improvement in housing services that the statistical office fails to record. Since the office combines the correctly measured π^c with π^h using the expenditure weight θ , measured aggregate inflation $\pi = (1 - \theta)\pi^c + \theta\pi^h$ follows by inserting for π^h from (51)

$$\pi = \pi^c + \frac{\theta}{1 - \theta} (\chi + \mu).\tag{53}$$

²⁴Note that Proposition 1 only refers to newly let rents. As remarked there, however, the average rent across the whole contract stock, $\sum_k \Psi_k P_{k,t}^z z_{k,t} = \theta P_t y_t^L G(x_\omega)$, grows at the same rate (see (40)).

Measured inflation π thus exceeds core inflation π^c by a *structural component* ζ defined as:

$$\zeta \equiv \frac{\theta}{1-\theta} (\chi + \mu) \quad (54)$$

a function of the fundamental component χ and the measurement bias μ . Note also that measured inflation overstates the true cost-of-living index by $\pi - \pi^{true} = \theta\mu$: the fundamental component is part of the true cost of living, while the bias is not.²⁵

A.6.8 Contribution of rental inflation to aggregate inflation

Equations (51)–(53) nest the common concepts that are used for inflation measurement.

- The purest form is an index of total rents per dwelling with no further adjustment for shifts in size or quality ($\xi^z = \xi^q = 0$). It follows that $\mu = g^z + g^q$, $\pi^h = \pi^v = \pi + g^y$ and $\pi = \pi^c + \frac{\theta}{1-\theta} g^y$. In this case the actual improvements of housing services g^z and g^q do not play a role.
- The typical practice is to monitor rents per square meter. This approach fully corrects for the *size* of flats ($\xi^z = 1$) but not (or at most for a tiny fraction) for their *quality*. For $\xi^q = 0$ one gets $\mu = g^q$ and $\pi^h = \pi^z = \pi + g^y - g^z$. Aggregate inflation is in this case given by $\pi = \pi^c + \frac{\theta}{1-\theta} (g^y - g^z)$.
- Only the use of hedonic methods could reduce the bias. For a fully quality-adjusted (hedonic) index ($\xi^z = \xi^q = 1$) it holds that $\mu = 0$ and measured rental inflation corresponds to its theoretical counterpart: $\pi^h = \pi^q$. Even in this case, however, the structural component is not eliminated if the fundamental component is positive ($\chi > 0$). In particular, $\pi = \pi^c + \frac{\theta}{1-\theta} (g^y - g^z - g^q)$. If, e.g., the average flat size is constant over time ($g^z = 0$) then the aggregate inflation rate will still grow above the underlying core inflation rate π^c as long as quality improvements are below the real income growth rate.

²⁵ Note that in the derivation of (53) I assume that nominal variables are themselves indexed to *measured* inflation π and not to the true inflation rate π^{true} as defined in (50). If one would assume that nominal income growth follows the latter concept then the structural component comes out as $\zeta = \frac{\theta}{1-\theta} \chi + \theta\mu$. The measurement bias enters measured aggregate inflation then only with weight θ rather than $\frac{\theta}{1-\theta}$: it operates only through the housing component of the index and does not feed back into the measurement of rents, whereas the fundamental component χ is also part of *true* inflation and therefore still carries over one to one. Finally, if one would assume that income is paid or valued in terms of the non-housing good, i.e. the budget constraint (35) reads as $P_t^c c_{k,t} + P_{k,t}^z z_{k,t} = P_t^c y_t^L$ then one would get $\zeta = \theta(\chi + \mu)$.

The magnitudes involved are not negligible. With a housing share of $\theta = 0.331$, a real growth rate of $g^y = 2\%$ and constant average flat size ($g^z = 0$) the structural component of measured inflation amounts to $\frac{0.331}{0.669} \times 2 \approx 1$ percentage point per year if $\pi^h = \pi^z$. Whether this percentage point is a measurement bias or a fundamental drift depends on the underlying quality improvements. If quality improves at the same rate as incomes then everything is a measurement bias. If there are no quality improvements whatsoever then the 1 p.p. is a fundamental trend. The decomposition does not change the result, however, that measured inflation lies above the core inflation rate. Errors of this size are consequential for the measurement of real wage growth and the conduct of monetary policy.

Put differently, measured rental inflation can exceed aggregate inflation for quite different reasons. On the one hand, there may be a true *fundamental* component: if flats do not improve in size or quality ($g^z = g^q = 0$) while incomes grow, then $\chi = g^y$ and $\mu = 0$ under every measurement concept—rents genuinely rise faster than the aggregate price level, and the statistics record this correctly. On the other hand, the excess may be a pure *measurement* effect: if the quality of flats grows in line with real incomes ($g^z = 0$, $g^q = g^y$), then the fundamental component vanishes ($\chi = 0$). Yet under non-hedonic measurement $\mu = g^y$, so that the recorded rate is still $\pi^h = \pi + g^y$. In both polar cases measured aggregate inflation contains a structural component $\zeta = \frac{\theta}{1-\theta}g^y$, i.e. a term by which it exceeds the underlying core inflation π^c .

A.6.9 Cash in advance constraint

The relations derived so far determine all inflation rates only up to a common level: they fix the wedges between π^h , π and π^c , but not the rates themselves. To determine the level of nominal variables one can use a simple formulation for monetary policy. In particular, assume that all households face a cash-in-advance (CIA) constraint requiring that their nominal money balances cover nominal expenditures on the non-housing good. Imposing the constraint with equality and using aggregate consumption (see (41)) implies:

$$P_t^c C_t = N_t P_t y_t^L (1 - \theta G(x_\omega)) = M_t, \quad (55)$$

where $M_t = M_0(1 + g^m)^t$ is the aggregate money supply. Since the term in brackets is constant in the steady state, taking growth rates gives $(1 + g^n)(1 + g^\eta) = 1 + g^m$, i.e. to first order

$$g^\eta = g^y + \pi = g^m - g^n. \quad (56)$$

Money growth thus pins down measured inflation $\pi = g^m - g^n - g^y$. Core inflation rate π^c then follows residually as $\pi^c = \pi - \zeta$ from (53).

A.6.10 From the model to the hedonic regression

This subsection shows how the hedonic regression (16) of the main text maps into the framework of this section, and what the time coefficient δ and the tenure discount γ measure in terms of the model's growth rates. Consider an observation i : a rental contract with tenure duration $Dur_i = k_i - 1$, observed at date t_i and therefore signed in period

$$\tau_i = t_i - Dur_i. \quad (57)$$

Step 1: The per-square-meter rent of contract i in the model. By the adjustment rule (38), the per-square-meter rent of a contract of tenure k_i equals the new-contract rent of its signing period, carried forward at the regulated rate ω :

$$P_{k_i, t_i}^z = (1 + \omega)^{Dur_i} P_{1, \tau_i}^z. \quad (58)$$

By the definition of the quality-adjusted price in (42), the new-contract rent per square meter is the price per unit of housing services times the quality embodied in the signing period's vintage, $P_{1, \tau}^z = P_{1, \tau}^q q_\tau$, and on the balanced-growth path of Proposition 1 the quality-adjusted price grows at π^q , i.e. $P_{1, \tau}^q = P_{1, 0}^q (1 + \pi^q)^\tau$. Substituting both into (58) and taking logarithms yields

$$\ln P_{k_i, t_i}^z = \ln P_{1, 0}^q + \tau_i \ln(1 + \pi^q) + Dur_i \ln(1 + \omega) + \ln q_{\tau_i}. \quad (59)$$

Eliminating the signing period via (57) gives

$$\ln P_{k_i, t_i}^z = \ln P_{1, 0}^q + t_i \ln(1 + \pi^q) + Dur_i [\ln(1 + \omega) - \ln(1 + \pi^q)] + \ln q_{\tau_i}. \quad (60)$$

The observed per-square-meter rent thus contains a time trend (reflecting the growth of the quality-adjusted price), a duration term (reflecting that continuing contracts are carried forward at ω rather than repriced at π^q), and the quality of the contract's vintage.

Step 2: Quality as characteristics. In the model, quality is a scalar index that grows at rate g^q across vintages. In the data there is no such index; instead, quality is described by a vector of (mostly binary) characteristics $\mathbf{X}_i$. The two are connected by the standard

hedonic assumption that log quality is linear in characteristics,

$$\ln q_i = \mathbf{X}_i' \beta + u_i, \quad (61)$$

where u_i collects unobserved quality components. The crucial observation is that quality *growth* then appears in the data not as a trend in any individual regressor but as a drift in the *composition* of characteristics across vintages: flats of more recent vintages are more likely to have central heating, to fall into a higher quality category, or to belong to a more recent construction period. Formally, I decompose the vintage drift of log quality into an observed and an unobserved part,

$$E[\mathbf{X}_i' \beta \mid \tau] = \mathbf{c}_x + \xi^q \tau \ln(1 + g^q), \quad E[u_i \mid \tau] = \mathbf{c}_u + (1 - \xi^q) \tau \ln(1 + g^q), \quad (62)$$

with $\mathbf{c}_x + \mathbf{c}_u = \ln q_0$, so that the two parts add up to the model's quality path $\ln q_\tau = \ln q_0 + \tau \ln(1 + g^q)$. Equation (62) *defines* the recording fraction ξ^q of Section A.6.7 in econometric terms: it is the share of the vintage drift in log quality that is spanned by the observable characteristics. Writing $u_i = \mathbf{c}_u + (1 - \xi^q) \tau_i \ln(1 + g^q) + \varepsilon_i$ with $E[\varepsilon_i \mid \tau_i] = 0$ isolates the mean-zero residual.

Step 3: The estimating equation. Substituting (61)–(62) into (60) and again eliminating $\tau_i = t_i - Dur_i$ from the unobserved drift term yields

$$\ln Rentsqm_i = \alpha + \mathbf{X}_i' \beta + \gamma Dur_i + \delta t_i + \varepsilon_i, \quad (63)$$

which is exactly specification (16) of the main text, with $\alpha = \ln P_{1,0}^q + \mathbf{c}_u$ and

$$\begin{aligned} \delta &= \ln(1 + \pi^q) + (1 - \xi^q) \ln(1 + g^q) \approx \pi^q + (1 - \xi^q) g^q \\ &= \pi + g^y - g^z - \xi^q g^q = \pi^h, \end{aligned} \quad (64)$$

$$\gamma = \ln(1 + \omega) - \delta \approx \omega - \delta. \quad (65)$$

Interpretation. Equation (64) states that the time coefficient of the hedonic regression estimates precisely the *measured* rental inflation concept π^h of the model, with the recording fraction ξ^q determined by the richness of the control vector $\mathbf{X}_i$. The nested cases of Section A.6.8 reappear as regression specifications: without quality controls ($\xi^q = 0$) the trend recovers $\pi^z = \pi + g^y - g^z$; with complete controls ($\xi^q = 1$) it recovers the ideal concept $\pi^q = \pi + g^y - g^z - g^q$; and replacing the dependent variable by the log of *total* rents removes the size adjustment and recovers $\pi^v = \pi + g^y$ (the per-square-meter nor-

malization of $Rentsqm_i$ is what implements $\xi^z = 1$). Since δ identifies $\pi^h = \pi + \chi + \mu$ but not the split between χ and μ , the regression shares the observational-equivalence property of Section 3.1: separating the fundamental component from the measurement bias would require knowledge of the unobserved part of quality growth, which is unavailable by construction.

The relation $\gamma + \delta = \ln(1 + \omega) \approx \omega$ of equation (65) provides a simple consistency check that holds in *every* specification: over one year, a given contract advances by one unit in t_i and one unit in Dur_i simultaneously, and its rent grows at the regulated rate ω , so the two coefficients must sum to ω . It also explains why the estimated tenure discount depends on the rent concept: $\gamma \approx \omega - \pi^v$, $\omega - \pi^z$ and $\omega - \pi^q$ for the per-dwelling, per-square-meter and hedonic specifications, respectively.

B Data

B.1 Data description

The main data sources are the Scientific Use Files (SUF) from Statistics Austria’s Microcensus Labour Force Survey/Housing Survey, waves 2005–2024, accessed via the AUSSDA Dataverse (Statistics Austria 2025). See: <https://data.aussda.at/>. Each wave is a separately published dataset in AUSSDA with its own DOI. Wave-specific DOIs can be retrieved from the dataset landing pages and are available upon request.

B.2 Variable definitions and descriptive statistics

Table B1 lists the sources and definitions of the main variables used in the paper. Over the years, the Microcensus has changed a number of variable names, coding schemes and question wordings. I have constructed variables that are as consistent as possible over the entire time span; details of the harmonization are available upon request. Some residual ambiguity remains. The contract type “private”, for example, also comprises dwellings provided by the employer (*Dienstwohnungen*), which are frequently let free of charge or at a nominal rent.

Of particular importance is the definition of the rent. In line with the concept of the model, the rent should refer to the payment for the housing service alone and exclude all other components of housing expenditure, in particular operating costs (*Betriebskosten*), heating and other running costs. The survey question, however, asks for the

total monthly payment for the dwelling (“How much was paid last month, i.e. in [month], for this dwelling, including operating costs and other housing costs?”). Subsequent questions ask whether this amount includes operating costs, heating costs and the cost of a parking space (*Autoabstellplatz*) and, if so, how much each of these components amounts to. Unfortunately, the information on heating and parking does not seem to be entirely consistent over time. For parking spaces, the share of respondents reporting that the cost is included in the total rises considerably over the sample period, which is more likely to reflect changes in the questionnaire than in actual contracts. For heating, the indicator of whether costs are included is not available for the entire time span, and the reported amounts remain almost constant in nominal terms over two decades, which is implausible given the development of energy prices.

In order not to contaminate the rent series with these definitional inconsistencies, I subtract only the operating costs from total housing expenditure and leave the remaining components in place. Operating costs are reported reliably and consistently across all waves, so that the resulting *net rent* is comparable over time. The net rent may therefore still include heating and parking costs for some households. This slightly overstates the level of rents, but since the treatment is identical for old and new contracts, it does not affect the comparison between the two groups that is at the center of the analysis.

Table B2 reports the weighted summary statistics for the resulting sample.

C Additional empirical results

In this part of the appendix I collect various additional empirical results. In Section C.1 I present additional information concerning the stylized facts as reported in Section 4.4.1 of the paper. In Section C.2 I look in more detail at the different subsegments of the rental market while in Section C.3 I report how the composition of the shelter index in Austria would change if one were to use a new-tenant index in contrast to the current all-tenant index.

C.1 Stylized facts in the model and in the data

The simple theoretical model makes a number of predictions concerning the contract duration, the tenure discounts and the time dummies. In particular, the model implies a linear relation between (i) log relative frequencies and duration and (ii) log rents and duration or elapsed time. As mentioned in the text, this linear relation only holds, however, if all

Table B1: Variable definitions and wave-specific source variables (Part I)

Variable(s)	Source variables (by wave)	Definition
<i>Rental Information</i>		
Rent level: rentsqm, logrentsqm	All waves: wkges, wkbetr, wm2 (missing if wkges== -3 or wkbetr== -3)	rentsqm=(wkges-wkbetr)/wm2; logrentsqm=log(rentsqm)
Contract duration: duration	All waves: arefwo, wvertr	duration=(arefwo - wvertr)/365.25 (years)
New contract: newcontract	duration	newcontract = 1 if duration ∈ (0, 1]
Contract type: private, municipal, cooperative	2005Q1–2013Q4: wrechtk 2014Q1–2020Q4: wrecht, wrecht2 2021Q1+: wrecht1, wrechthm	private=1 if private housing; municipal=1 if municipal hous- ing; cooperative=1 if cooperative housing;
<i>Location</i>		
Region: vienna, center-east, west, south	All waves: xnuts2	vienna=1 if Vienna; center-east=1 if Lower Austria or Upper Austria or Styria; west=1 if Salzburg or Tyrol or Vorarlberg; south=1 if Carinthia or Burgen- land;
Urbanization: dxurblo, dxurbmid, dxurbhigh	All waves: xurb	dxurblo=1 if xurb==3 (low); dxurbmid=1 if xurb==2 (mid); dxurbhigh=1 if xurb==1 (high);
<i>Building</i>		
Construction Year: dwerrcat1-dwerrcat7	2005Q1–2020Q4: werr with year- specific recodes 2021Q1+: awerrkat	dwerrcat1=1 for <1945; dwerrcat2=1 for 1945–60; dwerrcat3=1 for 1961–70; dwerrcat4=1 for 1971–80; dwerrcat5=1 for 1981–2000; dwerrcat6=1 for 2001–2010; dwerrcat7=1 for 2011+ or built within the last 5 years;
Number of apartments: dwanz1_2	2005Q1–2020Q4: wanzw 2021Q1+: wanzwo	dwanz1_2=1 if one or two apts;
<i>Dwelling Size</i>		
dwm2quintstatat1– dwm2quintstatat5	All waves: wm2 (flat size in m^2)	dwm2quintstatat1=1 ... (0, 48], dwm2quintstatat2=1 ... (48, 60], dwm2quintstatat3=1... (60, 72], dwm2quintstatat4=1... (72, 85], dwm2quintstatat5=1... (85, ∞).

Table B1: Variable definitions and wave-specific source variables (Part II)

Variable(s)	Source variables (by wave)	Definition / categories
<i>Category</i>		
dkatbcd	All waves: xwauskat	dkatbcd = 1 if quality categories B/C/D
<i>Heating</i>		
dwheiz1-dwheiz4	2005Q1-2011Q4: wheiz 2012Q1-2020Q4: wheiz 2021Q1+: wheizart	dwheiz1=1: district heating; dwheiz2=1: house central; dwheiz3=1: apartment/floor central; dwheiz4=1: single-room or no heating;

Table B2: Summary Statistics (weighted)

	N	Mean	SD	Min	Max
rentsqm	126068	5.73	3.172	0.00	58.33
logrentsqm	125569	1.59	0.601	-4.94	4.07
duration	126068	11.80	14.124	-1.00	120.54
newcontract	125936	0.13	0.334	0.00	1.00
private	126068	0.45	0.497	0.00	1.00
municipal	126068	0.18	0.383	0.00	1.00
cooperative	126068	0.38	0.485	0.00	1.00
vienna	126068	0.43	0.495	0.00	1.00
center-east	126068	0.36	0.479	0.00	1.00
west	126068	0.15	0.355	0.00	1.00
south	126068	0.07	0.248	0.00	1.00
dxurbldw	126068	0.15	0.358	0.00	1.00
dxurbmid	126068	0.24	0.427	0.00	1.00
dxurbhigh	126068	0.61	0.488	0.00	1.00
dwerrcat1	126068	0.28	0.450	0.00	1.00
dwerrcat2	126068	0.13	0.337	0.00	1.00
dwerrcat3	126068	0.14	0.347	0.00	1.00
dwerrcat4	126068	0.11	0.314	0.00	1.00
dwerrcat5	126068	0.19	0.389	0.00	1.00
dwerrcat6	126068	0.08	0.265	0.00	1.00
dwerrcat7	126068	0.08	0.264	0.00	1.00
dwanz1_2	126068	0.08	0.274	0.00	1.00
dwm2quintstatat1	126068	0.22	0.413	0.00	1.00
dwm2quintstatat2	126068	0.22	0.413	0.00	1.00
dwm2quintstatat3	126068	0.18	0.380	0.00	1.00
dwm2quintstatat4	126068	0.20	0.397	0.00	1.00
dwm2quintstatat5	126068	0.19	0.394	0.00	1.00
dkatbcd	126068	0.09	0.285	0.00	1.00
dwheiz1	126068	0.41	0.492	0.00	1.00
dwheiz2	126068	0.24	0.428	0.00	1.00
dwheiz3	126068	0.19	0.394	0.00	1.00
dwheiz4	126068	0.16	0.364	0.00	1.00

model parameters (growth rates, separation probability etc.) are constant and I study the correspondence between the theoretical predictions and the data in Section 4.4.1. In this part of the appendix I add more details to this analysis. In particular, in the main part of the paper I have mainly used anti-log transformation in order to discuss the result in the form of percentage changes which are easier to interpret. For short time intervals these two approaches lead to very similar results (due to the fact that $\ln(1+x) \approx x$ and $\ln(1 + \frac{x_t - x_s}{x_s}) = \ln(\frac{x_t}{x_s}) \approx \frac{x_t - x_s}{x_s}$ for $t > s$). Over longer intervals (i.e. when one compares rents over longer time spans or contracts with very different durations) this approximation is, however, less accurate.

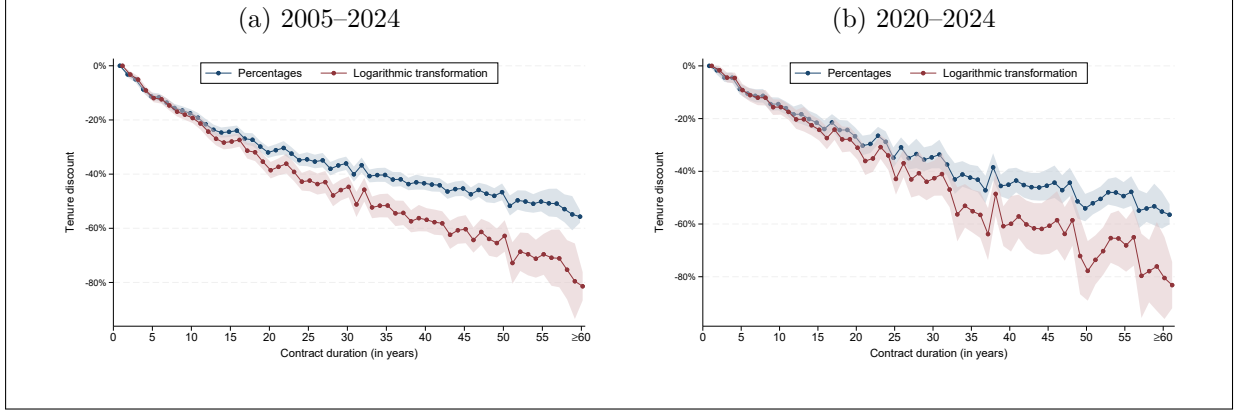
C.1.1 Tenure discounts

Result 3 of the theoretical model states that the logarithm of the tenure discount is linear in the contract duration k . I have derived it there for the rents per dwelling $R_{kt}^{old} = P_{kt}^{v,old}$ but it holds for any rent measure $P_{kt}^{h,old}$ and is given by: $\ln(P_{kt}^{h,old}) = \ln(P_t^{h,new}) - (k-1)(\ln(1+\pi^h) - \ln(1+\omega))$ (where I leave out the index j). In the main text of the paper I have illustrated the size of tenure discounts in percentage points, i.e. $\frac{P_{kt}^{h,old}}{P_t^{h,new}}$, which is easier to interpret (see Figure 2b). Even in this form the relation appears quite linear. It is, however, interesting to also show the pattern of tenure discounts in the logarithmic form. This is done in Figure C1 for the entire market where for the sake of comparison I also repeat the representation of Figure 2b. As one can see, for shorter durations the two representations lead to almost indistinguishable results while for longer durations the logarithmic transformation overestimates the underlying percentage changes. The theoretical prediction of a linear relation between the logarithmic rent and the contract duration is, however, strongly confirmed by the data. The tenure discount for 30 years is almost exactly half the size of the one for 60 years.

C.1.2 Time dummies

A similar analysis can also be conducted for the time dummies. In particular, the theoretical model predicts for rents per dwelling that $R_t^* = R_0 (1 + \pi^h)^t$ (see equation (2) where I write $\pi^h = \pi^v = \eta$) which implies a linear relation between the logarithmic rent and the time trend: $\ln(R_t^*) = \ln(\bar{R}_t^{new}) = \ln(R_0) + t \times \ln(1 + \pi^h)$. Similarly, $\ln(\bar{R}_t^{old}) = \ln(\Omega_0) + t \times \ln(1 + \pi^h)$ where Ω_0 is a constant that follows from (7). Parallel equations hold for the other rent measures P^z and P^q . In the main text of the paper I have again illustrated the size of time dummies (for the quality-adjusted rent) in

Figure C1: Tenure discounts in logs and in percentage terms



Note: The figure shows the pattern of tenure discounts in percentage terms $\frac{P_k^{h,old}}{P_k^{h,new}}$ together with the logarithmic transformation $\ln(P_k^{h,old}) - \ln(P_k^{h,new})$ using for P^h the specification with quality-adjustments. *Data source:* Statistics Austria (2025).

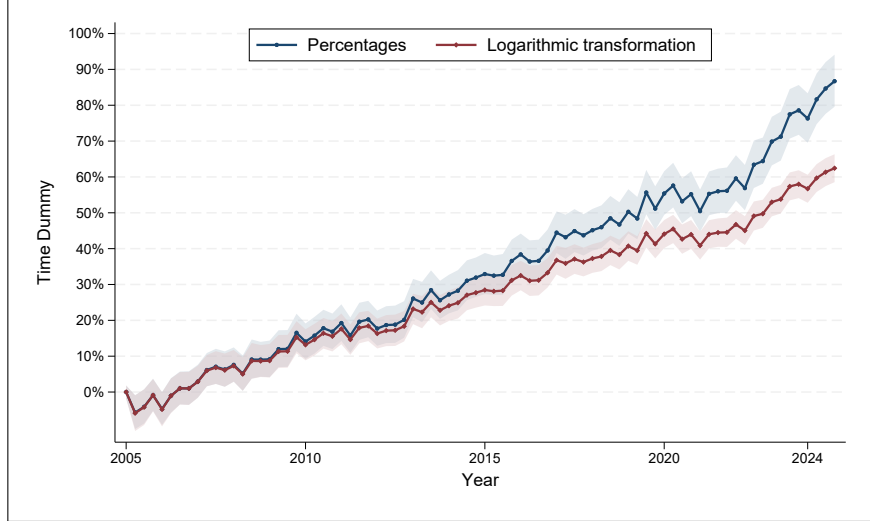
percentage points but in Figure C2 I also show the logarithmic expression. The picture shows again that the logarithmic approximation is quite accurate for shorter time periods but the deviations grow larger for longer periods.

C.1.3 Difference in rental inflation between old and new contracts

In Section 3.2 I have shown that structural shifts in the rental market can lead to long adjustment periods in which the growth rate of continuing and new rents might deviate from each other. I have illustrated this with the case of a steady increase in the separation probability (or a steady decrease in the contract duration) as could be observed in the private market in Austria. In Figure 6 I have shown that this can increase rent inflation by up to 0.3 percentage points.

In a next step one can investigate whether this pattern is also reflected in other submarkets. In particular, the examples of Figures 1 and 6 suggest that an increase in n and/or s lowers the average contract duration and thereby raises the growth rate of continuing relative to new rents (abstracting for the moment from any other supply or demand influences). The model thus predicts a negative relation between the change in average duration and the growth differential $\pi^{h,old} - \pi^{h,new}$. In Figure C3 I plot the difference in growth rates of old and new contracts against the change in the average duration between early (2005–2009) and late (2020–2024) periods for a sample of 16 submarkets. As predicted by the model, there seems to be a negative relation between

Figure C2: Time dummies in logs and in percentage terms



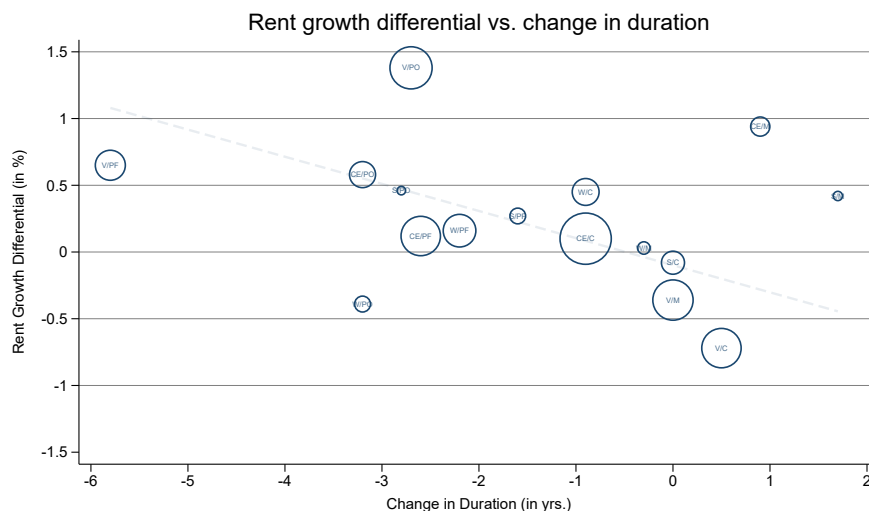
Note: The figure shows the pattern of time dummies (for old contracts) in percentage terms $\frac{P_t^{h,old}}{R_0^{h,old}}$ together with the logarithmic transformation $\ln(P_t^{h,old}) - \ln(P_0^{h,old})$ using for P^h the specification with quality-adjustments. *Source:* Statistics Austria (2025); own calculations.

these magnitudes (which is statistically significant if one leaves out the municipal rents).

C.1.4 Average flat size and expenditure share

The *net rent expenditure share* is defined as the ratio of the monthly rent, net of operating costs, to the monthly net income of the respondent: $\sigma_{i,t}^{net} = R_{i,t}/y_{i,t}^{L,net}$. Since the income measure refers to net earnings from the main dependent employment, I restrict the sample to employed renters (ILO definition) below the age of 65. As the income information is available in the Microcensus only from 2011 onwards, the analysis covers the period 2011–2023. Observations with expenditure shares above one are excluded, and all averages are computed using survey weights. The pattern in Figure C4a contains two interesting results. First, the average net expenditure share for new contracts is remarkably stable over time, fluctuating narrowly around 25% without a pronounced trend—in line with the constant expenditure share implied by the Cobb–Douglas specification of the model. Second, the share is considerably higher for new contracts (25% for tenures below one year) than for older contracts (21%). This pattern, too, follows from the model: new renters choose their flat at the current market rent and thus spend the full share θ of their income, while the rent burden of continuing tenants declines with tenure as long as the adjustment rate of existing contracts falls short of nominal income growth ($\omega < \eta$).

Figure C3: Rent growth differential vs. change in duration



Note: The figure plots the difference in rent growth for old and new contracts against the change in contract duration between early (2005–2009) and late (2020–2024) periods together with a linear fit. *Source:* Statistics Austria (2025); own calculations.

In addition it is interesting to look at the development of dwelling size. As shown in Figure C4b the average size of rental dwellings has been essentially flat over the whole period 2005–2024: it fluctuates narrowly around 68–69 m², with 68.1 m² at the beginning and 68.8 m² at the end of the sample period. This supports the benchmark assumption of the model that the size of flats remains constant over time ($g^z = 0$), which is also used in the calibration of the structural component. Interestingly, newly let flats are on average somewhat *smaller* than the stock of continuing contracts (65.1 m² versus 68.9 m²). This gap does not reflect shrinking dwellings — it is roughly constant over time—but rather the composition of the new-let market, in which smaller urban and fixed-term flats with high turnover are overrepresented. Since the gap is stable, it affects the levels but not the growth rates on which the analysis rests.

Finally, one can look at the average number of household members. Figure C4c shows a slight decline over the sample period, from about 2.03 members in 2005 to 1.91 in 2024, or roughly 0.33% per year. The decline is of similar magnitude in both segments indicating that it reflects a general demographic development—the secular rise of single-person households—rather than anything specific to the tenure structure of the rental market.

Since average flat size changes little over the period, this translates almost one-for-one into rising floor space per household member, which increases from 42.0 m² to 44.2 m²,

again about 0.27% per year. The level of per-capita space is systematically lower for new contracts which again has to do with the fact that newly let flats are on average smaller.

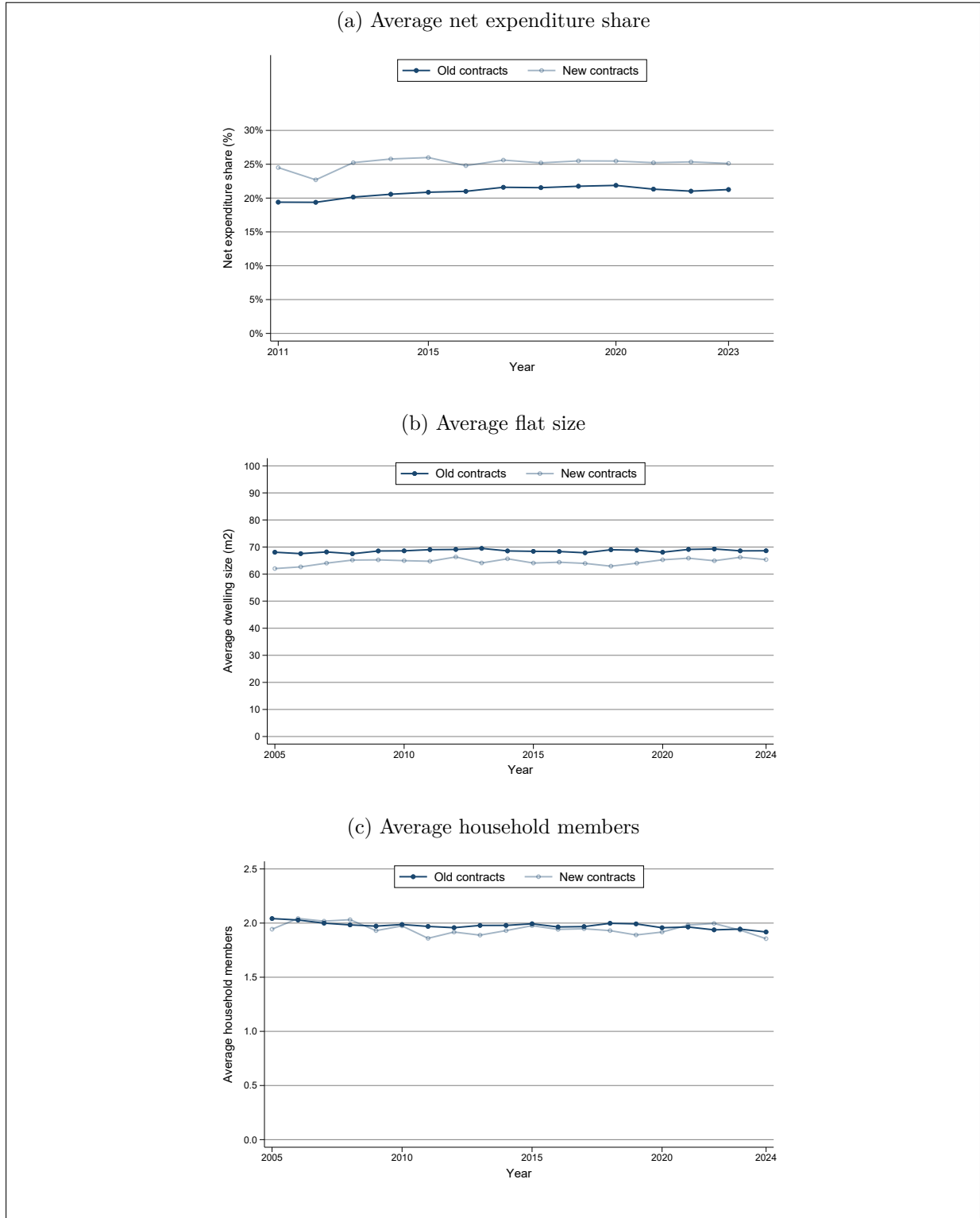
C.2 Heterogeneous markets—Stylized facts

In this appendix I collect the results for various segments of the rental market. I focus on heterogeneity along two main dimensions: contract type (private, municipal and cooperative rents) and region (Vienna, Center/East, West, South). In particular, I focus on a contract-specific split, a regional split and also a submarket-split (that differentiates by both contract type and region).

Identifying the most appropriate level of disaggregation is not straightforward: it should not be too detailed, yet fine enough to capture the most relevant divisions and shifts in the market. This involves a trade-off between defining sufficiently small and specific submarkets and maintaining enough observations for further distinctions, such as between older and newly built dwellings. In the text, I have often distinguished between six groups: municipal rents, cooperative rents, and private rents, where the latter are further divided into fixed-term and unlimited contracts and according to whether the dwelling is located in a building constructed before 1945 (and thus falls under the second-generation regimes of reference rent or category rent). In this appendix, I abstract from the distinction between fixed-term and unlimited contracts. This leaves four contract types: private rents in buildings constructed before 1945 (“prewar regulated”, i.e. reference or category rent), private rents in buildings constructed after 1945 (“postwar free rents”), municipal rents and cooperative rents.

The regional differences are primarily driven by urbanization, economic activity, and local regulations. Vienna, the capital, has a unique housing model with a large share of municipal and cooperative housing. Due to strong population growth over the past two decades, the rental market in Vienna is increasingly tight, a trend that also applies to other major cities such as Salzburg and Innsbruck (where limited land availability and strong tourism-driven demand has further increased the housing shortages). Rural areas generally have lower rental and property prices, but fewer rental options, as homeownership is more common. Additionally, the Western regions typically experience higher property prices, influenced by their proximity to Switzerland and Germany. For most of the analyses I will work with four regions. Vienna is kept as a separate category whereas I subsume Lower Austria, Upper Austria, and Styria into a Center/East region. Salzburg, Tyrol, and Vorarlberg, on the other hand, are grouped into the West region while Burgen-

Figure C4: Average flat size and net expenditure share



Note: Panel (a) shows the average net rent expenditure share—the monthly rent net of operating costs relative to the monthly net income of the respondent—for employed renters below the age of 65 (available from 2011 onwards); panel (b) shows the average size of rental dwellings (in m²), panel (c) the average members per household, both for 2005–2024. All panels distinguish between new contracts (tenure below one year) and older contracts. All averages are computed using survey weights. *Source:* Statistics Austria (2025); own calculations.

land and Carinthia form the South region. A finer differentiation is often not reasonable due to the small number of observations for some states (although I use it for some of the cross-submarket regressions).

In the first subsection of this section I present and discuss some important contract characteristics for the period 2020–2024, including the shares, contract durations, the percentages of new and fixed-term contracts, the average growth rates and the tenure discounts. In the second subsection I focus on changes over time (showing results for the entire sample together with the ones for an early and a late period), again for various characteristics of the contract but also characteristics of the dwelling (like average flat size) and the net expenditure shares.

C.2.1 Heterogeneity (contract type and region), 2020–2024

In Table C1 I summarize the main properties of these disaggregated splits for the period 2020–2024 to get a first impression.²⁶ The table indicates that private and cooperative housing are the most common forms of rental dwellings in Austria (46% and 38%, respectively). Private rentals differ from the two types of social housing in several key aspects. Notably, the share of new contracts is significantly higher in the private sector (24% compared to less than 10%), and fixed-term contracts are far more prevalent (50% versus less than 6%). Consequently, the average rental contract duration is considerably shorter in the private sector, averaging 7 years, compared to 13 and 17 years in the cooperative and municipal housing sectors, respectively. Additionally, (quality-adjusted) rent growth has been more pronounced in the private sector, with an increase of 97% from 2005 to 2024, compared to around 70% in the social housing sectors. This is also reflected in a tenure discount of nearly 2% per year—significantly higher than in the other two sectors.

In the second block of Table C1 I turn to the regional disparities. Vienna shows the largest share of rental dwellings (41%), followed by the Center/East region (37%). The average characteristics of rental contracts also differ significantly across several dimensions. For example, the contract duration and the average rent growth rate is notably higher in Vienna than in the rest of Austria. However, these differences must be interpreted with caution, as they primarily reflect the varying composition of contract types

²⁶Note that there are slight differences from the shares reported in column 2 of Table 1, which also refer to the 2020–2024 average. These differences arise from small definitional discrepancies. In Table C1, I differentiate only by the building’s construction period—postwar (≥ 1945) versus prewar (< 1945)—and I do not account for apartment size (i.e., whether it is smaller than 30 m² or larger than 130 m²). Furthermore, I include only observations for which the data contain information on whether the contract is of fixed duration. This restriction excludes about 1.1% of all observations.

Table C1: Contract characteristics by submarket and region

Submarket	Size (%)	Dur. (years)	New (%)	Fixed (%)	Fix/New (%)	LastTD (%)	Growth (%)	Ten.Disc. (%)
	2020-24					2005-24		
All	100.0	10.8	15.2	25.8	60.1	85.48	3.33	-1.34
Priv./Post	26.5	4.2	27.8	60.1	79.9	95.83	3.47	-1.72
Priv./Pre	19.6	11.1	18.7	36.8	69.7	97.83	3.93	-2.22
<i>Private</i>	46.1	7.1	23.9	50.2	75.6	96.68	3.66	-1.94
Munic.	15.7	17.0	5.6	3.5	18.3	72.61	2.95	-1.14
Coop.	38.2	12.7	8.7	5.6	16.6	69.66	2.86	-0.66
Vienna	41.0	13.6	11.7	20.1	58.0	99.96	3.71	-1.74
Center/East	36.8	9.1	16.4	22.1	49.5	70.80	3.14	-1.22
West	15.6	8.0	22.3	51.9	83.9	77.83	3.23	-1.47
South	6.6	10.1	13.3	17.0	44.9	47.54	2.72	-0.98
CE/C	18.5	11.5	10.1	3.6	10.1	67.52	2.77	-0.75
Vie/Pre	12.5	13.2	16.0	31.8	67.3	108.70	4.24	-2.36
Vie/M	11.4	18.0	4.0	0.6	2.5	73.00	2.92	-1.18
CE/Post	10.9	4.3	26.2	50.5	72.1	70.45	3.13	-1.53
Vie/C	10.9	14.7	5.8	2.5	10.5	70.75	2.91	-0.49

Note: The table shows important characteristics of rental markets, disaggregated by contract type, region and type-and-region (for five out of sixteen submarkets). The values are population-weighted and refer to the entire period 2020–2024 except for the last three columns that are based on the entire period 2005–2024. LastTD refers to the last time dummy and is the average of the time dummies in the hedonic regression for the year 2024 while the average growth rate comes from a model with interaction effects (see Appendix D.2). The tenure discount is the percentage reduction in the rent per year of contract duration. *Source:* Statistics Austria (2025); own calculations.

across regions. In both Vienna and the Center/East region, for instance, the share of private rentals is similar (between 40% and 45%), but Vienna has a much higher share of municipal housing (30% compared to 8%).

Given the importance of compositional effects, it seems advisable to focus on a disaggregated analysis. At the bottom of Table C1 I show the characteristics for the three largest submarkets: cooperative rentals in the Center/East, private prewar rentals in Vienna and municipal rentals in Vienna, which account for 18.5%, 12.5% and 11.4% of the total rental market, respectively. The last block of the table makes clear that the prewar private rental market in Vienna is distinctive, not only for its large share of fixed-term contracts, but even more for its high (quality-adjusted) growth rate (+109%) and the substantial tenure discount (-2.4% per annum).

C.2.2 Heterogeneity over time

In this subsection I look at the development of submarket characteristics over time. Table C2 is similar to Table C1, but reports the values for the entire sample period and for an early (2005–2009) and a late (2020–2024) sub-period. In addition it also shows the share of fixed-term among all new contracts.²⁷

As mentioned above, the largest group are private rents (postwar: 27%, prewar: 20%), followed by cooperative rents (38%) and municipal rents (16%). The share of the latter has fallen over time by approximately 4 pp, while that of cooperative rents has increased by approximately 3.5 pp. The average contract duration decreased between the starting period (2005–09) and the end period (2020–24) from 12.7 years to 10.8 years. This fall is mainly due to changes within the private sector, where the average contract duration has fallen from 10.7 years to 7.1 years, with little change in the other two segments. At the same time, the share of new contracts is substantially higher in the private segment, at 23.9% in the end period (compared to 8.7% and 5.6% in the other two segments), up from 16% in the starting period. As shown in the next three columns of the table, the fall in contract duration and the increase in new contracts mainly reflect the sharp increase in fixed-term contracts in the private rental market, from a share of 27% to a share of 50%. Fixed-term contracts are a rare phenomenon in the other two segments, with an average share of 3% to 5%. Finally, as shown in the last three columns, most new contracts in the private segment are now fixed-term (70% for prewar buildings and almost 80% for

²⁷Note that for the analysis of Table C2 I have left out all observations for which I do not have information whether the rental contract is fixed-term or unlimited. This was not done for the data underlying Table 1 which explains the small differences in the shares.

Table C2: Contract characteristics by submarket, region, and period

Submarket	Share			Cont. Dur.			New			Fixed-Term			Fixed/New		
	All	Start	End	All	Start	End	All	Start	End	All	Start	End	All	Start	End
All contracts	100.0	100.0	100.0	11.8	12.7	10.8	12.9	11.6	15.2	20.1	14.0	25.8	49.6	38.3	60.1
Priv./Post	23.8	23.4	26.5	5.5	7.5	4.2	23.2	19.5	27.8	49.4	34.2	60.1	71.7	56.9	79.9
Priv./Pre	20.7	22.4	19.6	12.7	14.1	11.1	14.5	12.0	18.7	29.0	19.3	36.8	61.0	50.1	69.7
<i>Private</i>	44.5	45.8	46.1	8.9	10.7	7.1	19.2	15.9	23.9	39.9	26.9	50.2	66.7	53.6	75.6
Munic.	17.8	19.5	15.7	16.9	16.8	17.0	6.1	6.6	5.6	3.1	3.0	3.5	13.6	12.3	18.3
Coop.	37.7	34.7	38.2	12.8	13.1	12.7	8.7	8.8	8.7	4.8	3.3	5.6	13.9	10.8	16.6
Vienna	42.9	45.2	41.0	14.5	15.4	13.6	9.5	8.3	11.7	14.8	8.8	20.1	45.4	29.0	58.0
Center/East	35.7	34.7	36.8	10.0	10.9	9.1	14.3	13.3	16.4	17.7	13.6	22.1	40.5	31.6	49.5
West	14.9	13.8	15.6	8.9	9.7	8.0	18.8	17.4	22.3	43.3	34.4	51.9	76.7	69.9	83.9
South	6.6	6.3	6.6	10.2	10.7	10.1	13.0	13.1	13.3	13.2	9.4	17.0	34.2	25.5	44.9
CE/C	18.4	17.1	18.5	11.9	12.4	11.5	9.9	10.0	10.1	3.3	2.8	3.6	8.8	8.6	10.1
Vie/Pre	13.6	15.1	12.5	14.6	15.9	13.2	12.0	9.6	16.0	24.4	14.9	31.8	57.5	43.3	67.3
Vie/M	13.0	14.1	11.4	17.8	18.0	18.0	4.7	5.2	4.0	0.9	1.3	0.6	3.3	3.6	2.5
CE/Post	9.4	9.1	10.9	5.3	6.9	4.3	22.5	19.4	26.2	42.3	31.3	50.5	63.9	48.7	72.1
Vie/C	10.6	9.9	10.9	14.5	14.1	14.7	6.2	6.2	5.8	2.4	1.6	2.5	11.1	7.2	10.5

Note: The periods are: All (2005–2024), Start (2005–2009), End (2020–2024). The splits are the same as in Table C1. In particular, Priv./Pre refers to regulated private contracts in buildings built before 1945, Priv./Post to private contracts in buildings built after 1945; *Private* is their share-weighted average. Share refers to the proportion of the four contract types among all rental contracts in the respective time period. Analogously, the other columns report the average contract duration, the share of new contracts, the share of fixed-term contracts, and the share of fixed-term contracts among all new contracts. *Source:* Statistics Austria (2025); own calculations.

postwar buildings). Even in the two non-private segments, fixed-term contracts account for an increasing share of new leases (between 17% and 18%).

In Table C3 I report average flat size, household size, flat size per household member, and the net housing expenditure share for the same submarkets, regions, and periods as in Table C1. Flat sizes and household sizes differ only moderately across submarkets, whereas the expenditure share is markedly higher in the private segment (26.0%) than in municipal (18.9%) and cooperative housing (21.1%). Over time, average flat size remains essentially unchanged (67.5 to 68.3 m²), while household size declines slightly (2.00 to 1.94), so that flat size per household member rises from 42.1 to 43.9 m². This increase is concentrated outside Vienna, most notably in the Center/East (42.2 to 45.5 m²) and the South (45.9 to 49.4 m²), whereas it stagnates in Vienna (42.4 to 42.2 m²). The expenditure share increases in all submarkets and regions, from 22.2% to 23.8% overall, with the largest increases for regulated private contracts in pre-1945 buildings (23.0% to 24.9%) and in Vienna (21.2% to 23.1%). As shown in Figure C4 this increase is likely to be due to an increase in the share of new contracts.

Table C3: Flat size and expenditure shares by submarket, region, and period

Submarket	Share			Flat Size			HH Members			Size/Member			Net Exp. Share		
	All	Start	End	All	Start	End	All	Start	End	All	Start	End	All	Start	End
All contracts	100.0	100.0	100.0	68.1	67.5	68.3	1.97	2.00	1.94	43.1	42.1	43.9	23.1	22.2	23.8
Priv./Post	23.8	23.4	26.5	67.7	67.8	67.8	1.97	2.06	1.95	42.0	40.9	42.4	27.4	27.0	27.6
Priv./Pre	20.7	22.4	19.6	71.9	70.7	71.8	1.96	1.98	1.90	45.7	45.2	46.6	24.4	23.0	24.9
<i>Private</i>	44.5	45.8	46.1	69.7	69.3	69.5	1.96	2.02	1.93	43.7	43.0	44.2	26.0	25.0	26.5
Munic.	17.8	19.5	15.7	60.6	60.7	60.6	2.04	2.02	2.03	38.1	38.1	38.5	18.9	18.3	19.7
Coop.	37.7	34.7	38.2	69.7	69.0	69.9	1.95	1.97	1.93	44.7	43.3	45.6	21.1	20.5	21.5
Vienna	42.9	45.2	41.0	67.0	66.5	67.1	1.99	1.97	1.99	42.2	42.4	42.2	22.3	21.2	23.1
Center/East	35.7	34.7	36.8	68.6	67.7	69.1	1.94	2.00	1.90	44.0	42.2	45.5	22.3	21.6	22.9
West	14.9	13.8	15.6	68.1	67.8	68.2	2.05	2.12	2.00	41.1	39.6	41.9	28.0	27.1	28.4
South	6.6	6.3	6.6	72.3	72.8	72.1	1.86	1.97	1.78	47.8	45.9	49.4	20.9	20.4	21.2
CE/C	18.4	17.1	18.5	67.6	66.2	68.3	1.93	1.95	1.89	44.1	42.2	45.8	20.7	20.3	21.2
Vie/Pre	13.6	15.1	12.5	71.5	70.2	71.6	1.96	1.95	1.92	45.7	45.8	46.2	24.2	22.6	24.8
Vie/M	13.0	14.1	11.4	59.8	60.1	59.6	2.09	2.05	2.10	36.7	37.3	36.6	18.3	17.7	18.9
CE/Post	9.4	9.1	10.9	71.1	71.4	70.9	2.01	2.14	1.98	43.5	41.9	44.0	25.5	25.2	25.8
Vie/C	10.6	9.9	10.9	72.8	72.8	72.5	1.95	1.95	2.00	45.9	45.4	45.3	20.3	19.8	20.9

Note: The periods are: All (2005–2024), Start (2005–2009), End (2020–2024). For the expenditure share: Start (2011–2015), End (2020–2023). The splits are the same as in Table C2. Share refers to the proportion of the respective submarket among all rental contracts in the respective time period (in %). The other columns report the average flat size (in m²), the average number of household members, the average flat size per household member (in m²), and the average net housing expenditure as a share of household income (in %), only for households in the labor force below the age of 65. *Source:* Statistics Austria (2025); own calculations.

C.3 New-tenant vs. all-tenant rent indices

As discussed in the text, the conventional shelter component in the CPI is based on a cost-of-living concept, and statistical offices therefore aim to sample a representative mix of new and continuing rental contracts. In recent years, however, concerns have been raised that the dominance of continuing contracts implies that rental inflation—and hence its contribution to aggregate inflation—adjusts only sluggishly to market conditions. As a result, several authors have proposed alternative rent measures based on new-tenant contracts (Adams et al. 2024). There is thus a clear trade-off involved. On the one hand, focusing on new-tenant rents may be more informative for monetary policy, as these rents tend to drive rental price dynamics going forward. On the other hand, a new-tenant rent index is not consistent with the cost-of-living concept underlying the CPI and may provide a distorted picture of inflation, particularly if it is not appropriately reweighted.

The theoretical model highlights that an all-tenant index and a new-tenant index may differ markedly outside a hypothetical long-run equilibrium situation. In particular, when the rental market is affected by structural shifts or short-term shocks, the combination of a sizable gap between rents in old and new contracts (arising from tenure discounts and

long contract durations) and heterogeneity can generate a misleading divergence between the dynamics of the new-tenant index and the all-tenant index.

This pattern is illustrated in Table C4. The composition of the sample implies both a geographic and a contract-type bias. Geographically, western provinces are substantially overrepresented, while Vienna is underrepresented. A key reason is that fixed-term contracts are much more prevalent in the West (including in segments such as municipal housing), which increases their likelihood of appearing in a sample based on tenant turnover. In addition, the sample is biased toward contract types with higher separation rates, while contract forms with low separation rates—most notably municipal and cooperative housing, which tend to be cheaper and exhibit less rent dynamics—are underrepresented.

Table C4: Shares in an All-tenant vs. New-tenant Index

(a) By contract type			(b) By region		
Contract Type	Share (All)	Share (New)	Region	Share (All)	Share (New)
Private			Vienna	41.0	31.6
Built $\geq$ 1945	26.5	48.3	Center/East	36.8	39.8
Built $<$ 1945	19.6	24.1	West	15.6	22.9
Municip.	15.7	5.8	South	6.6	5.7
Coop.	38.2	21.8			
(c) By submarket			(d) By limitedness		
Sub-market	Share (All)	Share (New)	Limit	Share (All)	Share (New)
CEast/C	18.5	12.3	Unlimited	74.2	39.9
Vie/M	11.4	3.1	Fixed-Term	25.8	60.1
Vie/C	10.9	4.2			
Vie/Pre	12.5	13.2			
West/Post	7.5	15.6			

Note: The tables show the shares of various subaggregates when an index is based on all rents or only on new rents (2020–2024). *Source:* Statistics Austria (2025); own calculations.

D Regressions results

In this appendix I report the regression results both for the homogeneous specification (based on alternative variants of equation (16)) and for a fully interacted model described below. These are summarized in Sections D.1 and D.2, respectively. For the former I also report separate results for the beginning of the sample period (2005–2009) and the end of the period (2020–2024). In Section D.3 I report the results for some alternative specifications based on the model with homogeneous coefficients.

D.1 Homogeneous coefficients

In Table D1 I collect information for the benchmark regression based on equation (16) with homogeneous coefficients for all contract types and all regions. The benchmark specification is estimated on ongoing contracts (tenure > 1 year). I analyse ongoing and newly signed contracts separately, since a central aim of the analysis is to assess whether the two follow different trajectories—in the time dummies in particular, but potentially also in the hedonic coefficients. I take ongoing contracts as the benchmark because they are far more numerous and yield more stable coefficient estimates. Results for new contracts and for the full sample (ongoing and new contracts) are reported later for comparison.

The first three columns in Table D1 report the relative frequencies for all dummy variables and the average duration of rental contracts (all population weighted).²⁸ The next three columns show the estimated coefficients of the basic regression. I leave out the standard errors but indicate the level of statistical significance with stars. The summary Table 2 from the main text is an extract from this and some of the following tables and it also contains the standard errors for the tenure discount and the time trend. Most variables are highly significant as can also be seen from the coefficient plots in the next section. The last three columns show the product of the first two blocks of columns, i.e. the estimated coefficients times the relative frequency of the respective category. These columns thus indicate the relative importance of these variables for the (logarithmic) rent. All of this information is reported for the entire sample (2005–2024) and for two subsamples (2005–2009 and 2020–2024). As an example, around 19% of all rented flats are in buildings that have been built between 1981 and 2000 (column 1). The impact on

²⁸Note that the durations do not correspond exactly to the ones in the text and in Tables C1 and C2 since here I only include ongoing contracts, i.e. the ones with duration > 1 .

the logarithmic rent is 0.261 (which corresponds to $e^{0.261} - 1 = 29.9\%$). The presence of these newer buildings thus has a total impact of 0.049 ($=0.261 \times 0.188$) on the logarithm of the rent per square meter. The largest effect of all explanatory variables is found for contract duration (with a total effect of -0.18) followed by the contract types (-0.069 and -0.091 for municipal and cooperative contracts, respectively) and the construction year (0.049 for buildings completed between 1981 and 2000).²⁹

The sum of all the coefficients multiplied with the relative frequencies of their occurrence is shown in the line “Sum”. It comes out as -0.370 . This is the total influence of all the characteristics of the flats vis-à-vis the “basic flat”. The basic flat is defined by the omitted category of each set of dummies: a unit smaller than 48 m^2 in a building with three or more flats, completed before 1945, located in a highly urbanized area of Vienna, equipped with district heating, classified in category A, and let as a private postwar rental. Since private rentals in buildings completed before 1945 are by definition classified as prewar, this reference cell is not populated in the data. The constant should therefore be read as a normalization rather than as the rent of an actual flat; the interpretation of the individual coefficients as differences relative to the omitted categories is unaffected. The hedonic regression (16) also contains a time trend δ . It is estimated as 0.032. Adding the constant, the sum of the coefficients multiplied with their frequencies and the time trend multiplied with the average time period $\bar{t}$ one gets the predicted logarithmic rent. It comes out as 1.548.³⁰

It is interesting to contrast these results to the one of a model that only contains time dummies (and no other explanatory variables). The constant is now lower (1.17 vs. 1.59 before) which makes sense since all the characteristics that tend to reduce the rent vis-à-vis the basic rent are absent. The time trend in this “pure regression” is larger (0.037 vs. 0.032) which indicates that part of the changes in the characteristics are captured by the time trend. Note, however, that the predicted values are the same in both models (and given by 1.548).

One can also transform the estimated coefficients into percentage changes using the formula $e^{\beta_j} - 1$, which provides a different interpretation. This is shown in Table D2.

²⁹If one adds up the contributions of the dummies for the variables in each category the total impact comes out as: 0.13 (construction year), -0.08 (Size), -0.02 (category), -0.04 (heating), -0.16 (type), -0.05 (urbanization), 0.03 (region).

³⁰In fact, this is the same value that one get if one uses the prediction after completing the regression (e.g. by using the command `predict` in STATA). This follows from the fact that the predicted variable in a regression model that includes only dummy variables (i.e. a “saturated model”) is equal to the sum of the products of the relative frequencies of the categories and their corresponding estimated coefficients (plus the constant).

The transformation is particularly useful for univariate assessments. The transformed coefficients indicate the marginal change in the basic rent (i.e., the rent for the overall basic category) in percentage terms when an apartment differs in *only* this one category. If multiple categories differ simultaneously, the transformation should be applied to the sum of the coefficients, rather than summing the individual transformations.³¹

In Tables D3 and D4 I also show the (transformed) results for the case where I use new or all contracts (continuing and new), respectively. The results are qualitatively similar. One can observe a somewhat stronger reaction of new contracts to certain characteristics (e.g. size) and a more muted reaction to others (e.g. construction year before 2011). This is compatible with an interpretation in which small flats have become particularly sought after, and for which the construction period plays little role in the price—except for very recently built units. The coefficient on duration—the tenure discount—based on the entire sample of old and new contracts is slightly larger in absolute magnitude than for the sample of ongoing contracts (−1.37% vs. −1.33% in Table D2).

In some of the graphs I have used quarterly time dummies instead of a time trend. The corresponding regressions are shown in Tables D5 and D6 (for the transformation in percentages). The estimated coefficients are basically identical to the regressions in Tables D1 and D2. At the bottom of the page I now show instead of the estimated time trend δ the last and the average time dummy. One can use a parallel approach as above to decompose the total predicted rent into a time effect and an effect due to the explanatory variables (which evidently is zero for the comparison model without explanatory variables).

Finally, and for the sake of later comparison, one can also substitute the contract duration variable (the only variable that has not been defined as a 0/1-dummy in Tables D5 and D6) with a set of six contract duration dummies. This is shown in Tables D7 and D8. The broad picture is the same as before.

D.2 Heterogeneous coefficients

The common-coefficient assumption underlying the results of the previous section is restrictive: characteristics are plausibly priced differently across submarkets—for example, extra floor space or outdoor amenities may be valued differently in rural areas than in

³¹In contrast to Table D1, the rows $C(1+S)(1+\delta)^t$ and $C_p(1+\delta_p)^t$ do not coincide. S is a frequency-weighted averages of the transformed coefficients $e^\beta - 1$, and the average of exponentials differs from the exponential of the average (Jensen's inequality). The two lines therefore only approximate $\exp(1.548)$ and are not exactly equal (the exact equality holds in logs Table D1).

Table D1: Coefficients (baseline (logs)), linear time trend and continuous duration: old contracts, all contract types, all regions

Variables	Share			Coeff.			Product		
	05-24	05-09	20-24	05-24	05-09	20-24	05-24	05-09	20-24
Const. (C)				1.594***	1.486***	2.106***			
Duration									
Years	13.4	14.3	12.7	-0.013***	-0.012***	-0.014**	-0.180	-0.176	-0.172
Cons. Year									
...-1945	28.1%	30.5%	26.6%						
1945-1960	13.2%	14.7%	11.5%	0.063*	0.058	0.051	0.008	0.009	0.006
1961-1970	14.2%	15.1%	13.3%	0.123***	0.127***	0.106**	0.018	0.019	0.014
1971-1980	11.2%	11.3%	10.3%	0.193***	0.224***	0.144***	0.022	0.025	0.015
1981-2000	18.8%	22.1%	16.3%	0.261***	0.266***	0.219***	0.049	0.059	0.036
2001-2010	7.6%	2.6%	8.8%	0.246***	0.201**	0.269***	0.019	0.005	0.024
2011-...	6.8%	3.8%	13.3%	0.285***	0.218***	0.300***	0.019	0.008	0.040
Size (m²)									
<48	20.9%	21.9%	20.1%						
(48,60]	21.8%	21.5%	22.1%	-0.057*	-0.050	-0.061**	-0.012	-0.011	-0.014
(60,72]	17.7%	17.6%	17.8%	-0.088**	-0.080*	-0.100**	-0.016	-0.014	-0.018
(72,85]	20.0%	19.4%	20.7%	-0.119**	-0.116*	-0.122***	-0.024	-0.023	-0.025
>85	19.6%	19.6%	19.3%	-0.159**	-0.155*	-0.160***	-0.031	-0.030	-0.031
Category									
A	90.8%	87.7%	92.5%						
B or C	6.8%	8.4%	6.4%	-0.119***	-0.126***	-0.150***	-0.008	-0.011	-0.010
D	2.4%	3.9%	1.1%	-0.520***	-0.477***	-0.537***	-0.013	-0.019	-0.006
Heating									
District	42.0%	34.7%	48.4%						
Central	22.7%	20.9%	23.1%	0.021	0.039	0.011	0.005	0.008	0.003
Flat/floor	19.3%	20.1%	20.3%	-0.086***	-0.100***	-0.108***	-0.017	-0.020	-0.022
Room	16.0%	24.3%	8.2%	-0.161***	-0.162***	-0.112***	-0.026	-0.039	-0.009
Flats in bldg.									
≥3 flats	92.0%	91.6%	92.2%						
<3 flats	8.0%	8.4%	7.8%	-0.129***	-0.100**	-0.135***	-0.010	-0.008	-0.011
Type									
Private, postwar	21.0%	20.8%	22.5%						
Private, prewar	20.3%	22.1%	18.8%	0.013	0.018	0.024	0.003	0.004	0.005
Municipal	19.1%	20.5%	17.5%	-0.362***	-0.273***	-0.396***	-0.069	-0.056	-0.069
Coop.	39.6%	36.7%	41.2%	-0.230***	-0.164***	-0.265***	-0.091	-0.060	-0.109
Urban.									
High	61.9%	67.2%	58.2%						
Medium	23.4%	17.5%	27.3%	-0.093***	-0.109***	-0.082**	-0.022	-0.019	-0.022
Low	14.7%	15.3%	14.5%	-0.155**	-0.160**	-0.163**	-0.023	-0.024	-0.024
Region									
Vienna	44.5%	46.3%	42.9%						
Cen./East	35.1%	34.2%	36.3%	0.014	0.067***	-0.027	0.005	0.023	-0.010
West	13.8%	13.1%	14.1%	0.213***	0.257***	0.177**	0.029	0.034	0.025
South	6.6%	6.4%	6.7%	-0.079*	-0.008	-0.136**	-0.005	-0.000	-0.009
N				108,723	30,537	28,402			
R2 (adj.)				0.441	0.295	0.463			
Sum (S)							-0.370	-0.317	-0.395
Trend δ (p.a.)				0.032***	0.038***	0.044***			
Mean $\bar{t}$ (yrs)				10.09	2.92	2.38			
C+S+$\delta\bar{t}$				1.548	1.280	1.816			
Model with only a time trend									
Constant (C_p)				1.170	1.172	1.705			
Trend δ_p (p.a.)				0.037***	0.037***	0.047***			
$C_p + \delta_p \bar{t}$				1.548	1.280	1.816			

Note: Dependent variable: log rent per m² (net of operating costs). Linear time trend in years, first quarter of the period = 0; $\bar{t}$ is the mean of the trend variable. Coefficients shown without standard errors; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D2: Coefficients (in percentages), linear time trend and continuous duration: old contracts, all contract types, all regions

Variables	Share			Coeff.	Coeff.	Coeff.	Product		
	05–24	05–09	20–24	05–24	05–09	20–24	05–24	05–09	20–24
Const. (C)				4.92***	4.42***	8.22***			
Duration									
Years	13.4	14.3	12.7	-1.33%***	-1.23%***	-1.35%**	-17.8%	-17.5%	-17.1%
Cons. Year									
...–1945	28.1%	30.5%	26.6%						
1945–1960	13.2%	14.7%	11.5%	6.47%*	5.99%	5.25%	0.9%	0.9%	0.6%
1961–1970	14.2%	15.1%	13.3%	13.14%***	13.53%***	11.14%**	1.9%	2.0%	1.5%
1971–1980	11.2%	11.3%	10.3%	21.28%***	25.16%***	15.48%***	2.4%	2.9%	1.6%
1981–2000	18.8%	22.1%	16.3%	29.85%***	30.53%***	24.45%***	5.6%	6.7%	4.0%
2001–2010	7.6%	2.6%	8.8%	27.91%***	22.27%**	30.85%***	2.1%	0.6%	2.7%
2011–...	6.8%	3.8%	13.3%	33.00%***	24.34%***	34.95%***	2.3%	0.9%	4.6%
Size (m²)									
<48	20.9%	21.9%	20.1%						
(48,60]	21.8%	21.5%	22.1%	-5.54%*	-4.90%	-5.95%**	-1.2%	-1.1%	-1.3%
(60,72]	17.7%	17.6%	17.8%	-8.42%**	-7.70%*	-9.50%**	-1.5%	-1.4%	-1.7%
(72,85]	20.0%	19.4%	20.7%	-11.20%**	-10.96%*	-11.49%***	-2.2%	-2.1%	-2.4%
>85	19.6%	19.6%	19.3%	-14.70%**	-14.34%*	-14.78%***	-2.9%	-2.8%	-2.8%
Category									
A	90.8%	87.7%	92.5%						
B or C	6.8%	8.4%	6.4%	-11.25%***	-11.82%***	-13.96%***	-0.8%	-1.0%	-0.9%
D	2.4%	3.9%	1.1%	-40.57%***	-37.91%***	-41.53%***	-1.0%	-1.5%	-0.5%
Heating									
District	42.0%	34.7%	48.4%						
Central	22.7%	20.9%	23.1%	2.09%	3.97%	1.15%	0.5%	0.8%	0.3%
Flat/floor	19.3%	20.1%	20.3%	-8.26%***	-9.51%***	-10.25%***	-1.6%	-1.9%	-2.1%
Room	16.0%	24.3%	8.2%	-14.86%***	-14.93%***	-10.56%***	-2.4%	-3.6%	-0.9%
Flats in bldg.									
≥3 flats	92.0%	91.6%	92.2%						
<3 flats	8.0%	8.4%	7.8%	-12.09%***	-9.53%**	-12.66%***	-1.0%	-0.8%	-1.0%
Type									
Private, postwar	21.0%	20.8%	22.5%						
Private, prewar	20.3%	22.1%	18.8%	1.26%	1.79%	2.45%	0.3%	0.4%	0.5%
Municipal	19.1%	20.5%	17.5%	-30.38%***	-23.91%***	-32.67%***	-5.8%	-4.9%	-5.7%
Coop.	39.6%	36.7%	41.2%	-20.55%***	-15.09%***	-23.28%***	-8.1%	-5.5%	-9.6%
Urban.									
High	61.9%	67.2%	58.2%						
Medium	23.4%	17.5%	27.3%	-8.88%***	-10.33%***	-7.84%**	-2.1%	-1.8%	-2.1%
Low	14.7%	15.3%	14.5%	-14.33%**	-14.79%**	-15.02%**	-2.1%	-2.3%	-2.2%
Region									
Vienna	44.5%	46.3%	42.9%						
Gen./East	35.1%	34.2%	36.3%	1.38%	6.91%***	-2.65%	0.5%	2.4%	-1.0%
West	13.8%	13.1%	14.1%	23.69%***	29.34%***	19.31%**	3.3%	3.8%	2.7%
South	6.6%	6.4%	6.7%	-7.62%*	-0.77%	-12.75%**	-0.5%	-0.0%	-0.9%
N				108,723	30,537	28,402			
R2 (adj.)				0.441	0.295	0.463			
Sum (S)							-31.4%	-26.8%	-33.7%
Trend δ (p.a.)				3.27%***	3.88%***	4.46%***			
Mean $\bar{t}$ (yrs)				10.09	2.92	2.38			
C(1+S)(1+δ)^t				4.67	3.62	6.05			
Model with only a time trend									
Constant (C_p)				3.22	3.23	5.50			
Trend δ_p (p.a.)				3.82%***	3.79%***	4.76%***			
$C_p(1 + \delta_p)^t$				4.70	3.60	6.14			

Note: Dependent variable: log rent per m² (net of operating costs). Linear time trend in years, first quarter of the period = 0; $\bar{t}$ is the mean of the trend variable. Coefficients (shown without standard errors) are transformed as $e^{\beta} - 1$; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D3: Coefficients (in percentages), linear time trend and continuous duration: new contracts, all contract types, all regions

Variables	Share				Coeff.		Product		
	05–24	05–09	20–24		05–09	20–24	05–24	05–09	20–24
Const. (C)				6.41***	5.89***	9.89***			
Cons. Year									
...–1945	27.4%	28.4%	27.1%						
1945–1960	11.7%	13.0%	10.2%	-4.79%	-10.59%	-4.59%	-0.6%	-1.4%	-0.5%
1961–1970	12.7%	12.7%	12.0%	-1.38%	-7.18%	1.18%	-0.2%	-0.9%	0.1%
1971–1980	10.9%	12.2%	9.3%	2.09%	-2.79%	1.95%	0.2%	-0.3%	0.2%
1981–2000	17.1%	22.1%	14.4%	9.46%*	7.29%	7.90%	1.6%	1.6%	1.1%
2001–2010	7.5%	3.0%	8.0%	15.45%***	8.67%	19.22%**	1.2%	0.3%	1.5%
2011–...	12.8%	8.6%	19.1%	26.72%***	11.92%	32.58%***	3.4%	1.0%	6.2%
Size (m²)									
<48	27.4%	29.1%	26.1%						
(48,60]	22.7%	22.0%	23.7%	-9.21%***	-10.78%**	-9.20%***	-2.1%	-2.4%	-2.2%
(60,72]	16.4%	15.7%	16.2%	-12.92%***	-11.22%**	-12.72%***	-2.1%	-1.8%	-2.1%
(72,85]	17.2%	16.8%	18.0%	-16.81%***	-15.64%***	-16.87%***	-2.9%	-2.6%	-3.0%
>85	16.3%	16.5%	16.1%	-18.88%***	-19.78%**	-18.37%**	-3.1%	-3.3%	-2.9%
Category									
A	93.4%	90.0%	93.8%						
B or C	4.7%	6.2%	5.3%	-12.37%***	-20.96%***	-4.47%	-0.6%	-1.3%	-0.2%
D	1.8%	3.8%	0.9%	-23.15%*	-26.94%*	-20.85%	-0.4%	-1.0%	-0.2%
Heating									
District	35.2%	29.7%	38.1%						
Central	34.2%	32.5%	34.3%	4.56%**	8.21%**	1.83%	1.6%	2.7%	0.6%
Flat/floor	17.9%	17.5%	20.6%	-0.13%	6.51%**	-4.60%	-0.0%	1.1%	-0.9%
Room	12.7%	20.4%	7.0%	-6.82%***	0.98%	-8.51%	-0.9%	0.2%	-0.6%
Flats in bldg.									
≥3 flats	90.5%	88.1%	91.1%						
<3 flats	9.5%	11.9%	8.9%	-11.60%***	-7.05%*	-13.56%**	-1.1%	-0.8%	-1.2%
Type									
Private, postwar	42.9%	39.2%	48.4%						
Private, prewar	23.2%	23.0%	24.0%	-4.66%	-4.97%	-2.72%	-1.1%	-1.1%	-0.7%
Municipal	8.4%	11.2%	5.8%	-35.57%***	-31.75%***	-35.61%***	-3.0%	-3.5%	-2.1%
Coop.	25.5%	26.6%	21.8%	-27.54%***	-23.25%***	-29.06%***	-7.0%	-6.2%	-6.3%
Urban.									
High	53.8%	58.6%	51.3%						
Medium	28.0%	22.0%	31.6%	-12.85%***	-16.02%**	-10.97%**	-3.6%	-3.5%	-3.5%
Low	18.1%	19.4%	17.1%	-19.76%***	-23.34%**	-18.41%***	-3.6%	-4.5%	-3.1%
Region									
Vienna	31.9%	32.1%	31.6%						
Cen./East	39.6%	39.8%	39.8%	-4.73%	6.82%	-10.05%	-1.9%	2.7%	-4.0%
West	21.8%	21.0%	22.8%	19.44%**	31.78%***	15.64%*	4.2%	6.7%	3.6%
South	6.7%	7.2%	5.8%	-11.99%*	-0.75%	-17.73%**	-0.8%	-0.1%	-1.0%
N				16,715	4,094	5,333			
R2 (adj.)				0.424	0.251	0.428			
Sum (S)							-22.6%	-18.5%	-21.2%
Trend δ (p.a.)				3.02%***	3.00%***	4.35%***			
Mean $\bar{t}$ (yrs)				10.75	2.91	2.47			
C(1+S)(1+δ)^t				6.83	5.23	8.66			
Model with only a time trend									
Constant (C_p)				4.61	4.72	7.55			
Trend δ_p (p.a.)				3.57%***	2.45%***	4.81%***			
$C_p(1 + \delta_p)^t$				6.72	5.07	8.48			

Note: Dependent variable: log rent per m² (net of operating costs). Linear time trend in years, first quarter of the period = 0; $\bar{t}$ is the mean of the trend variable. Coefficients (shown without standard errors) are transformed as $e^\beta - 1$; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D4: Coefficients (in percentages), linear time trend and continuous duration: all contracts, all contract types, all regions

Variables	Share			Coeff.	Coeff.	Coeff.	Product		
	05–24	05–09	20–24	05–24	05–09	20–24	05–24	05–09	20–24
Const. (C)				5.08***	4.58***	8.42***			
Duration									
Years	11.8	12.7	10.8	-1.37%***	-1.29%***	-1.37%**	-16.1%	-16.4%	-14.8%
Cons. Year									
...–1945	28.0%	30.2%	26.7%						
1945–1960	13.0%	14.5%	11.3%	5.87%*	4.89%	4.74%	0.8%	0.7%	0.5%
1961–1970	14.0%	14.8%	13.1%	12.43%***	12.32%***	10.82%**	1.7%	1.8%	1.4%
1971–1980	11.1%	11.4%	10.2%	19.96%***	22.92%***	14.70%***	2.2%	2.6%	1.5%
1981–2000	18.6%	22.1%	16.0%	28.32%***	28.71%***	23.37%***	5.3%	6.3%	3.7%
2001–2010	7.6%	2.6%	8.6%	27.34%***	21.28%**	30.65%***	2.1%	0.6%	2.7%
2011–...	7.6%	4.3%	14.1%	33.66%***	23.72%***	36.50%***	2.6%	1.0%	5.2%
Size (m²)									
<48	21.7%	22.7%	21.0%						
(48,60]	21.9%	21.6%	22.3%	-6.27%*	-5.81%	-6.83%***	-1.4%	-1.3%	-1.5%
(60,72]	17.5%	17.4%	17.6%	-9.32%**	-8.43%*	-10.32%***	-1.6%	-1.5%	-1.8%
(72,85]	19.7%	19.1%	20.3%	-12.14%**	-11.70%*	-12.60%***	-2.4%	-2.2%	-2.6%
>85	19.2%	19.2%	18.8%	-15.65%**	-15.42%**	-15.81%***	-3.0%	-3.0%	-3.0%
Category									
A	91.1%	87.9%	92.7%						
B or C	6.5%	8.1%	6.2%	-11.57%***	-13.02%***	-12.68%***	-0.8%	-1.1%	-0.8%
D	2.3%	3.9%	1.1%	-39.59%***	-37.12%***	-39.80%***	-0.9%	-1.5%	-0.4%
Heating									
District	41.1%	34.1%	46.8%						
Central	24.2%	22.2%	24.8%	2.41%*	4.41%*	1.14%	0.6%	1.0%	0.3%
Flat/floor	19.1%	19.8%	20.3%	-7.26%***	-7.86%**	-9.35%***	-1.4%	-1.6%	-1.9%
Room	15.6%	23.9%	8.1%	-13.85%***	-13.27%***	-10.42%***	-2.2%	-3.2%	-0.8%
Flats in bldg.									
≥3 flats	91.8%	91.2%	92.0%						
<3 flats	8.2%	8.8%	8.0%	-12.05%***	-9.18%***	-12.76%***	-1.0%	-0.8%	-1.0%
Type									
Private, postwar	23.8%	22.9%	26.5%						
Private, prewar	20.7%	22.2%	19.6%	1.52%	1.93%	2.89%	0.3%	0.4%	0.6%
Municipal	17.7%	19.4%	15.7%	-31.08%***	-24.73%***	-33.23%***	-5.5%	-4.8%	-5.2%
Coop.	37.8%	35.5%	38.2%	-21.32%***	-16.06%***	-23.93%***	-8.1%	-5.7%	-9.1%
Urban.									
High	60.8%	66.2%	57.1%						
Medium	24.0%	18.0%	28.0%	-9.65%***	-11.16%***	-8.51%**	-2.3%	-2.0%	-2.4%
Low	15.2%	15.7%	14.9%	-15.45%**	-16.21%**	-15.91%**	-2.3%	-2.6%	-2.4%
Region									
Vienna	42.9%	44.7%	41.2%						
Gen./East	35.7%	34.9%	36.8%	0.83%	7.24%***	-3.70%	0.3%	2.5%	-1.4%
West	14.8%	14.0%	15.4%	23.57%***	30.33%***	19.04%**	3.5%	4.2%	2.9%
South	6.6%	6.5%	6.6%	-7.86%*	-0.52%	-13.28%**	-0.5%	-0.0%	-0.9%
N				125,569	34,663	33,790			
R2 (adj.)				0.456	0.305	0.481			
Sum (S)							-30.1%	-26.2%	-31.2%
Trend δ (p.a.)				3.26%***	3.84%***	4.46%***			
Mean $\bar{t}$ (yrs)				10.17	2.92	2.39			
C(1+S)(1+δ)^t				4.92	3.77	6.43			
Model with only a time trend									
Constant (C_p)				3.35	3.37	5.75			
Trend δ_p (p.a.)				3.86%***	3.62%***	4.97%***			
$C_p(1 + \delta_p)^t$				4.92	3.74	6.45			

Note: Dependent variable: log rent per m² (net of operating costs). Linear time trend in years, first quarter of the period = 0; $\bar{t}$ is the mean of the trend variable. Coefficients (shown without standard errors) are transformed as $e^{\beta} - 1$; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D5: Coefficients (baseline (logs)), Quarterly time dummies and continuous duration: old contracts, all contract types, all regions

Variables	Share			Coeff.			Product		
	05–24	05–09	20–24	05–24	05–09	20–24	05–24	05–09	20–24
Const. (C)				1.629***	1.544***	2.150***			
Duration									
Years	13.4	14.3	12.7	-0.013***	-0.012***	-0.014**	-0.179	-0.176	-0.173
Cons.Year									
...–1945	28.1%	30.5%	26.6%						
1945–1960	13.2%	14.7%	11.5%	0.062*	0.058	0.051	0.008	0.008	0.006
1961–1970	14.2%	15.1%	13.3%	0.123***	0.127***	0.105**	0.018	0.019	0.014
1971–1980	11.2%	11.3%	10.3%	0.192***	0.225***	0.143***	0.021	0.025	0.015
1981–2000	18.8%	22.1%	16.3%	0.261***	0.266***	0.219***	0.049	0.059	0.036
2001–2010	7.6%	2.6%	8.8%	0.246***	0.202**	0.269***	0.019	0.005	0.024
2011–...	6.8%	3.8%	13.3%	0.285***	0.217***	0.300***	0.019	0.008	0.040
Size (m²)									
<48	20.9%	21.9%	20.1%						
(48,60]	21.8%	21.5%	22.1%	-0.057*	-0.051	-0.061**	-0.012	-0.011	-0.013
(60,72]	17.7%	17.6%	17.8%	-0.088**	-0.080*	-0.100**	-0.016	-0.014	-0.018
(72,85]	20.0%	19.4%	20.7%	-0.119**	-0.116*	-0.122***	-0.024	-0.023	-0.025
>85	19.6%	19.6%	19.3%	-0.159**	-0.155*	-0.160***	-0.031	-0.030	-0.031
Category									
A	90.8%	87.7%	92.5%						
B or C	6.8%	8.4%	6.4%	-0.118***	-0.125***	-0.128**	-0.008	-0.011	-0.008
D	2.4%	3.9%	1.1%	-0.521***	-0.477***	-0.527***	-0.013	-0.019	-0.006
Heating									
District	42.0%	34.7%	48.4%						
Central	22.7%	20.9%	23.1%	0.022	0.039	0.013	0.005	0.008	0.003
Flat/floor	19.3%	20.1%	20.3%	-0.088***	-0.101***	-0.107***	-0.017	-0.020	-0.022
Room	16.0%	24.3%	8.2%	-0.161***	-0.161***	-0.131***	-0.026	-0.039	-0.011
Flats in bldg.									
≥3 flats	92.0%	91.6%	92.2%						
<3 flats	8.0%	8.4%	7.8%	-0.129***	-0.101**	-0.134***	-0.010	-0.008	-0.010
Type									
Private, postwar	21.0%	20.8%	22.5%						
Private, prewar	20.3%	22.1%	18.8%	0.012	0.017	0.025	0.002	0.004	0.005
Municipal	19.1%	20.5%	17.5%	-0.363***	-0.274***	-0.394***	-0.069	-0.056	-0.069
Coop.	39.6%	36.7%	41.2%	-0.231***	-0.165***	-0.264***	-0.091	-0.060	-0.109
Urban.									
High	61.9%	67.2%	58.2%						
Medium	23.4%	17.5%	27.3%	-0.093***	-0.109***	-0.082**	-0.022	-0.019	-0.022
Low	14.7%	15.3%	14.5%	-0.155**	-0.161**	-0.163**	-0.023	-0.025	-0.024
Region									
Vienna	44.5%	46.3%	42.9%						
Cen./East	35.1%	34.2%	36.3%	0.013	0.067***	-0.027	0.005	0.023	-0.010
West	13.8%	13.1%	14.1%	0.211***	0.258***	0.176**	0.029	0.034	0.025
South	6.6%	6.4%	6.7%	-0.080*	-0.007	-0.137**	-0.005	-0.000	-0.009
N				108,723	30,537	28,402			
R2 (adj.)				0.442	0.296	0.465			
Sum (S)							-0.371	-0.318	-0.393
(Last TD)				0.632	0.150	0.172			
Mean TD (M)				0.290	0.054	0.059			
C+S+M				1.548	1.280	1.816			
Model with only time dummies									
Constant (C_p)				1.236	1.236	1.748			
(Last TD)				0.705	0.147	0.193			
Mean TD (M_p)				0.312	0.044	0.067			
$C_p + M_p$				1.548	1.280	1.816			

Note: Dependent variable: log rent per m² (net of operating costs). Quarterly time dummies (first period omitted); Last TD is the coefficient of the last period, Mean TD the weighted average of all time-dummy coefficients. Coefficients shown without standard errors; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D6: Coefficients (in percentages), Quarterly time dummies and continuous duration: old contracts, all contract types, all regions

Variables	Share			05-24	Coeff.		Product		
	05-24	05-09	20-24		05-09	20-24	05-24	05-09	20-24
Const. (C)				5.10***	4.68***	8.58***			
Duration									
Years	13.4	14.3	12.7	-1.33%***	-1.23%***	-1.35%**	-17.8%	-17.5%	-17.2%
Cons.Year									
...-1945	28.1%	30.5%	26.6%						
1945-1960	13.2%	14.7%	11.5%	6.44%*	5.93%	5.28%	0.9%	0.9%	0.6%
1961-1970	14.2%	15.1%	13.3%	13.11%***	13.54%***	11.08%**	1.9%	2.0%	1.5%
1971-1980	11.2%	11.3%	10.3%	21.21%***	25.20%***	15.41%***	2.4%	2.9%	1.6%
1981-2000	18.8%	22.1%	16.3%	29.88%***	30.51%***	24.54%***	5.6%	6.7%	4.0%
2001-2010	7.6%	2.6%	8.8%	27.86%***	22.33%**	30.81%***	2.1%	0.6%	2.7%
2011-...	6.8%	3.8%	13.3%	32.93%***	24.25%***	34.99%***	2.2%	0.9%	4.6%
Size (m²)									
<48	20.9%	21.9%	20.1%						
(48,60]	21.8%	21.5%	22.1%	-5.55%*	-4.93%	-5.92%**	-1.2%	-1.1%	-1.3%
(60,72]	17.7%	17.6%	17.8%	-8.42%**	-7.72%*	-9.48%**	-1.5%	-1.4%	-1.7%
(72,85]	20.0%	19.4%	20.7%	-11.22%**	-10.99%*	-11.50%***	-2.2%	-2.1%	-2.4%
>85	19.6%	19.6%	19.3%	-14.72%**	-14.40%*	-14.77%***	-2.9%	-2.8%	-2.8%
Category									
A	90.8%	87.7%	92.5%						
B or C	6.8%	8.4%	6.4%	-11.13%***	-11.79%***	-12.03%***	-0.8%	-1.0%	-0.8%
D	2.4%	3.9%	1.1%	-40.61%***	-37.92%***	-40.97%***	-1.0%	-1.5%	-0.5%
Heating									
District	42.0%	34.7%	48.4%						
Central	22.7%	20.9%	23.1%	2.23%	3.96%	1.30%	0.5%	0.8%	0.3%
Flat/floor	19.3%	20.1%	20.3%	-8.43%***	-9.57%***	-10.17%***	-1.6%	-1.9%	-2.1%
Room	16.0%	24.3%	8.2%	-14.91%***	-14.90%***	-12.31%***	-2.4%	-3.6%	-1.0%
Flats in bldg.									
≥3 flats	92.0%	91.6%	92.2%						
<3 flats	8.0%	8.4%	7.8%	-12.10%***	-9.60%**	-12.53%***	-1.0%	-0.8%	-1.0%
Type									
Private, postwar	21.0%	20.8%	22.5%						
Private, prewar	20.3%	22.1%	18.8%	1.23%	1.69%	2.57%	0.2%	0.4%	0.5%
Municipal	19.1%	20.5%	17.5%	-30.43%***	-23.97%***	-32.57%***	-5.8%	-4.9%	-5.7%
Coop.	39.6%	36.7%	41.2%	-20.61%***	-15.18%***	-23.19%***	-8.2%	-5.6%	-9.6%
Urban.									
High	61.9%	67.2%	58.2%						
Medium	23.4%	17.5%	27.3%	-8.84%***	-10.37%***	-7.88%**	-2.1%	-1.8%	-2.2%
Low	14.7%	15.3%	14.5%	-14.34%**	-14.85%**	-15.00%**	-2.1%	-2.3%	-2.2%
Region									
Vienna	44.5%	46.3%	42.9%						
Cen./East	35.1%	34.2%	36.3%	1.30%	6.95%***	-2.66%	0.5%	2.4%	-1.0%
West	13.8%	13.1%	14.1%	23.51%***	29.39%***	19.24%**	3.2%	3.8%	2.7%
South	6.6%	6.4%	6.7%	-7.71%*	-0.70%	-12.78%**	-0.5%	-0.0%	-0.9%
N				108,723	30,537	28,402			
R2 (adj.)				0.442	0.296	0.465			
Sum (S)							-31.5%	-26.9%	-33.6%
(Last TD)				88.15%	16.22%	18.78%			
Mean TD (M)				35.89%	5.82%	6.35%			
C(1+S)(1+M)				4.75	3.62	6.06			
Model with only time dummies									
Constant (C_p)				3.44	3.44	5.74			
(Last TD)				102.35%	15.86%	21.24%			
Mean TD (M_p)				39.82%	4.76%	7.24%			
$C_p(1 + M_p)$				4.81	3.61	6.16			

Note: Dependent variable: log rent per m² (net of operating costs). Quarterly time dummies (first period omitted); Last TD is the coefficient of the last period, Mean TD the weighted average of all time-dummy coefficients. Coefficients (shown without standard errors) are transformed as $e^\beta - 1$; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D7: Coefficients (baseline (logs)), Quarterly time dummies and duration dummies: old contracts, all contract types, all regions

Variables	Share			Coeff.			Product		
	05-24	05-09	20-24	05-24	05-09	20-24	05-24	05-09	20-24
Const. (C)				1.653***	1.590***	2.160***			
Duration									
(1,2]	13.8%	12.0%	16.0%						
(2,5]	25.1%	23.3%	27.3%	-0.052***	-0.072**	-0.039***	-0.013	-0.017	-0.011
(5,10]	19.3%	20.8%	17.0%	-0.139***	-0.169***	-0.114***	-0.027	-0.035	-0.019
(10,20]	18.1%	17.8%	17.5%	-0.255**	-0.296**	-0.217**	-0.046	-0.053	-0.038
(20,30]	9.5%	10.1%	9.8%	-0.399**	-0.415**	-0.356**	-0.038	-0.042	-0.035
>30	14.1%	15.9%	12.4%	-0.582**	-0.557**	-0.596**	-0.082	-0.089	-0.074
Cons.Year									
...-1945	28.1%	30.5%	26.6%						
1945-1960	13.2%	14.7%	11.5%	0.059*	0.055	0.047	0.008	0.008	0.005
1961-1970	14.2%	15.1%	13.3%	0.122***	0.136***	0.091**	0.017	0.021	0.012
1971-1980	11.2%	11.3%	10.3%	0.206***	0.247***	0.141***	0.023	0.028	0.015
1981-2000	18.8%	22.1%	16.3%	0.276***	0.281***	0.231***	0.052	0.062	0.038
2001-2010	7.6%	2.6%	8.8%	0.252***	0.198**	0.269***	0.019	0.005	0.024
2011-...	6.8%	3.8%	13.3%	0.269***	0.177**	0.291***	0.018	0.007	0.039
Size (m²)									
<48	20.9%	21.9%	20.1%						
(48,60]	21.8%	21.5%	22.1%	-0.061*	-0.052	-0.065***	-0.013	-0.011	-0.014
(60,72]	17.7%	17.6%	17.8%	-0.092**	-0.079*	-0.106***	-0.016	-0.014	-0.019
(72,85]	20.0%	19.4%	20.7%	-0.120**	-0.109*	-0.127***	-0.024	-0.021	-0.026
>85	19.6%	19.6%	19.3%	-0.159**	-0.149*	-0.162***	-0.031	-0.029	-0.031
Category									
A	90.8%	87.7%	92.5%						
B or C	6.8%	8.4%	6.4%	-0.114***	-0.122***	-0.129**	-0.008	-0.010	-0.008
D	2.4%	3.9%	1.1%	-0.509***	-0.457***	-0.521***	-0.012	-0.018	-0.006
Heating									
District	42.0%	34.7%	48.4%						
Central	22.7%	20.9%	23.1%	0.019	0.032	0.010	0.004	0.007	0.002
Flat/floor	19.3%	20.1%	20.3%	-0.092***	-0.103***	-0.112***	-0.018	-0.021	-0.023
Room	16.0%	24.3%	8.2%	-0.171***	-0.169***	-0.139***	-0.027	-0.041	-0.011
Flats in bldg.									
≥3 flats	92.0%	91.6%	92.2%						
<3 flats	8.0%	8.4%	7.8%	-0.125***	-0.097**	-0.134***	-0.010	-0.008	-0.010
Type									
Private, postwar	21.0%	20.8%	22.5%						
Private, prewar	20.3%	22.1%	18.8%	0.017	0.023	0.024	0.003	0.005	0.005
Municipal	19.1%	20.5%	17.5%	-0.352***	-0.262***	-0.389***	-0.067	-0.054	-0.068
Coop.	39.6%	36.7%	41.2%	-0.218***	-0.147***	-0.257***	-0.086	-0.054	-0.106
Urban.									
High	61.9%	67.2%	58.2%						
Medium	23.4%	17.5%	27.3%	-0.090***	-0.107***	-0.079**	-0.021	-0.019	-0.022
Low	14.7%	15.3%	14.5%	-0.151**	-0.158**	-0.156**	-0.022	-0.024	-0.023
Region									
Vienna	44.5%	46.3%	42.9%						
Cen./East	35.1%	34.2%	36.3%	0.008	0.062***	-0.033	0.003	0.021	-0.012
West	13.8%	13.1%	14.1%	0.205***	0.252***	0.170**	0.028	0.033	0.024
South	6.6%	6.4%	6.7%	-0.084*	-0.011	-0.140**	-0.006	-0.001	-0.009
N				108,723	30,537	28,402			
R2 (adj.)				0.440	0.298	0.460			
Sum (S)							-0.392	-0.364	-0.403
(Last TD)				0.631	0.150	0.174			
Mean TD (M)				0.287	0.055	0.059			
C+S+M				1.548	1.280	1.816			
Model with only time dummies									
Constant (C_p)				1.236	1.236	1.748			
(Last TD)				0.705	0.147	0.193			
Mean TD (M_p)				0.312	0.044	0.067			
$C_p + M_p$				1.548	1.280	1.816			

Note: Dependent variable: log rent per m² (net of operating costs). Quarterly time dummies (first period omitted); Last TD is the coefficient of the last period, Mean TD the weighted average of all time-dummy coefficients. Coefficients shown without standard errors; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

Table D8: Coefficients (in percentages), Quarterly time dummies and duration dummies: old contracts, all contract types, all regions

Variables	Share			Coeff.			Product		
	05–24	05–09	20–24	05–24	05–09	20–24	05–24	05–09	20–24
Const. (C)				5.22***	4.90***	8.67***			
Duration									
(1,2]	13.8%	12.0%	16.0%						
(2,5]	25.1%	23.3%	27.3%	-5.08%***	-6.98%**	-3.83%***	-1.3%	-1.6%	-1.0%
(5,10]	19.3%	20.8%	17.0%	-13.00%***	-15.51%***	-10.77%***	-2.5%	-3.2%	-1.8%
(10,20]	18.1%	17.8%	17.5%	-22.52%**	-25.60%**	-19.54%**	-4.1%	-4.6%	-3.4%
(20,30]	9.5%	10.1%	9.8%	-32.89%**	-33.95%**	-29.98%**	-3.1%	-3.4%	-2.9%
>30	14.1%	15.9%	12.4%	-44.12%**	-42.72%**	-44.92%**	-6.2%	-6.8%	-5.6%
Cons. Year									
...–1945	28.1%	30.5%	26.6%						
1945–1960	13.2%	14.7%	11.5%	6.05%*	5.61%	4.79%	0.8%	0.8%	0.6%
1961–1970	14.2%	15.1%	13.3%	12.92%***	14.61%***	9.49%**	1.8%	2.2%	1.3%
1971–1980	11.2%	11.3%	10.3%	22.90%***	27.98%***	15.13%***	2.6%	3.2%	1.6%
1981–2000	18.8%	22.1%	16.3%	31.76%***	32.48%***	26.00%***	6.0%	7.2%	4.2%
2001–2010	7.6%	2.6%	8.8%	28.68%***	21.86%**	30.90%***	2.2%	0.6%	2.7%
2011–...	6.8%	3.8%	13.3%	30.90%***	19.42%**	33.81%***	2.1%	0.7%	4.5%
Size (m²)									
<48	20.9%	21.9%	20.1%						
(48,60]	21.8%	21.5%	22.1%	-5.88%*	-5.07%	-6.26%***	-1.3%	-1.1%	-1.4%
(60,72]	17.7%	17.6%	17.8%	-8.75%**	-7.63%*	-10.06%***	-1.5%	-1.3%	-1.8%
(72,85]	20.0%	19.4%	20.7%	-11.28%**	-10.36%*	-11.92%***	-2.3%	-2.0%	-2.5%
>85	19.6%	19.6%	19.3%	-14.69%**	-13.88%*	-14.92%***	-2.9%	-2.7%	-2.9%
Category									
A	90.8%	87.7%	92.5%						
B or C	6.8%	8.4%	6.4%	-10.81%***	-11.50%***	-12.13%**	-0.7%	-1.0%	-0.8%
D	2.4%	3.9%	1.1%	-39.90%***	-36.69%***	-40.59%***	-1.0%	-1.4%	-0.5%
Heating									
District	42.0%	34.7%	48.4%						
Central	22.7%	20.9%	23.1%	1.89%	3.25%	1.00%	0.4%	0.7%	0.2%
Flat/floor	19.3%	20.1%	20.3%	-8.76%***	-9.80%***	-10.62%***	-1.7%	-2.0%	-2.2%
Room	16.0%	24.3%	8.2%	-15.70%***	-15.56%***	-12.99%***	-2.5%	-3.8%	-1.1%
Flats in bldg.									
≥3 flats	92.0%	91.6%	92.2%						
<3 flats	8.0%	8.4%	7.8%	-11.79%***	-9.21%**	-12.54%***	-0.9%	-0.8%	-1.0%
Type									
Private, postwar	21.0%	20.8%	22.5%						
Private, prewar	20.3%	22.1%	18.8%	1.74%	2.33%	2.45%	0.4%	0.5%	0.5%
Municipal	19.1%	20.5%	17.5%	-29.67%***	-23.02%***	-32.22%***	-5.7%	-4.7%	-5.6%
Coop.	39.6%	36.7%	41.2%	-19.56%***	-13.71%***	-22.67%***	-7.7%	-5.0%	-9.3%
Urban.									
High	61.9%	67.2%	58.2%						
Medium	23.4%	17.5%	27.3%	-8.61%***	-10.18%***	-7.58%**	-2.0%	-1.8%	-2.1%
Low	14.7%	15.3%	14.5%	-14.03%**	-14.61%**	-14.48%**	-2.1%	-2.2%	-2.1%
Region									
Vienna	44.5%	46.3%	42.9%						
Gen./East	35.1%	34.2%	36.3%	0.79%	6.44%***	-3.23%	0.3%	2.2%	-1.2%
West	13.8%	13.1%	14.1%	22.78%***	28.68%***	18.56%**	3.1%	3.8%	2.6%
South	6.6%	6.4%	6.7%	-8.08%*	-1.13%	-13.04%**	-0.5%	-0.1%	-0.9%
N				108,723	30,537	28,402			
R2 (adj.)				0.440	0.298	0.460			
Sum (S)							-30.4%	-27.8%	-31.8%
(Last TD)				87.99%	16.21%	19.00%			
Mean TD (M)				35.49%	5.86%	6.29%			
C(1+S)(1+M)				4.93	3.75	6.28			
Model with only time dummies									
Constant (C_p)				3.44	3.44	5.74			
(Last TD)				102.35%	15.86%	21.24%			
Mean TD (M_p)				39.82%	4.76%	7.24%			
$C_p(1 + M_p)$				4.81	3.61	6.16			

Note: Dependent variable: log rent per m² (net of operating costs). Quarterly time dummies (first period omitted); Last TD is the coefficient of the last period, Mean TD the weighted average of all time-dummy coefficients. Coefficients (shown without standard errors) are transformed as $e^\beta - 1$; *** p<0.001, ** p<0.01, * p<0.05, based on standard errors clustered by region × contract type. Shares and products are population weighted.

dense urban settings. Likewise, the theoretical model implies that tenure discounts depend on the growth rate of new-lease rents, which varies substantially across submarkets. To obtain more robust inference, I focus therefore in this section on results from specifications that allow for heterogeneous coefficients across groups $j = 1, \dots, J$. In particular I use interaction models of the form

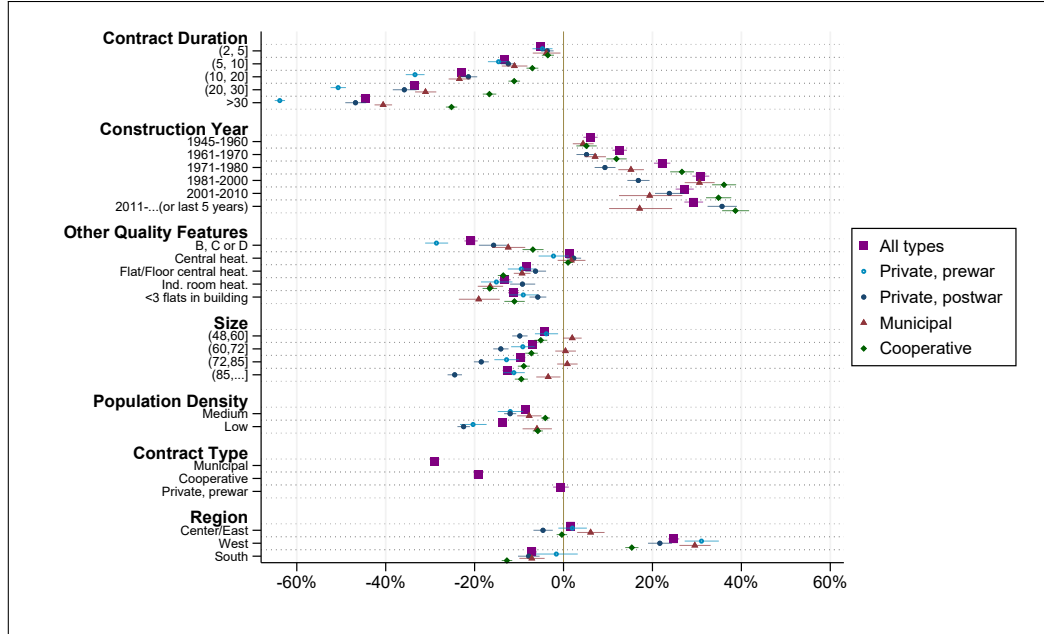
$$\ln(Rentsqm_i) = \sum_{j=1}^J D_{ij} \left(\alpha_j + \mathbf{X}_i' \beta_j + \gamma_j Dur_i + \delta_j t \right) + \varepsilon_i, \quad (66)$$

where $D_{ij} = 1$ when observation i belongs to group j . Both the intercepts α_j (associated with the group dummies) and all slope coefficients— β_j , γ_j and δ_j —are allowed to vary across groups where one intercept is normalized for identification (e.g., $\alpha_1 = 0$). Estimating this fully interacted model is algebraically equivalent to running separate regressions for each group. The pooled specification, however, also delivers the group-specific intercepts α_j and allows formal tests of whether coefficients differ significantly across groups.

To summarize the sometimes convoluted results in an intuitive and easily digestible way, I employ coefficient plots (error-bar plots). In particular, I show below the error-bar plots for various disaggregations: for 4 groups (splitting the private sector into prewar and postwar contracts), for 6 groups (differentiating in addition between unlimited and fixed-term private contracts) and for 16 groups (by contract type and region). The resulting figure is already fairly complex, and any further disaggregations would compromise readability. While I focus again on the results for regressions that only include ongoing contracts, I also show for the first two diseggregations separate pictures for old and new contracts.

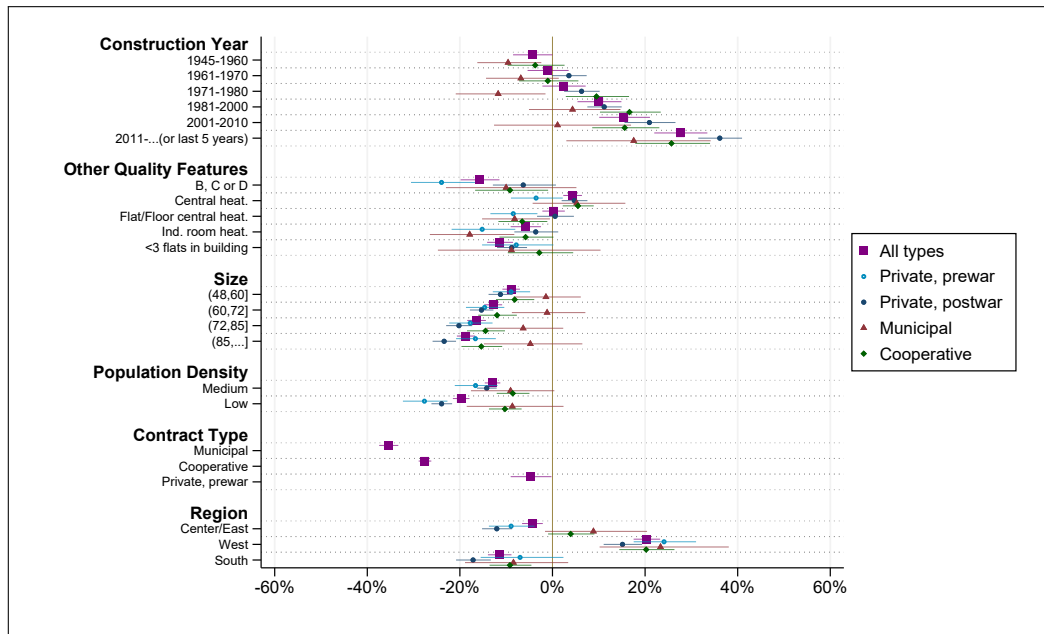
In all of the figures I use six dummy variables for the contract duration. This is in line with the results in Tables D7 and D8 but different to the main specification where I use a continuous variable and also different to the specification in Figure 2b where I use a set of annual categories. Furthermore, the coefficients in Figure D1 are always transformed, i.e. they indicate how a marginal change in one explanatory variable will affect the rent expressed in percentage terms. Figure D1 thus is directly comparable to the results of Table D8 with one slight difference. In the figures I group categories B, C, and D together, since category D has very few observations (especially for municipal and cooperative rents), leading to large confidence intervals that obscure the results. For comparison, all figures also include the coefficients of a uniform regression (in purple color) in which case the regressions also include dummies for the contract type.

Figure D1: Coefficients of the hedonic regression for old contracts (4 types)



Note: The figure shows the coefficients of the explanatory variables in the hedonic regression for old contracts and the period 2005–2024, split by contract type (4 groups). The x-axis shows the effect of a marginal change in one explanatory variable in percentage terms.

Figure D2: Coefficients of the hedonic regression for new contracts (4 types)



Note: The figure shows the coefficients of the explanatory variables in the hedonic regression for new contracts and the period 2005–2024, split by contract type (4 groups). The x-axis shows the effect of a marginal change in one explanatory variable in percentage terms.

Contract duration again has a strong effect (around -45% for durations > 30 years) and turns out to be the most important determinant of rents per square meter. This conclusion is supported not only by comparing the size of the estimated coefficients, but also by the frequency-weighted contributions of the coefficients (see Tables D5 to D8) and by the dominance statistic (not shown). The results in Figure D1 also indicate that the effect of duration is more pronounced for private contracts. Regarding the sign and magnitude of the other explanatory variables, they align with expectations. The rent per square meter is higher for more recently built houses (up to $+34\%$ for construction after 2011) and lower for larger units (by as much as -15% for sizes above 85 m^2). Similarly, rent is lower for units in lower categories (-40% for the lowest quality D), for units without central heating (-16% for room heating), and for units located outside urban centers (by as much as -14%). The effect of apartment size is present in all segments, though it is least pronounced in municipal housing, which might be due to the policies of social housing providers. Turning to the contract types, municipal rents are on average 29% lower than in the baseline category (private postwar contracts). It is, however, unclear whether this difference reflects unobserved quality characteristics or the benefits of social housing policies. Cooperative contracts exhibit a discount of 19% , although in this case it is important to note that I lack information on the upfront payment required for most contracts, which functions similarly to an advance rent payment. There is no statistically significant difference between prewar and postwar private contracts. Finally, rents in the West are on average 25% higher than in Vienna (the base category), while they are about 7% lower in the South.

The results for new contracts shown in Figure D2 are qualitatively similar although less precisely estimated (due to the smaller number of observations).

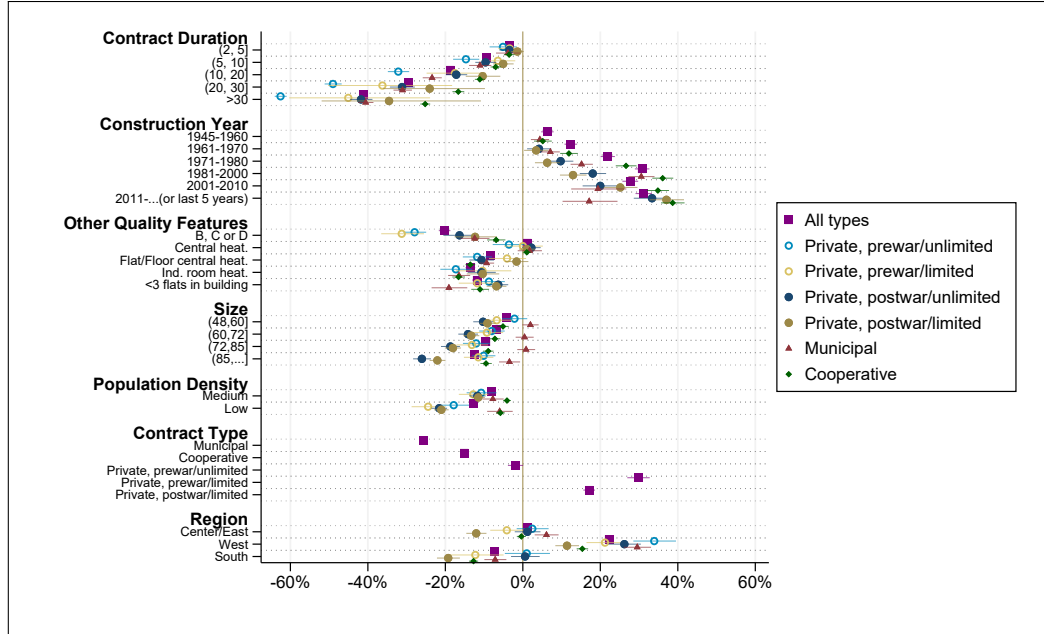
In Figures D3 and D4 I repeat the same exercise for a disaggregation in six types of contracts (distinguishing in addition between unlimited and fixed-term duration). The results are again fairly similar. In particular, the coefficients for unlimited and fixed-term contracts for the postwar period are often close.

In Figure D5 I repeat this exercise but now for the disaggregation with respect to both contract type (4 groups) and region (4 groups), i.e. a total of 16 groups.

D.3 Alternative specifications

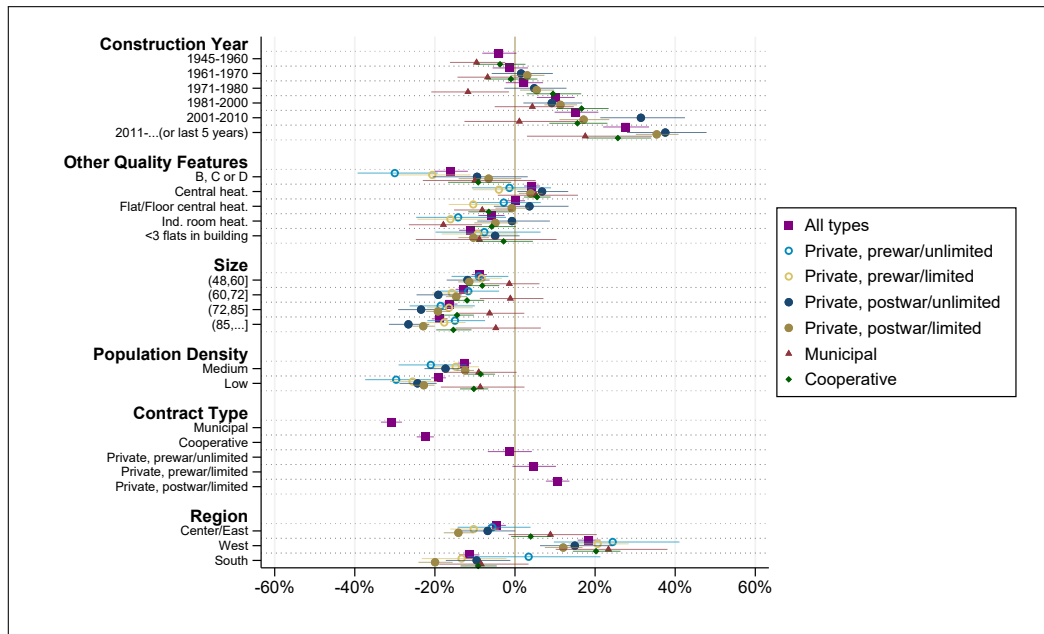
To further assess the validity of the results, I conduct a series of robustness tests by exploring alternative model specifications. These tests aim to examine whether the findings

Figure D3: Coefficients of the hedonic regression for old contracts (6 types)



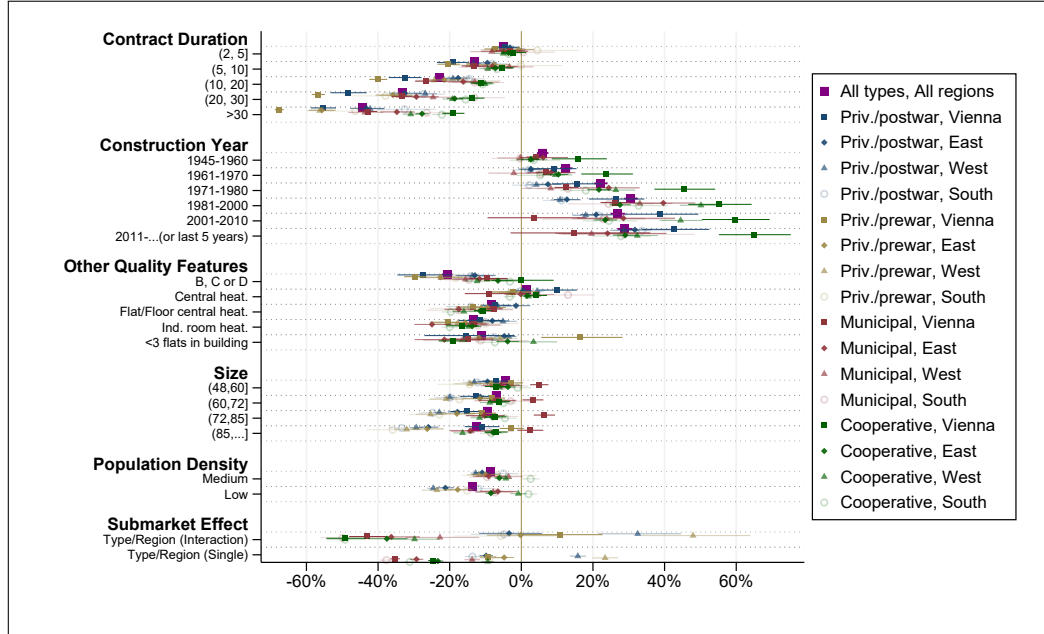
Note: The figure shows the coefficients of the explanatory variables in the hedonic regression for old contracts and the period 2005–2024, split by contract type (6 groups). The x-axis shows the effect of a marginal change in one explanatory variable in percentage terms.

Figure D4: Coefficients of the hedonic regression for new contracts (6 types)



Note: The figure shows the coefficients of the explanatory variables in the hedonic regression for new contracts and the period 2005–2024, split by contract type (6 groups). The x-axis shows the effect of a marginal change in one explanatory variable in percentage terms.

Figure D5: Coefficients of the hedonic regression for old contracts (16 groups)



Note: The figure shows the coefficients of the explanatory variables in an interaction model (66) together with the results of a homogeneous model. The x-axis shows the effect of a marginal change in one explanatory variable in percentage terms.

remain consistent under different assumptions and data treatments. The robustness exercises are structured into three categories. First, I use different samples and alternative definitions of key explanatory variables to test whether the results hold across varying data selections. Second, I redefine the dependent variables to evaluate the sensitivity of the estimates to alternative outcome measures. Third, I incorporate additional explanatory variables to control for potential omitted variable bias and assess whether the main effects remain stable.

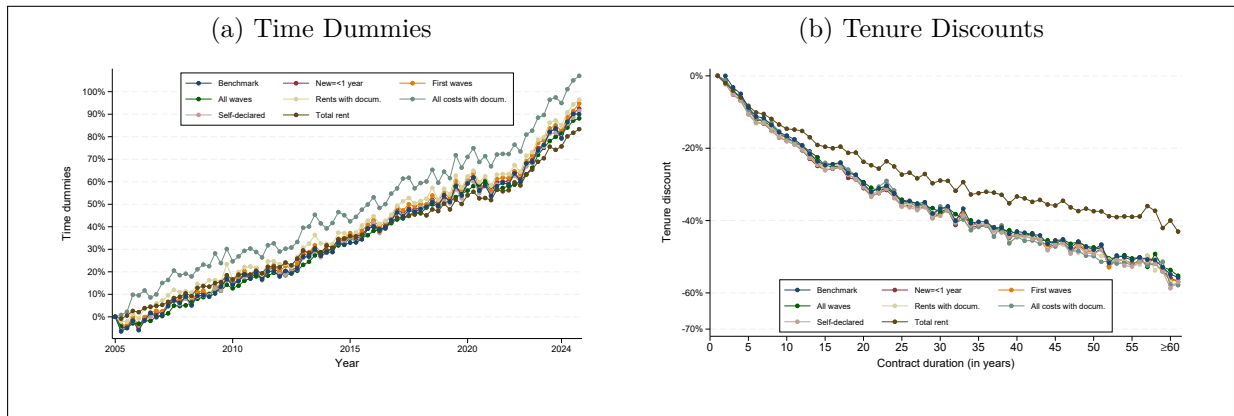
D.3.1 Different samples and definitions of explanatory variables

In Figure D6, I present the pattern of the time dummies for old contracts based on various alternative specifications. These specifications allow for a more comprehensive examination of the robustness of the results by testing different assumptions and data treatments.

The **benchmark specification** serves as the reference point for all robustness checks. One alternative definition considers **new contracts** as those shorter than a quarter instead of the original one-year threshold. Another approach, labeled **first waves**, relies

on the first waves of the survey data rather than the first wave when a household actually responded. Expanding the sample further, the **all waves** specification includes observations from all five waves of the survey. To improve data reliability, the **rents with documentation** specification focuses on cases where rent amounts are based on verifiable sources, such as legal contracts or bank statements. Extending this, the **all costs with documentation** specification includes both rents and operating costs when supported by documentation. Conversely, the **self-declared** specification limits the sample to observations where rent information was provided without supporting documents. Additionally, I include a specification that uses **total rent, including operating costs**, to account for a broader definition of housing expenditures.

Figure D6: Tenure discounts and time dummies, alternative specifications



Note: The picture shows (a) time dummies and (b) tenure discounts for old contracts between 2005 and 2024 and for various specifications as explained in the text. *Source:* Statistics Austria (2025); own calculations.

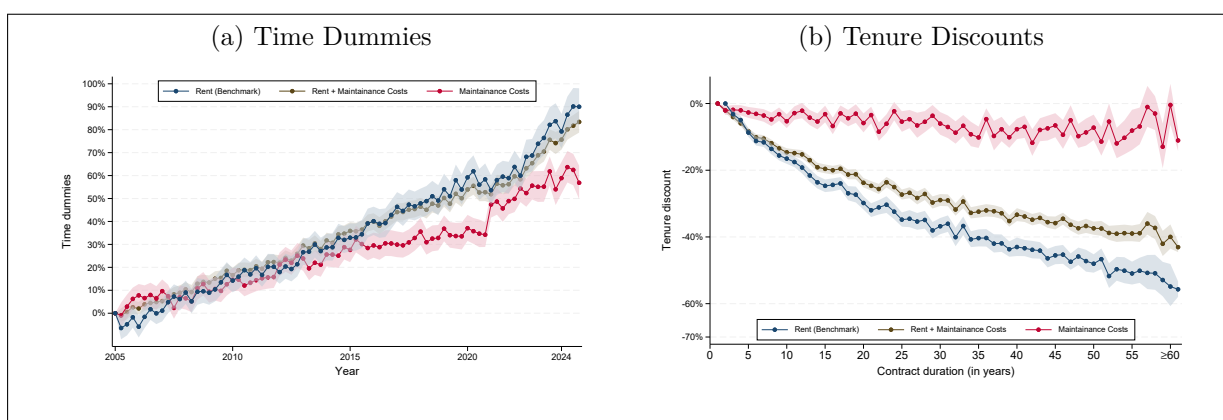
As can be observed, the development of time dummies is very similar across the different specifications with the exception of the case that only includes observations where the payment for the rent and the operating costs is based on official documents. In this case one loses, however, almost half of the observations and this might not be a random sample (especially at the beginning of the time sample).

The tenure discounts are also quite homogeneous across the specifications. In this case it is only the total rents that stand out. This, however, is not surprising since total rents also include operating costs and there does not exist a reason why they should be lower for older contracts.

D.3.2 Gross rents vs. net rents

In fact, in Figure D7 I compare net rents, operating costs and gross rents. The average growth rate of operating costs is lower than the one for rents and more in line with the development of the rate of inflation. The growth rate of gross rents is closer to the development of net rents (due to the fact that rents contribute a larger share—about 3/4—to the total). The pattern of tenure discounts is as expected. Operating costs only show a weak (and barely significant) discount for older contracts. This is also reflected in the pattern of gross rents that is less steep than the one for net rents.

Figure D7: Inclusion or exclusion of operating costs



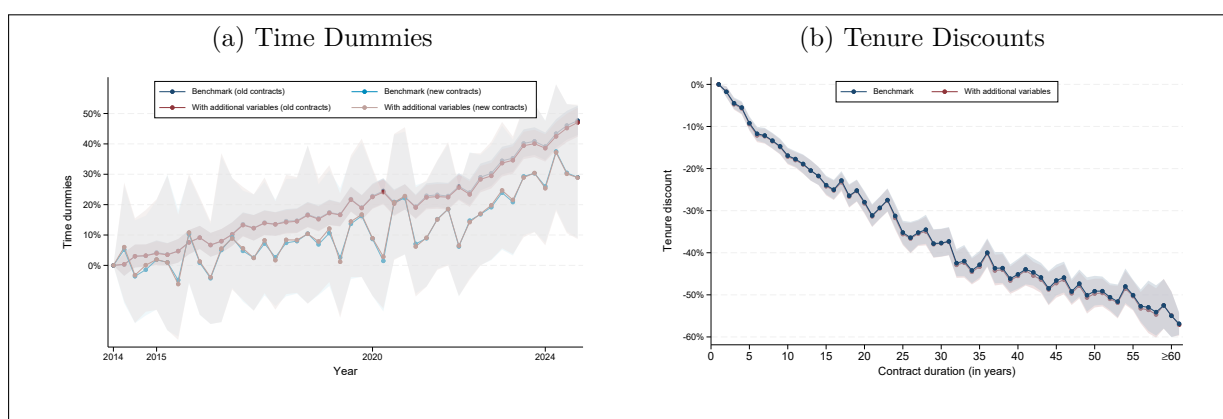
Note: The picture shows (a) time dummies and (b) tenure discounts for old contracts between 2005 and 2024 and for rents, operating costs and total rents. *Source:* Statistics Austria (2025); own calculations.

D.3.3 Additional explanatory variables

As a final robustness exercise, I also examine the surveys from 2014 onwards, which include a small set of additional questions that provide valuable information to control for the quality of the rental properties. Specifically, these variables capture the presence of features such as an elevator, a private garden, a balcony or terrace, and the number of included garage spaces. As shown in Figure D8b the pattern of the tenure discounts is almost identical for the extended regressions. The development of the time dummies (Figure D8a) is somewhat slower indicating that (a small part) of the increase in the rents per m² in the benchmark regression might be due to quality improvements that have not been captured with the standard variables. The left-hand panel of Figure D8 also reveals that—contrary to the baseline picture in Figure 2c—the growth rate of new contracts appears to have been below that of old contracts. This, however, might again be an

artifact of the insufficient number of observations on which the series for new contracts is based. As is apparent from Figure 2c, in the starting year 2014 the time dummy for new contracts lies markedly above the line for old contracts only to return sharply a few quarters later. Since the year 2014 is the starting point in Figure D8a this dampens the measured increase of the development of new contracts.

Figure D8: Tenure discounts and time dummies, 2014–2024



Note: The picture shows (a) time dummies and (b) tenure discounts for old contracts between 2014 and 2024 and for various specifications as explained in the text. *Source:* Statistics Austria (2025); own calculations.

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