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Rental Externality, Tenure Security, and Housing Quality

by

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Abstract

This paper considers three tenure modes - owner-owned housing, tenant-owned housing, and landlord-owned housing - and models the effect of the rental externality and tenure security on housing quality. We show theoretically that the rental externality has no impact on the housing quality of tenant-owned housing, but tenure security has an ambiguous effect when the user's utilization and the owner's maintenance are complements. We also show that the rental externality and tenure security both reduce landlord-owned housing quality when the user's utilization and the owner's maintenance are substitutes. Empirical investigation yields results that are consistent with the theoretical predictions.

Keywords: tenure mode; property rights; tenure rights; rental externality; tenure security; housing quality

JEL classification: K11 (Property Law); K12 (Contract Law); R38 (Government Policies, Regulatory Policies)

1 Introduction

Property and tenure rights are important influences on housing quality. As Hirsch and Rufolo (1999) have argued, housing services are produced using two inputs: namely, land and the housing unit itself. The two can be readily separated, and either can be owned or rented. Thus, dwellings have potentially different ownership patterns. In this paper, we consider three different tenure modes. The first is owner-owned and owner-occupied housing, where the land and the housing unit are owned by an owner who leases them both to his or herself. The second is tenant-owned and tenant-occupied housing, where the land is owned by a landowner who leases it to a tenant who owns the housing unit on that land. The third is landlord-owned and tenant-occupied housing, where land and the housing unit are owned by a landlord who leases both to a tenant. We refer to the first type of ownership as owner-owned housing, the second as tenant-owned housing, and the third as landlord-owned housing.[1]

Sweeney (1974) has shown that owner-occupants maintain their housing units at a higher standard than landlords because of pride in ownership. That is, owner-occupants value the extra utility from maintenance more than the market, so the marginal benefit of maintenance to owner-occupants exceeds that to landlords. Therefore, landlord-owned housing deteriorates more quickly than owner-owned housing. Henderson and Ioannides (1983) have argued that in rental-housing contracts, the rights to use assets are temporarily transferred to tenants. Because tenants, unlike owner-occupants, do not necessarily care about future asset values, they tend to over-utilize dwellings. This leads to the excessive deterioration of housing properties. This is Henderson and Ioannides' (1983) so-called rental externality.[2] On the other hand, in rental-land contracts, tenants are residual claimants on housing. Therefore, they care about housing as owner-occupants.

Housing policy, such as the security of tenure rights, that is guaranteed by (tenancy) rent

[1] Kanemoto (1990) has argued that tenant-owned housing is rare in many developed economies because the housing unit and the land are usually treated as a single property.

[2] Galster (1983) found empirical evidence that owner-owned housing has both a higher maintenance effort and a lower incidence of housing problems than landlord-owned housing. Shilling et al. (1991) also concluded that landlord-owned housing depreciates faster than owner-owned housing. Gatzlaff et al. (1998), however, established that owner-owned housing depreciates relative to landlord-owned housing in some submarkets.

controls also affects housing quality.[3] For example, Albon and Stafford (1990), Arnault (1975), Frankena (1975), Kanemoto (1990), Kiefer (1980), Moorhouse (1972) and Seshimo (2003) have examined the impact of (tenancy) rent control on the maintenance of (or investment in) rental dwellings. They show that because (tenancy) rent control may reduce the profit of rental housing businesses, landlords reduce maintenance on their housing. However, Olsen (1988) has argued that if tenants maintain the quality of their housing, (tenancy) rent control does not necessarily reduce the quality of landlord-owned housing. This is because rent reductions are effectively transfers from landlords to tenants. However, in rental-housing contracts, tenants are not residual claimants on the housing unit. Therefore, tenants do not consider a landlord's benefit from any alternative use of the dwelling. For this reason, the tenant maintenance rate may be less than the landlord maintenance rate. In rental-land contracts, Kanemoto (1990) has shown that tenure security promotes optimal investment because it incorporates perfect property rights.[4] However, Seshimo (2003) has argued that over-investment is generated by tenure security. This is because tenants undervalue the benefits from land-use conversion relative to continuation of the contract.

However, these analyses have all examined the decisions of owners and users in isolation. In fact, and as put forward by Miceli (1992), both decisions affect housing quality. Seshimo (2003), for example, only considered the effects of investment on rental-housing contracts.[5] In this paper, both the owner and the user make an investment in each tenure mode. Furthermore, investment by both affects housing quality. However, investment by tenants has different effects on the quality of dwellings to those predicted by Kanemoto (1990), Miceli (1992), and Olsen (1988). All of these studies assume that a tenant's investment has positive

[3]Rent control forces rent below market-clearing levels at an increased rate. On the other hand, tenancy rent control governs rent increases within a tenancy, but has no power between tenancies. Many jurisdictions around the world now implement forms of tenancy rent control. These include, amongst others, Canada, France, Germany, India, Italy, Japan, Sweden, Switzerland, and some parts of the U.S. See Arnott (2003) for details of tenancy rent control.

[4]Perfect property rights imply that subletting is allowed.

[5]In this model, a landlord's investment and that of the tenant occur sequentially. The landlord first undertakes building investment on the land, and the tenant subsequently makes a relationship-specific investment in the rental dwelling. Seshimo (2003) showed that if tenant protection is perfect, the tenant over-invests in the rental dwelling to increase compensation for having to involuntarily vacate the dwelling. This reduces the opportunity to convert the use of the land. The landlord expects this to occur, and consequently decreases investment in the building. The opposite result arises when tenure security is not protected.

effects on rental-housing quality, whereas in this paper it is assumed that it has negative effects. In our model, a tenant's investment can be interpreted as a relationship-specific investment, as described by Seshimo (2003), or in terms of utilization intensity, as referred to by Henderson and Ioannides (1983). It is costly for landlords to remove or mitigate damages caused by a tenant's investment or utilization. Therefore, tenant investment may have negative effects on housing quality. In fact, rental housing contracts that forbid tenant investment are common in Japan. Any evidence may justify our assumptions.

In the theoretical part of this paper, we obtain the following results.

- The rental externality problem does not occur in tenant-owned housing. When the user's utilization and the owner's maintenance are complements, the effect of tenure security on the quality of tenant-owned housing is ambiguous.
- When the user's utilization and the owner's maintenance are substitutes, the quality of landlord-owned housing is lower than that of owner-owned housing due to the rental externality. Tenure security further reduces the quality of landlord-owned housing.

We test these predictions empirically. To do so, we follow Gyourko and Linneman (1990) by estimating whether rent-controlled buildings are in good condition. Our empirical results confirm the above theoretical predictions.

The remainder of the paper is organized as follows. In Section 2, we present a benchmark theoretical model without tenure security and consider the payoff functions of the user and the owner. In Section 3, we introduce tenure security. In Section 4, we investigate the effect of the rental externality and tenure security on housing quality. The data and empirical model used are discussed in Section 5, along with the empirical results. With these results, we investigate the welfare and policy implications for tenure security in Section 6. Section 7 summarizes the main conclusions of the paper.

2 The Effects of the Rental Externality

As Hirsch and Rufolo (1999) have argued, housing services are produced using two inputs: land and the housing unit. Either can be owned or rented. Accordingly, there are four entities

involved: (i) the owner of the land; (ii) the owner of the housing; (iii) the user of the land; and (iv) the user of the housing. Since a building is constructed on the land, the user of the housing is in effect the user of the land during the term of the lease. In this paper, we suggest that housing can be owned and used under the following three tenure modes. The first type of ownership is owner-owned housing, in which land and the housing unit are owned by an owner who leases both to his or herself. In this case, entities (i)–(iv) above are the same individual. The second type is tenant-owned housing, in which land is owned by a landowner who leases it to a tenant who owns the housing unit on the land. In this case, the landowner is entity (i) and the tenant is entities (ii), (iii), and (iv). The third type is landlord-owned housing, in which land and the housing unit are owned by a landlord who leases both to a tenant. In this case, the landlord is entities (i) and (ii) and the tenant is entities (iii) and (iv).

Because we focus on the quality of housing, we assume that housing comprises a single unit constructed on a plot of a land, and that its construction cost is 0. In this section, we consider a two-period model without tenure security in which we only focus on the effects of the rental externality on housing quality. Housing quality in period 1 is given. Housing quality in period 2 (q_2) is assumed to be a function of m, the maintenance undertaken by the owner of the housing to mitigate quality deterioration during period 1, and u, the intensity with which the user of housing utilizes the unit in period 1. That is, m and u undertaken in period 1 have spillover effects on housing quality in period 2. We assume that repair work, which the owner of the housing performs, is completed at the end of period 1. As a result, the current level of m does not affect housing quality in period 1. Moreover, additional m and u are assumed to be zero in the second period.[6] The variable m represents large-scale investment in the structural part of the housing unit, such as maintenance of a roof, a wall or a support. This maintenance increases q_2 at a decreasing rate. Thus, $q_{2m} > 0$, and $q_{2mm} < 0$. The variable u represents the intensity with which the user of the housing utilizes the unit. Utilization has positive effects for the user living in the dwelling. However, utilization damages walls and

[6]The level of investment in our model is determined in the first period. See Kanemoto (1990) for the relationship between additional investment and tenure security.

floors. Thus, u has negative effects on the social evaluation of q_2; i.e., $q_{2u} < 0$.[7] We do not make an assumption about the depreciation rate, and instead assume that $q_{2u} < 0$. It seems plausible that higher rates of utilization by the user lower housing quality at an increasing rate. Thus, we assume that $q_{2uu} < 0$. The sign of q_{2um} is discussed below.

The utilization rate u is effective in both periods, but m is effective in period 2 for the initial user's utility. Thus, the initial user derives utility of $v_1(u)$ in period 1 and $v_2(u, m)$ in period 2 from housing, where $v_{tu} > 0$, $v_{tuu} < 0$ ($t \in \{1, 2\}$), $v_{2m} > 0$, $v_{2mm} < 0$. The sign of v_{2um} is discussed below. The user also derives utility from the location of the land. However, we ignore this effect because we assume that the initial tenant can potentially move to other dwellings.[8]

The rental price in period 1 (R_1) depends on the value (quality) of housing r_1 and on the value of the location of the land γ_1; i.e., $R_1 = R_1(r_1, \gamma_1)$. We assume that the rental price has the additive form $R_1 = r_1 + \gamma_1$. The rental price in period 2 (R_2) depends on the value (quality) of housing r_2 and on the value of the location of the land γ_2; i.e., $R_2 = r_2 + \gamma_2$. We assume that $q_2(u, m)$ can be expressed in pecuniary terms. Thus, $r_2 = q_2(u, m)$. The value of the location of the land γ_2 is a random variable, and both the owner and the user know the probability distribution function (pdf) $f(\gamma_2)$, which is assumed to be uniform on the interval $[0, \bar{\gamma}_2]$, where $0 < \bar{\gamma}_2$.[9]

In each period, the landowner offers the homeowner (the user of land) a rent γ_t, and the homeowner offers the user of the dwelling a gross rent R_t. At the beginning of period 1, the

[7] Consider rented housing. Assume that both the landlord and the potential tenant observe u, but that a court cannot (Henderson and Ioannides 1983, Kanemoto 1990). In this case, it is difficult to write a contract that requires the tenant to restore the rental housing to its original condition. Hence, the landlord cannot charge the tenant for wear and tear of the rental housing caused by the tenant's activities. The landlord takes a deposit from the tenant to mitigate over-utilization by the tenant. However, because the court cannot observe the utilization rate of the tenant, deposits are ineffective. Furthermore, the Japanese Ministry of Land, Infrastructure, and Transport has introduced guidelines relating to the return of deposits. These guidelines state that landlords should return deposits to tenants when the following types of damage have occurred: (a) indentations in carpet caused by furniture; (b) screw-holes made by the tenant for the installation of air-conditioning; (c) thumbtack-holes made by the tenant; (d) tobacco stains on walls; and (e) stains on walls from electric discharge by refrigerators. Hence, it is difficult for landlords to induce responsible behavior by tenants by imposing a deposit.

[8] See Eq. (2) below.

[9] The effects of the rental externality on housing quality do not depend on the functional form of the pdf. Similarly, the effects of tenure security on tenant-owned housing quality do not depend on this assumption. The effects of tenure security on landlord-owned housing quality, however, do depend on this simplifying assumption.

owner and the user make a one-period lease contract. The tenancy terminates at the end of period 1. In the second period, rent is offered by the owner, and the initial user decides to either continue to rent or move at the beginning of period 2. Before examining this, we consider the relationship between q_2 and v_2.

If the utilization rate is 0, or in other words, if the initial user does not add any investment during period 1, it is plausible that the second-period user's utility from the housing equals the social evaluation q_2. However, since we assume $u > 0$ and $q_{2u} < 0$ (u only benefits the initial user), the second-period user's utility v_2 from the housing exceeds the social evaluation. Thus,

$$\forall m \quad v_2(u, m) > q_2(u, m).$$

Furthermore, assume that

$$\exists \gamma_2' \in (0, \bar{\gamma}_2] \quad v_2(u, m) < q_2(u, m) + \gamma_2'.$$

This implies that the second period user's utility can be less than the second period value of the land with a dwelling, if we consider the random variable γ_2.

We also assume that

$$\forall u, m \quad v_{2m} = q_{2m}. \tag{1}$$

This assumption implies that the marginal utility of m for the initial tenant is equivalent to the marginal social evaluation of m for all u and m.

In our model, the sign of the cross-partial derivatives of $v_2(u, m)$ and $q_2(u, m)$ are of critical importance, because these signs affect the type of strategic interaction between the inputs of owners and users. From assumption Eq. (1), v_{2um} must equal q_{2um}; i.e., $v_{2um} = q_{2um}$. Therefore, if v_{2um} is negative (positive), then q_{2um} is negative (positive).[10]

We normalize the reservation utility level at 0 when the initial user lives in another dwelling in period 2. Then the maximum rent that he or she pays for the dwelling while enjoying a

[10]For example, suppose that a tenant accidentally spills sauce on the carpet and the landlord cleans it up. The more sauce that is spilt, the more difficult it is for the landlord to clean up. In this case, q_{2um} is negative. Next, suppose that the tenant papers the walls. As Seshimo (2003) has stated, the tenant cannot enjoy the wallpaper without the wall (which is maintained well). In this case, q_{2um} is positive.

utility level of at least 0 can be written as $v_2(u, m)$. Suppose that the owner has no bargaining power.[11] Then, at the beginning of the second period, the owner of the housing offers the gross rent $R_2 = q_2(u, m) + \gamma_2$. The initial user renews the contract if the maximum rent is greater than or equal to the offered rent. Otherwise, he or she moves to other housing and obtains the reservation utility level. Hence, the efficient renewal-move condition is as follows:

$$\begin{cases} F(\gamma_2^*) = \Pr[v_2(u, m) \geq q_2(u, m) + \gamma_2] & \Rightarrow \quad \text{renewal}, \\ 1 - F(\gamma_2^*) = \Pr[v_2(u, m) < q_2(u, m) + \gamma_2] & \Rightarrow \quad \text{move}, \end{cases} \tag{2}$$

where $F(\gamma_2)$ is the cumulative distribution function (cdf) of γ_2. Equation (2) implies that the tenant renews the contract if γ_2 is less than or equal to γ_2^*, or otherwise moves to other housing in period 2. We refer to γ_2^* as the critical value. From Eq. (2), we have

$$\gamma_2^* = \gamma_2^*(u, m) = v_2(u, m) - q_2(u, m).$$

The critical value thus depends on both u and m.

2.1 Payoffs to the Owner and the User

Assume that the owner and the user are both risk neutral and have the same discount factor, set at unity. Then, from Eq. (2), the utility of the user of the housing and the land is

$$v_1(u) - R_1 - g(u) + \int_0^{\gamma_2^*} [v_2(u, m) - q_2(u, m) - \gamma_2] f(\gamma_2) d\gamma_2, \tag{3}$$

where $g(u)$ is the cost of utilization during period 1, in which $g_u > 0$ and $g_{uu} > 0$ for all u.

Consider the housing owner. The owner obtains $q_2(u, m)$ whether or not the initial user renews the contract in period 2 with both owner-owned housing and landlord-owned housing because the property rights are protected. In tenant-owned housing, the landowner and the homeowner are separated. Thus the homeowner (=tenant) has to return the land and lose the dwelling when he or she moves in period 2. Land Lease and House Lease Law in Japan (Article 13), however, admits that the tenant has a right of claim to the landowner to purchase the housing at the market price. Therefore, the homeowner in tenant-owned housing also obtains $q_2(u, m)$ whether or not he or she renews the contract in period 2. Noting that the net rent

[11] See Kanemoto (1990) and Seshimo (2003) for the effect of the bargaining power of lessors and lessees on housing investment.

for the homeowner in each period is $r_t = R_t - \gamma_t$, then, the homeowner's profit can be written as

$$r_1 - c(m) + \int_0^{\overline{\gamma}_2} q_2(u,m) f(\gamma_2) d\gamma_2, \tag{4}$$

where $c(m)$ is the cost of maintenance in period 1, in which $c_m > 0$ and $c_{mm} > 0$ for all m.

We next examine the profit of the owner of the land. The landowner obtains γ_2 whether or not the initial user renews the contract in period 2. Therefore, the profit for the landowner is

$$\gamma_1 + \int_0^{\overline{\gamma}_2} \gamma_2 f(\gamma_2) d\gamma_2. \tag{5}$$

In the following sections, we consider the payoffs in each tenure mode.

2.1.1 Owner-owned housing

The payoff for owner-owned housing is the sum of the user's payoff (Eq. (3)), the homeowner's payoff (Eq. (4)), and the landowner's payoff (Eq. (5)). From the assumption that $f(\gamma_2)$ is uniform, the utility (V) of the owner can be rewritten as

$$\max_{u,\,m} V_O = v_1(u) - g(u) - c(m) + \frac{\gamma_2^*}{\overline{\gamma}_2} v_2(u,m) + \frac{\overline{\gamma}_2 - \gamma_2^*}{\overline{\gamma}_2} \left[q_2(u,m) + \frac{\overline{\gamma}_2 + \gamma_2^*}{2} \right]. \tag{6}$$

where the subscript O refers to owner-owned housing. Eq. (6) implies that the owner chooses u and m to maximize not only his or her utility (the sum of the first and fourth terms on the right-hand side) but also potential future tenants' or buyers' utilities (the last term on the right-hand side).

The first-order conditions for u and m are

$$V_{Ou} = v_{1u} + \frac{\gamma_2^*}{\overline{\gamma}_2}(v_{2u} - q_{2u}) + q_{2u} - g_u = 0, \tag{7}$$

$$V_{Om} = q_{2m} - c_m = 0. \tag{8}$$

These two equations define the utilization rate function $u_O(m)$ and the maintenance function $m_O(u)$.[12] The sign of both the utilization rate function and the maintenance function depend on the mixed partial of the objective function with respect to u and m. We define the following:

[12] We assume that an interior solution exists to the first-order conditions, respectively. This is assumed to hold throughout this paper.

Definition 1 *If the mixed partial of the objective function with respect to u and m is negative (positive), both the utilization rate function and the maintenance function become a(n) decreasing (increasing) function. That is, u and m are substitutes (complements). We refer to the substitutes (complements) case as case S (C).*

The equilibrium input levels, (u_O, m_O), can be found by solving Eq. (7) and (8) simultaneously, which yields the intersection point of the two functions.[13]

2.1.2 Tenant-owned housing

Note that the homeowner is the tenant (the user of the land and the housing) in the rental-land contract. Thus, the payoff for the tenant is the sum of Eqs. (3) and (4). Noting that $f(\gamma_2)$ is uniform, the maximization problem for the tenant is

$$\max_{u,m} V_T = v_1(u) - \gamma_1 - g(u) - c(m) + \frac{\gamma_2^*}{\overline{\gamma}_2}\left[v_2(u,m) - \frac{\gamma_2^*}{2}\right] + \frac{\overline{\gamma}_2 - \gamma_2^*}{\overline{\gamma}_2} q_2(u,m). \tag{9}$$

where the subscript T refers to tenant-owned housing.

Consider the landowner (the owner of the land). The payoff for the landowner (Π_T) is equal to Eq. (5). Therefore, the profit for the landowner can be written as

$$\Pi_T = \gamma_1 + \frac{\overline{\gamma}_2}{2}.$$

The solution to Eq. (9) satisfies

$$V_{Tu} = v_{1u} + \frac{\gamma_2^*}{\overline{\gamma}_2}(v_{2u} - q_{2u}) + q_{2u} - g_u = 0, \tag{10}$$

$$V_{Tm} = q_{2m} - c_m = 0. \tag{11}$$

These two equations define the functions $u_T(m)$ and $m_T(u)$. The values of u and m that simultaneously satisfy Eqs. (10) and (11) are denoted by (u_T, m_T).

2.1.3 Landlord-owned housing

In the rental-housing contract, the maximization problem for the tenant can be rewritten as

$$\max_{u} V_L = v_1(u) - R_1 - g(u) + \frac{\gamma_2^*}{\overline{\gamma}_2}\left[v_2(u,m) - q_2(u,m) - \frac{\gamma_2^*}{2}\right], \tag{12}$$

[13] The second-order condition for a maximum is assumed to hold throughout the paper. Moreover, only the unique equilibrium is considered below.

where the subscript L refers to landlord-owned housing.

Consider the landlord (the owner of the land and the housing). The payoff for the landlord (Π_L) is the sum of Eqs. (4) and (5). Therefore, the profit-maximization problem for the landlord can be written as

$$\max_m \ \Pi_L = R_1 - c(m) + q_2(u, m) + \frac{\overline{\gamma}_2}{2}. \tag{13}$$

Eq. (13) implies that the landlord obtains $R_2 = q_2(u, m) + \gamma_2$ whether or not the initial tenant renews the contract in period 2. This implies that the property rights are perfectly protected in landlord-owned housing when there is no tenure security.

The solutions to Eqs. (12) and (13) satisfy, respectively

$$V_{Lu} = v_{1u} + \frac{\gamma_2^*}{\overline{\gamma}_2}(v_{2u} - q_{2u}) - g_u = 0, \tag{14}$$

$$\Pi_{Lm} = q_{2m} - c_m = 0. \tag{15}$$

From this condition, we obtain the function $u_L(m)$ and $m_L(u)$. The utilization-rate function $u_L(m)$, however, does not depend on m.[14] The reason for this is that the tenant cannot increase utility by changing the rate of utilization when landlord maintenance changes, because the increment of landlord maintenance induces a rent increase just sufficient to offset the marginal utility of m in period 2 (see Eq. (1)). The equilibrium input levels, u_L and m_L, can be found by simultaneously solving Eqs. (14) and (15). [15]

3 The Effects of Tenure Security

In this section, we consider the effects of tenure security on the payoff functions. In Japan, for the landowner (landlord) to terminate the contract despite the tenant's desire for renewal, he or she must approach a court and prove *just cause* (Land Lease and House Lease Law, Article 6 for land leases and Article 28 for house leases). In the rental-land (rental-housing) contract, just cause is acknowledged by a court when the owner's need for the land (housing) unit is greater than that of the tenant. To introduce this into our model, we interpret just cause as

[14] We have $du_L(m)/dm = -V_{Lum}/V_{Luu}$, where $V_{Lum} = 0$.

[15] The stability condition is assumed to hold throughout the paper.

follows. At the beginning of the second period, the court compares the owner's revenue and the initial tenant's utility, and accords the owner the right to use the land (housing) unit if the former is greater than the latter. Otherwise, it gives the tenant the right to use. The court, however, has a tendency to underestimate the owner's revenue due to tenure security. Furthermore, to prevent eviction with a rent increase (Articles 11 and 32), the court lowers the contract-renewal rent to the level of the owner's revenue, which is underestimated.

3.1 Tenant-owned housing

If both the landowner and the initial tenant expect this to occur, the initial tenant's choice at the beginning of period 2 in the rental-land contract case can be represented as follows:

$$\begin{cases} F(\hat{\gamma}_2) = \Pr[v_2(u,m) \geq q_2(u,m) + \frac{1}{\alpha}\gamma_2] & \Rightarrow \quad \text{renewal}, \\ 1 - F(\hat{\gamma}_2) = \Pr[v_2(u,m) < q_2(u,m) + \frac{1}{\alpha}\gamma_2] & \Rightarrow \quad \text{move}, \end{cases} \tag{16}$$

where α ($\alpha > 1$) is the parameter representing the underestimation by the court that the landlord and the initial tenant anticipate.[16] Thus, the critical value changes as follows:

$$\hat{\gamma}_2 = \hat{\gamma}_2(u, m, \alpha) = \alpha \left[v_2(u,m) - q_2(u,m) \right].$$

Because $\alpha > 1$, we have $\hat{\gamma}_2 > \gamma_2^*$. Hence, the probability of renewal is higher when $\alpha > 1$. Thus, α implies the degree of tenure security.

In Japan, when the tenant is the owner of the housing, the property rights for the housing are protected by tenancy rent control (Article 13). Noting this, Eq. (16), and the form of $f(\varepsilon)$, the maximization problem of the tenant becomes

$$\max_{u,m} V_T^S = v_1(u) - \gamma_1 - c(m) - g(u) + \frac{\hat{\gamma}_2}{\overline{\gamma}_2} \left[v_2(u,m) - \frac{1}{\alpha}\frac{\hat{\gamma}_2}{2} \right] + \frac{\overline{\gamma}_2 - \hat{\gamma}_2}{\overline{\gamma}_2} q_2(u,m). \tag{17}$$

where superscript S refers to the case with tenure security. Because tenure security raises the probability of renewal, it increases the expected payoff when the tenant renews the contract.

[16] Landowners (or landlords) may discount the contract-renewal rent voluntarily to retain current tenants to whom they wish to continue renting the unit. However, we ignore this voluntary tenure discount. See Hubert (1995) for tenure discount issues.

In the case of tenure security, the landowner can obtain γ_2 when the initial tenant moves to other housing in period 2. However, he or she only obtains $(1/\alpha)\gamma_2$ when the initial tenant renews the contract. That is, landownership is reduced by tenure security. Therefore, the profit for the landowner is as follows:

$$\Pi_T^S = \frac{\hat{\gamma}_2}{\overline{\gamma}_2}\left(\frac{1}{\alpha}\frac{\hat{\gamma}_2}{2}\right) + \frac{\overline{\gamma}_2 - \hat{\gamma}_2}{\overline{\gamma}_2}\left(\frac{\overline{\gamma}_2 + \hat{\gamma}_2}{2}\right).$$

The first-order conditions for Eq. (17) are

$$V_{Tu}^S = v_{1u} + \frac{\hat{\gamma}_2}{\overline{\gamma}_2}(v_{2u} - q_{2u}) + q_{2u} - g_u = 0, \tag{18}$$

$$V_{Tm}^S = q_{2m} - c_m = 0. \tag{19}$$

Eqs. (18) and (19) define the functions $u_T^S(m,\alpha)$ and $m_T^S(u)$. The equilibrium is the set of u and m that satisfies these two equations, and is denoted by (u_T^S, m_T^S).

3.2 Landlord-owned housing

Because tenure security lowers the contract-renewal rent $R_2 = q_2(u,m) + \gamma_2$, the initial tenant's choice at the beginning of period 2 in a rental-housing contract can be represented as follows:

$$\begin{cases} F(\tilde{\gamma}_2) = \Pr\{v_2(u,m) \geq \frac{1}{\alpha}[q_2(u,m) + \gamma_2]\} & \Rightarrow \quad \text{renewal}, \\ 1 - F(\tilde{\gamma}_2) = \Pr\{v_2(u,m) < \frac{1}{\alpha}[q_2(u,m) + \gamma_2]\} & \Rightarrow \quad \text{move}. \end{cases} \tag{20}$$

The critical value changes as follows:

$$\tilde{\gamma}_2 = \tilde{\gamma}_2(u,m,\alpha) = \alpha v_2(u,m) - q_2(u,m).$$

Because $\alpha > 1$, we have $\tilde{\gamma}_2 > \gamma_2^*$.

Noting Eq. (20), and the form of $f(\varepsilon)$, the maximization problem of the tenant becomes

$$\max_u V_L^S = v_1(u) - R_1 - g(u) + \frac{\tilde{\gamma}_2}{\overline{\gamma}_2}\left[v_2(u,m) - \frac{1}{\alpha}q_2(u,m) - \frac{1}{\alpha}\frac{\tilde{\gamma}_2}{2}\right]. \tag{21}$$

Thus, tenure security increases the expected payoff when the tenant renews the contract.

In the case of tenure security, the landlord can obtain $q_2(u,m)+\gamma_2$ when the initial tenant moves to other housing in period 2. However, he or she only obtains $(1/\alpha)[q_2(u,m)+\gamma_2]$ when

the initial tenant renews the contract. That is, property rights are reduced by tenure security. Therefore, the profit-maximization problem for the landlord is as follows:

$$\max_m \ \Pi_L^S = R_1 - c(m) + \frac{\tilde{\gamma}_2}{\overline{\gamma}_2}\frac{1}{\alpha}\left[q_2(u,m) + \frac{\tilde{\gamma}_2}{2}\right] + \frac{\overline{\gamma}_2 - \tilde{\gamma}_2}{\overline{\gamma}_2}\left[q_2(u,m) + \frac{\overline{\gamma}_2 + \tilde{\gamma}_2}{2}\right]. \tag{22}$$

The first-order conditions for Eqs. (21) and (22) are

$$V_{Lu}^S = v_{1u} + \frac{\tilde{\gamma}_2}{\overline{\gamma}_2}\left(v_{2u} - \frac{1}{\alpha}q_{2u}\right) - g_u = 0, \tag{23}$$

$$\Pi_{Lm}^S = \left(\frac{\tilde{\gamma}_2}{\overline{\gamma}_2}\frac{1}{\alpha} + \frac{\overline{\gamma}_2 - \tilde{\gamma}_2}{\overline{\gamma}_2}\right)q_{2m} + \frac{\tilde{\gamma}_{2m}}{\overline{\gamma}_2}\left(\frac{1}{\alpha} - 1\right)(q_2 + \tilde{\gamma}_2) - c_m = 0, \tag{24}$$

respectively. We obtain $u_L^S(m,\alpha)$ from Eq. (23), and $m_L^S(u,\alpha)$ from Eq. (24). The equilibrium is the intersection point of $u_L^S(m,\alpha)$ and $m_L^S(u,\alpha)$, and is denoted by (u_L^S, m_L^S).

4 Housing Quality

Because owner-owned housing internalizes all payoff functions, the equilibrium input levels, u_O and m_O, are efficient solutions. Therefore, we set $q_2(u_O, m_O)$ as the quality benchmark, and compare this with the quality of tenant-owned housing and landlord-owned housing.

4.1 Tenant-Owned Housing

First, we compare the first-order condition of owner-owned housing with that of tenant-owned housing to investigate the impact of the rental externality on housing quality. Comparing Eq. (7) with Eq. (10), we have $u_O(m) = u_T(m)$ for all m. The tenant utilizes the housing similar to owner-owned housing because he or she can capture its residual value in period 2. Second, we can determine the effect of tenure security by comparing Eq. (10) with Eq. (18). We have $u_T(m) < u_T^S(m,\alpha)$ for all m, given $\alpha > 1$. The strengthening of tenure rights by tenancy rent control tends to increase over-utilization of the dwelling by the tenant.

Consider the level of m. Comparing Eqs. (8) with (11), and with Eq. (19), we have $m_O(u) = m_T(u) = m_T^S(u)$ for all u. This result is inconsistent with Kanemoto (1990). In his model, the tenant can not capture the benefit of the dwelling in period 2, if the tenant has no security of tenure. Because tenure security raises the marginal benefit of investment in

period 2, it consequently increases tenant investment in period 1. In our model, however, the tenant perfectly receives the benefits of housing in period 2, regardless of tenure security.

From the above analysis, we obtain the following propositions.

Proposition 1 *(i) In case S,* $u_O = u_T < u_T^S$*,* $m_O = m_T > m_T^S$*. Thus, we have*

$$q_2(u_O, m_O) = q_2(u_T, m_T) > q_2(u_T^S, m_T^S). \tag{25}$$

(ii) In case C, $u_O = u_T < u_T^S$*,* $m_O = m_T < m_T^S$*. Thus,*

$$q_2(u_O, m_O) = q_2(u_T, m_T) \gtreqless q_2(u_T^S, m_T^S). \tag{26}$$

Figures 1 illustrates case C, where E_O is the equilibrium for owner-owned housing. Because $u_O(m) = u_T(m)$ and $m_O(u) = m_T(u)$, the equilibrium for tenant-owned housing without tenure security is also $E_O = E_T$.

Because tenure security shifts the curve for u above $u_T(m)$; e.g., $u_T^S(m, \alpha)$, the equilibrium for tenant-owned housing with tenure security moves to E_T^S. The over-investment occurs because u and m are complements. Thus, there is the case where tenure security raises the quality of tenant-owned housing in case C.

4.2 Landlord-owned housing

Consider next the quality of landlord-owned housing. First, compare Eq. (7) with Eq. (14). Because $q_{2u} < 0$, the marginal benefit of u is larger in Eq. (14) than in Eq. (7) while the marginal costs are the same. Hence, $u_O(m) < u_L(m)$ for all m. That is, the tenant ignores the rental externality and has an incentive to over-utilize rental housing. This result is consistent with Henderson and Ioannides (1983). Second, comparing Eq. (14) and Eq. (23) indicates that $u_L(m) < u_L^S(m, \alpha)$ for all m, given $\alpha > 1$. That is, the marginal profit of u is increased by tenure security. This result is consistent with Seshimo (2003). Therefore, $u_O(m) < u_L(m) < u_L^S(m, \alpha)$.

Eq. (8) is equivalent to Eq. (15). Hence, landlord maintenance in landlord-owned housing is equal to that in owner-owned housing; i.e., $m_O(u) = m_L(u)$ for all u. This is because the landlord derives the benefit of his or her maintenance from the rent increase in period 2. As

discussed in Section 2.1.3, this implies that property rights are protected when there is no tenancy rent control. Comparing Eq. (15) and Eq. (24) reveals that $m_L(u) > m_L^S(u, \alpha)$ for all u, given $\alpha > 1$. This implies that the marginal profit of m is reduced by tenure security. This result is consistent with Kanemoto (1990) and Seshimo (2003).

Accordingly, we obtain the following proposition.

Proposition 2 *(i) In case S,* $u_O < u_L < u_L^S$ *and* $m_O > m_L > m_L^S$*. Thus, we have*

$$q_2(u_O, m_O) > q_2(u_L, m_L) > q_2(u_L^S, m_L^S). \tag{27}$$

(ii) In case C, $u_O < u_L < u_L^S$*,* $m_O < m_L$*,* $m_O \lesseqgtr m_L^S$*,* $m_L \lesseqgtr m_L^S$*. Thus, the ranking of quality in case C is ambiguous.*

In case S, the equilibrium of landlord-owned housing without tenure security is located on $m_O(u)$ above u_O; e.g., E_L in Fig. 2. The landlord's under-investment results from over-utilization by the tenant. Thus, double-moral hazard occurs in case S.

Proposition 2 (i) also implies that the levels of over-utilization and under-investment due to the rental externality increase, largely because of tenure security in case S. Figure 2 compares the equilibrium with tenure security (E_L^S) and without it (E_L) in case S. The equilibrium moves in the gray area above u_L; e.g., E_L^S, when tenure rights are strengthened and property rights are weakened by tenancy rent control. Therefore, tenure security accelerates the deterioration of rental-housing quality induced initially by the effect of the rental externality in case S.

5 Empirical Analysis

5.1 The Data and the Empirical Model

Let us summarize the previous section. Proposition 1 implies that the rental externality has no impact on the quality of tenant-owned housing ($q_2(u_O, m_O) = q_2(u_T, m_T)$) in both cases S and C. Equation (25) shows that tenure security reduces the quality of tenant-owned housing ($q_2(u_T, m_T) > q_2(u_T^S, m_T^S)$) in case S. Eq. (26), however, implies that housing quality varies ambiguously due to tenure security in case C ($q_2(u_T, m_T) \lesseqgtr q_2(u_T^S, m_T^S)$). Equation

(27) shows that the quality of landlord-owned housing deteriorates relative to that of owner-owned housing according to the rental externality in case S ($q_2(u_O, m_O) > q_2(u_L, m_L)$). In addition, this equation predicts that tenure security accelerates the deterioration of landlord-owned housing in this case ($q_2(u_L, m_L) > q_2(u_L^S, m_L^S)$). However, in case C, it is possible for the quality of landlord-owned housing to exceed that of owner-owned housing. Therefore, the model demonstrates that the impact of the rental externality and tenure security on housing quality is an empirical question. In this section, we investigate the empirical evidence on this issue.

We use the 1998 Japanese Housing Demand Survey (JHDS) conducted by the Ministry of Land, Infrastructure and Transport. In practice, we cannot directly estimate $q_2(u, m)$ because q_2 is unobservable. However, the JHDS provides information on the degree of dilapidation in the following three categories: repairs not needed, or slight repairs needed; major repairs needed; and dilapidated beyond repair. As in Gyourko and Linneman (1990), we refer to housing needing no or slight repairs as **sound**. Housing needing major repairs and dilapidated housing are referred to as **not sound**. Table 1 shows the percentage of sound housing in the sample. By defining a dummy variable for 'sound', the following probit specification is estimated:

$$\Pr(\text{Sound} = 1) = \Phi(X\beta), \tag{28}$$

where $\Pr(\text{Sound} = 1)$ is the probability that the unit is sound, Φ is the standard normal cdf, X is the vector of explanatory variables, and β is the vector of probit coefficients.[17]

We do not observe u and m, which are elements of X. That is, we cannot obtain m for landlord-owned housing or u for all housing from the JHDS. Therefore, we use the following equations to estimate the effects of the rental externality and tenure security on housing quality.

[17] The dummy variable, sound, is defined as follows:

$$\begin{aligned} \text{Sound} &= 1 \quad \text{if} \quad q_2 > \bar{q}_2, \\ \text{Sound} &= 0 \quad \text{otherwise}, \end{aligned}$$

where $\bar{q}_2$ is the critical quality of not being sound.

First, we use the tenure-mode dummies, **tenant-owned housing** (**landlord-owned housing**), with **owner-owned housing** being the reference tenure mode, which control for building age, to capture the effect of the rental externality by using the observations on owner-owned housing and tenant-owned (landlord-owned) housing. As shown, the propensity to utilize and maintain the dwelling (the equilibrium input levels of u and m) depends on the tenure mode. Hence, these dummies are proxy variables for u and m. In estimating the rental externality, we also control for tenancy duration, because the longer-duration tenant-owned (landlord-owned) housing is protected by tenancy rent control. There are four categories of building age i: **built pre-1970**; **built 1971–1980**; **built 1981–1990**; and **built 1991–1998**. The JHDS records the year of relocation to the present dwelling. We use four categories determined by moving age j: **move-in pre-1970**; **move-in 1971–1980**; **move-in 1981–1990**; and **move-in 1991–1998**.[18] In the older category, periods for tenancy duration are long. Thus, we suppose that tenure security is less likely to influence the group with the most-recent moving age. Ultimately, we make the following three-way interaction terms to investigate the rental externality:

$$\text{Tenure-mode} \times \text{Building age}_i \times \text{Moving age}_j. \tag{29}$$

Owner-owned housings constructed between 1991 and 1998 into which respondents moved in during the same period are the reference group. The sign of the tenure-mode dummies where $j = 1991 - 1998$ tells us the effect of the rental externality.

Second, we use the moving-in year dummies in Eq. (29) to capture the effect of tenure security. As discussed, because the longer-duration housing is protected by tenancy rent control, a movement of tenure-mode dummies where $j \in \{1981-1990, 1971-1980, \text{pre}-1970\}$ from benchmark year ($j = 1991 - 1998$) suggests the effect of tenure security on housing quality. As found in theory, the propensity to utilize and maintain the dwelling depends on the degree of tenure security. Thus, these dummies also proxy u and m. On the other hand, we expect the quality of owner-owned housing does not depend on tenancy duration, because tenure security has no impact on this type of dwelling. Thus, we should observe

[18] If the current house was rebuilt on the same site after the respondent moved in, we have equated the moved-in year to the rebuilt year.

the coefficients of owner-owned housings (tenure-mode dummies in Eq. (29) are 0) remain constant.

In addition, we control for the construction material of building, city size, number of dwelling rooms (**room**), and the total annual income (before tax) earned by all households members (**income**) in estimating Eq. (28). Construction material is classified into the following four categories: buildings whose main frames are made of wood (this is the reference group); **wooden**; buildings whose main frames are made of ferroconcrete and steel ferroconcrete; steel reinforced concrete (**SRC**); buildings whose outer walls are made of blocks; **block**; and **others**. Three geographical categories are also included: twenty-three Tokyo wards; **Tokyo**; twelve major cities outside Tokyo; **large city**; and all other areas; **other area** (reference). Income is classified into nine different categories in the JHDS, from 1 (the lowest) to 9 (the highest). We include this income level index in the explanatory variables in Eq. (28).

To estimate only the effects of the rental externality and tenure security, we limit the sample to single-family houses. This is because there is a free-rider problem in condominiums and apartment buildings in the sense that owners have a disincentive to maintain common areas and users have an incentive to over-utilize these areas.

Table 1 reports frequencies, means, or modes for the variables used in the probit analysis. Screening the data from complete information on the selected variables produces a sample of $43,520$ observations. Of these 89.6% ($39,013$ dwellings) are owner-owned housing, 5.2% ($2,267$) are tenant-owned housing, and 5.2% ($2,240$) are landlord-owned housing, respectively. Note that 9.9% of owner-owned units are in structures reported as not sound, while 14.4% of tenant-owned units, and 24.5% of landlord-owned units are reported as being in housing in a not sound condition.

5.2 Estimation Results

Table 2 presents the probit coefficients and marginal effects of the rental externality and tenure security on tenant-owned housing.[19] The coefficients shown with bold figures indicate the effect of the rental externality. The statistically insignificant sign of these figures for the tenant-owned housing dummy implies that the rental externality has no impact on the quality of tenant-owned housing as expected.

The coefficients shown with figures in italics indicate the effect of tenure security on tenant-owned housing. Note that the italic figures for the tenant-owned housing dummy are all of negative sign, and two of them are significant. That is, there are no positive signs. This indicates that the quality of tenant-owned housing is lower than, or equal to, that of owner-owned housing due to tenure security. Figure 3 indicates the relationship between tenancy duration and housing quality for owner-owned housing, which obtain from Table 2. As expected, Figure 3 shows that the quality of owner-owned housing does not depend much on tenancy duration. By adding the marginal effect of owner-owned housing with moving age j controlled by building age i ($i \times j$) and that of tenant-owned housing dummy, we obtain the gross marginal effect of tenure security on tenant-owned housing with $i \times j$. For example, the gross marginal effect of tenant-owned housing with moving age $1971-1980$ constructed between 1971 and 1980 becomes $(-0.126 - 0.034) = -0.160$ (-16.0%). When the marginal effect is insignificant, we do not add the figure. By doing this, we obtain Figure 4. Figure 4 shows that the quality of tenant-owned housing depends on tenancy duration. In line with the theoretical prediction in case C, tenure security has an ambiguous effect on tenant-owned housing quality. For example, consider housing built before 1970. Housing moved into between 1991 and 1998 is more likely to be sound than housing moved into between 1981 and 1990 (with respective probabilities of -19.2% and -24.1%). However, housing moved into between 1981 and 1990 is more likely to be unsound than housing moved into between 1971 and 1980 (with respective probabilities of -24.1% and -18.5%).

[19] The marginal effects are calculated as

$$\Pr(\text{Sound} = 1)|_{\text{dummy variable} = 1} - \Pr(\text{Sound} = 1)|_{\text{dummy variable} = 0}.$$

Table 3 reports the probit coefficients and marginal effects of the rental externality (bold figures) and tenure security (italic figures) on landlord-owned housing. The statistically significant sign of the bold figures for the landlord-owned dummy (except for housing moved into between 1991 and 1998 constructed before 1970) implies that landlord-owned housing has a lower probability of being in sound condition than owner-owned housing. These results suggest that the rental externality reduces the quality of dwellings. They are then consistent with the theoretical predictions in case S.

Note that all italic figures have a statistically significant negative sign. Similar to Table 2, we obtain the relationship between tenancy duration and housing quality for each tenure mode. The impact of tenure security on owner-owned housing is qualitatively the same as those resulting from Figure 3: this figure is omitted. Figure 5 shows the more recent the move-in date, the smaller the absolute value of the marginal effect (except for housing moved into between 1981 and 1990 and constructed before 1970). This implies that the longer the tenancy duration, the greater the extent of deterioration. Thus, tenure security further reduces the quality of landlord-owned housing. This result confirms the theoretical prediction of case S.

6 Welfare and Policy Implications for Tenure Security

Considering the estimation results, we now investigate the welfare and policy implications for tenancy rent control (Land Lease and Housing Lease Law) in Japan. First, the impact of tenure security on the homeowner's utility of tenant-owned housing is found by differentiating Eq. (17) with respect to α. Using the envelope theorem, then this yields

$$V_{T\alpha}^{S} = \frac{\hat{\gamma}_2}{\overline{\gamma}_2}\frac{1}{\alpha^2}\left(\frac{\hat{\gamma}_2}{2}\right) > 0. \tag{30}$$

The RHS in Eq. (30) implies that tenure security lowers the contract-renewal rent for the tenant. Therefore tenure security increases the homeowner's utility. The impact of tenure security on the landowner's profit is represented by

$$\Pi_{T\alpha}^{S} = \frac{\hat{\gamma}_{2\alpha}}{\overline{\gamma}_2}\left(\frac{1}{\alpha} - 1\right)\hat{\gamma}_2 - \frac{1}{\alpha^2}\frac{\hat{\gamma}_2}{\overline{\gamma}_2}\frac{\hat{\gamma}_2}{2} + \Pi_{Tu}^{S}\frac{\partial u_T^S}{\partial \alpha} < 0, \tag{31}$$

where

$$\Pi^S_{Tu} = \frac{\hat{\gamma}_{2u}}{\overline{\gamma}_2}\left(\frac{1}{\alpha} - 1\right)\hat{\gamma}_2 < 0.$$

Note that $\partial u^S_T/\partial\alpha$ is positive in case C. Thus the third term of the RHS in Eq. (31) is negative. The second term on the RHS in Eq. (31) implies that tenure security lowers the contract renewal rent. Because the first term on the RHS in Eq. (31) is negative, the sign of Eq. (31) becomes negative. This implies that tenure security decreases the landowner's profits.

Since the decrease of the contract-renewal rent due to tenure security is transferred from the landowner to the initial tenant, the absolute value of Eq. (31) is larger than Eq. (30). This implies that tenure security creates an inefficiency result of the rental-land contract.

Next, consider the impact of tenure security on landlord-owned housing. Similar to the tenant-owned housing, we can drive the impact of tenure security on each player's welfare as the following:

$$V^S_{L\alpha} = \frac{\tilde{\gamma}_2}{\overline{\gamma}_2}\frac{1}{\alpha^2}\left(q_2 + \frac{\tilde{\gamma}_2}{2}\right) + V^S_{Lm}\frac{\partial m^S_L}{\partial\alpha}, \tag{32}$$

where

$$V^S_{Lm} = \frac{\tilde{\gamma}_{2m}}{\overline{\gamma}_2}\left(v_2 - \frac{1}{\alpha}q_2\right) > 0,$$

and

$$\Pi^S_{L\alpha} = \frac{\tilde{\gamma}_{2_\alpha}}{\overline{\gamma}_2}\left(\frac{1}{\alpha} - 1\right)(q_2 + \tilde{\gamma}_2) - \frac{1}{\alpha^2}\frac{\tilde{\gamma}_2}{\overline{\gamma}_2}\left(q_2 + \frac{\tilde{\gamma}_2}{2}\right) + \Pi^S_{Lu}\frac{\partial u^S_L}{\partial\alpha} < 0, \tag{33}$$

where

$$\Pi^S_{Lu} = \frac{\tilde{\gamma}_{2_u}}{\overline{\gamma}_2}\left(\frac{1}{\alpha} - 1\right)(q_2 + \tilde{\gamma}_2) + q_{2u} < 0.$$

The first term of RHS in Eq. (32) implies that tenure security lowers the contract-renewal rent for the tenant, and the sign is positive. Note that $\partial m^S_L/\partial\alpha$ is negative, because we observe case S in empirical section. Thus the second term of the RHS in Eq. (32) is negative. Therefore, tenure security may increase or decrease a tenant's utility. Note that $\partial u^S_L/\partial\alpha$ is positive in case S. Because all the term of RHS in Eq. (33) is negative, the sign of Eq. (33) becomes negative. This implies that tenure security decreases the landlord's profit.

From $V^S_{L\alpha}+ \Pi^S_{L\alpha}$, we obtain a negative sign. This implies that deterioration of rental-housing quality due to tenure security results in inefficiency of the rental-housing contract in case S.

The Land Lease and House Lease Law in Japan was recently revised. In 1992, the fixed-term rental-land contract that enabled landowners to refuse renewal of a contract that has expired was introduced (Articles 22 and 23) and that for rental-housing contract in 2000 (Article 38).[20] It is not necessary for the landowner (landlord) to show any just cause to terminate the contract under this contract. This implies that α is equal to 1 in our model. As a result, these reforms provide more efficient contracts.

A problem, however, still exists for tenant-owned housing and landlord-owned housing. First, Article 22 says that under a lease with a term of fifty years or more, the tenant (=homeowner) has no property rights over their dwelling, so no request can be made to the landowner to purchase the asset on the rented site: Article 13 does not apply. Kanemoto (1990) and Seshimo (2003) argue that if property rights are not perfectly protected, tenants do not adequately maintain their dwellings. The same is true of our model. Article 22 implies that $((\bar{\gamma}_2 - \gamma^*_2)/\bar{\gamma}_2)q_2$ vanishes from Eq. (9). Because the tenant can not receive the all benefits, the choice of u and m become inefficient. Thus, the rental externality problem occurs in tenant-owned housing under Article 22. Second, Articles 22 and 23 (Article 38) only apply to new rental-land (housing) contracts. If the tenant wishes to remain in his or her rental land (housing), the landowner (landlord) cannot easily refuse the request. That is, the landowner (landlord) who contracted with a tenant before the amendment does not have perfect property rights. Thus, the deterioration problem of rental-housing quality due to tenure security remains in older contracts. Our model offers a simple policy implication: protecting the property rights of the homeowner provides more efficient contracts. From this viewpoint, a fixed-term contract should be applied to contracts made before the amendments.

[20] In the Japanese market, dwellings protected by tenure security (the general contract) and unprotected dwellings (the fixed-term contract) coexist.

7 Conclusion

In this paper, we investigated three tenure modes: owner-owned housing; tenant-owned housing; and landlord-owned housing. We developed a model to determine the effect of the rental externality and tenure security on housing quality. We focused on both maintenance by the owner, which raises the quality of the accommodation, and utilization by the user, which reduces its quality. Our main theoretical and empirical results are summarized below.

- When property rights in tenant-owned housing are perfectly protected, a rental contract for land does not create a rental externality problem. Thus, the quality of tenant-owned housing does not differ from that of owner-owned housing. Tenure security, however, induces over-utilization, because it only strengthens the tenure rights. This induces over-maintenance, when the tenant's utilization and maintenance are complements. Therefore, the effect of tenure security on the quality of tenant-owned housing is ambiguous.

- If utilization by the tenant is not verifiable, then a rental contract for housing creates a rental externality problem: the initial tenant over-utilizes the housing. When the landlord reacts by reducing maintenance in line with the increased utilization rate, the higher the utilization rate, the lower the landlord's maintenance. Therefore, in this case, rental-housing quality is reduced by the rental externality. Because tenure security in Japan weakens the property rights of landlords and strengthens the tenure rights of tenants, tenure security further increases tenants' utilization and decreases landlords' maintenance when tenants' utilization and landlords' maintenance are substitutes. In this instance, tenure security accelerates the deterioration of rental housing, as does the rental externality.

- The empirical tests, conducted using data from the 1998 Japanese Housing Demand Survey, shows that the quality of tenant-owned housing does not differ from owner-owned housing in the absence of tenure security. It also shows that landlord-owned housing is less likely to be in a sound condition than owner-owned housing due to the

rental externality. Furthermore, the empirical results confirm that tenure security has an ambiguous effect on tenant-owned housing quality and accelerates deterioration in the quality of landlord-owned housing. Thus, our empirical results confirm the theoretical predictions.

- These theoretical and empirical results offer a major policy implication: protection of the property rights of the homeowner enhances the quality of dwellings and achieves more efficient contracts.

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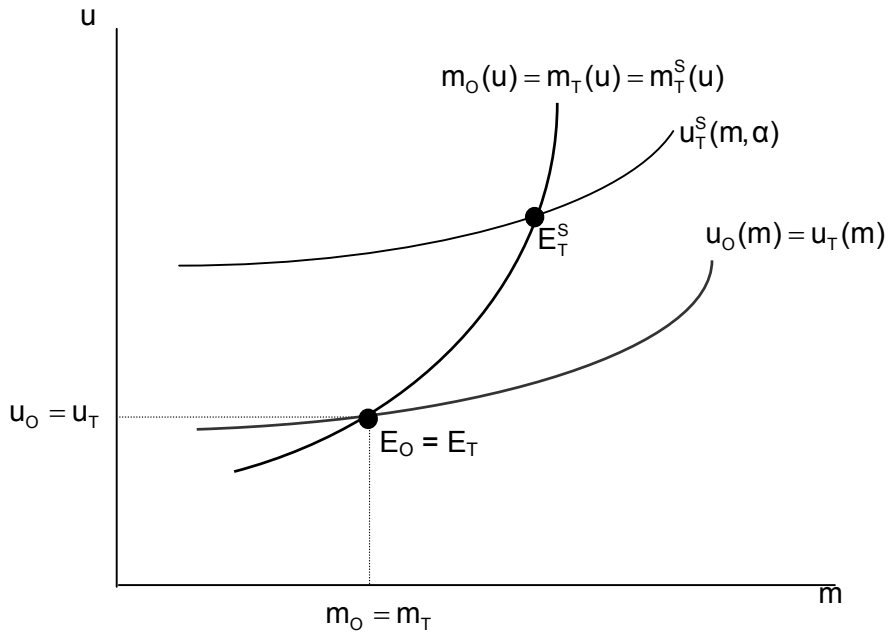

Fig. 1. Tenant-owned housing (Case C)

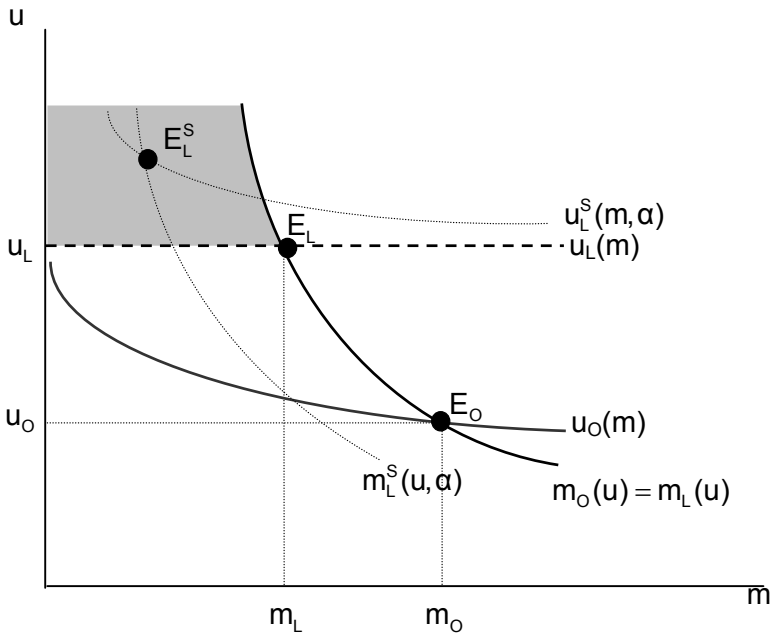

Fig. 2. Landlord-owned housing (Case S)

Table 1
Frequency/Mean/Mode of variables

Variable	All observations	Owner-owned	Tenant-owned	Landlord-owned
Building condition (%)				
Sound	89.2	90.1	85.4	75.5
Not sound	10.8	9.9	14.4	24.5
Tenure mode (%)				
Owner-owned	89.6			
Tenant-owned	5.2			
Landlord-owned	5.2			
Building age (%)				
Built pre-1970	26.5	25.7	35.8	35.9
Built 1971–1980	29.2	29.1	24.2	32.3
Built 1981–1990	24.9	25.1	21.1	21.6
Built 1991–1998	19.4	20.2	18.8	10.2
Move-in age (%)				
Move-in pre-1970	23.0	23.5	32.2	8.4
Move-in 1971–1980	26.3	27.1	23.7	10.1
Move-in 1981–1990	26.0	26.1	23.1	24.6
Move-in 1991–1998	24.7	23.3	21.1	57.0
Construction material (%)				
Wooden	92.2	92.2	91.1	95.1
SRC	5.5	5.6	6.8	3.6
Block	0.4	0.4	0.5	0.3
Others	1.9	1.9	1.6	1.0
Geography (%)				
Tokyo	2.0	1.7	7.3	1.8
Large city	10.2	10.0	10.7	14.4
Other area	87.8	88.4	82.0	83.8
Room	5.0	6.1	5.6	4.0
Income (million yen)	6–7	6–7	6–7	3–4
Number of observations	43,520	39,013	2,267	2,240

Table 2
Probit coefficients and marginal effects (Owner-owned and tenant-owned)

Variable	Coefficient	Standard error	Marginal effect
Intercept	1.668***	0.051	
Built pre-1970			
Move-in pre-1970	−1.392***	0.042	−0.193***
Move-in 1971–1980	−1.335***	0.078	−0.185***
Move-in 1981–1990	−1.313***	0.099	−0.182***
Move-in 1991–1998	−1.385***	0.114	−0.192***
Built 1971–1980			
Move-in 1971–1980	−0.913***	0.042	−0.126***
Move-in 1981–1990	−0.851***	0.074	−0.118***
Move-in 1991–1998	−0.886***	0.089	−0.123***
Built 1981–1990			
Move-in 1981–1990	−0.466***	0.045	−0.064***
Move-in 1991–1998	−0.479***	0.097	−0.066***
Built pre-1970×Tenant-owned			
Move-in pre-1970	*−0.00004*	0.053	−0.00001
Move-in 1971–1980	*−0.042*	0.248	−0.006
Move-in 1981–1990	*−0.427**	0.238	−0.059*
Move-in 1991–1998	**−0.158**	0.344	−0.022
Built 1971–1980×Tenant-owned			
Move-in 1971–1980	*−0.247****	0.069	−0.034***
Move-in 1981–1990	*−0.068*	0.333	−0.009
Move-in 1991–1998	**−0.449**	0.341	−0.062
Built 1981–1990×Tenant-owned			
Move-in 1981–1990	*−0.102*	0.100	−0.014
Move-in 1991–1998	**−0.436**	0.414	−0.060
Built 1991–1998×Tenant-owned			
Move-in 1991–1998	**0.029**	0.166	0.004
SRC	0.161***	0.048	
Block	−0.130	0.129	
Others	0.086	0.090	
Tokyo	−0.317***	0.058	
Large city	0.042	0.031	
Room	0.045***	0.006	
Income	0.055***	0.005	
Number of observations		41,280	
Pseudo R^2		0.122	
Log-likelihood		−11918.09	

Bold figures capture the effect of the rental externality.
Italic figures capture the effect of tenure security.
*** indicates significance at 1%; * indicates significance at 10%

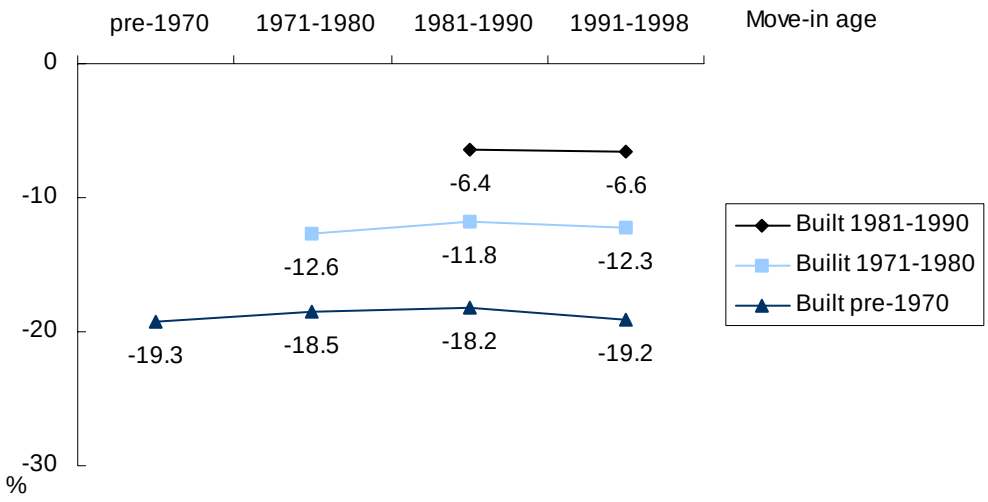

Fig. 3. The effect of tenure security on owner-owned housing.

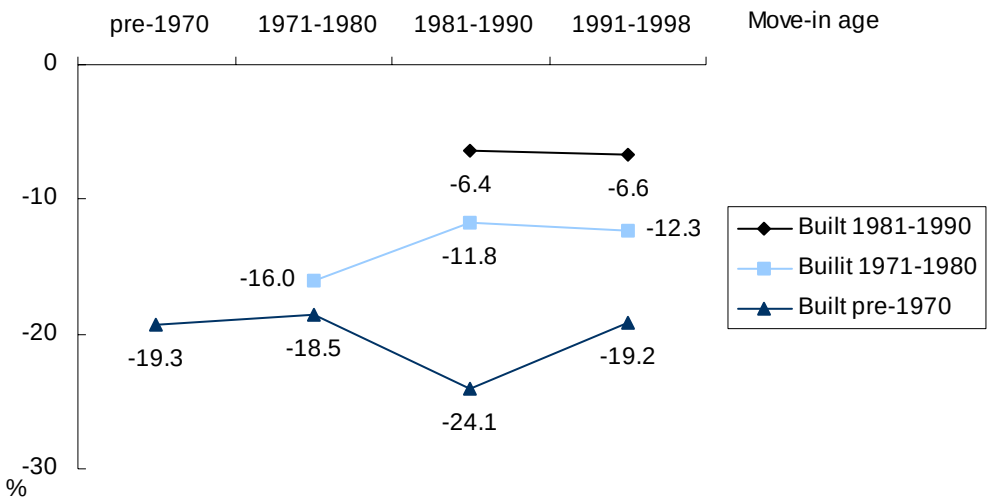

Fig. 4. The effect of tenure security on tenant-owned housing

Table 3
Probit coefficients and marginal effects (Owner-owned and landlord-owned)

Variable		Coefficient	Standard error	Marginal effect
Intercept		1.656***	0.051	
Built pre-1970				
	Move-in pre-1970	−1.386***	0.042	−0.199***
	Move-in 1971–1980	−1.332***	0.078	−0.191***
	Move-in 1981–1990	−1.308***	0.099	−0.187***
	Move-in 1991–1998	−1.380***	0.114	−0.198***
Built 1971–1980				
	Move-in 1971–1980	−0.911***	0.042	−0.130***
	Move-in 1981–1990	−0.848***	0.0744	−0.122***
	Move-in 1991–1998	−0.883***	0.089	−0.127***
Built 1981–1990				
	Move-in 1981–1990	−0.464***	0.045	−0.067***
	Move-in 1991–1998	−0.479***	0.097	−0.069***
Built pre-1970×Landlord-owned				
	Move-in pre-1970	*−0.474***	0.095	−0.068***
	Move-in 1971–1980	*−0.477***	0.134	−0.068***
	Move-in 1981–1990	*−0.518***	0.127	−0.074***
	Move-in 1991–1998	**−0.125**	0.132	−0.018
Built 1971–1980×Landlord-owned				
	Move-in 1971–1980	*−0.718***	0.129	−0.103***
	Move-in 1981–1990	*−0.395***	0.118	−0.057***
	Move-in 1991–1998	**−0.343*****	0.107	−0.049***
Built 1981–1990×Landlord-owned				
	Move-in 1981–1990	*−0.641****	0.129	−0.092***
	Move-in 1991–1998	**−0.295****	0.129	−0.042***
Built 1991–1998×Landlord-owned				
	Move-in 1991–1998	**−0.407*****	0.149	−0.058***
SRC		0.190***	0.049	
Block		−0.255**	0.127	
Others		0.111	0.092	
Tokyo		−0.335***	0.063	
Large city		0.046	0.030	
Room		0.044***	0.006	
Income		0.057***	0.005	
Number of observations			41,253	
Pseudo R^2			0.130	
Log-likelihood			−12204.04	

Bold figures capture the effect of the rental externality.
Italic figures capture the effect of tenure security.
*** indicates significance at 1%; ** indicates significance at 5%

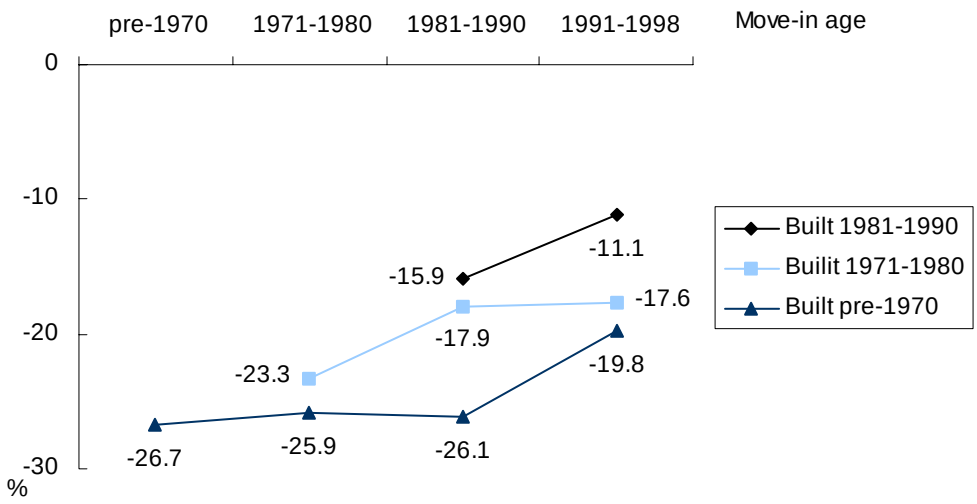

Fig. 5. The effect of tenure security on landlord-owned housing