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Three Essays on The Economics of The Tenant Protection Law
(借地借家法の経済学)

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Preface

Japanese rental housing has small average floor size, and its maintenance is not well. Japanese Economists argue that the Japanese Tenant Protection Law (hereafter called the JTPL) which guarantees security of tenure, is one of the reasons of these phenomena. Under the JTPL, it is almost impossible for landlords to refuse renewal of a rental contract that has expired, if the current tenant wants to continue it. Thus, they cannot put their housing to an alternative use, even if it is more profitable to do so. Furthermore, to prevent eviction based on rent increases, judicial precedents from tenancy suits have established that contract-renewal rent, which is the rent for an incumbent tenant, is not permitted to exceed the rent of comparable newly rented unit. Therefore, the JTPL works to disadvantage landlords, leading them to discourage both the supply and maintenance of rental housing.[1]

However, Japanese Economists do not take into account the tenant's behavior. Hence, they cannot prove that the JTPL reduces the housing consumption and tenant's investment. Moreover, they cannot consider the effects of the JTPL on the utility of tenants. Therefore, to complete the analysis of the JTPL, we must consider the tenant's behavior. Considering the tenant's behavior, the paper is organized as follows.

Chapter 1 examines the effects of the JTPL on the size of rental housing. To do this, we focus on asymmetric information on tenure length between tenants and landlords. Because contract-renewal rent is lower than the market rent of a comparable dwelling, landlord prefer short-term to long-term tenants. Tenure duration, however, will be better known to the tenant than the landlord, and thus this asymmetric information creates an adverse selection problem for landlords. The assumption of risk averse landlords gives the consistent result

[1] On March 1 2000 the Fixed-Term House Lease System that enables landlords to refuse renewal of a rental contract that has expired was introduced. However, it is applicable to new contracts only. That is, the old law applies to leases contracted before March 1, 2000.

that very small average size of rental housing in Japan.

Chapter 2 analyzes the effects of the JTPL on the housing rent. First, we convert the theoretical model in Chapter 1 into a model that can be verified empirically. Second we use the estimated parameters of one of the empirical studies to determine whether our model can explain the inefficiency of the JTPL. The results of numerical tests are consistent with the prediction of the theoretical model.

Chapter 3 addresses the issue of maintenance. To analyze the effects of the JTPL on rental-housing quality, we develop a non-cooperative game model involving the tenant and the landlord. We show that there is the case where the JTPL accelerates deterioration of the rental housing.

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Chapter 1

Floor Size of Rental Housing*

1.1 Introduction

According to 1998 *Housing and Land Survey of Japan*, the average floor space of 72% of the private rental-housing stock was less than 50 m^2, and only 9% was larger than 70 m^2. [2]

Why is the average floor space of Japanese rental dwellings so small? There may be three mechanisms at work. First, there may be a tenure selection toward households that prefer smaller units. It should be noted, however, 54.5% of tenants who live in the private rental housing are dissatisfied with the floor size of their dwellings (1993 *Housing Demand Survey of Japan*, Minster of Construction). Second, tenure choice may be a function of income; since income has increased with high economic growth, many households have moved into ownership. This explanation is very close to the first point, and essentially claims that rental housing is an inferior good. Average floor space for owner-occupied housing is generally larger than that of rental housing in many countries (see, for example, Kanemoto, 1997; Yamazaki, 1999). In Japan, however, the average floor space of rental housing relative to that of owner-occupied housing is much smaller than that of other countries.[3] It is thus particularly important to consider a third explanation: that the JTPL depressed unit size below what tenants would have chosen in the absence of this legislation.

Iwata (1976) was the first to claim that the above features of the rental-housing market in postwar Japan were caused by the 1941 amendment of the JTPL, which strengthened tenure

*This chapter is a revised version of Iwata (2002a).

[2]See Kanemoto (1997) for more detail about rental-housing conditions in Japan.

[3]The ratio of the average floor space of rental housing to that of owner-occupied housing is 0.69 in USA, 0.86 in UK, 0.61 in Germany and 0.67 in France, respectively, whereas that is only 0.37 in Japan (1996 *White Paper of Construction*). However, note that the definitions of floor space are different across countries. See Kanemoto (1997) about this problem.

security.[4] Two important consequences of the JTPL revision are:

(i) It is almost impossible for landlords to refuse renewal of a tenancy contract that expires, if the tenant wants to continue it.

In order for the landlord to terminate a contract despite the tenant's desire for renewal, he or she must go to court and prove just cause. Hence, this regulation is called "*just-cause eviction control.*" However, what constitutes a just cause is not shown clearly in the JTPL. Even when a just cause has been acknowledged by the courts, judicial precedents since the 1960s have required compensation from the landlord to the tenant for involuntarily vacating the dwelling.

Furthermore, to prevent eviction by rent increases, judicial precedents from tenancy suits have established the following:

(ii) The rent for an incumbent tenant, called here "contract-renewal rent," is not permitted to exceed the rent, called "market rent," of comparable newly rented units.

Initial rents are determined freely in the rental-housing market, but rent increases thereafter must go through the courts if the tenant does not accept the increases. Contract-renewal rents approved by the courts were lower than comparable market rents from the 1950s until the 1990s, when market rents increased markedly. The regulatory effect of this judicial precedent is called "*contract-renewal rent control.*" The purpose of this rent control is to protect tenants from eviction by economic pressure. [5]

Iwata (1976) argues that these two types of controls discourage the supply of rental housing and raise initial rents, ultimately reducing tenant welfare. Some economists such as Hatta

[4] The amendment was intended to protect tenants from arbitrary eviction by solving landlord-tenant disputes arising from the extreme shortage of housing stock during World War II.

[5] The JTPL has similar properties of "tenancy rent control" referred by Basu and Emerson (2000) and Raess and von Ungern-Sternberg (2002). They argue that tenancy rent control allows landlords to choose a nominal rent freely when taking on a new tenant, but places restrictions on raising the rent of, or evicting, an existing tenant. The JTPL has also similar properties of "the regulated tenure model" referred by Hubert (1991). He argues that regulated tenure model includes next two features: 1. Tenure laws provide the tenant with considerable security of tenure. 2. While there are little or no restrictions on the initial rent, the rent updating during the term is regulated.

(1996) and Yamazaki (1995) favor this argument. However, they consider the effects of the JTPL only on the supply side, not on the demand side. Hence, they cannot prove that, other things being equal, the JTPL reduces the equilibrium quantity of rental housing.

Germany has a more formal, but less strict, rent and eviction control than Japan.[6] In analyzing the effects of the German Tenant Protection Law (GTPL) on its rental-housing market, Eekhoff (1981) shows that given both perfectly anticipated length of tenure and perfect capital markets, the quantity (and the quality) of rental housing is unaffected by the GTPL, because the law only changes the timing of the rent streams, not their present discounted value. Consequently, its effect on the housing market is neutral.

Eekhoff (1981) also points out that the neutrality is not valid if tenure length is uncertain. He shows that the risk-averse landlord will charge a premium for the uncertainty of tenure length, with the result that initial rent will be higher than that in the neutrality case, thereby reducing tenant utility.[7] Under the JTPL, a landlord must go to court and prove "just cause" to evict the tenant when the contract expires, as long as the tenant wants to renew the contract, as we have mentioned above in (i). Therefore, it is important for landlords to know whether or not prospective tenants will want to renew their contracts. Seshimo (1998) proves that the JTPL reduces the size of the rental-housing market under asymmetric information on tenure length between tenants and landlords, assuming that tenants only choose whether or not to rent housing, but do not change quantities demanded as the rent changes. Furthermore, both tenants and landlords are assumed to be risk-neutral.[8] Considering the above features of the rental-housing market in postwar Japan, this paper examines the impacts of the JTPL on the floor space per rental-housing unit, the size of the rental-housing market, and tenants' welfare levels, by focusing on the effects of asymmetric information on tenure length between tenants and landlords, and using a more general framework than that of Seshimo (1998).

The paper is organized as follows. Section 1.2 formulates the rental-housing market model

[6]See Böursh-Supan (1986), Eckart (1984), Eekhoff (1981), Homburg (1993), Hubert (1991, 1995), and Schwager (1994) for details of rental-housing market regulation in Germany.

[7]Eckart (1984) analyzes the effects of the rent control part of the GTPL on tenants' utilities under an imperfect capital market.

[8]Böursh-Supan (1986), Homburg (1993), and Hubert (1995) analyze the effects of the GTPL, and Miron (1990) analyzes the effects of the Tenant Protection Law in Canada, considering the existence of asymmetric information between landlords and tenants. These papers, however, pay attention to asymmetric information on tenant quality, not to that on tenure length.

in the absence and presence of the JTPL, respectively, under the assumption that there is no asymmetric information on tenure length between tenants and landlords. Section 1.3 introduces asymmetry of information between tenants and landlords. Section 1.3.1 considers the effects of asymmetric information on the rental-housing market with and without the JTPL, and its welfare effects on tenants. In this section, we assume that landlords are risk-neutral. While Section 1.3.4 analyzes the case where landlords are risk-averse. Section 1.4 provides some concluding remarks.

1.2 The Symmetric Information Model

1.2.1 One Type Tenants Case

Model of the Rental-Housing Market without the JTPL

We formulate a rental-housing market model that describes the economy with or without the JTPL. To focus on the information problem about intended tenure length between landlords and tenants, we assume that the tenure length of all tenants is determined outside of our model.[9]

Consider a two-period partial equilibrium model. There are T tenants and L landlords. Tenants and landlords are both price-takers. We also assume that the capital market is perfect and the discount rate for the tenant and the landlord is 0.

First we assume that there are only one type of tenants in the market. We introduce two types of tenants in Section 1.2.2. The tenant in this section desires to renew the contract at the beginning or period 2. We call this type of tenants 'type-c (contract-renewal type).'

Demand for Rental Housing Assume that all tenants have the same two-period income y (y is given), and consume housing in each period and a composite good. The budget constraint is given by $y = r_c^1 h_c^1 + r_c^2 h_c^2 + z$, where r_c^1 and r_c^2 are the rent that he or she faces in period 1 and the expected rent in period 2, respectively, h^t ($t = 1, 2$) is the floor size of rental housing in period t, and z is the sum of the two-period consumptions on the composite good.

[9]We assume that the tenant types are given. Basu and Emerson (2000) relax this assumption and find that tenancy rent control reduces tenant mobility. Empirical studies also obtain this result. See Ault, Jackson, and Saba (1994), Gyourko and Linneman (1989), Linneman (1987), Munch and Svarer (2002), and Nagy (1995, 1997). Moreover, Hardman and Ioannides (1999) theoretically show that low rates of residential mobility due to rent control make labor markets less efficient, thereby dampening economic growth.

Each tenant maximizes his or her utility under this budget constraint. The utility function has a following form:

$$U_c = u_c(h_c^1, h_c^2, z_c).$$

Since type-c consumes the same floor space for two periods by renewing the contract, $h_c^1 = h_c^2 \equiv h_c$. Therefore, his or her objective function becomes $U_c = u(h_c, z_c)$, where $\frac{\partial u_c}{\partial h_c} > 0$, $\frac{\partial^2 u_c}{\partial h_c^2} < 0$, $\frac{\partial u_c}{\partial z} > 0$, $\frac{\partial^2 u_c}{\partial z^2} < 0$. The utility maximization problem of type-c can be written as

$$\begin{aligned} \max_{h_c, z} \quad U_c &= u(h_c, z_c) \\ \text{subject to} \quad y &= (r_c^1 + r_c^2)h_c + z_c. \end{aligned} \tag{1.1}$$

Let R_c denote the expected value of two period rent for type-c. Then R_c is defined as

$$R_c \equiv r_c^1 + r_c^2. \tag{1.2}$$

Solving the above problem (1.1), we obtain the following type-c demand functions:

$$h_c = \widehat{h_c}(R_c, y), \tag{1.3}$$

$$z_c = z_c(R_c, y). \tag{1.4}$$

Supply of Rental Housing Let us now consider the behavior of landlords. All landlords are identical and choose the total floor space at the beginning of period 1 so as to maximize their expected two-period profits. The total floor space in period 2 is fixed at the levels chosen in the first period. Therefore, if we write the chosen floor space as h_s, the cost of h_s is given by $g(h_s)$, where $g'(h_s) > 0$ and $g''(h_s) > 0$ for all h_s. We assume that the maintenance cost is zero in period 2. Note that h_s is the total floor space, but not the floor space for one unit of rental housing. That is, h_s can be divided continuously.

Since there is only one type in this section, it is plausible that we assume the following:

Assumption 1 (Symmetric Information) *All landlords know the type of any prospective tenant.*

Assumption 1 means that all landlords know the any tenant desires to renew the contract at the beginning of period 2. Therefore, the profit maximization problem of a landlord tenants becomes

$$\max_{h_s} \Pi = R_c h_s - g(h_s), \tag{1.5}$$

where subscript s refers to the supply side of floor space.

The supply function can be written as

$$h_s = h_s(R_c). \tag{1.6}$$

Market Equilibrium without the JTPL The market clearing conditions in periods 1 and 2 can be written as

$$\begin{aligned} Lh_s &= Th_c^1, \\ Lh_s &= Th_c^2. \end{aligned}$$

Because $h_c^1 = h_c^2 \equiv h_c$, these equations imply that

$$r_c^1 = r_c^2. \tag{1.7}$$

We also write the market clearing conditions in two-period as

$$Lh_s = Th_c. \tag{1.8}$$

Benchmark One Type Model Then the six-equation model consisting of (1.2), (1.3), (1.4), (1.6), (1.7) and (1.8), contains 6 variables, h_c, z_c, h_s, r_c^1, r_c^2 and R_c. This completes the description of the model without the JTPL. We call this model the *Benchmark One Type Model* (BOT Model.)

The Effects of the JTPL

We now consider the effects of the JTPL. The JTPL regulates the contract-renewal rent in period 2 as shown in (ii) of Section 1.1. It may be more precisely stated as follows:

Assumption 2 (Just-Cause Eviction Control) *If a tenant wants to renew the contract for period 2, the landlord cannot refuse the renewal.*

Assumption 3 (Contract-Renewal Rent Control) *The contract-renewal rent r_c^2 in period 2 is regulated at a level satisfying*

$$r_c^2 < r_c^1. \tag{1.7'}$$

From Assumptions 2 and 3, landlords must renew the contract with r_c^2 that is lower than first period rent. [10]

The economy under the JTPL can be described by a generalized version of the BOT Model. Note that both (1.7) and (1.7') are contained in

$$r_c^2 = \alpha r_c^1, \tag{1.7"}$$

where $0 < \alpha \leq 1$.[11] The parameter α measures the degree of tenant protection of JTPL.

When $\alpha = 1$, (1.7") degenerates into (1.7). If $0 < \alpha < 1$, on the other hand, (1.7") is consistent with (1.7'). Thus, the BOT Model with (1.7) replaced by (1.7") can describe the rental-housing market with or without the JTPL. We call this the *Symmetric Information of One Type Model* (SIOT Model).

We will now analyze the effect of the introduction of the JTPL by examining the effects of a change in α in the SIOT Model.

Core Model of SIOT Model To do this end, we can show that the SIOT Model could solve more simple as in the next two step. First, the four-equation model consisting of (1.3), (1.4), (1.6) and (1.8), contains 4 variables, h_c, z, h_s and R_c. We call this model the *Core Model* of the SIOT Model.

Neutrality of the JTPL Core Model of the SIOT Model determines all the variables of the BOT Model expect for r_c^1 and r_c^2. Second, once R_c is found in the Core Model of the SIOT Model, however, r_c^1 and r_c^2 can be also found from Eqs. (1.2) and (1.7").

Therefore, the SIOT Model is obtained by adding the two equations (1.2) and (1.7") of the Core Model of the SIOT Model.

[10] If there is inflation in the economy, as Basu and Emerson model (2000), the ceiling on the contract-renewal rent seems a binding constraint. However, there is no inflation in our model (See Eq. (1.7)), we assume as Assumption 3 to analyze the effects of the JTPL. Therefore, if there is deflation in the economy, the ceiling on the contract-renewal rent has no effect on the rental-housing market.

[11] Landlords may discount the contract-renewal rent voluntarily to induce current tenants who have shown themselves to be desirous of remaining in the units. However, we neglect this voluntary tenure discount. See Böursh-Supan (1986), Goodman and Kawai (1985), Guasch and Marshall (1987), Hubert (1995), and Miceli and Sirmans (1999) for tenure discount issues.

Since the Core Model of the SIOT Model does not contain Eqs. (1.2) and (1.7"), the variables of the Core Model of the SIOT Model are determined independently of α. Hence we obtain the following:

Proposition 1 (Neutrality of the JTPL 1) *In the Symmetric Information and One Type Model, JTPL enforcement has no effect on the expected value of the two-period rents. Hence it does not affect the size of the rental-housing market, the quantity of housing rented by each tenant, and his or her utility.*

Proposition 1 implies that under symmetric information on intended tenure length, the JTPL has no impact on the size of the rental-housing market. The JTPL raises the initial rent for type-c tenants just enough to offset a fall in the contract-renewal rent such that the expected value of two-period rents is kept constant. Therefore, the budget constraint does not affect by the JTPL. Consequently the JTPL has no impact on the floor space of the housing rented by each tenant. This is consistent with the argument of Eekhoff (1981) and Kanemoto (1996) under perfect capital market conditions.[12]

1.2.2 Two Types Tenants Case

Model of the Rental-Housing Market without the JTPL

We now introduce two types of tenants into the model. At the beginning of the second period, the first type renews the contract similarly to previous section, and the second type vacates

[12]Otani (1997) shows that the neutrality of the JTPL is an example of what is known as the Coase theorem. However, we think that proposition 1 is not an example of the Coase theorem. To show this, let see the definition of the Coase theorem.

First, Mankiw (2001) defines the Coase theorem as follows:

> The proposition that if private parties can bargain without cost over the allocation of resources, they can solve the problem of *externalities* on their own.

In fact, there are no externalities in our model.

Second, Milgrom and Robert (1992) defines the Coase theorem as follows:

> If the parties bargain to an efficient agreement (for themselves) and if their preferences display *no wealth effects*, then the value-creating activities that they will agree upon do not depend on the bargaining power of the parties or on what assets each owned when the bargaining began. ...

The Coase theorem is not valid if there are wealth (income) effects. Kuga (2000) mentions that the neutrality of the JTPL is valid only if the preferences are quasai-linear. However, we do not assume the quasai-linear utility function to obtain proposition 1.

his or her housing to move to other housing. We call the latter 'type-m (non contract-renewal and moving type).' All tenants know for certain which type they are. There are M type-m tenants and N type-c tenants, where $M + N = T$.

Demand for Rental Housing Assume that type-m also have the same two-period income y, and consume housing in each period and a composite good. The budget constraint of type-m is given by $y = r_m^1 h_m^1 + r_m^2 h_m^2 + z$.

For simplicity, we assume that the utility function of all tenants has a simple additive form:

$$U_i = u_i(h_i^1) + u_i(h_i^2) + z, \tag{1.9}$$

where $u_i'(h_i^t) > 0$, $u_i''(h_i^t) < 0$ for all h_i^t $(i = m, c)$.

The utility maximization problem of type-m can be rewritten as

$$\begin{aligned} \max_{h_m^1, h_m^2, z} U_m &= u_m(h_m^1) + u_m(h_m^2) + z \\ \text{subject to} \quad y &= r_m^1 h_m^1 + r_m^2 h_m^2 + z. \end{aligned} \tag{1.10}$$

Solving the above problem (1.10), we obtain the following t-th period, type-m demand function:

$$h_m^1 = \widehat{h_m}(r_m^1), \tag{1.11}$$

$$h_m^2 = \widehat{h_m}(r_m^2). \tag{1.11'}$$

These two functions have the same form $\widehat{h_m}(\cdot)$ because the utility function is two-period separable, time-additive, and time-invariant.

We now consider the behavior of type-c. Considering Eq. (1.9), maximization problem (1.1) can be rewritten as

$$\max_{h_c, z} U_c = 2u_c(h_c) + z \tag{1.1'}$$

$$\text{subject to} \quad y = (r_c^1 + r_c^2)h_c + z.$$

Solving the above problem (1.1'), we obtain the following type-c demand function:

$$h_c = h_c(R_c). \tag{1.3'}$$

Supply of Rental Housing Let us now consider the behavior of landlords. The setting for landlords' behavior is the same as in Section 1.2.1.

First suppose that there is no asymmetry of information between the landlord and the tenant. That is Assumption 1 is valid in this section.

Under Assumption 1 landlords can rent their dwellings only to a specific type of tenant. Therefore, the profit maximization problem of a landlord who rents his or her dwellings only to type-i tenants becomes

$$\max_{h_{si}} \Pi_i = R_i h_{si} - g(h_{si}), \tag{1.5'}$$

where subscript si refers to the supply to type-i tenants. Furthermore R_m denote the expected value of two period rent for type-m, and is defined as

$$R_m \equiv r_m^1 + r_m^2. \tag{1.12}$$

The supply function may be written as

$$h_{si} = h_s(R_i). \tag{1.6'}$$

The profit function can be written as

$$\Pi_i = \Pi(R_i). \tag{1.13}$$

This function is increasing with respect to R_i.

Competition requires that

$$\Pi(R_m) = \Pi(R_c) \equiv \Pi. \tag{1.14}$$

This result, Eq. (1.13), and the fact that the profit function is increasing with respect to arguments, yield

$$R_m = R_c \equiv R. \tag{1.15}$$

Thus, R is the common expected value of two-period rents for type-m and type-c. This implies that, at equilibrium, landlords must have the same return whether they let the rental housing to type-m or type-c tenants. From (1.2), (1.12) and (1.15) we have

$$R = r_i^1 + r_i^2. \tag{1.16}$$

Substituting (1.16) for R_i into the two equations of (1.14), we find that $h_{sm} = h_{sc} \equiv h_s$. Therefore, the supply function $h_s(\cdot)$ may be rewritten as

$$h_s = h_s(R). \tag{1.6"}$$

We note in passing that from (1.16), Eq. (1.3') can be rewritten as

$$h_c = h_c(R). \tag{1.3"}$$

Market Equilibrium The market clearing conditions in periods 1 and 2 can be written as

$$Lh_s = Mh_m^1 + Nh_c, \tag{1.17}$$

$$Lh_s = Mh_m^2 + Nh_c. \tag{1.17'}$$

These imply that

$$h_m^1 = h_m^2 \equiv h_m. \tag{1.18}$$

This equation means that type-m consumes the same floor space in the term periods.

In view of (1.18), Eqs. (1.17) and (1.17') can be written as

$$Lh_s = Mh_m + Nh_c. \tag{1.19}$$

The Benchmark Two Types Model We now have to introduce a mechanism that determines r_c^1 and r_c^2. To this end we assume the following:

Assumption 4 (Freedom of Contract-renewal) *Landlords who contract with type-c tenants in the first period can refuse a request for the renewal of the contract in the second period, and evict the tenants. Type-c tenants can also leave the contract if the rent is unsatisfactory.*

This implies that landlords who contract with type-c tenants in the first period will not accept $r_c^2 < r_m^2$. Neither will the tenant of type-c accept $r_c^2 > r_m^2$. The rent for the second period, therefore, must be equal for type-m and type-c, and we have

$$r_c^2 = r_m^2. \tag{1.20}$$

Then the 10-equation model consisting of (1.11), (1.11'), (1.3"), (1.6"), the two equations of (1.16), the two equations of (1.18), Eqs. (1.19) and (1.20), contains 10 variables, h_m^1, h_m^2, h_m, h_c, h_s, r_m^1, r_m^2, r_c^1, r_c^2 and R. We call this model the *Benchmark Two Types Model* (BTT Model). This model describes the economy where freedom of contract renewal is allowed in the second period for the type-c tenants.

The Effects of the JTPL

We now consider the effects of the JTPL. Hence, we again assume Assumptions 2 and 3 but do not assume Assumption 4. Because it must be exist the market rent in period 2 (r_m^2), Eq. (1.7') in Assumption 3 changes as follows:

$$r_c^2 < r_m^2. \tag{1.20'}$$

The reason that a landlord renews the contract even though r_c^2 is lower than r_m^2 is that from Assumption 2 the landlord does not have the option of letting the housing to type-m tenants.

The economy under the JTPL can be described by a generalized version of the BTT Model. The reason is the same as previous section. Both (1.20) and (1.20') are contained in

$$r_c^2 = \alpha r_m^2, \tag{1.20"}$$

Therefore, the BTT Model with (1.20) replaced by (1.20") can describe the rental-housing market with or without the JTPL.[13] We call this the *Symmetric Information and Two Types Model* (SITT Model).

We will now analyze the effect of the introduction of the JTPL by examining the effects of a change in α in the SITT Model.

The Core Model of the SITT Model To this end we first simplify the SITT Model. Substituting Eqs. (1.11), (1.3") and (1.6") into Eq. (1.17) and Eqs. (1.11'), (1.3') and (1.6")

[13]Our model can be applied to the case where the landlord gives compensation to the tenant and he or she moves to other housing. Suppose such compensation is a constant fraction of the market rent in the second period, i.e., ρr_m^2 $(0 < \rho \leq 1)$. Accordingly, the tenant required to vacate despite a desire to renew the contract in the second period has a net payment per unit of housing of $(r_m^2 - \rho r_m^2)$, which is lower than the market rent in the second period. Suppose that $(1 - \rho) = \alpha$. Then the effects of the compensation equal those of the decrease in the contract-renewal rent.

into Eq. (1.17'), we have

$$\widehat{h_m}(r_m^1) = \widehat{h_m}(r_m^2).$$

Since the t-th period type-m demand function is decreasing in rent, we obtain at the equilibrium

$$r_m^1 = r_m^2 \equiv r_m. \tag{1.21}$$

From Eqs. (1.16) and (1.21) we have

$$R = 2r_m. \tag{1.16'}$$

Equations (1.11), (1.11'), (1.18) and (1.21) imply that

$$h_m = \widehat{h_m}(r_m).$$

This and (1.16') imply that, at equilibrium, the demand of type-m must satisfy

$$h_m = h_m(R). \tag{1.22}$$

This is a reduced-form demand function that holds only at the equilibrium; for simplicity we will call it a type-m demand function.

From the four equations (1.3"), (1.6"), (1.19) and (1.22), we can find the values of h_m, h_c, h_m and R. Since (1.16') and (1.21) imply that

$$r_m^1 = r_m^2 = \frac{1}{2}R. \tag{1.23}$$

the values of r_m^1 and r_m^2 can also be found from R.

We call the eight-equation model consisting of (1.3"), (1.6"), the two equations of (1.18), (1.19), (1.22) and the two equations of (1.23), the *Core Model* of the SITT Model. It contains eight variables: h_m^1, h_m^2, h_m, h_c, h_s, r_m^1, r_m^2 and R.

Neutrality of the JTPL Thus, the Core Model of the SITT Model determines all the variables of the BTT Model except for r_c^1 and r_c^2. Once R is found in the Core Model of the SITT Model, however, r_c^1 and r_c^2 can also be found from

$$\frac{1}{2-\alpha}r_c^1 = \frac{1}{\alpha}r_c^2 = \frac{1}{2}R. \tag{1.24}$$

which follows from (1.16), (1.20") and (1.23).

Therefore, the SITT Model is obtained by adding the two equations of (1.24) to the Core Model of the SITT Model. In other words, the SITT Model can be decomposed into the Core Model of the SITT Model and the two equations of (1.24).

Since the Core Model of the SITT Model does not contain the two equations of (1.24), the variables of the Core Model of the SITT Model are determined independently of α. Hence we obtain the following:

Proposition 2 (Neutrality of the JTPL 2) *In the Symmetric Information and Two Types Model, JTPL enforcement has no effect on the expected value of the two-period rents. Hence it does not affect the size of the rental-housing market, the quantity of housing rented by each tenant, and his or her utility.*

Proposition 2 is a more general version of Proposition 1. That is, under symmetric information on intended tenure length, the JTPL has no impact on both the size of the rental-housing market and the floor space of the housing rented by each tenant.

From (1.24) it is clear that α affects only r_c^1 and r_c^2 in the SITT Model. Note that at the equilibrium of the BTT Model we have

$$r_m^1 = r_m^2 = r_c^1 = r_c^2,$$

which can be found by (1.23) and by letting $\alpha = 1$ in (1.24).

1.3 The Asymmetric Information Model

1.3.1 Risk-Neutral Landlords Case

Model of the Rental-Housing Market without the JTPL

Still keeping two types tenant, let we now consider the case of asymmetric information on tenure length between tenants and landlords without the JTPL. Therefore, we assume Assumption 4 but do not assume Assumptions 1, 2 and 3 in this section. We replace Assumption 1 by the following:

Assumption 5 (Asymmetric Information) *Landlords cannot tell the difference between type-m and type-c tenants, but they do know that with probability p a tenant is type-m, and with probability* $(1-p)$ *a tenant is type-c.*

In the absence of the JTPL, the landlords who contracted with type-c tenants in period 1 can evict them at the end of period 1, if they are not willing to pay the market rent in period 2 as shown in Assumption 4. Hence, (1.20) must hold in this section. In period 1, landlords let the rental housing both to type-m and type-c at the same rent, because they cannot tell the difference between tenants.[14] Accordingly, we have

$$r_c^1 = r_m^1. \tag{1.25}$$

From (1.20) and (1.25), (1.15) must hold. Therefore, the 10 equations (1.11), (1.11'), (1.3"), (1.6"), the two equations of (1.16), the two equations of (1.18), Eqs. (1.19) and (1.20) consist the model. This model is exactly the same as the BTT Model. That is, the equilibrium conditions of the BTT Model do not depend on whether information on intended tenure length between landlords and tenants is symmetric or not.[15] We summarize this as the following proposition:

Proposition 3 *Asymmetric information on intended tenure length has no effects on the rental-housing market, if the JTPL does not exist.*

Information about intended tenure length, however, becomes important for landlords if the JTPL exists. We will prove this in the following sections.

The Effects of the JTPL

We now introduce the JTPL into the economy with asymmetric information on tenure length between tenants and landlords. Hence, we again assume Assumptions 2 and 3.

[14]We do not consider the case in which landlords offer two contracts, one for each type, and the self-selection constraints are satisfied. Yamazaki (1999) provides a model in which landlords try to determine the difference of tenure length among tenants by supplying rental housing with different rent and floor size, under the assumption that the tenant's utility from the floor size of housing depends on tenure length. However, the type (tenure length) of tenant and their preference of floor size do not correlate in our model, and it is impossible for landlords to offer the contract described by Yamazaki (1999). We prove this in Chapter 2.

[15]Basu and Emerson (2000) show that if a landlord and a tenant can sign on any rental and eviction contract, such as writing a departure-date contingent contract (or putting in a rent-escalation clause), landlords can get around the asymmetric information problem.

In the first period, landlords let the rental housing both to type-m and type-c tenants at the same rent in the first period for the same reason as stated in Section 1.3.1. In the SITT Model with the JTPL ($\alpha \neq 1$), the first-period rent of type-c is not equal to that of type-m. This is a significant difference between Section 1.2.2 and this section. The expected contract-renewal rent can be written as (1.20") for the same reason as Section 1.2.2. Accordingly, R_m and R_c cannot be written as (1.15). From (1.12) and (1.21), R_m can be written as

$$R_m = 2r_m^1 = 2r_m^2. \tag{1.12'}$$

Then we can rewrite (1.22) as the following:

$$h_m = h_m(R_m). \tag{1.22'}$$

We now consider the supply side. Under Assumption 5, profit of a landlord becomes

$$\Pi_m = R_m h_s - g(h_s)$$

with probability p, and becomes

$$\Pi_c = R_c h_s - g(h_s)$$

with probability $(1-p)$. That is, landlords face unexpected changes in their profits under asymmetry of information on tenure length. In this section, we assume the following:

Assumption 6 (Risk Neutrality) *All landlords are risk-neutral.*

The risk-neutral landlord chooses h_s at the beginning of the first period so as to maximize expected profit. Thus, the profit maximization problem for a landlord can be written as

$$\max_{h_s} \; p\Pi_m + (1-p)\Pi_c.$$

We rewrite this as

$$\max_{h_s} \; R_s h_s - g(h_s) \tag{1.5"}$$

where

$$R_s \equiv pR_m + (1-p)R_c. \tag{1.26}$$

Eq. (1.26) shows that the expected value of two-period rents for landlords is equal to the average of R_m and R_c weighted by the proportion of type-m and type-c tenants. Thus, to mitigate the disadvantage of the adverse selection problem, landlords offer rent based upon the average tenure duration that they expect.[16] From (1.6"), the solution of (1.5") is

$$h_s = h_s(R_s). \tag{1.6"'}$$

We call the twelve-equation model consisting of (1.2), (1.3'), (1.6"'), the two equations of (1.18), the two equations of (1.12'), Eqs. (1.19), (1.20'), (1.22'), (1.25), and (1.26) the *Asymmetric Information and Risk-Neutral Landlords Model* (AIRNL Model). It contains 12 variables: h_m^1, h_m^2, h_m, h_c, h_s, r_m^1, r_m^2, r_c^1, r_c^2, R_m, R_c and R_s. Since the AIRNL Model dependents on α, this model is affected by the JTPL.

We examine the effects of the JTPL on the main variables: r, h_i, R_i, and v_i, where

$$r(\equiv r_m^1 = r_m^2 = r_c^1)$$

is the market rent in equilibrium from (1.12') and (1.25). Note that if the JTPL does not exist, then $\alpha = 1$. Therefore, by setting $\alpha = 1$, we have the same equilibrium conditions as BTT Model. On the other hand, the effect of JTPL enforcement may be represented by a decrease in α from 1. By totally differentiating the market equilibrium conditions, we obtain the following proposition:

Proposition 4 *In the Asymmetric Information and Risk-Neutral Landlords Model, JTPL enforcement yields the following result:*

(*i*) *The market rent rises.*

$$\frac{dr}{d\alpha} < 0$$

(*ii*) *The expected value of two-period rents for type-m tenants rises while that for type-c tenants falls.*

$$\frac{dR_m}{d\alpha} < 0, \frac{dR_c}{d\alpha} > 0.$$

(*iii*) *The equilibrium housing consumption of type-m tenants decreases while that of type-c tenants increases.*

$$\frac{dh_m}{d\alpha} > 0, \frac{dh_c}{d\alpha} < 0.$$

[16] This is similar to Basu and Emerson (2000) and Seshimo (1998).

(iv) The utility of type-m tenants decreases while that of type-c tenants increases.

$$\frac{dU_m}{d\alpha} < 0, \frac{dU_c}{d\alpha} > 0.$$

Proof. See Appendix A.1.1. ∎

We also have the following lemma for the equilibrium quantity of rental housing $H \equiv Lh_s$:

Lemma 1 *The direction of change in the equilibrium quantity of rental housing H is as follows:*

$$\text{sign } \frac{dH}{d\alpha} = \text{sign } [u_m''(h_m) - u_c''(h_c)]. \tag{1.27}$$

Proof. See Appendix A.1.2. ∎

Since a decrease in α entails an increase in the housing consumption of type-c and a decrease in the housing consumption of type-m (Proposition 3 (iii)), the impact on the equilibrium quantity of rental housing is indeterminate.

Lemma 1 implies that the direction of change in the size of rental-housing market depends on the difference between the second derivative of the utility function of type-m and that of type-c. In our model, the second derivative of the utility function is the slope of the demand function. Therefore, the direction of change in the size of rental-housing market only depends on demand side.

Suppose $u_m''(h_m) = u_c''(h_c)$ for any h. Then, the neutrality of the JTPL is satisfied in the sense that it does not affect the size of the rental-housing market. However, the utility of type-m tenants decreases because the quantity of rental housing that they demand decreases, while that of type-c tenants increases because the quantity of rental housing that they demand increases. This implies that JTPL enforcement leads to income redistribution from type-m to type-c,[17] even in the case where the size of the rental-housing market does not change.

If $u_m''(h_m) > u_c''(h_c)$, the size of the rental-housing market decreases due to JTPL enforcement.

[17] Basu and Emerson (2000) also shows that tenancy rent control is simply a transfer from the short-term tenant to the long-term tenant. Therefore, the conflict of interest is not between landlords and tenants but between tenants of one type and another.

However, if $u''_m(h_m) < u''_c(h_c)$, the size of the rental-housing market increases due to JTPL enforcement. This is because the increase in the total demand of type-c is larger than the decrease in that of type-m. Suppose $u_m(h_m) = u_c(h_c) = u(h)$. Then, it is more likely that $u''_m(h_m) < u''_c(h_c)$, since $h_m < h_c$ in equilibrium.[18] Hence, the JTPL enforcement is more likely to increase the size of the rental-housing market if the utility functions are not very different between type-m and type-c.[19]

We will examine in the next section whether their argument is valid in the case where landlords are risk-averse.

1.3.2 Risk-Averse Landlords Case

We now examine how the conclusions in Section 3.2 change if landlords are risk-averse. Therefore, we replace Assumption 6 with the following:

Assumption 7 (Risk Averter) *All landlords are risk-averse.*

The risk-averse landlord is supposed to maximize expected utility as follows:

$$\max_{h_s} \; p\psi(\Pi_m) + (1-p)\psi(\Pi_c), \tag{1.28}$$

where $\psi(\cdot)$ is a von Neumann-Morgenstern (vN-M) expected utility function such that $\psi'(\cdot) > 0$ and $\psi''(\cdot) < 0$.

By solving this maximization problem (1.28), we obtain the following supply function:

$$h_s = \widehat{h_s}(R_s). \tag{1.6""}$$

The supply function of risk-averse landlords $\widehat{h_s}(\cdot)$ is different from that of risk-neutral landlords $h_s(\cdot)$. Furthermore, R_s in (1.26) can be written as

$$R_s = \frac{p\psi'(\Pi_m)R_m + (1-p)\psi'(\Pi_c)R_c}{a}, \tag{1.26'}$$

[18] For example, assume that the utility function of all tenants is represented by $u = h^{\theta}$ where $0 < \theta < 1$. Then, since $u''(h)$ increases as h increases, $u''_m(h_m) < u''_c(h_c)$.

[19] The size of the rental-housing market always decreases in Seshimo (1998), which employs the same assumptions of asymmetric information on tenure length and landlord's risk neutrality as used here, but which adds the assumption that tenants choose to rent only a constant unit.

where a is defined as

$$a \equiv p\psi'(\Pi_m) + (1-p)\psi'(\Pi_c).$$

All of the equilibrium conditions in this section correspond to that in AIRNL Model expect that we replace (1.6"') by (1.6"") and (1.26) by (1.26'). Hence, (1.2), (1.3'), (1.6""), the two equations of (1.18), the two equations of (1.12'), Eqs. (1.19), (1.20'), (1.22'), (1.25), and (1.26') constitute the rental-housing market model in this section. We call this model the *Asymmetric Information and Risk-Averse Landlords Model* (AIRAL Model). In this model, the above 12 equations determine the twelve unknown variables h_m^1, h_m^2, h_m, h_c, h_s, r_m^1, r_m^2, r_c^1, r_c^2, R_m, R_c and R_s for a given α.

Let us assume the landlord's preference toward risk is as follows:

Assumption 8 (Decreasing Absolute Risk Aversion) *Absolute risk aversion of landlords $AR(\Pi_i) \equiv -\frac{\psi''(\Pi_i)}{\psi'(\Pi_i)}$ decreases, as Π_i increases. Furthermore $(1+\alpha)AR(\Pi_c) - 2AR(\Pi_m)$ where $\Pi_c = R_c h_c - g(h_s) < R_m h_m - g(h_s) = \Pi_m$ for any h and for a given α because $R_c (= (1+\alpha)r) < Rm(= 2r)$ in the presence of the JTPL.*

The effect of JTPL enforcement is represented by a decrease in α from 1. By totally differentiating the market equilibrium conditions, we obtain the following proposition:

Proposition 5 *In the Asymmetric Information and Risk-Averse Landlords Model, JTPL enforcement causes the following changes:*

(i) *The market rent rises.*

$$\frac{dr}{d\alpha} < 0$$

(ii) *The expected value of two-period rents for type-m tenants rises while that for type-c tenants is indeterminate.*

$$\frac{dR_m}{d\alpha} < 0, \frac{dR_c}{d\alpha} \gtreqless 0.$$

(iii) *The equilibrium housing consumption of type-m tenants decreases while the direction of the change in the housing consumption of type-c tenants is indeterminate.*

$$\frac{dh_m}{d\alpha} > 0, \frac{dh_c}{d\alpha} \lesseqgtr 0.$$

(iv) *The utility of type-m tenants decreases while the change in that of type-c tenants is indeterminate.*

$$\frac{dU_m}{d\alpha} < 0, \frac{dU_c}{d\alpha} \gtreqless 0.$$

Proof. See Appendix A.1.3. ■

There is a big difference between the effects of the JTPL on the demand of type-c tenants in the risk-neutral case and those in the risk-averse case.

The expected value of two-period rents for type-c tenants always decreases in the risk-neutral case due to JTPL enforcement, while the direction of its change is indeterminate in the risk-averse case. If the expected value of two-period rents for type-c increases in the risk-averse case due to JTPL enforcement, the housing consumption of type-c tenants decreases in equilibrium.

We also have the following lemma for equilibrium quantity of rental housing:

Lemma 2 *The direction of change in the equilibrium quantity of rental housing H can be written as*

$$\text{sign}\,\frac{dH}{d\alpha} = \text{sign}\,[\chi(\cdot)u''_m(h_m) - u''_c(h_c)], \tag{1.29}$$

where $\chi(\cdot)$ *is defined as*

$$\chi(\cdot) \equiv \frac{a\psi'(\Pi_m) - (1-p)fAR(\Pi_m)}{a\psi'(\Pi_c) + pfAR(\Pi_c)} < 1. \tag{1.30}$$

f *in* (1.30) *is defined as*

$$f \equiv (1-\alpha)\psi'(\Pi_c)\psi'(\Pi_m)rh_s.$$

Proof. See Appendix A.1.4. ■

Risk-averse landlords try to avert risk resulting from the unexpected changes in profits and decrease their supply more than risk-neutral landlords, with the result that the market size decreases more in the case of risk-averse landlords than of risk-neutral landlords. Hence, the expected value of two-period rents for type-c may increase in the risk-averse case.

From (1.29), the direction of the change in the total quantity of rental housing supplied in equilibrium depends on the utility functions of landlords and tenants. If the sign of (1.29) is positive, total quantity H decreases due to JTPL enforcement. This necessary condition for reduction of the size of the rental-housing market due to JTPL enforcement can always hold if the degree of risk aversion of landlords is sufficiently high. Therefore we obtain the following main lemma in this paper:

Lemma 3 *If the degree of risk aversion of landlords is sufficiently high, the following condition* (1.31) *is satisfied:*

$$\chi(\cdot) < \frac{u_c''(h_c)}{u_m''(h_m)} \tag{1.31}$$

If (1.31) *is satisfied, the size of the rental-housing market decreases due to JTPL enforcement.*

Proof. See Appendix A.1.5. ■

On the one hand, the left-hand side of (1.31) represents the factors on the supply side that depend on landlords' utilities and their degree of risk aversion. On the other hand, its right-hand side represents the factors on the demand side that depend on the ratio of second-order derivatives of type-c and type-m utility functions.

From (1.27), in the risk-neutral case, the necessary condition for JTPL enforcement to reduce the size of the rental-housing market is as follows:

$$1 < \frac{u_c''(h_c)}{u_m''(h_m)}. \tag{1.32}$$

Since $\chi(\cdot)$ is less than one as shown in (1.30), a comparison of (1.31) with (1.32) leads to the conclusion that JTPL enforcement is more likely to reduce the size of the rental-housing market in the risk-averse case than in the risk-neutral case. As the degree of risk aversion of landlords increases, $\chi(\cdot)$ decreases as shown in Appendix A.1.5. Hence, if the degree of risk aversion of landlords is sufficiently high, JTPL enforcement reduces the size of the rental-housing market. Moreover, under those circumstances, JTPL enforcement also raises the expected value of two-period rents for type-c, thereby decreasing the housing consumption of type-c in equilibrium. In this case, JTPL enforcement reduces not only the utility of type-m but also that of type-c, the group that the JTPL is presumably intended to protect against arbitrary eviction.

1.4 Concluding Remarks

This chapter examines the effects of the Japanese Tenant Protection Law (JTPL) on the rental-housing market by focusing on asymmetric information on tenure length between tenants and landlords. Our conclusions in this chapter are summarized as follows:

(I) In the Symmetric Information Model, the effects of the JTPL on the rental-housing market are neutral.

(II) In the Asymmetric Information and Risk-Neutral Landlords Model, the JTPL reduces the equilibrium demand of tenants with short tenure length, thereby reducing their utility. On the other hand, the JTPL increases the demand of tenants with long tenure length, thereby raising their utility.

The effect of the JTPL on the size of the rental-housing market depends on the utility functions of tenants. If their utility functions are not very different, the JTPL is more likely to increase the size of the rental-housing market. In this case, JTPL enforcement produces a large income redistribution from tenants with short tenure length to those with long tenure length.

(III) In the Asymmetric Information and Risk-Averse Landlords Model, the JTPL is more likely to decrease both the floor space per rental-housing unit and the size of the rental-housing market, thereby reducing all tenants' utilities. This is consistent with the fact that the average floor space per rental-housing unit has decreased markedly in Japan since World War II.

Since the assumptions in the Asymmetric Information and Risk-Averse Landlords Model are the most likely to be true, the JTPL is likely to have reduced the equilibrium quantity of rental housing, a resulting inefficiency in the Japanese rental-housing market. This paper does not examine whether landlords are able to tell the difference of tenure length between tenants by providing incentives to tenants. This issue is left for future research.

Appendix

A.1.1 Proof of Proposition 3

To reduce the number of unknown variables, we rewrite the AIRNL Model of Section 1.3.1 in the following way. First, since $h_m \equiv h_m^1 = h_m^2$ in equilibrium, we neglect the two equations of (1.18). Second, given (1.12') and (1.25), we have $r \equiv r_m^1 = r_m^2 = r_c^1$. With this and (1.20"), we can rewrite (1.12'), (1.2) and (1.26) as the following:

$$R_m = 2r. \tag{A.1.1}$$

$$R_c = (1+\alpha)r. \tag{A.1.2}$$

$$R_s = 2pr + (1-p)(1+\alpha)r. \tag{A.1.3}$$

Then the unknown variables h_m, h_c, h_s, r, R_m, R_c and R_s constitute a partial equilibrium of the AIRNL Model, if (1.19), (A.1.1), (A.1.2), (A.1.3) and the following conditions are satisfied:

$$R_m = 2u_m'(h_m), \tag{A.1.4}$$

$$R_c = 2u_c'(h_c), \tag{A.1.5}$$

$$R_s = g'(h_s), \tag{A.1.6}$$

Equations (A.1.4), (A.1.5) and (A.1.6) are implicit forms of the type-m demand function, type-c demand function and supply function, respectively. Therefore, we replace (1.22') by (A.1.4), (1.3") by (A.1.5) and (1.6"") by (A.1.6). From (A.1.1), (A.1.2) and (A.1.3), we can rewrite

$$r = u_m'(h_m), \tag{A.1.4'}$$

$$(1+\alpha)r = 2u_c'(h_c), \tag{A.1.5'}$$

$$2pr + (1-p)(1+\alpha)r = g'(h_s). \tag{A.1.6'}$$

Furthermore, we rewrite the market clearing condition (1.19) as

$$h_s = p\beta h_m + (1-p)\beta h_c \tag{A.1.7}$$

where $\beta = \frac{T}{L}$.

Total differentiation of the above equations (A.1.4'), (A.1.5'), (A.1.6') and (A.1.7) holding p fixed yields

$$dr = u''_m(h_m)dh_m, \tag{A.1.8}$$

$$dr = \frac{2u''_c(h_c)}{(1+\alpha)}dh_c - \frac{2u'_c(h_c)}{(1+\alpha)^2}d\alpha, \tag{A.1.9}$$

$$[2p + (1-p)(1+\alpha)]dr - g''(h_s)dh_s = -(1-p)rd\alpha \tag{A.1.10}$$

and

$$dh_s = p\beta dh_m + (1-p)\beta dh_c. \tag{A.1.11}$$

Substituting (A.1.8) into (A.1.9) to eliminate dr, and (A.1.8) and (A.1.11) into (A.1.10) to eliminate dr and dh_s, we obtain

$$\begin{pmatrix} u''_m(h_m) & -\frac{2u''_c(h_c)}{1+\alpha} \\ A & -(1-p)\beta g''(h_s) \end{pmatrix} \begin{pmatrix} \frac{dh_m}{d\alpha} \\ \frac{dh_c}{d\alpha} \end{pmatrix} = \begin{pmatrix} -\frac{2u'_c(h_c)}{(1+\alpha)^2} \\ -(1-p)r \end{pmatrix} \tag{A.1.12}$$

where the signs of the elements of the coefficient matrix on the left of (A.1.12) are as follows:

$$u''_m(h_m) < 0,$$

$$-\frac{2u''_c(h_c)}{(1+\alpha)} > 0,$$

$$A \equiv [2p + (1-p)(1+\alpha)]u''_m(h_m) - p\beta g''(h_s) < 0,$$

$$-(1-p)\beta g''(h_s) < 0.$$

The signs of the elements of the column vector on the right-hand side of (A.1.12) are as follows:

$$-\frac{2u'_c(h_c)}{(1+\alpha)^2} < 0,$$

$$-(1-p)r < 0.$$

Therefore, denoting the determinant of the matrix on the left-hand side of (A.1.12) by D, and using Cramer's rule, we obtain the following:

Proof of (ii) of Proposition 3

We have

$$\frac{dh_m}{d\alpha} = \frac{D_1}{D} > 0 \ (D_1 > 0). \tag{A.1.13}$$

where D_k $(k = 1, 2)$ is the determinant obtained from D by replacing its k-th column by the column vector on the right-hand side of (A.1.12).

Since the sign of D_2 is

$$D_2 = \begin{vmatrix} u_m''(h_m) & -\frac{2u_c'(h_c)}{(1+\alpha)^2} \\ A & -(1-p)r \end{vmatrix} = \frac{2u_c'(h_c)}{(1+\alpha)^2} p[2u_m''(h_m) - \beta g''(h_s)] < 0,$$

we obtain

$$\frac{dh_c}{d\alpha} = \frac{D_2}{D} < 0. \tag{A.1.14}$$

Proof of (i) of Proposition 3

From (A.1.8) and (A.1.13), we obtain

$$\frac{dr}{d\alpha} = u_m''(h_m)\frac{dh_m}{d\alpha} < 0. \tag{A.1.15}$$

Proof of (iii) of Proposition 3

From (A.1.1), $dR_m = 2dr$. From this and (A.1.15), we obtain

$$\frac{dR_m}{d\alpha} = 2\frac{dr}{d\alpha} < 0. \tag{A.1.16}$$

From (A.1.2) $dR_c = (1 + \alpha)dr + rd\alpha$. From this, (A.1.5') and (A.1.9), we obtain

$$\frac{dR_c}{d\alpha} = 2u_c''(h_c)\frac{dh_c}{d\alpha} > 0. \tag{A.1.17}$$

Proof of (iv) of Proposition 3

After substituting for z using budget constraint of type-m, and noting (1.18), we have the following type-m objective function:

$$U_m = 2u_m(h_m) + y - R_m h_m.$$

By differentiating this function with respect to α and using the envelope theorem and (A.1.16), we obtain

$$\frac{dU_m}{d\alpha} = -\frac{dR_m}{d\alpha}h_m > 0.$$

After substituting for z using budget constraint of type-c, we have the following type-c objective function:

$$U_c = 2u_c(h_c) + y - R_c h_c.$$

By differentiating this function with respect to α and using the envelope theorem and (A.1.17), we obtain

$$\frac{dU_c}{d\alpha} = -\frac{dR_c}{d\alpha} h_c < 0.$$

A.1.2 Proof of Lemma 1

From (A.1.11) we obtain

$$\frac{dh_s}{d\alpha} = p\beta \frac{dh_m}{d\alpha} + (1-p)\beta \frac{dh_c}{d\alpha}. \tag{A.1.18}$$

Substituting (A.1.13) and (A.1.14) into (A.1.18), we have

$$\frac{dh_s}{d\alpha} = \frac{2p(1-p)\beta r}{(1+\alpha)D}[u_m''(h_m) - u_c''(h_c)]. \tag{A.1.19}$$

Multiplying both sides of (A.1.19) by L and noting $\beta = \frac{T}{L}$, we obtain

$$\frac{dH}{d\alpha} = \frac{2p(1-p)Tr}{(1+\alpha)D}[u_m''(h_m) - u_c''(h_c)].$$

A.1.3 Proof of Proposition 4

Replacing (A.1.6') by the following first-order condition (A.1.6") for the maximization problem of risk-averse landlords, we have (1.19), (A.1.4'), (A.1.5'), and (A.1.6") for the equilibrium conditions of the AIRAL Model of Section 1.3.2.

$$\frac{2p\psi'(\pi_m)r + (1-p)\psi'(\pi_c)(1+\alpha)r}{p\psi'(\pi_m) + (1-p)\psi'(\pi_c)} = g'(h_s). \tag{A.1.6"}$$

Total differentiation of (1.19), (A.1.4'), (A.1.5'), and (A.1.6") holding p fixed yields (A.1.8), (A.1.9), (A.1.11) and

$$Bdr + Cdh_s = Ed\alpha, \tag{A.1.10'}$$

where

$$B = 2p\psi'(\pi_m) + (1-p)(1+\alpha)\psi'(\pi_c) + \frac{brh_s}{a}[(1+\alpha)AR(\pi_c) - 2AR(\pi_m)] > 0, \tag{A.1.20}$$

(from Assumption 8)

$$C = -ag''(h_s) + p\psi''(\pi_m)[2r - g'(h_s)]^2 + (1-p)\psi''(\pi_c)[(1+\alpha)r - g'(h_s)]^2 < 0,$$

and

$$E = -(1-p)r\left\{\psi'(\pi_c) + \psi''(\pi_c)[(1+\alpha)r - g'(h_s)]h_s\right\} < 0,$$

where b on the right-hand side of (A.1.20) is defined as

$$b \equiv p(1-p)(1-\alpha)\psi'(\pi_c)\psi'(\pi_m) > 0.$$

Substituting (A.1.8) into (A.1.9) to eliminate dr, and (A.1.8) and (A.1.11) into (A.1.10') to eliminate dr and dh_s, we obtain

$$\begin{pmatrix} u''_m(h_m) & -\frac{2u''_c(h_c)}{(1+\alpha)} \\ F & (1-p)\beta C \end{pmatrix} \begin{pmatrix} \frac{dh_m}{d\alpha} \\ \frac{dh_c}{d\alpha} \end{pmatrix} = \begin{pmatrix} -\frac{2u'_c(h_c)}{(1+\alpha)^2} \\ E \end{pmatrix} \tag{A.1.21}$$

where

$$F = Bu''_m(h_m) + p\beta C < 0,$$

and

$$(1-p)\beta C < 0.$$

Denote the determinant of the coefficient matrix on the left-hand side of (A.1.21) by $\hat{D}$, where $\hat{D} > 0$.

By using Cramer's rule, we obtain the following:

Proof of (ii) of Proposition 4

We have

$$\frac{dh_m}{d\alpha} = \frac{\hat{D}_1}{\hat{D}} > 0 \tag{A.1.22}$$

where $\hat{D}_k$ $(k = 1, 2)$ is the determinant obtained from $\hat{D}$ by replacing its k-th column by the column vector on the right-hand side of (A.1.21).

Since $D_2 \lesseqgtr 0$, we obtain

$$\frac{dh_c}{d\alpha} = \frac{\hat{D}_2}{\hat{D}} \lesseqgtr 0. \tag{A.1.23}$$

Proof of (i) of Proposition 4

From (A.1.22) we have

$$\frac{dr}{d\alpha} = u''_m(h_m)\frac{dh_m}{d\alpha} < 0. \tag{$a24$}$$

Proof of (iii) of Proposition 4

From (A.1.24) we have

$$\frac{dR_m}{d\alpha} = 2\frac{dr}{d\alpha} < 0. \tag{A.1.24}$$

From (A.1.23) we have

$$\frac{dR_c}{d\alpha} = 2u_c''(h_c)\frac{dh_c}{d\alpha} \gtreqless 0. \tag{A.1.26}$$

Proof of (iv) of Proposition 4

From (A.1.25) we have

$$\frac{dU_m}{d\alpha} = -\frac{dR_m}{d\alpha}h_m > 0.$$

From (A.1.26) we have

$$\frac{dU_c}{d\alpha} = -\frac{dR_c}{d\alpha}h_c \lesseqgtr 0.$$

A.1.4 Proof of Lemma 2

Substituting (A.1.22) and (A.1.23) into (A.1.18), and multiplying both sides by L, we obtain

$$\begin{aligned}\frac{dH}{d\alpha} &= \frac{2p(1-p)Tr}{(1+\alpha)\hat{D}}[\psi'(\pi_m)u_m''(h_m) - \psi'(\pi_c)u_c''(h_c)\\ &\quad -\frac{2bTr^2h_s}{a(1+\alpha)\hat{D}}[(1-p)u_m''(h_m)AR(\pi_m) + pu_c''(h_c)AR(\pi_c)] \gtrless 0.\end{aligned}$$

This equation can be written as

$$\frac{dH}{d\alpha} = \frac{a\psi'(\pi_m) - f(1-p)AR(\pi_m)}{a\psi'(\pi_c) + fpAR(\pi_c)}u_m''(h_m) - u_c''(h_c) \gtrless 0.$$

Hence, we obtain

$$\frac{dH}{d\alpha} = \chi(\cdot)u_m''(h_c) - u_c''(h_c) \gtrless 0.$$

A.1.5 Proof of Proposition 5

It is shown that agent A with utility function $\Phi(\pi_i)$ is more risk-averse than agent B with utility function $\psi(\pi_i)$ in the sense that absolute risk aversion of agent A (denoted by $-\frac{\Phi''(\pi_i)}{\Phi'(\pi_i)}$) is larger than that of agent B (denoted by $-\frac{\psi''(\pi_i)}{\psi'(\pi_i)}$) for all π_i, if there exists some increasing, strictly concave function ϕ such that

$$\Phi(\pi_i) = \phi(\psi(\pi_i)). \tag{A.1.27}$$

By differentiating (A.1.27) with respect to π_i, we obtain

$$\Phi'(\pi_i) = \phi_i' \cdot \psi_i',\ \Phi''(\pi_i) = \phi_i'' \cdot \psi_i'^2 + \phi_i' \cdot \psi_i''$$

where $\phi'(\psi(\pi_i)) \equiv \phi_i'$, $\phi''(\psi(\pi_i)) \equiv \phi_i''$, $\psi'(\pi_i) \equiv \psi_i'$ and $\psi''(\pi_i) \equiv \psi_i''$.

Replacing $\psi'(\pi_i)$ and $\psi''(\pi_i)$ of (1.30) with $\Phi'(\pi_i)$ and $\Phi''(\pi_i)$, we obtain

$$\chi(\Phi(\pi_i),\cdot) = \frac{G\Phi'(\pi_m) - (1-p)f\phi_m'\phi_c' AR_1(\pi_m)}{G\Phi'(\pi_c) + pf\phi_m'\phi_c' AR_1(\pi_c)} \tag{A.1.28}$$

where $G \equiv p\Phi'(\pi_m) + (1-p)\Phi'(\pi_c)$, and $AR_1 \equiv -\frac{\Phi''(\pi_i)}{\Phi'(\pi_i)}$.

Dividing both the denominator and numerator of the right-hand side of (A.1.28) by $\phi_m'\phi_c'$, we obtain

$$\chi(\Phi(\pi_i),\cdot) = \frac{a_1\psi_m' - (1-p)fAR_1(\pi_m)}{a_2\psi_c' + pfAR_1(\pi_c)} \tag{A.1.29}$$

where $a_1 \equiv p\frac{\phi_m'}{\phi_c'}\psi_m' + (1-p)\psi_c'$ and $a_2 \equiv p\psi_m' + (1-p)\frac{\phi_c'}{\phi_m'}\psi_c'$.

Let us compare $\chi(\psi(\pi_i),\cdot)$ of (1.30) with $\chi(\Phi(\pi_i),\cdot)$ of (A.1.29). Since $\pi_m > \pi_c$, $\phi_m' < \phi_c'$ and hence $a_1 < a < a_2$. Furthermore $AR(\pi_i) < AR_1(\pi_i)$. Consequently, we obtain

$$\chi(\psi(\pi_i),\cdot) > \chi(\Phi(\pi_i),\cdot). \tag{A.1.30}$$

Equation (A.1.30) implies that the larger the degree of risk aversion of landlords, the smaller is $\chi(\cdot)$.

Chapter 2

Rental-Housing Rent*

2.1 Introduction

A number of empirical studies of the JTPL, for example, Iwata (1997), Ohtake and Yamaga (2001), and Yamazaki (1999), show that tenure security raises the initial rent to compensate for the loss of contract-renewal rent suffered during occupancy.[2] These studies, however, do not take into account the tenants' behavior. As Nagy (1997) notes, if tenants believe that by remaining in their dwelling they can reduce rent payments, they will be willing to pay more in the current period. As we have showed in Chapter 1, if all tenants want to renew the rental contract when the tenancy expires and all landlords know this, then the JTPL raises the initial rent just enough to offset a fall in the contract-renewal rent such that the expected value of the rent stream is kept constant. Therefore, in this case, raising the initial rent has no impact on either the floor space rented by tenants or the tenants' utility. Therefore, these empirical studies of the JTPL cannot determine the effect of tenure security on either the housing consumption or the utility of tenants.

Linneman (1987) and Gyourko and Linneman (1989) use a cross-sectional micro date in New York City to measure the benefits of rent control. They define the benefit of rent control for those who dwell in the controlled sector as the difference between the uncontrolled rent predicted by controlled unit and actual rent paid on that unit. Nagy (1997) follows this

*This chapter is a revised version of Iwata (2002c).

[2]In Japan and Denmark, all the rental housing is basically controlled by (tenancy) rent control. Munch and Svarer (2001) try to capture the effect of rent control in Denmark by using data on owner-occupied housing to replace data on uncontrolled rental housing. Iwata (1997) and Yamazaki (1999) try to capture the effect of tenure security in Japan by using data on rental housing rented only by firms to replace data on uncontrolled rental housing sector. The reason for this is explained in Section 2.4. However, since the Fixed-Term House Lease System was introduced in March 2000, we can now obtain data on uncontrolled rental housing in Japan. Ohtake and Yamaga (2001) use these data to examine the effect of tenure security.

approach, but use a micro panel date from 1981 to 1987 in New York City. Nagy finds that in 1981, rent stabilized apartments had higher initial rent than non-stabilized apartments. However, between 1981 and 1987, rent grew more rapidly in the non-stabilized sector. As a result, tenants who remained in the same apartments in stabilized sector receive a benefit associated with rent control.[3] Early (2000) differs in the following two points compared with these analyses. First, since rent control increases the rental price in the uncontrolled sector, Early estimates not only the benefit of rent control for those who dwell in the controlled sector, but also the cost of rent control for those who dwell in the uncontrolled sector. Second, Early measures the tenants' benefit and cost from rent control as the utility difference between the situation with and the situation without rent control. Early finds that, controlling for higher prices in the uncontrolled sector, the average benefit to tenants in the regulated unit is negative.

Micro panel data themselves are hard to obtain for Japanese tenants. Therefore, Japanese economists try to measure the effect of the JTPL using data showing characteristics of landlords. For example, Iwata (1997), Ohtake and Yamaga (2001), and Yamazaki (1999) use cross-sectional micro data in Tokyo. From this data, they obtain the landlords' offer rent (the initial monthly rent). As mentioned above, they find that the JTPL raises the initial rent that landlords offer to compensate for the loss of contract-renewal rent. However, these empirical studies do not measure the costs and benefits of the JTPL to tenants.

Using the estimated parameter of Iwata (1997), this chapter develops both theoretical and empirical model for assessing the costs and benefits of the JTPL to tenants. The rest of the paper is organized as follows. Section 2.2 converts the theoretical model of Chapter 1 into a model that can be verified empirically. Since we use the estimated parameter of hedonic function to measure the costs and benefits of the JTPL, we adopt the hedonic prices model developed by Rosen (1974).[4] We also adopt a one-period model, rather than the two-

[3] Because dwellings are durable, landlords will choose to undermaintain their dwellings until their output of housing services declines to a level that is supported by controlled rent. Considering the maintenance expenditures of the landlord, Murray et al. (1991) simulate the effects of rent control in Los Angeles. They find that the average rent will decline as a result of the control but that the proportion of the rent reduction that is due to under-maintenance increases over time. Thus, most of the benefits of rent control to tenants realized early, while most of the costs was incurred later.

[4] Hedonic theory provides a framework for studying the contribution of individual characteristics to the value of differentiated products such as houses. In this paper, however, we only take into account the relations between hedonic rent and the floor size of rental housing.

period model of the previous chapter, because we can only obtain cross-sectional micro data in Japan. Section 2.2.1 formulates the model without the JTPL and Section 2.2.2 formulates it with the JTPL. Section 2.3 analyzes the effects of the JTPL. Section 2.3.1 analyzes the JTPL under the assumption that there is no asymmetric information between tenants and landlords. Section 2.3.2 considers asymmetry of information between tenants and landlords in the case where landlords are risk-neutral, while Section 2.3.3 considers the risk-averse case. Section 2.4 presents how to measure the costs and benefits of the JTPL to tenants. Section 2.5 shows the empirical results of Iwata (1997) and uses the parameters to determine whether our model can explain the inefficiency of tenure security in Japan. Section 2.6 provides some concluding remarks.

2.2 A Theoretical Model of Rental-Housing Rent

We consider a one-period partial equilibrium model of rental housing. Moreover, we assume a competitive rental-housing market. There is one type of landlord and two types of tenant in the market. All landlords (owners of the housing) manage rental housing for one term. The building exists after this period. On the one hand, if landlords rent the building after the tenancy period, they obtain rental income. However, as the mental cost to the landlords of not being able to use the building themselves becomes ∞, they receive disutility from renting the building after the tenancy period. On the other hand, if the landlords use the building themselves, they obtain some utility from it. Assume that the utility of each landlord for self-use is 0, i.e., it is larger than rental housing business. Then, landlords choose to use the building themselves after the tenancy period. In the rental-housing market, a fraction of $(1-p)$ tenants is willing to renew the contract after the expiration of the tenancy period, whereas a fraction of p tenants terminates the contract voluntarily. We call the former 'type-c,' as Chapter 1, and the latter 'type-t (non contract-renewal and terminate type).' All tenants know for certain which type they are. We also assume that the capital market is perfect and the discount rate for tenants and landlords is 0.[5]

[5]We consider a positive discount rate in Section 2.5.

2.2.1 Fixed-Term Rental Housing Model

Landlord's Behavior and Hedonic Rent Function First, consider a model without the JTPL. If landlords are allowed to provide a fixed-term contract, they can refuse the tenant's proposal to renew the contract. Information on intended tenure length thus has no effect on the rental-housing contract. Let us write the rent function as $R(h)$, where h is the chosen floor space in square meters. All landlords have the same cost function of h, written as $g(h)$, where $g_h > 0$ and $g_{hh} \geq 0$ for all h. Then, the profit maximization problem for the landlord can be written as

$$\max_h \ \Pi^F = R(h) - g(h) \tag{2.1}$$

regardless of the type of tenant, where superscript F refers to fixed-term rental housing. From Eq. (2.1), the landlord's offer rent function can be written as the following:

$$O^F(h; \Pi^F) = \max_h \ \Pi^F + g(h) \tag{2.2}$$

where

$$\frac{\partial O}{\partial h} > 0, \ \frac{\partial O^2}{\partial^2 h} > 0, \ \frac{\partial O}{\partial \Pi} > 0 \tag{2.3}$$

follow directly from $g_h > 0$ and $g_{hh} \geq 0$ expect the last property.

Since there is only one type of landlord who has the same cost function, an equilibrium hedonic rent function would be equal to the offer rent function. Thus,

$$R^F(h) = O^F(h; \Pi^F). \tag{2.4}$$

Competition requires that profit is 0. Hence, $\Pi^F = 0$, which satisfies Eq. (2.4).

Tenant's Behavior Turning now to tenants, we assume that all tenants have the same fixed income y, and consume housing floor space h and a composite good z, which serves as the numeraire. The budget constraint of type-i ($i = c, t$) is given by $y = R(h) + z$. For simplicity, assume that the utility function has a simple additive form:

$$U_i^F = u_i(h, \theta) + z,$$

where θ is the preferences parameter for housing floor space. Moreover, assume that

$$\frac{\partial u_i}{\partial h} > 0, \ \frac{\partial u_i^2}{\partial^2 h} < 0, \ \frac{\partial u_i}{\partial \theta} > 0, \ \frac{\partial u_i^2}{\partial \theta \partial h} > 0. \tag{2.5}$$

The meaning of the third and the fourth assumptions are discussed below.

On the one hand, type-t tenants voluntarily vacate the dwelling after the tenancy expires. On the other hand, type-c tenants involuntarily vacate the dwelling, because tenure security does not exist. Although their reasons are different, both types of tenant vacate the dwelling after the tenancy period. The utility maximization problem for type-i thus can be written as

$$\begin{aligned} \max_{h,z} \ U_i^F &= u_i(h,\theta) + z \\ \text{subject to} \ \ y &= R(h) + z. \end{aligned}$$

After substituting for z using the budget constraint, the bid rent function can be written as the following:

$$B_i^F(h; U_i^F, \theta) = \max_h \ u_i(h,\theta) + y - U_i^F \tag{2.6}$$

where

$$\frac{\partial B_i}{\partial h} > 0, \ \frac{\partial B_i^2}{\partial^2 h} < 0, \ \frac{\partial B_i}{\partial \theta} > 0, \ \frac{\partial B_i^2}{\partial \theta \partial h} > 0, \ \frac{\partial B_i}{\partial U_i} > 0. \tag{2.7}$$

These properties follow immediately from Eq. (2.5) except the last property. The third property means that if tenant A has a stronger preference for a greater floor size of rental housing than tenant B, i.e., θ of tenant A is larger than that of tenant B, then tenant A's bid rent becomes higher than that of tenant B for all h. The fourth property means that the agent with the higher bid rent also has a higher marginal bid rent.

Market Equilibrium Since there is a variety of tenants dependent on θ but only one type of landlord, the equilibria are described by the following:

$$R^F(h) = B_i^F(h; U_i, \theta), \tag{2.8}$$

$$\frac{\partial R^F(h)}{\partial h} = \frac{\partial B_i^F(h; U_i, \theta)}{\partial h}. \tag{2.9}$$

Since the utility function is separable, the unknown variable h can be obtained only from Eq. (2.9). Substituting this into Eq. (2.8), the unknown variable U_i can be calculated. This completes the description of the Fixed-Term Rental Housing Model.

Eqs. (2.8) and (2.9) mean that all bid rent curves will be tangential to the hedonic rent curve in equilibrium. Given Eq. (2.3), the hedonic rent curve is convex. Given Eq. (2.7), bid rent curves are concave, and a higher θ shifts the bid rent curves up, and makes them steeper.

To simplify the figure, only six different tenants are shown in Fig.2.1, i.e., bid rent curves B^F_{ij}, where $j \in \{\theta_1, \theta_2, \theta_3\}$ and $\theta_1 < \theta_2 < \theta_3$. From Fig.2.1 we find that if the preference for housing floor size is the same, then tenants dwell in the same size of rental housing regardless of the type of tenant. We denote optimum floor size as h^*_{ij} and optimum utility level as U^*_{ij}, which satisfy Eqs. (2.8) and (2.9).

[Figure 2.1. inserts here]

2.2.2 Just-Cause Rental Housing Model

Next, we consider a model with the JTPL. The JTPL has substantially prohibited landlords from providing a fixed-term contract.[6] That is, in order for the landlord to terminate the contract despite the tenant's desire for renewal he or she must approach a court and prove just cause. Just cause is acknowledged by a court when the landlord's need for the housing unit is larger than that of the tenant.[7] However, since the 1960s the court has begun to pass a judgment which accepts just cause, when the landlord paid compensation for removal to the tenant for involuntarily vacating the dwelling. We summarize this property of the JTPL as follows:

(iii) If the landlord paid compensation for removal to the tenant for involuntarily vacating the dwelling, the court accepts just cause.

That is, compensation for removal became the complement of just cause. To introduce this into our model, we interpret the complement of just cause as follows:

Assumption 9 (Compensation for Removal 1) *At the end of the tenancy period, if the landlord pays compensation for removal $\alpha(h)$ to the type-c tenant, where $\alpha(0) = 0$, $\alpha(h) > 0$, $\alpha_h > 0$, and $\alpha_{hh} = 0$, then just cause is approved by the court.*

[6]On March 1, 2000 the Fixed-Term House Lease System that enables landlords to refuse renewal of a rental contract that has expired was introduced.

[7]Since the cost to the landlord of not being able to use the building after the tenancy period is ∞, it is always efficient for the landlord to reside in a building after the expiry of the tenancy term in our model. The court, however, cannot observe both the landlord's need for the building and the need of the type-c tenant. Furthermore, the court has a tendency to underestimate the landlord's utility and overestimate the type-c tenant's utility due to tenure security.

However, we assume that the court can prove just cause without compensation for removal when type-t tenants pretend to be type-c and take legal action. This assumption rules out opportunistic behavior by type-t tenants. In Section 2.4, we will discuss in more detail the property of compensation for removal in order to calculate it numerically.

Tenant's Behavior First, consider the effect of the JTPL on the type-c's bid rent function. From the Assumption 9, type-c tenants receive compensation for removal at the end of the tenancy period. Therefore, their net rent for the rental dwelling becomes $R(h) - \alpha(h)$. Noting that the discount rate for the tenant is 0, then the bid rent function for type-c can be rewritten as the following:

$$B_c^J(h; U_c^J, \theta) = \max_h \; u_c(h, \theta) + y + \alpha(h) - U_c^J$$

where superscript J refers to the just-cause rental housing.

On the other hand, because type-t tenants terminate the contract at the end of a tenancy period for themselves, they cannot receive compensation for removal. Therefore, their bid rent function is equal to Eq. (2.6).

Landlord Behavior We turn now to landlords, who must pay compensation for removal if they contract with type-c tenants. In this case, their net rent for rental-housing businesses becomes $R(h) - \alpha(h)$. On the other hand, if they contract with type-t tenants, their net rent for rental housing becomes $R(h)$. Hence, profit for the landlord becomes

$$\Pi^J = R(h) - \alpha(h) - g(h) \tag{2.10}$$

with probability $(1-p)$, and becomes $\Pi^F = R(h) - g(h)$ with probability p.

2.3 The Effects of the JTPL

2.3.1 The Symmetric Information Equilibrium

The equilibrium to be described in this section is a symmetric information equilibrium in the sense that landlords are assumed to know the type of any prospective tenant. Therefore, we assume Assumption 1 in Chapter 1. In this case, landlords can rent their dwellings only to a specific type of tenant.

If landlords rent their dwellings to type-t tenants, then the fixed-term contract is validated even though the JTPL is effected, because type-t tenants terminate the contract voluntarily. Therefore, the landlord's offer rent function for type-t is equivalent to Eq. (2.2). Since type-t's bid rent function equals Eq. (2.6), as noted, the equilibrium is described by equations (2.8) and (2.9). That is, tenure security has no effect on the type-t's contract if information is symmetric. Therefore, $h_{tj}^F = h_{tj}^*$ and $U_{tj}^F = U_{tj}^*$ in equilibrium.

On the other hand, the landlord's offer rent function for type-c tenants can be written as

$$O^J(h;\Pi^J) = \max_h \ \Pi^J + g(h) + \alpha(h)$$

from Eq. (2.10). Competition requires that $\Pi^F = \Pi^J = 0$. Therefore, the offer rent for type-c rises by just $\alpha(h)$ for any h. Since $R^J(h) = O^J(h;\Pi^J)$ in equilibrium, we have

$$R^J(h) = B_c^J(h;U_c^J,\theta). \tag{2.11}$$

Since $\alpha(h)$ is transferred from the landlord to the type-c tenant, Eq. (2.11) is equivalent to Eq. (2.8). Hence, the derivative of Eq. (2.11) with respect to h is equivalent to Eq. (2.9). This implies that tenure security also has no effect on type-c tenant's contract if information is symmetric. Therefore, $h_{cj}^J = h_{cj}^*$ and $U_{cj}^J = U_{cj}^*$ in equilibrium.

To simplify the analysis, only four different values of θ are graphed in Figure 2.2. The hedonic rent function which type-c tenants face shifts up from R^F to R^J (the dashed curve) just enough to offset a loss in compensation for removal. Bid rent curves for type-c tenants, however, shift up to the same height, because the tenants gain compensation for removal.[8] Thus, the symmetric information outcome for type-c tenants, whose preference is θ_1, becomes E_{c1}^J and that for θ_2 becomes E_{c2}^J, respectively. Therefore, the chosen floor size level for type-c tenants is unaffected by the JTPL when the information is symmetric. On the other hand, any bid rent curves for type-t tenants will be tangential to the hedonic rent curve R^F in equilibrium. Thus, the chosen floor size level for type-t tenants is also unaffected by the JTPL when the information is symmetric.

[Figure 2.2. inserts here]

[8] Nagy (1995) empirically shows that the longer term tenants offer higher bids because they benefit by locking into lower future rent. This result is consistent with our theoretical model.

We may now state a proposition that is similar to Proposition 2.

Proposition 6 (Neutrality of the JTPL 3) *If the information of tenant's type is symmetric, the JTPL has no effect on the quantity of housing rented by each tenant, and his or her utility.*

2.3.2 The Asymmetric Information Equilibrium under Risk Neutrality

We now consider the case of asymmetric information on the tenants' type between tenants and landlords in the presence of the JTPL. Therefore, we assume Assumption 5 in Chapter 1. In this case, landlords face an adverse selection problem if they offer the symmetric information contract, because type-c tenants are better off by pretending to be type-t tenants and choosing contract E_{tj}^F in Fig.2.2. Since the tenants' type and their preference of floor size are not correlated, it is impossible for landlords to offer a contract, which satisfies the incentive compatibility constraint for tenants and the zero profit condition for landlords. The reason is as follows. Suppose first that all tenants have the same preference for floor space, i.e., θ_2 in Fig.2.2. Then, the separate contracts become E_{t2}^C for type-t and E_{c2}^J for type-c. Next, suppose that there are two preferences for floor space, i.e., θ_1 and θ_2. Then, contract E_{t2}^C cannot satisfy the incentive compatibility constraint for tenants, whose preference for floor space is θ_1. This result is different from Yamazaki (1999), which applied Rothschild and Stiglitz (1976). We thus assume a more simple contract as the previous chapter.

First, we consider the risk-neutral landlords and then subsequently introduce risk aversion to examine how this alters the previous conclusions. Therefore, we assume Assumption 6 in Chapter 1. On average, the risk-neutral landlord offering a contract will attract a fraction p of type-t tenants, and a fraction $(1-p)$ of type-c tenants. Thus, the expected profit maximization problem from such a contract is given by

$$\max_h \ \Pi^N = p\Pi^F + (1-p)\Pi^J \tag{2.12}$$

where superscript N refers to the risk-neutral landlord. From Eq. (2.12), the offer rent function can be written as the following:

$$O^N(h;p,\Pi^N) = \max_h \ \Pi^N + g(h) + (1-p)\alpha(h). \tag{2.13}$$

Competition requires that $\Pi^N = 0$. Therefore, the offer rent rises by just $(1-p)\alpha(h)$ for any tenants. Since $R^N(h) = O^N(h; p, \Pi^N)$ in equilibrium, we have

$$\begin{aligned} R^N(h) &= B_i^N(h; U_i, \theta), \\ \frac{\partial R^N(h)}{\partial h} &= \frac{\partial B_i^N(h; U_i, \theta)}{\partial h}. \end{aligned} \tag{2.14}$$

From Eq. (2.13) and $R^N(h) = O^N(h; p, \Pi^N)$, the hedonic rent curve R^N is between R^J and R^F, as shown by the dotted curve in Figure 2.3. Any equilibrium must be on this curve. Furthermore, from Eq. (2.14), all bid rent curves will be tangential to the hedonic rent curve R^N in equilibrium. For example, the equilibrium for type-c tenants with θ_2 becomes E_{c2}^N, and that for type-t tenants with θ_2 becomes E_{t2}^N. On the one hand, type-c tenants prefer these contracts, since the net rental price becomes lower. Therefore, their chosen floor space becomes larger ($h_{c2}^* < h_{c2}^N$), thereby raising their utility ($U_{c2}^* < U_{c2}^N$). On the other hand, type-t tenants do not prefer these contracts since the rental price becomes higher. Therefore, their chosen floor space becomes smaller ($h_{t2}^* > h_{t2}^N$), thereby lowering their utility ($U_{t2}^* > U_{t2}^N$).

[Figure 2.3. inserts here]

In summary, we obtain a Proposition 7 that is similar to Proposition 4.

Proposition 7 *If the information of tenant's type is asymmetric, and the landlord is risk-neutral, the JTPL lowers initial rent for type-c tenants. Therefore, their chosen floor space becomes larger, thereby raising their utility. On the other hand, the JTPL rises initial rent for type-t tenants. Therefore, their chosen floor space becomes smaller, thereby lowering their utility.*

2.3.3 The Effects of Risk Aversion

This section introduces risk aversion into the model. Therefore, we replace Assumption 6 by Assumption 7 in Chapter 1. This seems to be a more realistic approach, as we have mentioned at Chapter 1. A similar argument can be made here.

The risk-averse landlord is supposed to maximize expected utility as follows:

$$\max_h \ \Pi^A = p\psi(\Pi^F) + (1-p)\psi(\Pi^J) \tag{2.15}$$

where superscript A refers to the risk-averse landlord and $\psi(\cdot)$ is a vN-M expected utility function such that $\frac{d\psi(\Pi^k)}{d\Pi^k} \equiv \psi'_k > 0$, $\frac{d^2\psi(\Pi^k)}{d\Pi^{k2}} \equiv \psi''_k < 0$ $(k = F, J)$. The first-order condition of Eq. (2.15) can be written as follows:

$$\frac{\partial O^A(h; p, \Pi^A)}{\partial h} = g_h + (1-p)\Psi'\alpha_h, \tag{2.16}$$

where

$$\Psi' = \frac{\psi'_J}{p\psi'_F + (1-p)\psi'_J}. \tag{2.17}$$

On the other hand, the first-order condition of Eq. (2.13) can be written as the following:

$$\frac{\partial O^N(h; p, \Pi^N)}{\partial h} = g_h + (1-p)\alpha_h \tag{2.18}$$

Since $\Pi^J < \Pi^F$, $\psi'_J > \psi'_F$. Therefore, $\Psi' > 1$. Consequently, a comparison of Eq. (2.16) with Eq. (2.18) yields,

$$\frac{\partial O^A(h; p, \Pi^A)}{\partial h} > \frac{\partial O^N(h; p, \Pi^N)}{\partial h} \qquad \forall h, \tag{2.19}$$

where competition requires that $\Pi^A = \Pi^N = 0$. The landlord's offer rent function can be obtained from the integration of Eq. (2.19). Hence,

$$O^A(h; p, \Pi^A) = \int \frac{\partial O^A(h; p, \Pi^A)}{\partial h} dh > \int \frac{\partial O^N(h; p, \Pi^N)}{\partial h} dh = O^N(h; p, \Pi^N) \qquad \forall h.$$

The assumption that there is only one variety of landlord yields

$$R^A(h) > R^N(h) \qquad \forall h.$$

Let us call Ψ the risk aversion parameter, which is defined as the following:

$$\Psi \equiv \int \Psi' dh.$$

We have the following lemma for the risk aversion parameter:

Lemma 4 *The more landlords that are risk averse, the larger the risk aversion parameter becomes.*

Proof. To obtain a more risk averse vN-M expected utility function than $\psi(\cdot)$, we must do a concave transformation of $\psi(\cdot)$. We denote it as $\phi(\psi(\Pi))$, where $\phi(\cdot)$ is an increasing concave function. Replacing ψ'_k of Eq.(2.17) with ϕ'_k, we have

$$\Phi' = \frac{\phi'_J}{p\phi'_F + (1-p)\phi'_J}. \tag{2.20}$$

Subtracting Eq.(2.20) from Eq.(2.17), we have

$$\operatorname{sign} \Phi' - \Psi' = \operatorname{sign} \psi'_F \psi'_J (\phi'_J - \phi'_F) \qquad \forall h. \tag{2.21}$$

Since $\Pi^J < \Pi^F$ we have $\psi(\Pi^J) < \psi(\Pi^F)$. Thus, $\phi'_J > \phi'_F$. Therefore, the sign of Eq.(2.21) becomes positive. Denoting the new risk parameter as $\Phi(\equiv \int \Phi' dh)$, we then have $\Phi > \Psi$. ∎

If landlords are sufficiently risk averse, then R^A is likely to lie above R^J in Figure 2.3. In this case, tenure security also raises the rent for type-c tenants, thereby decreasing the housing consumption of type-c tenants in equilibrium ($h^*_{c2} < h^A_{cj}$). This theoretical prediction is consistent with the phenomenon that the average size of Japanese rental housing is very small. Hence, tenure security reduces not only the utility of type-t tenants, but also that of type-c tenants ($U^*_{c2} > U^A_{c2}$).

We summarize the results of this section as follows:

Proposition 8 *If the information of tenant's type is asymmetric, and the landlord is sufficiently risk averse, the JTPL raises the initial rent by more than the amount lost in compensation for removal. The JTPL thus decreases the housing consumption of both types of tenant. Therefore, the JTPL reduces the utility of all tenants.*

2.4 Mesurement of the Costs and Benefits of the JTPL

To investigate the effect of the JTPL, Iwata (1997) uses data from August 1995 in the Tokyo area *Shuu kan Chintai Special* (Recruit, weekly information on vacant rental housing). It is not possible to obtain the characteristics of tenants from these data, but he can obtain the characteristics of the landlords, such as the landlords' offer rent (the initial monthly rent that the landlords offer) and floor size of rental housing in square meters that they supply. Hence, he can estimate the market hedonic rent function R, by assuming all the landlords' cost functions to be the same.

Fixed-Term House Lease System (FTHLS) that enables landlords to refuse renewal of a rental contract that has expired was introduced on March 1, 2000. Therefore, for the 1995 data all of the rental housing is just-cause rental housing. However, Iwata (1997) and Yamazaki (1999) try to capture the effect of tenure security as follows. They use the data of rental housing rented only by firms to replace fixed-term rental housing. The firms provide the employees with rental housing as welfare facilities. Landlords believe that the firms are more likely to leave when asked to do so. Hence, the rental housing rented only by the firms could not be affected by just cause. Iwata (1997) amd Yamazaki (1999) thus estimate monthly rent which is offered by the landlords for the tenants and for the firms, respectively, and captures the effect of the JTPL on the rental-housing price. In order to make the expressions in agreement with the theoretical model, the rental housing rented only by the firms is hereafter referred to as the fixed-term rental housing.

Even though we cannot obtain the characteristics of tenants, we can measure the tenants' benefit or cost from the JTPL approximately as follows: Suppose that tenants do not change the housing cunsumption level due to the JTPL. The bid rent function of type-c rises $\alpha(h)$ due to the JTPL. Just-cause rental housing R^J also rises $\alpha(h)$ due to the JTPL. As we mentiond in Section 2.3.1, $B_c^J = R^J$ in equilibrium. Therefore, we can calculate the type-c's benefit or cost from the JTPL (BC_c) approximately as the difference between the numerical value of just-cause rental housing R^J (which is also obtained from the estimated rent of fixed-term rental housing that we will discuss below) and the estimated rent of just-cause rental housing R^E. Second, because the bid rent function of type-t does not rises due to the JTPL, we can measure the type-t's cost from the JTPL (C_t) as the difference between the estimated rent of just-cause rental housing R^E and the estimated rent of fixed-term rental housing R^F. As we mentiond in Section 2.2.1, $B_t^F = R^F$ in equilibrium. Thus we have

$$BC_c = B_c^J - R^E = R^J - R^E, \tag{2.22}$$

$$C_t = R^E - B_t^F = R^E - R^F. \tag{2.23}$$

If $R^J > R^E > R^F$, then type-c tenants receive a benefit and type-t tenants incur a cost associated with the existence of the JTPL. If $R^E > R^J > R^F$, however, then both types of tenant face a cost associated with the JTPL. Note that Eqs. (2.22) and (2.23) are approximation for measurement of the costs and benefits to tenants as we mentioned above. To show this, see Fig. 2.3, for example. Eq. (2.22) mesures the benefit of type-c tenants with θ_2 as the difference between points E_{c2}^J and E^N. But if $R^J > R^E$, type-c tenants choose E_{c2}^N. That is, they choose larger floor space due to the JTPL. As in Fig. 2.3, utility level of point E^N_{c2} is higher than point E^N. Therefore, Eq. (2.22) underestimates the benefit of type-c tenants with θ_2 in this case. However, we use the measurment of Eqs. (2.22) and (2.23) because we cannot obtain the characterisics of tenants from data.

2.5 Numerical Tests of Compensation for Removal

Now, let us consider compensation for removal. It is said that compensation for removal is determined on a case-by-case basis, and that these costs cannot be easily predicted in advance. The fundamental view of compensation for removal, however, is compensating the tenant's loss for involuntarily vacating the dwelling. Hence, in this paper, we interpret the complement of just cause as the following:

Assumption 10 (Compensation for Removal 2) *If landlords compensate the tenants by paying them an amount equal to the difference between their rent and the alternative rental housing, then just cause will be accepted. Moreover, the conditions of the alternative rental housing would be equivalent to that of the current dwelling.*

Let rh be the expected market rent of alternative rental housing. On the other hand, let $\overline{r}h$ be the contract renewal rent of the current dwelling. Then, from Assumption 10, compensation for removal can be written as follows:

$$\alpha h = \frac{\Delta r}{(1+\rho)} h = \frac{(r-\overline{r})}{(1+\rho)} h$$

where ρ is the discount rate. To prevent eviction based on rent increases, judicial precedents from tenancy suits have established that contract renewal rent is not permitted to exceed the rent of comparable newly rented units. In general, the relation of r and $\overline{r}$ becomes $r > \overline{r}$.

Assume that $g(h) = gh$. The hedonic rent functions $R^K(h)$ $(K = F, J, N, A)$, then become

$$R^K(h) = \beta^K h$$

where

$$\begin{aligned} \beta^F &= g, \\ \beta^J &= g + \alpha, \end{aligned}$$

$$\begin{aligned}\beta^N &= g + (1-p)\alpha, \\ \beta^A &= g + (1-p)\Psi\alpha.\end{aligned}$$

From Iwata (1997), the coefficient for the fixed-term rental housing is $\beta^F = 1589.7$ and that for the just-cause rental housing is 2717.99 (these two figures are in 1995 yen). We, however, cannot know whether the latter value is β^J or β^N or β^A. Therefore, we calculate compensation for removal and examine which one Iwata (1997) estimated.

The standard rental contract in Japan is for two years. At the end of the two year period, landlords cannot refuse renewal of the contract, if the current tenant wants to continue it. However, if landlords compensate the tenant with an amount equal to the difference between their rent and the alternative rental housing for five years and the moving cost, the tenant may agree to the refused renewal of the contract.[9] Assume that all the rental contracts in Iwata (1997) are for two years (24 months). In this case, landlords must pay compensation for removal at the end of the tenancy period. We thus can write monthly compensation for removal per square meter as follows:

$$\alpha = \sum_{n=3}^{7} \frac{\triangle r_n}{(1+\rho)^n} + \frac{mc}{(1+\rho)^3 \cdot 24}$$

where mc is the moving cost per square meters . To calculate this equation, we have to adopt a suitable numerical value of $\triangle r_n$, ρ, and mc.

First, we calculate the monthly rent difference per floor size $\triangle r_n$. Assume that landlords and tenants expect that the new rent grows per year at the same rate as the average annual growth rate of rent for the past five years. On the other hand, assume that they expect that the contract-renewal rent is fixed.[10] Then, rent difference per year can written as $r_n - \overline{r_n} = (1+\chi)^n\beta^F - \beta^F$, where χ is the average annual growth rate of rent. From *Consumer Price Index* (Japanese Bureau of Statistics), the average annual growth rate of private rental-housing rent between 1889 to 1994 was 2.56% per year in Tokyo. Therefore, we have $\chi = .0256$. Because we also have $\beta^F = 1589.7$ from Iwata (1997), we can thus calculate the rent difference.

Next, we consider the discount rate. Assume that the discount rate for tenants and landlords is the interest rate of time deposits. From 1995 *Economic Statistics Annual* (Bank

[9]See Mizumoto et al. (1999).

[10]This assumption is similar to Basu and Emerson (2000). They assume that there is positive inflation in the economy, and tenancy rent control forbid rent increases.

of Japan), 2.153% of average interest rate on time deposits (five years - less than six years, deposits of less than three million yen) in August 1995 is adopted here. Therefore, $\rho = .02153$.

Finally, we calculate the moving cost. From several transportation business homepages, e.g., Keio Unyu (http//www.keio.co.jp), and the 1995 *Population Survey* (Japanese Bureau of Statistics), the moving cost MC within Tokyo can be written as follows:[11]

$$\begin{aligned} MC &= 30,000 \text{ yen if } 0 < h \leq 30 \\ &= 45,000 \text{ yen if } 30 < h \leq 45 \\ &= 60,000 \text{ yen if } 45 < h \leq 60 \\ &= \cdots \end{aligned}$$

From this we assume that the moving cost per square meters $mc = 1,000$ yen.

Now, we have all the figures to calculate α. We have $\alpha = 997.63$. From this we have $\beta^J = 2588.33$.

We now calculate $(1-p)$. For persons who relocated to their present dwelling after 1989, the 1993 *Housing Survey of Japan* (Japanese Bureau of Statistics) records the duration that they had lived in their previous residence. Of the persons who lived in rental housing, 44.2% had a rental duration of less than three years. We thus assume that the proportion of type-c tenants is 55.8%. Therefore, $(1-p) = .558$. From this we have $\beta^N = 2146.15$.

As noted, the coefficient for the just-cause rental housing is 2717.99. This value is larger than $\beta^N = 2146.15$. Therefore, it is plausible to assume landlords are risk-averse. That is, the data of the just-cause rental housing that we can observe in Iwata (1997) would lie on the R^A. Since we now know the value of $\beta^A(= 2717.99)$, we can obtain the value of the risk parameter as

$$\Psi = \frac{(\beta^A - \beta^F)}{(\beta^N - \beta^F)} = 2.03.$$

Because this value is sufficiently large, R^A lies above R^J. From this, we know that tenure security lowers not only the floor space of type-t tenants, but also that of type-c tenants, thereby reducing all tenants' utility. This result is consistent with the prediction of the

[11]From several transportation business homepages, we only obtain the relations between the moving cost, floor plans ('madori' in Japanese), and the number of family members. Because we can obtain the floor size of a dwelling per person from *Population Survey*, we also use this survey to calculate the relations between the moving cost and the floor size.

theoretical model in Section 2.3.3.

Lastly, we may calculate per square meters of the cost and benefit of the JTPL from Eqs. (2.22), (2.23), the estimated parameter, and the numerical value as follows:

$$\begin{aligned}\frac{BC_c}{h} &= \beta^J - \beta^A = -129.66 \quad \text{yen,}\\ \frac{C_t}{h} &= \beta^A - \beta^F = -1128.29 \quad \text{yen.}\end{aligned}$$

Thus, both types of tenant face a cost associated with the JTPL.

2.6 Concluding Remarks

A number of empirical studies of the Japanese Tenant Protection Law (JTPL) show that tenure security raises the initial rent to compensate landlords for the loss of the contract-renewal rent suffered during occupancy. These studies, however, do not take into account the tenants' behavior. Therefore, they cannot determine the effects of tenure security on either the housing consumption or the utility of tenants. The purpose of this chapter has been to provide a theoretical model for empirical studies and test whether the JTPL reduces the demand for floor space rented by tenants and lowers their utility.

The theoretical analysis predicted that if landlords are sufficiently risk averse, the JTPL raises the initial rent by more than the amount lost in compensation for removal. The JTPL thus decreases the housing consumption of both the tenants who voluntarily vacate the dwelling and the tenants who involuntarily vacate the dwelling. Therefore, the JTPL reduces the utility of all tenants.

We tested this prediction using the estimated parameters of Iwata (1997).[12] The results showed that landlords are sufficiently risk averse, thereby raising the initial rent by more than the amount of the loss of compensation for removal. This implies that all tenants incur a cost associated with the JTPL. Therefore, the effects of the JTPL are consistent with the theoretical prediction.

[12]Since the FTHLS was introduced in March 2000, we can now obtain data on uncontrolled rental housing. Iwata and Yamaga (2002) use data from both 1995 and 2000 in the Tokyo area to capture the costs of benefits of the JTPL to tenants.

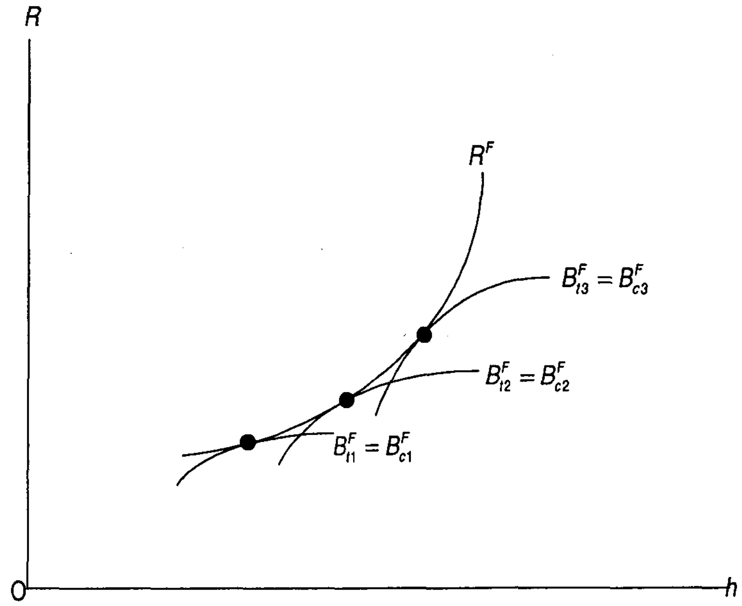

Figure 2.1.

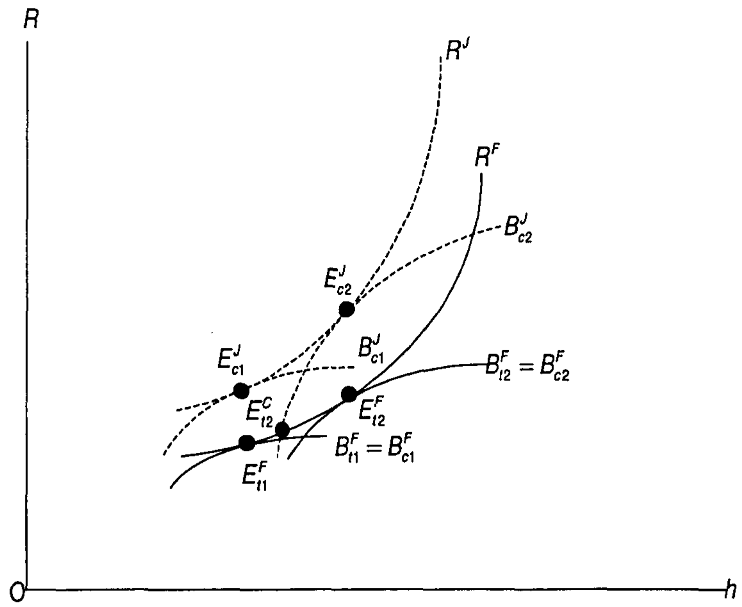

Figure 2.2.

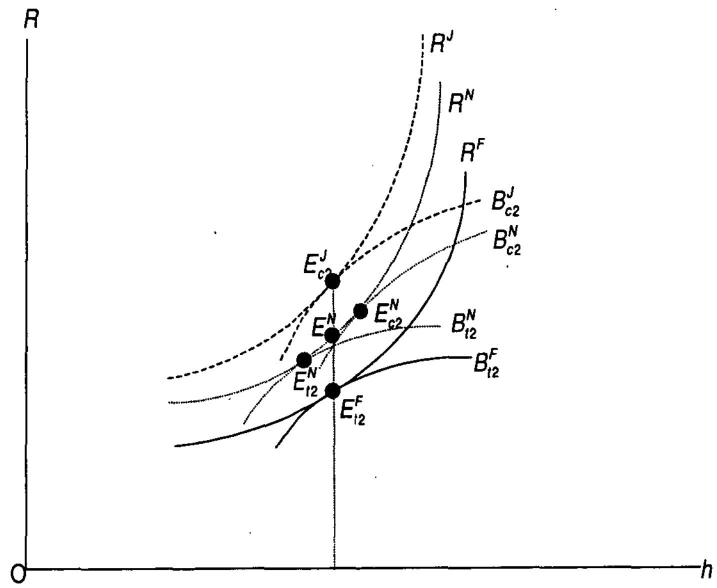

Figure 2.3.

Chapter 3

Rental-Housing Quality *

3.1 Introduction

A large number of rental housing properties with inadequate maintenance is observed in the urban areas of Japan. There may be two deterioration mechanisms for explaining rental-housing quality.

First, a "fundamental rental externality", defined by Henderson and Ioannides (1983), is the deterioration mechanism for rental housing. They argue that it is difficult for landlords to be compensated for the full damage caused by a tenant's utilization of rental housing. Therefore, compared with owner-occupied housing, tenants tend to over-utilize their dwellings, which leads to excessive deterioration of rental-housing properties. Kanemoto (1990) argues that such tenant maintenance has this effect on rental-housing quality not only during the tenancy period but after the tenancy period as well. He shows that if tenant maintenance is not verifiable by a third party, tenants do not consider the long-term benefits of maintenance and consequently their investment in maintenance is reduced.

Second, security of tenure that is guaranteed by the JTPL also affects rental-housing quality.[2] Albon and Stafford (1990), Arnault (1975), Frankena (1975), Kiefer (1980) and Moorhouse (1972) have examined the impact of rent control on the maintenance (or investment) of rental dwellings. They show that because rent control might reduce the profit of

*This chapter is a revised version of Iwata (2002b).

[2]There are other explanations for the deterioration of (rental) housing in urban areas. For example, Sweeny (1974) introduces the filtering-down model. Kim (2002) develops an evolutionary game-theoretic model of homeowners and mortgage lenders to examine urban neighborhood deterioration. He shows that there exists an evolutionary stable equilibrium in which all homeowners do not maintain their homes well and all lenders do not provide loans.

rental-housing businesses, landlords reduce maintenance of their housing.[3] In addition, the JTPL reduces the profit of rental-housing businesses. In fact, Kanemoto (1990) is able to prove that if tenants have perfect security of tenure, landlords reduce their investment. Olsen (1988), however, argues that if tenants maintain the quality of their housing, rent control will not necessarily reduce the quality of rental-housing. Because the JTPL includes a rent control provision, Olsen's argument also may be applied to the effects of the JTPL on rental-housing quality.

However, these analyses have all examined the landlord's and tenant's decisions in isolation. In fact, both of them affect rental-housing quality, as Miceli (1992) argues. Seshimo (2002) considers this and examines the effects of tenure security. In his model, a landlord's investment and that of a tenant occur sequentially. First, the landlord undertakes the building investment on the land, and the tenant subsequently makes a relation-specific investment in the rental dwelling. Seshimo (2002) shows that if tenant protection is perfect, then the tenant over-invests in the rental dwelling to increase compensation for having to involuntarily vacate the dwelling.[4] This reduces the opportunity for conversion of the land use. The landlord expects this and consequently decreases investment in the building. Seshimo (2002), however, does not consider rental-housing quality.

This chapter applies a model developed by Miceli (1992). He considers both the effects of landlord maintenance and that of the tenant on rental-housing quality, and examines the impact of the habitability law in the presence of the rental externality. A landlord's investment and that of a tenant occur simultaneously. The differences between Miceli (1992) and this paper are as follows. First, Miceli (1992) assumes that a tenant's investment produces positive effects on rental-housing quality, as in Kanemoto (1990) and Olsen (1988), but we assume that it produces negative effects. In our model, a tenant's investment can be interpreted as a relation-specific investment, such as described by Seshimo (2002), or as an intensity

[3] Gyourko and Linneman (1990) and Moon and Stotsky (1993) show that rent-controlled buildings are more likely to deteriorate than uncontrolled buildings.

[4] Seshimo (2002) shows that if tenant protection does not exist, then the tenant under-invests in the rental dwelling. That is, the hold-up problem occurs. Furthermore, he shows that the optimal tenant's investment can be drawn by the fixed-term tenancy contract.

Raess and von Ungern-Sternberg (2002) also show the hold-up problem of tenants. However, they assume that a tenant's investment is not a physical one but a psychological one, such as making friends with neighbors.

of utilization mentioned by Henderson and Ioannides (1983).[5] It is costly for landlords to remove or mitigate damages caused by a tenant's investment or utilization. Therefore, a tenant's investment may have negative effects on the rental-housing quality. In fact, rental contracts that forbid a tenant's investment are common in Japan. This may provide evidence for our assumption. Second, Miceli (1992) examines the impact of the habitability law, which compels landlords to maintain their units in accordance with local housing codes, but we examine the impact of the JTPL that protects security of tenure.

The rest of the paper is organized as follows. Section 3.2 examines the effects of the rental externality on rental-housing quality in the absence of tenure security. To do this, we compare the non-cooperative solution with the co-operative solution, as in Miceli (1992). Section 3.3 analyzes the effects of the JTPL on rental-housing quality. In this section, we also consider the impacts of the JTPL on a tenant's utility and landlord's profit. Section 3.4 summarizes the conclusions of this chapter.

3.2 The Effects of the Rental Externality

Consider a two-period model without the JTPL. At the beginning of period 1, a landlord and a tenant make a one-period lease contract. In this contract, the tenant rents a single unit of rental housing in the first period, with a rent of R_1. Both the landlord and the tenant contribute to the rental-housing quality in period 1, as we will discuss below. In the second period a rent of R_2 is offered by the landlord, and the tenant decides to either continue to rent the dwelling or to move at the beginning of period 2.[6]

Suppose that both the landlord and the tenant expect that the second period rent depends both on the rental-housing quality q_2 in period 2 and a random variable ε, i.e., $R_2 = R_2(q_2, \varepsilon)$. The rental-housing quality q_2 is assumed to be a function of two variables: m, the maintenance undertaken by the landlord during period 1, and u, the intensity with which the tenant utilizes the unit in period 1. That is, m and u undertaken in period 1 have spill-over effects on the

[5] Iwata (2001) assumes that both a landlord's investment and a tenant's investment produce positive effects on rental-housing quality, and analyzes the effects of the JTPL. Iwata shows that if landlord maintenance and tenant maintenance are perfect substitutes, and the maintenance cost function is the same as that of the landlord, then the JTPL leads to less maintenance. Consequently, the JTPL lowers rental-housing quality. Otherwise, it is indeterminate whether the JTPL leads to less maintenance.

[6] Note that some notations are different from the previous chapter.

rental-housing quality in period 2. The current maintenance of m, however, does not affect on the rental-housing quality in period 1. Moreover, additional m and u are zero in the second period.[7] The variable m represents large-scale investment in the structural portion of the housing, 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 can be interpreted as a free activity by the tenant, such as painting a wall, changing wallpaper or replacing furniture. These activities provide positive effects for a tenant living in the dwelling. However, these activities damage walls and floors. Assume that both the landlord and the potential tenant can observe u, but a court cannot. In this case, it is difficult to write a contract requiring that the tenant must 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 his or her activities, and consequently u imposes negative effects on the social evaluation of q_2, i.e., $q_{2u} < 0$.[8] This negative sign implies a rental externality. It seems to be plausible that higher rates of utilization by the initial tenant lower the rental-housing quality at an increasing rate. Thus, we assume that $q_{2uu} < 0$. The sign of q_{2um} will be discussed below.

The random variable ε represents the uncertainty of the benefits for the landlord in period 2. Assume that both the landlord and the tenant know the probability distribution function $f(\varepsilon)$. For simplicity, $f(\varepsilon)$ is assumed to be uniform distributed on the interval $[0 \quad \bar{\varepsilon}]$, where $0 < \bar{\varepsilon}$.

For simplicity, assume that R_2 has an additive form, i.e., $R_2 = q_2 + \varepsilon$. This can be interpreted as follows. The second-period rent is determined dependent on the quality of the rental housing q_2. However, there may exist a tenant who will want to rent the dwelling at a rent $q_2 + \varepsilon$, which is higher than or equal to q_2. If the landlord contracts with this tenant, he or she can obtain $q_2 + \varepsilon$. The rent offered in period 2 thus becomes $q_2 + \varepsilon$.

[7] All decisions are determined in the first period in our model. See Kanemoto (1990) for the relationship between the additional investment and tenure security.

[8] The landlord has a strategy that takes a deposit from the tenant to mitigate his or her over-utilization. However, because the court cannot observe the utilization rate of the tenant, concerns about the return of a deposit are not removed in Japan. Therefore, The Ministry of Land, Infrastructure and Transport introduced the guideline concerning the return of a deposit. According to this, the landlord should return a deposit to the tenant where the following damages have occurred: (i) denting of a carpet by furniture, (ii) a screw hole that the tenant has made for air-conditioner installation, (iii) a thumbtack hole made by a tenant, (iv) a stain on the wall made by the tobacco tar, and (v) a stain on a wall made by the electric discharge of a refrigerator. Hence it is difficult for the landlord to correct a tenant's activity by imposing a deposit.

The utilization rate u is effective in both periods, but m is effective in period 2 for the initial tenant's utility. Thus the initial tenant obtains $v_1(u)$ of utility in period 1 and $v_2(u,m)$ of utility in period 2 from the rental housing, where $v_{tu} > 0$, $v_{tuu} < 0$ $(t = 1,2)$, $v_{2m} > 0$, $v_{2mm} < 0$. The sign of v_{2um} will be discussed below.

If the utilization rate is 0, in other words, if the initial tenant does not add any investment during period 1, then it is plausible that the second period tenant's utility from the rental housing equals the social evaluation q_2. However, since $q_{2u} < 0$ (u benefits only the initial tenant), if $u > 0$, the second period tenant's utility v_2 from the rental housing in period 2 becomes larger than the social evaluation. Thus,

$$\forall m \quad v_2(u,m) \geq q_2(u,m) \quad \text{if} \quad u \geq 0.$$

Furthermore assume that

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

This implies that there is a case where the second period tenant's utility becomes less than the second period rent of the dwelling, if we consider the random variable ε.

Let us normalize the reservation utility level at 0 when the initial tenant moves to another dwelling, and denote the maximum rent as r_2 when he or she renews the contract. Then the maximum rent that he or she can pay for the dwelling while enjoying a utility level at least 0 can be written as $r_2 = v_2(u,m)$.

Suppose that the landlord has no bargaining power. Then, if the tenant has no tenure security, the landlord offers $R_2 = q_2 + \varepsilon$ at the beginning of the second period. The initial tenant renews the contract if the maximum rent is larger than or equal to the offered rent. Otherwise, he or she moves to other rental housing and obtains the reservation utility level. Therefore, the initial tenant's choice at the beginning of period 2 can be written as follows:

$$\begin{cases} F(\widehat{\varepsilon}) = \Pr[v_2(u,m) \geq q_2(u,m) + \varepsilon] & \Rightarrow \quad \text{renewal,} \\ 1 - F(\widehat{\varepsilon}) = \Pr[v_2(u,m) < q_2(u,m) + \varepsilon] & \Rightarrow \quad \text{move,} \end{cases} \tag{3.1}$$

where $F(\varepsilon)$ is a cumulative distribution function of ε. Eq. (3.1) implies that the tenant renews the contract if ε is less than or equal to $\widehat{\varepsilon}$, or otherwise moves to other rental housing in period 2. We call $\widehat{\varepsilon}$ the critical value. From Eq. (3.1) we have

$$\widehat{\varepsilon}(u,m) = v_2(u,m) - q_2(u,m). \tag{3.2}$$

The critical value thus depends on both u and m.

Tenant's Behavior Assume that the landlord and the tenant are both risk neutral and have the same discount factor, set at one. Then, from Eq. (3.1), the utility maximization problem for the tenant without tenure security is given as follows:

$$\max_u V^n = v_1(u) - R_1 - g(u) + \int_0^{\widehat{\varepsilon}(u,m)} \left(v_2(u,m) - q_2(u,m) - \varepsilon\right) f(\varepsilon) d\varepsilon \tag{3.3}$$

where superscript n refers to the case with no tenure security. Furthermore, $g(u)$ is the cost of utilization during period 1, where $g_u > 0$ and $g_{uu} > 0$ for all u. From the assumption that $f(\varepsilon)$ is uniform distributed, the maximization problem (3.3) can be rewritten as

$$\max_u V^n = v_1(u) - R_1 - g(u) + \frac{\widehat{\varepsilon}}{\bar{\varepsilon}} \left(v_2(u,m) - q_2(u,m) - \frac{\widehat{\varepsilon}}{2}\right).$$

The first-order condition is

$$V_u^n = v_{1u} + \frac{\widehat{\varepsilon}}{\bar{\varepsilon}}(v_{2u} - q_{2u}) - g_u = 0. \tag{3.4}$$

From this condition, we obtain the tenant's reaction function, $u^n = u^n(m)$.

Assume that

Assumption 11

$$\forall u, m \quad v_{2m} = q_{2m}. \tag{3.5}$$

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.

The sign of the reaction function depends on the signs of v_{2um} and q_{2um}. From the Assumption 11 that $v_{2m} = q_{2m}$ for all u, v_{2um} must equal q_{2um}, i.e., $v_{2um} = q_{2um}$. Therefore, if, for example, v_{2um} is negative, then q_{2um} is also negative.[9] We call this substitutes case

[9]For example, suppose that the tenant spills sauce on the carpet and the landlord cleans it up with mop. The greater the quantity of spilt sauce, the more difficult it is for the landlord to mop it up.

Case S. Conversely, if v_{2um} is positive,[10] then q_{2um} is positive. We call this complements case Case C.

Assume that $V^n_{uu} < 0$ for the second-order condition of the utility maximization problem. Then the tenant's reaction function does not depend on m in both Cases S and C. 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. (3.5).).

Landlord's Behavior and Non-cooperative Solution without the JTPL Turning now to the landlord. For the case with no tenure security, the landlord obtains $q_2(u,m)+\varepsilon$ whether the initial tenant renews the contract or not in period 2. Therefore, the profit maximization problem for the landlord can be written as

$$\max_m \ \Pi^n = R_1 - c(m) + \int_0^{\overline{\varepsilon}} (q_2(u,m)+\varepsilon) f(\varepsilon) d\varepsilon \tag{3.6}$$

where $c(m)$ is the cost of maintenance during period 1, where $c_m > 0$ and $c_{mm} > 0$ for all m. From the assumption that $f(\varepsilon)$ is uniform distributed, the maximization problem (3.6) can be rewritten as

$$\max_m \ \Pi^n = R_1 - c(m) + q_2(u,m) + \frac{\overline{\varepsilon}}{2}.$$

The first-order condition of this problem is

$$\Pi^n_m = q_{2m} - c_m = 0. \tag{3.7}$$

We obtain the landlord's reaction function, $m^n = m^n(u)$, from this condition. On the one hand, this reaction function is decreasing with respect to u in Case S. This implies that the higher the utilization by the initial tenant, the lower the landlord maintenance. On the other hand, in Case C, this reaction function is increasing with respect to u. This implies that the higher the utilization by the initial tenant, the higher the landlord maintenance.

The Nash equilibrium is the set of u and m that satisfies the two equations (3.4) and (3.7). This is denoted by (u^N, m^N) and will be examined below in comparison with the social optimal solution.

[10]For example, the tenant cannot enjoy wallpaper without the wall (Seshimo, 2002).

Social Optimal Solution Consider next the social optimal choices of u and m. The social welfare function W is defined as the sum of the tenant's utility function and the landlord's profit function. Substituting Eqs. (3.3) and (3.6) for W, the problem is thus to choose u and m to

$$\max_{u,m} W = v_1(u) + \left[\int_0^{\widehat{\varepsilon}(u,m)} v_2(u,m)f(\varepsilon)d\varepsilon + \int_{\widehat{\varepsilon}(u,m)}^{\overline{\varepsilon}} \left(q_2(u,m)+\varepsilon\right) f(\varepsilon)d\varepsilon\right] - c(m) - g(u).^{11} \tag{3.8}$$

From the assumption that $f(\varepsilon)$ is uniform, the maximization problem Eq. (3.8) can be rewritten as

$$\max_{u,m} W = v_1(u) + \left[\frac{\widehat{\varepsilon}}{\overline{\varepsilon}}v_2(u,m) + \frac{\overline{\varepsilon}-\widehat{\varepsilon}}{\overline{\varepsilon}}\left(q_2(u,m) + \frac{\overline{\varepsilon}+\widehat{\varepsilon}}{2}\right)\right] - c(m) - g(u).$$

The first-order conditions for u and m are as follows:

$$W_u = v_{1u} + \frac{\widehat{\varepsilon}}{\overline{\varepsilon}}(v_{2u} - q_{2u}) + q_{2u} - g_u = 0. \tag{3.9}$$

$$W_m = q_{2m} - c_m = 0. \tag{3.10}$$

These two equations define the reaction functions $u^o = u^o(m)$ and $m^o = m^o(u)$. The signs of derivatives of the reaction functions are found by differentiating Eqs. (3.9) and (3.10). Note that if $V^n_{uu} < 0$, $W_{uu} < 0$. This condition and the sign of q_{2um} determine the signs of the reaction functions. If $q_{2um} < 0$ (i.e., Case S), both $u^o(m)$ and $m^o(u)$ become decreasing functions. If, however, $q_{2um} > 0$ (i.e., Case C), both $u^o(m)$ and $m^o(u)$ become increasing functions. The pair of u and m that simultaneously satisfies Eqs. (3.9) and (3.10) becomes the social optimal pair, and it is denoted by (u^*, m^*). Only unique and stable equilibria are considered below.[12]

Eq. (3.10) is equivalent to Eq. (3.7). Hence, the landlord maintenance in the rental-housing case is equal to the social optimal maintenance for all u (i.e., $m^o(u) = m^n(u)$ for all u). This is because the landlord captures the benefit of his or her maintenance by the rent increase in period 2.

[11] Eq. (3.8) may be interpreted as the maximization problem for owner-occupied housing. That is, the owner chooses u and m to maximize not only his or her utility but also potential future tenants' or buyers' utilities. If the owner leases the housing or sells the housing in period 2, he or she obtains $q_2 + \varepsilon$ and occupies another dwelling.

[12] If the landlord's reaction curve is steeper than that of the tenant, (u^*, m^*) is stable.

Next, compare Eq. (3.9) with Eq. (3.4). Because $q_{2u} < 0$, the marginal benefit of u is larger in Eq. (3.4) than in Eq. (3.9) while the marginal costs are the same. Hence the best response for the utilization rate in the rental-housing case is larger than the social optimal case for all m (i.e., $u^o(m) < u^n(m)$ for all m). That is, the initial tenant ignores the rental externality and has an incentive to over-utilize his or her rental housing, as Henderson and Ioannides (1993) argue.

Now compare the social optimal solution and the non-cooperative one in both Case S and Case C. First consider Case S. If the social optimum equilibrium is stable, $u^* < u^N$ and $m^* > m^N$ because u and m are substitutes. In this case, the landlord's under-investment results from the over-utilization by the initial tenant. The rental-housing quality is thus lowered due to the rental externality, i.e., $q_2(u^*, m^*) > q_2(u^N, m^N)$.

Next consider Case C. If the social optimum equilibrium is stable, $u^* < u^N$ and $m^* < m^N$ because u and m are complements. That is, the landlord over-invests in maintenance because the initial tenant over-utilizes the dwelling. Thus the effect of the rental externality on rental-housing quality is ambiguous in Case C.

We may now state a lemma as follows:

Lemma 5 (*i*) *If u and m are substitutes, the rental-housing quality is lowered due to the rental externality.* (*ii*) *If u and m are complements, the effect of the rental externality on rental-housing quality is ambiguous.*

Fig. 3.1 illustrates Case S. The Nash equilibrium (E^N) is given by the intersection of u^n and m^n, and the social optimal equilibrium (E^O) is given by the intersection of u^o and m^o. As drawn, $m^o = m^n$, but $u^o < u^n$. This shows that the initial tenant over-utilizes the dwelling from the social point of view. As u and m are substitutes, the higher is the utilization rate above u^o, the lower is the investment of m below the social optimal level.

[Figure 3.1. inserts here]

3.3 The Effects of the JTPL

Next, consider the effects of the JTPL on rental-housing quality. In Japan, for example, in order for the landlord to terminate the contract despite the tenant's desire for renewal he or she must approach a court and prove just cause. Just cause is acknowledged by a court when the landlord's need for the housing unit is larger than that of the tenant. To introduce this into our model, we interpret just cause as follows. At the beginning of the second period, the court compares the landlord's profit with the initial tenant's utility, and accords the landlord the right to use the housing unit if the former is greater than the latter. Otherwise, it gives the tenant the right to use it. However,

Assumption 12 (Eviction Control and Rent Control) *The court has a tendency to underestimate the landlord's profit due to the JTPL. Furthermore, to prevent eviction by rent increases, the court lowers the contract-renewal rent to the level of the landlord's profit, which is underestimated.*

If both the landlord and the initial tenant expect Assumption 12, then the initial tenant's choice at the beginning of period 2 can be represented as follows:

$$\left\{\begin{array}{rcl} F(\widetilde{\varepsilon}) = \Pr\left\{v_2(u,m) \geq \frac{1}{\alpha}(q_2(u,m)+\varepsilon)\right\} & \Rightarrow & \text{renewal}, \\ 1 - F(\widetilde{\varepsilon}) = \Pr\left\{v_2(u,m) < \frac{1}{\alpha}(q_2(u,m)+\varepsilon)\right\} & \Rightarrow & \text{move}, \end{array}\right. \tag{3.11}$$

where α ($\alpha \geq 1$) is the underestimation parameter of the court that the landlord and the initial tenant anticipate. Thus the critical value changes as follows:

$$\widetilde{\varepsilon}(u,m,\alpha) = \alpha v_2(u,m) - q_2(u,m). \tag{3.12}$$

When $\alpha = 1$ then Eq. (3.12) degenerates into Eq. (3.2), i.e., $\widetilde{\varepsilon} = \widehat{\varepsilon}$. On the other hand, then $\widetilde{\varepsilon} > \widehat{\varepsilon}$. Hence the probability of renewal becomes higher if $\alpha > 1$. Thus α implies a degree of tenure security.

Tenant's Behavior From Eq. (3.11), the utility maximization problem for the tenant with tenure security is given as follows:

$$\max_u V^l = v_1(u) - R_1 - g(u) + \int_0^{\widetilde{\varepsilon}} \left[v_2(u,m) - \frac{1}{\alpha}(q_2(u,m)+\varepsilon)\right] f(\varepsilon)d\varepsilon \tag{3.13}$$

where superscript l refers to the case with the JTPL. From the assumption that $f(\varepsilon)$ is uniform, the maximization problem (3.13) can be rewritten as

$$\max_u V^l = v_1(u) - R_1 - g(u) + \nu_2(u,m,\alpha) \tag{3.13'}$$

where

$$\nu_2(u,m,\alpha) \equiv \frac{\tilde{\varepsilon}}{\bar{\varepsilon}}\left[v_2(u,m) - \frac{1}{\alpha}\left(q_2(u,m) + \frac{\tilde{\varepsilon}}{2}\right)\right].$$

The tenant's reaction function can be written as $u^l = u^l(m,\alpha)$, by solving this problem. The sign of the derivatives of the tenant's reaction function are found by differentiating the first-order condition of (3.13'). Assuming $V^l_{mm} < 0$ for the second-order condition of the utility maximization problem, then this function is increasing with respect to α because the marginal profit of u increases as the degree of tenure security increases ($V^l_{u\alpha} > 0$). Therefore, $u^n(m) < u^l(m,\alpha)$ for all m. This result is consistent with Seshimo (2002). The sign of V^l_{um} is indeterminate in Case S. Therefore, the sign of the derivative of $u^l(m,\alpha)$ with respect to m is indeterminate. On the other hand, $V^l_{um} > 0$ in Case C. Therefore, the tenant's reaction function is increasing with respect to m in Case C.

Landlord's Behavior and Non-cooperative Solution with the JTPL In the case of tenure security, the landlord can obtain $q_2(u,m) + \varepsilon$ when the initial tenant moves to other rental housing in period 2. However he or she obtains only $\frac{1}{\alpha}(q_2(u,m) + \varepsilon)$ when the initial tenant renews the contract. Therefore the profit maximization problem for the landlord can be given as follows:

$$\max_m \ \Pi^l{=}R_1 - c(m) + \left[\int_0^{\tilde{\varepsilon}} \frac{1}{\alpha}(q_2(u,m)+\varepsilon)f(\varepsilon)d\varepsilon + \int_{\tilde{\varepsilon}}^{\bar{\varepsilon}} (q_2(u,m)+\varepsilon)f(\varepsilon)d\varepsilon\right]. \quad (3.14)$$

From the assumption that $f(\varepsilon)$ is uniform, the maximization problem (3.14) can be rewritten as

$$\max_m \ \Pi^l{=}R_1 - c(m) + \pi_2(u,m,\alpha) \quad (3.14')$$

where

$$\pi_2(u,m,\alpha) \equiv \frac{\tilde{\varepsilon}}{\bar{\varepsilon}}\frac{1}{\alpha}\left(q_2(u,m) + \frac{\tilde{\varepsilon}}{2}\right) + \frac{\bar{\varepsilon} - \tilde{\varepsilon}}{\bar{\varepsilon}}\left(q_2(u,m) + \frac{\bar{\varepsilon} + \tilde{\varepsilon}}{2}\right).$$

Solving this problem, we obtain the landlord's reaction function $m^l = m^l(u,\alpha)$. Similarly to the tenant's reaction function, the signs of the derivatives of this function are found by differentiating the first-order condition of (3.14'). Assuming $\Pi^l_{mm} < 0$ for the second-order condition of the profit maximization problem, then this function is decreasing with respect to α because the marginal profit of m decreases as the degree of tenure security increases

($\Pi^l_{m\alpha} < 0$). Therefore, $m^n(u) < m^l(u, \alpha)$ for all u. This result is consistent with Kanemoto (1990). On the other hand, the sign of the derivative of this function with respect to u is indeterminate because Π^l_{mu} is indeterminate, in both Cases S and C.

The pair of u and m, that simultaneously satisfies $u^l = u^l(m, \alpha)$ and $m^l = m^l(u, \alpha)$ is the Nash equilibrium with the JTPL and is denoted by (u^L, m^L).

3.3.1 Rental-Housing Quality

The difference between the Nash equilibrium in the case where $\alpha = 1$ and the Nash equilibrium in the case where $\alpha > 1$ shows the effects of the JTPL. Differentiating both the landlord's reaction function and the tenant's with respect to α and evaluating the derivatives at $\alpha = 1$ yields following proposition:

Proposition 9 *(i) The level of over-utilization due to the rental externality becomes larger, due largely to the JTPL in both Case S and Case C.*

$$\left.\frac{\partial u^L}{\partial \alpha}\right|_{\alpha=1} > 0, \tag{3.15}$$

(ii) The level of under-investment due to the rental externality becomes larger, due largely to the JTPL if $q_{2um} < 0$ (i.e., in Case S). On the other hand, if $q_{2um} > 0$ (i.e., in Case C), landlord maintenance is increased by the rental externality, but varies ambiguously in relation to the JTPL.

$$\left.\frac{\partial m^L}{\partial \alpha}\right|_{\alpha=1} \begin{cases} < 0 & \text{if} \quad q_{2um} < 0 \\ \gtreqless 0 & \text{if} \quad q_{2um} > 0 \end{cases} \tag{3.16}$$

Proof. See the Appendix. ■

Therefore, the JTPL accelerates deterioration of rental-housing quality in conjunction with the rental externality in Case S. As a result, the ranking of the optimal level of rental-housing quality and the non-cooperative quality in Case S becomes:

$$q_2(u^*, m^*) > q_2(u^N, m^N) > q_2(u^L, m^L).$$

Fig. 3.2 compares the Nash equilibria with and without the JTPL in Case S. Because landlord maintenance is decreasing with respect to α, his or her reaction function m^l curve shifts leftward from m^n regardless of its slope. The tenant's reaction curve u^l shifts upward from u^n regardless of its slope, because his or her utilization rate is increasing with respect to α. Therefore, the Nash equilibrium with the JTPL is in the gray area, e.g., E^L. As a result, the JTPL decreases m and increases u in equilibrium.

[Figure 3.2. inserts here]

We turn now to Case C. As in The level of over-utilization due to the rental externality increases, due largely to the JTPL in a similar fashion to that of Case S, but the direction of landlord maintenance is indeterminate. As a result, the rental-housing quality varies ambiguously in relation to the JTPL. However, if $\left.\frac{\partial m^L}{\partial \alpha}\right|_{\alpha=1}$ is less than or equal to 0, the quality level with the JTPL falls below that without the JTPL. Furthermore, if m^L becomes less than m^*, the rental-housing quality level falls below the optimal quality level due to the JTPL, even in Case C.

We may now state a lemma as follows:

Lemma 6 (*i*) *If u and m are substitutes, the JTPL accelerates deterioration of rental-housing quality in conjunction with the rental externality.* (*ii*) *If u and m are complements, the effect of the JTPL on rental-housing quality is ambiguous.*

3.3.2 Initial Tenant's Utility and Landlord's Profit

The impact of the JTPL on the initial tenant's utility is found by differentiating the tenant's utility function with respect to α and evaluating the derivative at $\alpha = 1$. Using the envelope theorem, then this yields

$$\left.\frac{\partial V^L}{\partial \alpha}\right|_{\alpha=1} = \left.\frac{\partial \nu_2^L}{\partial \alpha}\right|_{\alpha=1} > 0, \tag{3.17}$$

where

$$\left.\frac{\partial \nu_2^L}{\partial \alpha}\right|_{\alpha=1} = \frac{\widehat{\varepsilon}}{\overline{\varepsilon}}\left(q_2 + \frac{\widehat{\varepsilon}}{2}\right).$$

The RHS in Eq. (3.17) implies that the JTPL lowers the contract-renewal rent for the initial tenant. Therefore the JTPL increases the initial tenant's utility.

The impact of the JTPL on the landlord's profit is represented by

$$\left.\frac{\partial \Pi^L}{\partial \alpha}\right|_{\alpha=1} = q_{2u} \left.\frac{\partial u^L}{\partial \alpha}\right|_{\alpha=1} + \left.\frac{\partial \pi_2^L}{\partial \alpha}\right|_{\alpha=1} < 0, \tag{3.18}$$

where

$$\left.\frac{\partial \pi_2^L}{\partial \alpha}\right|_{\alpha=1} = -\frac{\widehat{\varepsilon}}{\overline{\varepsilon}}\left(q_2 + \frac{\widehat{\varepsilon}}{2}\right).$$

Note that $\left.\frac{\partial u^L}{\partial \alpha}\right|_{\alpha=1}$ is positive in both Cases S and C. Thus the first term of the RHS in Eq. (3.18) is negative and it implies that the increased utilization due to the JTPL lowers the rent in period 2.[13] The second term on the RHS in Eq. (3.18) implies that the JTPL lowers the contract renewal rent. Therefore, the second term of RHS in Eq. (3.18) is also negative. These imply that the JTPL decreases the landlord's profit in both Cases S and C.

Since the decrease of the contract-renewal rent due to the JTPL is transferred from the landlord to the initial tenant, the absolute value of Eq. (3.18) is larger than Eq. (3.17) by an amount equal to the absolute value of the first term of the RHS in Eq. (3.18). This implies that deterioration of rental-housing quality due to the increased utilization results in inefficiency of the rental-housing market in both Case S and Case C. [14]

3.4 Concluding Remarks

This chapter examines the effects of the rental externality and the JTPL on rental-housing quality by focusing on both maintenance by the landlord, which raises the quality of accommodation, and utilization of the tenant, which reduces the quality. Our main conclusions are summarized as follows:

(I) 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. Moreover, if landlords react by reducing their maintenance in line with the increased utilization rate, the higher the utilization rate, the lower the landlord maintenance. Rental-housing quality is thus diminished by the rental externality in this case. However, if landlords

[13] The variable q_2 is the social value (including value for potential tenants) of the rental-housing quality. Let us write the utility of potential tenants as $v_p(q_2)$. Then the first term on the RHS in Eq. (3.18) may also imply that tenure security lowers the utility of potential tenants.

[14] Therefore, the optimal degree of tenure security is $\alpha = 1$, but the first-best investment cannot be achieved by this contract due to the rental externality.

react by increasing their maintenance in line with the increased utilization rate, the higher the utilization rate, the higher the landlord maintenance. The effect of the rental externality on rental-housing quality is indeterminate in this case.

(II) The Japanese Tenant Protection Law (JTPL) protects tenure security to such an extent that landlords cannot refuse renewal of an expired rental contract if the current tenant wants to continue it. Furthermore, to prevent rent increases, the court lowers the contract-renewal rent, which is defined as the rent for an incumbent tenant, below the rent of comparable newly rented dwellings in the neighborhood. Therefore, tenure security in Japan further increases utilization by tenants. If landlords react by reducing their maintenance in line with the increased utilization rate, the JTPL further reduces the landlords' maintenance. Hence, the JTPL accelerates deterioration of rental-housing accommodation, along with the rental externality in this case. If landlords react by increasing their maintenance in line with the increased utilization rate, the effect of the JTPL on rental-housing quality is ambiguous. However, we show that there exists a case where the rental-housing quality level falls from the optimal quality level due to the JTPL even in this case.

As stated in (II), it is most likely that the JTPL is one of main causes of rental-housing deterioration in Japan. On March 1, 2000 the JTPL was revised and the Fixed-Term House Lease System (FTHLS) was introduced. Under the fixed-term contract, the tenant must vacate the housing when the tenancy expires if the landlord does want not to renew the contract. It is not necessary for the landlord to show any just cause to terminate the contract under this system. The new system, however, is permitted for new contracts only. Therefore, the FTHLS does not affect rental-housing contracts that took effect before March 1 2000. As long as a just cause system is applied to the contracts that were made before March 1 2000, rental-housing quality may not be improved. From this viewpoint, a fixed-term contract should also be applied to contracts made before March 1 2000.

Appendix

The Nash equilibrium is described by the next two conditions:

$$\begin{aligned} V_u^l &= 0, \\ \Pi_m^l &= 0. \end{aligned}$$

Differentiating these equations with respect to α yields the following system:

$$\begin{pmatrix} V_{uu}^l & V_{um}^l \\ \Pi_{mu}^l & \Pi_{mm}^l \end{pmatrix} \begin{pmatrix} \frac{\partial u}{\partial \alpha} \\ \frac{\partial m}{\partial \alpha} \end{pmatrix} = \begin{pmatrix} -V_{u\alpha}^l \\ -\Pi_{m\alpha}^l \end{pmatrix}.$$

Evaluating the derivatives at $\alpha = 1$, then this system can be rewritten as

$$\begin{pmatrix} V_{uu}^n & V_{um}^n \\ \Pi_{mu}^n & \Pi_{mm}^n \end{pmatrix} \begin{pmatrix} \left.\frac{\partial u}{\partial \alpha}\right|_{\alpha=1} \\ \left.\frac{\partial m}{\partial \alpha}\right|_{\alpha=1} \end{pmatrix} = \begin{pmatrix} -\left.V_{u\alpha}^l\right|_{\alpha=1} \\ -\left.\Pi_{m\alpha}^l\right|_{\alpha=1} \end{pmatrix},$$

where

$$\begin{aligned} V_{uu}^n &= \left.V_{uu}^l\right|_{\alpha=1} = v_{1uu} + \frac{\widehat{\varepsilon}}{\overline{\varepsilon}}(v_{2uu} - q_{2uu}) + \frac{\widehat{\varepsilon}_u}{\overline{\varepsilon}}(v_{2u} - q_{2u}) - g_{uu}, \\ V_{um}^n &= \left.V_{um}^l\right|_{\alpha=1} = \frac{\widehat{\varepsilon}}{\overline{\varepsilon}}(v_{2um} - q_{2um}) + \frac{\widehat{\varepsilon}_m}{\overline{\varepsilon}}(v_{2m} - q_{2m}), \\ \Pi_{mm}^n &= \left.\Pi_{mm}^l\right|_{\alpha=1} = q_{2mm} - c_{mm} < 0, \\ \Pi_{mu}^n &= \left.\Pi_{mu}^l\right|_{\alpha=1} = q_{2um}, \\ -\left.V_{u\alpha}^l\right|_{\alpha=1} &= -\frac{1}{\overline{\varepsilon}}(v_2 v_{2u} - q_2 q_{2u}) < 0, \\ -\left.\Pi_{m\alpha}^l\right|_{\alpha=1} &= \frac{\widehat{\varepsilon}}{\overline{\varepsilon}} q_{2m} > 0. \end{aligned}$$

From the assumption $V_{uu}^n < 0$ and $V_{um}^n = 0$. Furthermore, $\Pi_{mu}^n = q_{2um} < 0$ in Case S, but $\Pi_{mu}^n = q_{2um} > 0$ in Case C.

Applying Cramer's rule yields the following:

$$\begin{aligned} \left.\frac{\partial u}{\partial \alpha}\right|_{\alpha=1} &= \frac{\begin{vmatrix} -\left.V_{u\alpha}^l\right|_{\alpha=1} & V_{um}^n \\ -\left.\Pi_{m\alpha}^l\right|_{\alpha=1} & \Pi_{mm}^n \end{vmatrix}}{D^n} > 0, \\ \left.\frac{\partial m}{\partial \alpha}\right|_{\alpha=1} &= \frac{\begin{vmatrix} V_{uu}^n & -\left.V_{u\alpha}^l\right|_{\alpha=1} \\ \Pi_{mu}^n & -\left.\Pi_{m\alpha}^l\right|_{\alpha=1} \end{vmatrix}}{D^n} \begin{cases} < 0 & \text{if } q_{2um} < 0 \\ \gtreqless 0 & \text{if } q_{2um} > 0 \end{cases}, \end{aligned}$$

where

$$D^n = \begin{vmatrix} V_{uu}^n & V_{um}^n \\ \Pi_{mu}^n & \Pi_{mm}^n \end{vmatrix} > 0.$$

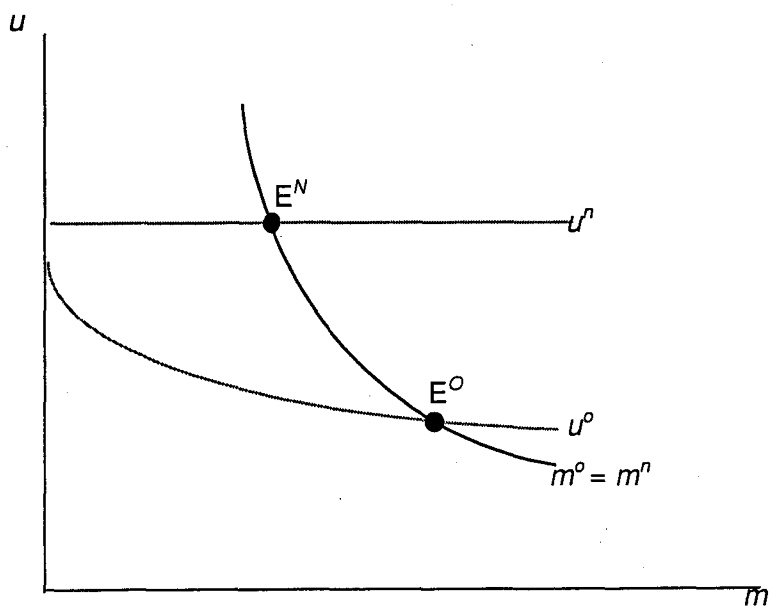

Figure 3.1.

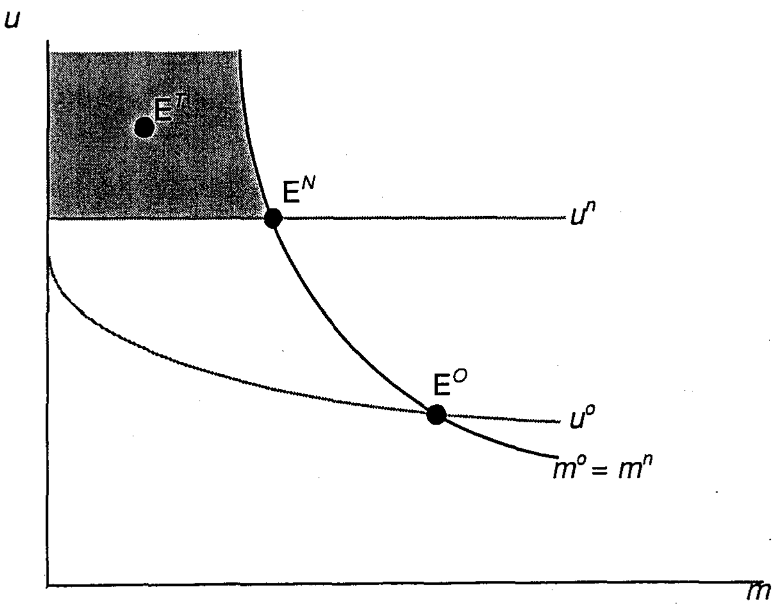

Figure 3.2.

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