Agrarian land tenancy in prewar Japan:

Contract choice and implications on productivity*

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Abstract

We study the contract choice and its productivity implication in the prewar Japanese agriculture, where a unique contractual form, a rent reduction contract, predominated. Theoretically, this contract is more efficient than a share tenancy or a fixed-rent contract in terms of incentives and risk-sharing. The prevalence of this contract raises the question of why such efficient contract was uncommon outside Japan. Based on historical documents and previous studies, we argue that transaction costs on the execution of rent reduction were the key elements in the adoption of this contract. However, in case of Japan, local communities played some role in governing the process of rent reduction and mitigated such costs. Thus the study proposes transaction costs and institutions as another determinant of tenancy contract choice. We also find that an increase in the prevalence of tenancy was associated with lower average rice yield at the prefectural level and such correlation was stronger in prefectures with a greater proportion of share tenancy.

Keywords: tenancy contract; rent reduction; risk-sharing; moral hazard; transaction costs; Japan.
JEL Classification: D23; D82; O12; Q15

1. Introduction

The choice of contract form in agrarian landlord-tenancy relationships has attracted many economists and economic historians, mainly due to its implication on productivity. They have asked why a seemingly inefficient share tenancy prevailed in some regions in some time periods, which seems to suffer from Marshallian inefficiency, an incentive problem in which a tenant under-provides efforts compared to a fixed-rent contract (for a historical study, see for example Hoffman (1982, 1984); Ackerberg and Botticini (2000, 2002)). The standard argument resolves the puzzle by noting the benefit of risk-sharing held by a share tenancy (e.g., Stiglitz (1974) and Holmstrom (1987). For a survey of the literature, see Singh (1989), Otsuka et al (1992), Huffman and Just (2004), and Otsuka (2007)).

The experience of the land tenancy relationships in prewar Japan is unique in two aspects. First, growth in agricultural production and productivity since the late nineteenth century was accompanied by the development of extensive land tenancy relations. This is notable because depending upon the contractual form adopted, tenancy can potentially undermine productivity, i.e., if a share tenancy is predominant and the Marshallian inefficiency is present. Second, a distinguishing feature of the Japanese tenancy is the prevalence of a unique contractual form, rent reduction contract, which is a fixed-rent contract with state-contingent rent reduction when crop failure occurs. A rent reduction contract is potentially more efficient than a share tenancy or a pure fixed-rent contract when risk is low, because it provides decent incentives (because it is a fixed-rent contract for “good yield” states) while it reduces the risk borne by the tenant (because it reduces rent in bad years) at the same time (Arimoto 2005). Therefore, the prevalence of this contractual form could have mitigated the problem of incentives and sustained productivity growth even under extensive tenancy relations.

The prevalence of rent reduction contracts in Japan raises the question of contract choice. Instead of asking why a seemingly inefficient share tenancy arrangement prevailed as in the previous studies, we reverse the question: Why is a seemingly efficient rent reduction contract uncommon in many countries and why did it prevail in prewar Japan? What are the implications of the prevalence of rent reduction contracts on productivity and agricultural development in Japan?

While the first question is too broad and the international comparison on the determinants of contract choice is beyond the scope of our paper, we suggest transaction costs as the key element to

answer the question. Based on various historical documents and previous historical studies, we show that a rent reduction contract incurred transaction costs for inspecting yield and negotiating on whether rent should be reduced and, if so, at what rate. These costs could discourage the adoption of a rent reduction contract despite its potential efficiency in terms of incentives and risk-sharing. However, in prewar Japan, local communities played a role in reducing such costs by governing and institutionalizing the process of rent reduction. This suggests that transaction costs and the role of the community in reducing such costs were critical in the adoption of rent reduction contracts. Using village-level data in Iwate prefecture in Japan, we investigate the correlation between the potential determinants of contract choice and the adoption of share tenancy. We found preliminary correlations that share tenancy was adopted in riskier villages and suggestive evidences that transaction costs and community played a role in the adoption of rent reduction contracts.

In order to answer the second question concerning productivity, we conducted fixed-effect estimations using prefecture-level panel data to investigate whether changes in the prevalence of tenancy had any effect on productivity within in each prefecture. We found that an increase in the percentage of paddies cultivated under tenancy was associated with lower average rice yield and such correlation was stronger in prefectures with a greater proportion of share tenancy. By combining these two results we can infer that the prevalence of rent reduction contracts was sustained by the informal community institutions and that this helped prevent a serious decline in agricultural productivity.

This paper contributes to the literature on tenancy contract choice in two ways, that is, by expanding the choice set of contracts and by indicating transaction costs as an additional determinant of contract choice. While the previous studies have only considered linear contracts (i.e., fixed-rent contract, share tenancy, and fixed-wage contract), we allow non-linear contracts and take a rent reduction contract into account as another alternative. As the determinants of contract choice, the previous literatures have focused on the provision of incentives (Marshallian inefficiency), risk-sharing, and transaction costs in monitoring and supervising the tenant’s behavior. We extend the arguments by stressing the importance of transaction costs in the implementation of complex contracts with rent reduction and the role of the community. The question of why a rent reduction contract is uncommon outside Japan was first raised by Ohno (1989). He suggested the importance of transaction costs in answering this question but remained open the question of why it was possible

to adopt it in Japan despite such costs. We complement his argument by noting the role of community in lowering the costs.

The rest of the paper is organized as follows. Section 2 presents a brief overview of the agricultural sector and tenancy relationships in prewar Japan. Section 3 summarizes the discussions on tenancy contract choice and presents the results of preliminary quantitative investigation of contract choice using village-level data from Iwate prefecture. In Section 4, we provide the results of prefecture-level fixed-effect estimation on the correlation between contract choice and productivity. Section 5 concludes the paper.

2. Agriculture and land tenancy in prewar Japan[1]

2.1. Agricultural production and land tenancy

In the late nineteenth and early twentieth centuries, agricultural production grew fairly rapidly in Japan. The annual growth rates of agricultural output were 1.6% and 2.0% in 1880-1900 and 1900-1920, respectively (Hayami, 1973, pp.32-41)[2]. According to the decomposition of the growth of agricultural output into those of inputs and productivity by Hayami (1973), the production growth is mostly accounted for by the growth of labor productivity. Meanwhile, the labor productivity growth is mainly accounted for by the growth of TFP. The basic cause for the especially high TFP growth before World War I was the creation and dissemination of a newly coordinated agricultural technology, which is called the "Meiji Agricultural Method", which had been developed since the late Tokugawa Era (Yagi 1990).

The agricultural growth was accompanied by the expansion of land tenancy relationships. There were more than five million farm households and this number remained essentially unchanged throughout the prewar period. They were mainly small farms; the average arable land size per farm household was close to 1 ha. At the same time, a large proportion of those farms were tenanted land (**Table 1**). Nearly 70% of the farm households cultivated some plots under tenancy, either as owner-cum tenants or pure tenants. In terms of area of arable land, the proportion of tenanted land was around 45% from the early twentieth century to 1940. It is notable that the landlords were

[1] For background of Japanese agricultural history written in English, see Dore (1959), Hayami and Yamada (1991), Francks (2006), Kawagoe (1999), and Waswo (1977, 1988).

[2] These growth rates are based on the long-term estimation of the agricultural output by Yujiro Hayami and Saburo Yamada (Appendix of Hayami 1973). There is a long controversy on the agricultural output level in the late nineteenth century and the later growth rate. Concerning the controversy, see Nakamura (1966), Hayami (1973) chap.3 and Waswo (1988).

usually small and not so different from the tenants. In 1928, 49.6% of the farm households owned less than 0.5 ha and only 3.18% owned large holdings of more than 5 ha[3].

[**Table 1:** Extent of tenancy relations]

2.2. Tenancy contracts

Tenancy agreements were verbal and contracts were rarely written down. According to the *Taisho 10 Survey of Tenancy Customs* (MAC, 1926), the most comprehensive survey of farm tenancy customs in prewar Japan conducted in 1921, more than 70% of the farm tenancy was arranged verbally. Similarly, only 80 out of 439 landlords (18%) studied in *The Survey on the Custom of Tenancy Rent Reduction and Exemption* (Teikoku Nokai, 1927), who were sampled from each county across Japan, had written down the contract. Even a written contract seemed to lack legal formality and binding force; the Survey reports that "The contents of these contracts are incomplete from the viewpoint of the concept of a lease contract (p. 34, our translation)."

Most tenancy arrangements had no explicit contract duration. An arrangement was expected to last until either the landlord or the tenant asked for cancellation. For those that had a specific contract term, the duration was usually 3 to 5 years or longer for paddies and farms, and 5 to 10 years for fruit orchards, mulberry farms, and tea fields (MAF 1926, p.221)[4]. The Japanese landlord-tenant relationships were usually stable and the contract durations were relatively long, which were supported by regional mutual trust among villagers (Sakane, 1999).

Input-sharing, often observed in South and Southeast Asia, was uncommon. Landlords rarely provided inputs or services other than the land and land tax, both under a share tenancy or a rent reduction contract (MAF, 1934, p. 350).

Unlike in most Asian countries where the average proportion of share tenancies in tenanted land exceeded 50% in 1990 (Otsuka 2007), the predominant form of paddy tenancy in prewar Japan was a fixed-rent tenancy-in-kind paid after the harvest. Share tenancy was only observed in shadowy fields in the mountainous areas, paddy fields with cold water, mountainous farms, newly cultivated

[3] Toyo Keizai Shinposha (1991), p.167, p.173.

[4] Bandiera (2007) studies tenancy contract duration in Italy, 1870-1880, and finds that the choice of contract length was driven by the need to provide incentives for non-observable investment, taking into account transaction costs and imperfections in the credit markets that made incentive provision costly. The fact that the contract durations were longer for fruits and mulberries relative to annual crops in prewar Japan seems to be consistent with this argument.

areas or poor fields where the yield is unstable due to flood or drought (MAF, 1934, p. 341), covering only 1.6% and 2.1% of the area of paddy and field under tenancy in 1941[5]. At the prefectural level, Aomori, Iwate, Akita, Nagano, Gifu, and Okinawa prefecture had more than 5% of their tenanted paddy under share tenancy, where the agricultural production were relative unstable due to uneasy weather conditions.

The unique characteristic of the Japanese fixed-rent contract is that landlords were expected to reduce the rent temporarily in years of crop failure[6]. Within the 449 landlords studied in the above mentioned *Survey*, 445 reduced the rent in case of inevitable crop failure, and two out of the remaining four had adopted a share tenancy. The majority of landlords (279 out of 439, or 64%) had explicit reduction schedules. The actual rent, r, to be paid under a fixed-rent contract with rent reduction can be written as:

$$r(y) = \begin{cases} R & if \quad y \geq \hat{y} \\ R - \phi(y) & if \quad y < \hat{y} \end{cases}$$

where R is the predetermined fixed base rent, y is the realized output and $\hat{y}$ is the cut-off value of output---usually 70%--80% of average output over recent years---used as the criteria for "crop failure". The function $\phi(\cdot)$ specifies the amount of the reduction. For example, $\phi(y) = \hat{y} - y$ implies that the rent reduction is proportional to the decline of output. We shall henceforth refer to this contract as a rent reduction contract. The ex post adjustment of rents only took place in bad years, and there were generally no increase of rent in good years. Thus, ex-post state-contingent rent adjustment was upwardly rigid. Moreover, since it was uncommon to raise the fixed-rent except after the landlord invested in land improvement or irrigation, the tenant came to have more crops to their hand as land productivity rose, leading into changing output distribution between a landlord and a tenant (**Figure 1**).

[**Figure 1:** Distribution of output in tenancy relations]

Since formal tenancy contracts were rarely written down, reduction of rent was determined by negotiations between landlords and tenants. Typically, rent reduction was initiated by a request from the tenant. The landlord and the tenants then conducted a yield sampling, known as *kemi* or

[5] See Sakane (2005), Table 1-1, 1-2, 1-6, for area under share tenancy by prefectures in 1941.

[6] See Waswo (1977), ch. 2 for description (written in English) of rent reduction and landlord-tenancy relations in prewar Japan.

tsubogari (literally meaning to harvest a plot of one *tsubo*, approximately 3.3 m^2) by harvesting the output on a unit sample plot within a paddy. They then used the result of sampling to estimate the total output. In many cases, rent reduction was granted only when there was at least a certain amount (20%-30%) of damage to the crops.

There are at least three rationales behind rent reduction: limited liability, *de facto* fixed-wage contracts, and risk-sharing. Because most rents in prewar Japan had to be paid in kind, the upper bound of rent cannot exceed the output. Rent reduction can be interpreted as a custom of meeting this ex post restriction of limited liability (see Shetty (1988), Basu (1992), and Ray and Singh (2001) for a discussion of the relationship between rent reduction, share tenancy, and limited liability). On the other hand, Japanese historians conventionally interpret rent reduction as a device for exploiting the surplus from tenants[7]. In some cases, the fixed base rent was set at such a high level that it was almost impossible for tenants to pay. Under these circumstances, the landlord grants a rent reduction to secure the tenant's fixed subsistence output and extracts the remainder. Thus in this case, it is essentially a fixed-wage contract. Finally, rent reduction can be considered as a device to reduce the tenant's burden of risk, which we will discuss in detail below.

3. Choice and distribution of tenancy contracts

3.1. Incentives and risk-sharing

As the standard argument on tenancy contracts addresses, landlords who adopted a share tenancy in prewar Japan did seem to suffer from the tenant's moral hazard. A report commissioned by the *Teikoku Nokai* (Imperial Agricultural Association) found that share tenancy reduced the tenant's incentives and lowered his effort. The following statement conveys Marshallian inefficiency:

> "Under a share tenancy, output is allocated by fixed rate regardless of the yield. So even if the tenant makes more effort and as a result increases the output, half of the increment will be taken by the landlord. Therefore, it reduces the tenant's effort to improve his output, resulting in dominance of low productivity and low rent revenue caused by primitive and extensive farming. (Teikoku Nokai, 1942. p. 49, our translation)"

[7] See for example Teruoka (1970, p.58) and Nakamura (1979, p.147).

The previous studies on tenancy contract choice indicate the benefit of risk-sharing in justifying the adoption of share tenancy[8]. Thus, it is predicted that the share tenancy should prevail in villages with high risks and adopted by tenants who are more risk averse[9].

A rent reduction contract can be considered as an alternative and possibly superior means of balancing risk-sharing and provision of incentives. Arimoto (2005) extends the standard principal-agent model and shows that a landlord can benefit from incorporating a rent reduction into a pure fixed-rent contract if the tenant is risk-averse, because it reduces the tenant's risk. Moreover, because it is basically a fixed-rent contract for a "good yield" state, a rent reduction contract provides more incentives to a tenant. Therefore it is more efficient when risk is not of great concern (i.e., when production risk is not too severe and/or when a tenant is not too risk-averse). Given that landlords insure against risk in bad years by reducing rents, risk-sharing becomes less important when choosing between contracts.

3.2. Transaction costs

Despite its superiority in terms of incentives and risk-sharing, a rent reduction contract is not necessarily better than a share tenancy because of the associated transaction costs. According to the report *Special Tenancy Customs* (Iwate Prefecture, 1932), the main reason for the adoption of a share tenancy was instability in crop output, which made impossible for a tenant to pay the fixed-rent almost every year, and hence the landlord and the tenant were obliged to negotiate rent reductions frequently. The *Taisho 10 Survey of Tenancy Custom* (MAC 1926) reports that share tenancy was observed in those areas where disasters were frequent and therefore negotiations for rent reduction were troublesome. Rents under rent reduction contract were reported to be lower than those of the pure fixed-rent contract without rent reduction[10] by 10%-20% (MAC 1926, p.209). The difference in the rent can be interpreted to reflect transaction costs.

In the context of prewar Japan, two transaction costs associated with the implementation of rent reduction were observed: costs of verifying crop yields (verification costs) and costs of negotiating

[8] However, the inefficiency in terms of incentives associated with share tenancy is not straightforward because the landlord might be able to monitor and enforce the tenant's effort (Cheung 1969) or can mitigate the moral hazard by providing dynamic incentives of refusing contract renewal of unsatisfactory tenant (Otsuka 2007; Sadoulet et al 1994). Kinship can also mitigate moral hazard under share tenancy (Sadoulet et al 1997).

[9] For recent studies, see Ackerberg and Botticini (2002) and Chiappori and Salanie (2003). However, Allen and Lueck (1999) rejects risk-sharing hypothesis.

[10] Pure fixed-rent contracts without rent reduction (*jomen*) did exist but were rare.

rent reductions (negotiation costs). Note that these transaction costs are of implementation process of rent reduction and are different from those of previous studies that focused on the costs of enforcement, supervision, monitoring, and management of inputs and outputs (see, for example, Cheung (1969), Alston et al (1984), Eswaran and Kotwal (1985), Shaban (1987), Allen and Lueck (1995), and Chew (1998)).

Verification costs were necessary because rent reduction is granted only when the output y was below the threshold, $\hat{y}$, and the landlord and the tenant had to inspect the output to confirm that this condition holds. This required substantial effort and time in sampling the crop and achieving an agreement of the verification since a landlord has no incentive to reduce the rent ex post and tends to overestimate the actual output, whereas a tenant is motivated to understate the output to get a greater rent reduction. In practice, determining the "standard" output $\bar{y}$ ---average output over recent years---was essential for implementing rent reduction because the threshold level of output $\hat{y}$ to start granting the rent reduction was based on it. However, reaching agreement on $\bar{y}$ was not easy because output tended to vary with the fertility of the plots and the technology used (Teikoku Nokai, 1927, p. 22).

The literature of loan contracts with costly state verification (CSV) provides theoretical foundation of the optimal contract under costly verification of state (Townsend 1979, Gale and Hellwig 1985, Gariano and Simmons 2006). The essence of the CSV models is that optimal loan contracts have the properties of fixed repayment (rent) for all "good" states above certain cutoff state, while in the "bad" states verification takes place and repayment is reduces according to the sate (rent reduction). This is consistent with the costly verification of yield and resulting rent schedule of fixed rent with rent reduction in our context.

Note that share tenancy does not require precise measure of output and verification cost was unnecessary, since the essence of share tenancy is to *share* the output; the absolute amount of output did not matter as long as the parties can split the output with the agreed ration. In practice, the parties to a share contract divided output on the basis of *taba-wake*---"sharing sheaves"---, which involved setting out the harvested sheaves in the paddy, after which each party took its turn in taking every other sheaf. By letting a tenant stack up the sheaves in a way what he believes is equal and allowing a landlord to choose the sheaves he takes satisfies both parties and leaves no room for conflict. Thus, share tenancy does not require state verification and should be categorized in a different class of contracts than those with CSV.

Negotiation costs under a rent reduction contract were relevant because, in many cases, tenancy contracts were verbal arrangements lacking legal formality. The process of rent reduction was dominated by moral codes, social norms and customs. There were no explicit agreements between landlords and tenants on definitions of production shock or how to measure it. Rent reduction rates were also indeterminate.

We note that, just like a rent reduction contract, share tenancy was not free of transaction costs. The cost of attending and monitoring the harvesting, which was necessary every year, was perceived to be one of the costs of share tenancy along with tenant's shirking. Rents for paddies under a share tenancy were shared either in standing crops before harvesting (so the landlord had to harvest by herself), in sheaves immediately after harvesting, or in grain after threshing and drying; the latter was customary. In any case, it was common for the landlord under share tenancy to attend the harvesting after agreeing with the tenant on which day to harvest, in order to avoid underreporting of output and to make certain of collecting the rent[11]. To reduce this cost, absentee landlords and large landlords were more likely to adopt rent reduction contracts than resident landlords (MAF, 1934, p. 402).

In summary, while rent reduction contracts can save the attendance cost that is necessary under share tenancy every year, it incurred investigation and negotiation costs in bad years that might have outweighed such benefit. Therefore, a rent reduction contract mitigates the trade-off between incentives and risk-sharing but generate a new trade-off between incentives and transaction costs.

These transaction costs were in fact relevant and large. Indeed, some landlords switched back to share tenancies to avoid frequent late payment and rent reduction. Requests for rent reductions and determination of the rate of reduction were two of the main causes of the tenancy disputes that arose in the 1920s and 1930s. Disputes arose over where and how to sample the harvest. For example, in Gunma prefecture, in 1927, a dispute arose when tenants requested a rent reduction by claiming a 15% decrease in the yield, while the landlords asserted that the yield was above average (Sato, 1987, p. 54). In Yamanashi prefecture, the landlords and the ward mayor, a witness to the sampling, accepted a request to resample made by the tenants, who claimed that a primary sampling paddy did not fairly evaluate the crop of that year (Sato, 1987, p. 210). After agreeing on the estimation of output, the parties then had to negotiate the rent reduction, which was another source of dispute.

[11] Otsuka (2007) also notes the same point.

3.3. The role of community

After the rise of the disputes, the communities gradually started to form the informal institutions to govern the individual tenancy arrangements in the village. The quasi-legal–based tenancy relationships referred to as the "collective landlord-tenant relationships"' were based on either a "cooperative association"' or a "collective tenancy contract" (Sakane, 1990). A cooperative association was a village organization with a committee to coordinate tenancy relationships. It maintained collective relationships between the landlords and the tenants in the village under the yield verification (*kemi*) committee and collectively determined the criteria for rent reductions (Shoji, 1991)[12]. A collective tenancy contract is a formal contract written after the tenancy conciliation based on the Tenancy Conciliation Law of 1924. In case of the collective tenancy contract of 1931 in Kawarajiri village in Kyoto, the contract prescribed the procedure for yield sampling when crops were bad: a request for yield sampling had to be made at least ten days before the harvest; the first yield sampling had to be performed by representatives of the landlords and tenants with agricultural committee staff in attendance; and if agreement could not be reached after the first sampling, the parties had to delegate the sampling to the agricultural committee staff, whose decision the parties had to accept (Sakane, 1990).

These cases suggest that the transaction costs associated with rent reductions were reduced by the communal governance of tenancy relationships. The process of rent reduction became collective and objective, which reduced arbitrariness and uncertainty. The main characteristic of prewar Japanese tenancy relationships, relative to those of other Asian countries, was that they were embedded in the communal society. It was common for communities to intervene in private tenancy relationships relating to yield sampling, collection of rents, rice quality inspections, and rent reductions. These communal interventions possibly originated from the *Murauke* system in the Tokugawa period, the village taxation system under which village member households were jointly responsible for paying the land tax imposed to a village. Under this joint liability, a village held various social activities including the management of irrigation systems and community forests, politics, and ceremonial functions, which likely enhanced social capital.

[12] An example is the *Showa-kai* formed in 1927 in Umaji village of Kyoto Prefecture after the tenancy dispute over bad crops in 1926 (Sakane, 1990). The dispute was settled by a rent reduction of 23% and an understanding that all future issues between landlords and tenants should be dealt with the cooperative association---the *Showa-kai*. The *Showa-kai* comprised ten board members: five each representing the tenants and the landlords. It was given an exclusive authority to sample and inspect output in bad years and to decide the rates of rent reduction. The rent-reduction system institutionalized by the *Showa-kai* was successful in preventing tenancy disputes after that.

3.4. Determinants of tenancy contract choice: The case of Iwate prefecture

Iwate prefecture, located in northeastern Japan, was one of the few prefectures that had a high prevalence of share tenancy. We use village-level tenancy contract data in Iwate prefecture to examine the correlation between the contract choice and its potential determinants. Due to limitation of the data, our intention here is not to provide a rigorous test on the hypotheses of contract choice on risk-sharing and transaction costs, but to observe simple correlations of which we do not assert causality.

The dependent variable is the proportion of the area cultivated under share tenancy as a percentage of the total tenanted area (hereafter, the percentage of share tenancy) in February 1930 for 100 of the 236 villages in Iwate prefecture (reported in Iwate Prefecture 1932). We complemented the missing observations with the percentage of share tenancy at the county level in 1935 reported in Iwate Prefecture (1954). Because the contract data reflects the contractual status after the 1929 crop season, we match them with other village-level data that represents potential determinants of contract choice, mainly constructed from the *Annual Statistics of Iwate Prefecture* (*Iwate Ken Tokei Sho*) for 1929.

Our empirical specification is the following:

$$\%Share_i = \beta_0 + \beta_1 Risk_i + \beta_2 Wealth_i + \beta_3 Community_i * Risk_i + \varepsilon_i .$$

The dependent variable *%Share* is the percentage of share tenancy in tenanted paddies in village *i* in 1929. $Risk_i$ is the measure of risk of rice production, $Wealth_i$ is the vector of variables that capture the average wealth level of tenant farmers that would affect their attitude and tolerance toward risk, $Community_i$ represents communal ties in village *i*, and ε_i is the error term.

The indicator of risk of rice production is the village-level coefficient of variation of the rice yield over 15 years from 1920 to 1934[13]. The period 1920-1934 covers 10 years (1920-1929) before

[13] Rice yield could be endogenous to contract choice. We construct our risk variables based on rice yield because, to our knowledge, there is no theoretical reasoning to believe that the choice of contract affects yield *variability* but *mean*. However, it might be reasonable to imagine that tenants cultivating under rent reduction contracts may try to reduce yield variability compared to those cultivating under share tenancy, because the former burden involves more risk. In this case, risk measured by rice yield under rent reduction contract would be smaller and therefore the coefficient will be overestimated. Nonetheless, it is unlikely that the farmers were able to control risk given the technology of the period of our study.

the year under consideration 1929, and 5 years after (1930-1934). The latter 5 years is included to capture the disastrous crop failure in 1934. This is to take into account that Iwate is periodically attacked by severe crop failures that halve the output approximately every 10 years, but the 1920s was exceptionally stable (**Figure 2**). We wish to include at least one severe crop failure and 1934 is the nearest from 1929[14].

[**Figure 2:** Rice yield in Iwate prefecture, 1900-50.]

Figure 3 shows a map the geographic distribution of share tenancy, measures of risk, and the terrain of Iwate prefecture. One can observe that share tenancy was concentrated in the coastal areas on the Pacific Ocean, where the rice production was relatively risky compared to inland. One cause of frequent and severe crop failures in the coastal areas was the seasonal wind known as *Yamase*, a cool moist air current originating in the Okhotsk Sea that blasts from the Pacific Ocean side of the Northeast region in early summer (Bokura, 1998). A remarkable feature of cool summers in the Northwest region is that there is a stark difference between the damage caused to the Pacific side of the region and that caused to the Sea of Japan side. This is because the *Yamase* is only 1,000 to 1,500 meters above the ocean and the wind from the Pacific side is blocked and weakened by the mountains and highlands before reaching the Sea of Japan side. In the Iwate prefecture, the wind is blocked by the Kitakami Highlands. This topographical condition leads to substantial rice yield variability in the areas along the Pacific Ocean.

[**Figure 3:** Distribution of tenancy contracts, terrain, and risk in Iwate]

Table 2 reports the village-level cross-section two-limit Tobit estimates of the determinants of tenancy contract choice. A positive coefficient indicates that an increase in the independent variable is positively correlated with the percentage of share tenancy in tenanted paddies. In any specification, the risk variable has positive and statistically significant coefficients, implying that share tenancy was likely to be adopted in the villages with greater risk. Paddy-to-field ratio is included to capture both the relative importance of paddy production in agriculture and also to control for terrain (i.e., paddy-field ration is lower where the terrain is steeper).

[14] When we only use the coefficient of variation of rice yield for 1920-29, the estimated coefficient is positive but statistically insignificant.

[**Table 2:** Tobit estimates of tenancy contract choice in Iwate prefecture, 1929]

In column (2), we add variables that proxy the tenant's wealth and income. The variables used are the average landholdings (paddies and fields) per farm household and gross average total output per household (including non-farm households)[15]. The proportion of tenant farmers is included to control for the fact that tenant's landholdings are typically smaller than that of the owner-cultivators. The coefficients are in expected sign but not statistically significant.

Investigation on the correlation between the role of community and the choice of contract is not easy since it is very hard to find a satisfactory variable that represents the strength of communal ties. Direct data on the distribution of cooperative associations or collective tenancy contracts are not available. We thus attempt to examine the correlation by using several indirect proxies that would arguably represent communal ties. The community variables are interacted with the risk variable since transaction costs and the role of the community on rent reduction matters in villages with more chance of having a rent reduction.

Paddy-to-field ratio is considered to capture communal ties since paddies require collective action to operate and manage irrigation and commons (Tamaki, 1983, pp.19-20). Two variables of village-wide risk-coping institutions---dummy variables indicating the existence of at least one credit cooperative and a rice bank in each village in 1929[16] are included. Since the formation of these institutions is voluntary, it is likely that villages with these institutions have stronger social ties. Moreover, these would enable the tenants to adopt riskier contracts. The proportion of male residents who was born in the residing village is meant to capture the homogeneity of the population[17].

[15] These variables were computed by dividing the total landholdings, or gross total output, aggregated at the village-level by the number of resident households in the village.

[16] The credit cooperative variable is based on the complete list of industrial cooperatives in Japan in 1924 (Sangyo kumiai chuo kai, 1925). The rice bank variable comes from the individual rice bank (*goso*) data collected around 1936 by the *Sekisetsu chiho noson keizai chosa sho* (Research Institute of Rural Economy in Snowy Region) of the Ministry of Agriculture and Forestry. The results of this survey are summarized in the report *Tohoku chiho ni okeru biko goso ni kansuru chosa* (Survey of the precautionary rice banks in Tohoku region) in 1936. Rice banks established after 1929 are excluded, most of which were established following the famine in 1934 by the relief fund provided by the Emperor and the government.

[17] It was unlikely that the migrants worked as a farmer and therefore, the relevance of this variable to capture social ties among the landlords and tenants is not strong. The motivation of using this variable is to capture the homogeneity of the population.

We also construct a set of variables that represent collective action in the village in 1960. These variables indicate the ratio of relevant agricultural hamlets to total agricultural hamlets within the village that conducted voluntary collective activities on pest control, shipping of agricultural produce, and communal ownership of agricultural machines[18]. Unfortunately, these data are not collected until 1960. Although the variables represent the status of collective action in 1960, it would be a reasonable proxy of communal ties in 1930 since it is unlikely that solidarity was strengthened during the 30 years. During the two periods, the villages experienced several major socio-economic events such as the World War II and the postwar land reform, but most of the events seem to have eroded the social ties within the community. Thus, we may interpret that the social ties these variables capture are the "remains" of those in 1930.

Column (3) presents results including community variables. The interaction terms of paddy-to-field ratio*c.v. of rice yield and collective pest control in 1960*c.v. of rice yield are negative and statistically significant. For other community variables, the sign of the coefficients are mostly in expected sign but statistically insignificant.

Overall, we observe a robust positive correlation between c.v. of rice yield and the prevalence of share tenancy. This is in support for both risk-sharing hypothesis and transaction cost story because share tenancy was favored in risky areas to share risk, and rent reduction contract was disliked in places where frequent rent reduction was expected. However, statistically insignificant correlation between the wealth variables and contract choice casts some doubt on the risk-sharing hypothesis. Since our wealth variables are proxy of risk attitudes of tenants, the insignificance of these variables may be due to measurement error. Unfortunately, limitation of data prohibits us from using instrument variables to cope with this problem. Some of our community variables have expected and statistically significant correlations with the adoption of rent reduction contracts, which is in support for transaction cost hypothesis. However, while our preferred interpretation of paddy-to-field ratio is the strength of communal ties, it can also be interpreted as terrain, wealth, or stability of income (because paddy production is more stable than field production). Also, note that several interpretations are possible for collective action variables as well. Primarily, if the intensity of voluntary collective action in 1960 reflects strong communal ties in the 1920s, we may interpret that communities were able to lower transaction costs. However, the actual causality may be the reverse; villages might have been able to conduct collective actions in 1960 because they built up

[18] These data are derived from the Agricultural Community Survey conducted as part of Census of Agriculture and Forestry every 10 years.

social capital by governing the process of rent reduction in the prewar period. Another possible interpretation could be that such communities might also have been effective in providing informal mutual insurance.

In sum, the estimation results are partly consistent with both risk-sharing and transaction cost hypotheses. Although we are unlikely to provide clear identification of the hypotheses due to limitation of data, the quantitative evidence is suggestive for the role of transaction cost and community in the adoption of rent reduction contracts.

4. Contract choice and productivity

4.1. Previous results

In studies reported to date, no difference in land productivity between owner-cultivation and tenancy in Japan has been found. By comparing rice yield per unit plot of paddy and rice yield per working hour reported in several agricultural household surveys, Kajii (1986) concludes that paddies under owner-cultivation were more productive than those under tenancy in around 1900 but the difference became less clear thereafter. Owner-cultivation was no more productive than tenancy in the 1930s, once the farming area is controlled for.

Kawagoe (1995) reaches the same conclusion using different household surveys. The differences in productivity seem to come from differences in the cultivation area where farmers with larger farms tended to be more productive. Moreover, Kawagoe confirms no productivity difference at the prefectural level by comparing the growth rate of rice yield before and after the land reform implemented after World War II. The land reform transformed the majority of the tenanted land to owner-cultivation, so prefectures with a high tenancy rate before the reform should have higher productivity growth if there were any productivity difference between owner-cultivation and tenancy. He finds *negative* but statistically insignificant correlation between tenancy rate before the land reform and productivity growth, implying that the reform had no impact on productivity and that productivities were similar regardless of the prevalence of tenancy.

These studies however, do not take into account the choice of contracts. Since the majority of the contracts in prewar Japan were rent reduction contracts and that this contract provides fairly good incentives to the tenant, it may not be so surprising to see no productivity difference between owner-cultivation and tenancy.

On the other hand, the descriptive evidences of low productivity under share tenancy compared to "ordinary" tenancy (i.e., rent reduction contract) are mixed. The report *Share Tenancy in Japan* (MAF, 1934) indicates that, while there were regions where share tenancy was equally productive as that under rent reduction contract, the land productivity under share tenancy was only 2/3 to 1/2 in many cases. However, the causality of inefficiency is not so clear. The report suggests two reasons: the paddies rented out for share tenancy were less fertile to begin with (so the causality is reversed in this case), and the tenants take charge of cultivating their own paddies, applying more fertilizer and frequent weeding than the paddies under share tenancy (MAF, 1934, p. 375).

4.2. Prefecture-level fixed-effect analysis on productivity

To investigate the effect of contract choice on productivity, we conducted prefecture-level fixed-effect estimations, regressing rice yield on percentage of area of tenanted paddies to all paddies and its interaction term with the measures of the extent of share tenancy. If the rice yields in share tenanted paddies were lower than those under rent reduction contracts, then prefectures with a higher proportion of share tenancy within tenanted paddies would see the mean rice yield decline as the percentage of tenanted paddies increased. The dataset is constructed from Kayo (1983) and consists of all 45 prefectures in Japan excluding Hokkaido and Okinawa for 23 years from 1915 to 1937[19] resulting in a total of 1035 observations.

Average rice yield per unit plot of paddy in a prefecture can be written as $y = p^O y^O + p^T y^T$, where p^O, p^T is the percentage of area of paddy under owner-cultivation and tenancy, respectively, and y^O, y^T is the corresponding yield. Since $p^O = 1 - p^T$, we estimate the following:

$$y_{it} = \beta_0 + \beta_1 p_{it}^T + \beta_2 p_{it}^T * share_i + \delta_i + \gamma_t + \varepsilon_{it},$$

where y_{it} represents rice yield in prefecture i in year t and δ_i, γ_t are prefecture and year fixed effects. Given prefecture fixed effects, β_1 measures the effect of a one percentage point increase in the share of area under tenancy on overall rice yield. The term $p_{it}^T * share_i$ represents the interaction of the percentage of tenanted paddies and the prevalence of share tenancy within

[19] We cannot extend our sample period beyond 1937, because the wartime control on the agriculture started in 1938.

tenanted paddies. Since the measure of prevalence of share tenancy is only available for one period in 1941, we are forced to assume that this has not changed throughout the period of consideration until 1941.

Table 3 presents the results of prefectural-level fixed-effect estimation of rice yield per unit plot of paddy. Prefecture fixed-effects and year dummies are included in all specifications. Column (1) shows that an increase in the percentage of paddies cultivated under tenancy is associated with lower average rice yield within each prefecture. Column (2) uses the percentage of tenant farmers (separated into owner-cum-tenant and tenant farmers) to all farmers instead of tenanted paddies. Productivity is lower the more share of tenant farmers. In column (3), we interact the percentage of tenanted paddies with a dummy variable of 'share tenancy prefecture', which equals 1 if a prefecture had more than 5%[20] of paddies cultivated under share tenancy, and 0 otherwise. The magnitude of the coefficient of interaction term is fifteen times larger than the coefficient of percentage of tenanted paddies. This implies that an increase of tenancy had a greater negative impact on rice yield in prefectures with higher prevalence of share tenancy Column (4) presents the result using limited periods by dropping the observations during World War I (1915-18), since the war boosted the food price and stimulated agricultural production.

[**Table 3:** Tenancy and productivity: Prefecture-level fixed-effect estimates, 1915-1934.]

The result in column (1) indicates that a one percentage point increase in the percentage of tenanted paddy decreases the overall rice yield by 0.004 koku/tan. The mean rice yield of 45 prefectures over 1915-37 is 1.972 koku/tan so this implies a 0.20% decline resulting in 1.968 koku/tan. Evaluating at the mean, we obtain the following system of equations:

$$1.972 = 0.517 y^T + 0.483 y^O$$
$$1.968 = 0.527 y^T + 0.473 y^O ,$$

where 0.517 and 0.483 is the mean share of area of tenanted paddies and owner-cultivated paddies respectively. Solving this yields 1.779 koku/tan for tenanted paddies and 2.179 for owner-cultivated paddies, where the ratio of the former to the latter is 0.816, i.e. productivity of the tenanted paddies was 18.4 % lower than owner-cultivated paddies.

[20] Five percent criterion is chosen to include enough prefectures as 'share tenancy prefectures'.

In columns (5) and (6), we drop 19 observations from extremely bad years when the rice yield was less than 70% of the mean intertemporal rice yield of a given prefecture. The coefficient of the percentage of tenanted paddy is now -0.002 in column (5), which is equivalent to a 0.10% decrease, evaluating at the mean. The calculated rice yield for tenanted paddies is 1.8754 koku/tan and 2.0754 koku/tan for owner-cultivated paddies, where the ratio is 0.9036; tenanted paddies are 10% less productive than those under owner cultivation. The coefficient of the interaction of percentage of tenanted paddies and the dummy variable 'share tenancy prefecture' in column (6) is smaller than that of the percentage of tenanted paddies but is statistically insignificant. This is because 9 out of the 19 observations dropped were those of 'share tenancy prefecture'.

These results indicate that the change of cultivators from owners to tenants tend to had negative effect on rice yield in prewar Japan at the prefecture level[21]. Moreover, some evidences suggest that productivity loss due to tenancy was likely to be larger in prefectures with a greater proportion of share tenancy. The latter result suggests that tenants put less effort and inputs under share tenancy. However, it might also be the case that tenants were less productive in their ability or unable to supply fertilizers due to credit constraint than owners.

Why is our result different to the previous studies? Our analysis has two major differences from the prefecture-level investigation by Kawagoe (1995). First, we limited our analysis to the prewar period (1915-1934) while Kawagoe used a longer period from 1923 and 1959 (averaged over 5 years centering on 1923 and 1959). Second, we used annual data, whereas Kawagoe used only two time points. Since we used a shorter interval and looked at the period before World War II, our results are less likely to be biased by omitted variables that affect productivity growth other than the potential inefficiency caused by tenancy. In particular, several policies enacted after World War II seem to have enhanced productivity. The government procurement food price was raised after 1952 to stimulate food production. Public investment in land increased after the establishment of the Land Improvement Act in 1949 also fostered productivity growth.

5. Concluding comments

In this paper, we study the choice of tenancy contracts and its implication on productivity in the case of prewar Japan. Japanese farm tenancy was dominated by a unique rent reduction contract,

[21] We obtained very similar results with average paddy area per household as an explanatory variable to control for the productivity difference between different farm sizes. The results are available on request.

which has the advantage of providing incentives and mitigating risk from the tenant better than other types of contracts. However, historical evidences suggest that rent reduction contracts incurred transaction costs in the implementation of a complex contract, particularly on inspecting the output and negotiating the size of the rent reduction. We discuss that the community provided local informal institutions that governed the implementation of rent reduction, which helped in reducing such costs. This implies that transaction costs and the presence of informal community institutions that mediate and enforce the rent reductions are one of the critical determinants in the adoption of a rent reduction contract and tenancy contract choice. By using village-level data of Iwate prefecture in 1930, we find suggestive evidences that transaction costs and community played a role in the adoption of rent reduction contracts.

In consideration for contract choice and productivity, we find that an increase in the prevalence of tenancy was associated with lower average rice yield at the prefectural level and such correlation was stronger in prefectures with a greater proportion of share tenancy. This implies that change of cultivator from owner to tenant had negative impact on productivity, possibly through disincentive of share tenancy, or by the difference of production ability or financial ability to purchase sufficient inputs among owners and tenants.

In short, the agriculture in prewar Japan may have benefitted from the adoption of rent reduction contracts that prevented the dramatic decline of productivity due to widespread tenancy. Such a unique contract was likely to be sustained by the informal communal institutions that mitigated the transaction costs of rent reduction.

In the quest of understanding why a rent reduction contract is unpopularity outside Japan, this paper suggests transaction costs and role of the community in reducing it as key elements in the adoption of such contract. While we mostly relied on historical anecdotal evidences to make this argument due to limitation of data, further quantitative analysis using data from current developing countries would be interesting. We leave this international comparative study for future research.

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Figures

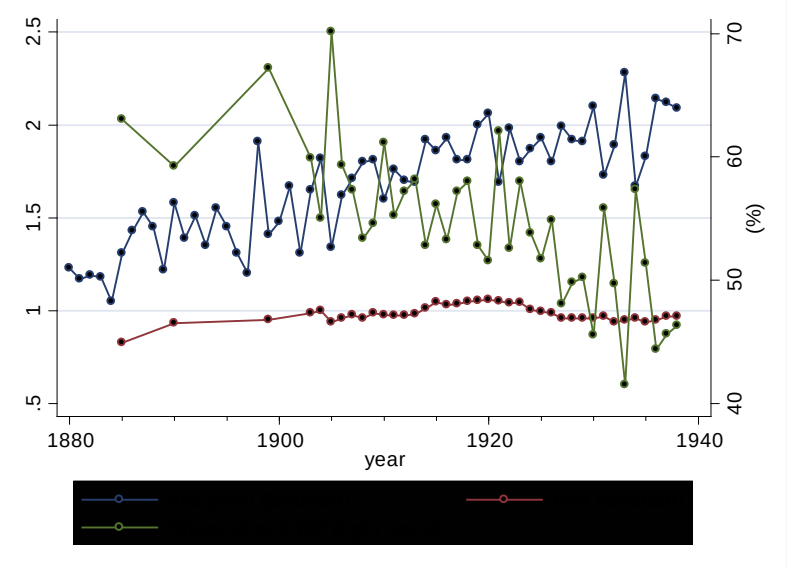

Figure 1: Distribution of output in tenancy relations

Source: Umemura et al (1966); Bureau of Food, Ministry of Agriculture and Commerce of Japan (1922); Bureau of Food Administration of Japan(1948); Bureau of Agriculture, Ministry of Agriculture and Commerce of Japan, *Kokumotsu Yoran* (*Handbook of Grain*), various issues.

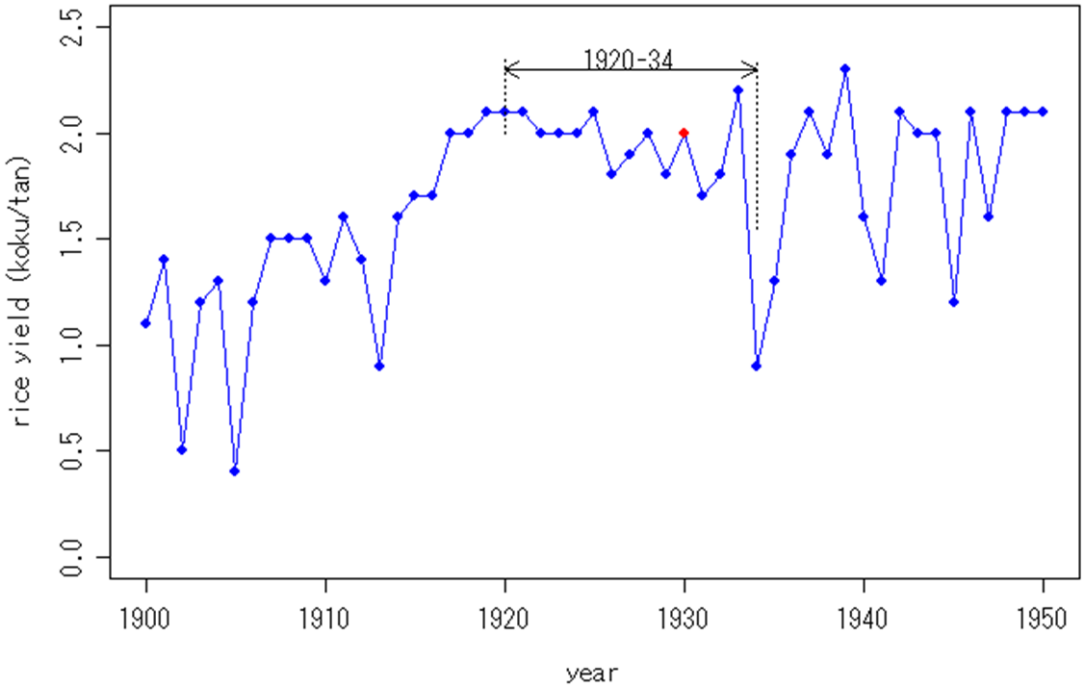

Figure 2: Rice yield in Iwate prefecture, 1900-50.

Source: Kayo (1987).

Figure 3: Distribution of tenancy contracts, terrain, and risk in Iwate

Tables

Table 1: Extent of tenancy relations

	Number of farmers				Area of arable land		
	Total	owner farmers	owner-cum-tenant farmers	tenant farmers	Total	owned	tenanted
	(1,000 households)				(1,000 ha)		
1908	5,408	1,800	2,117	1,492	5,504	3,005	2,499
1913	5,444	1,745	2,178	1,521	5,794	3,159	2,635
1918	5,477	1,697	2,229	1,550	6,027	3,250	2,777
1923	5,440	1,665	2,240	1,536	6,039	3,231	2,808
1928	5,576	1,748	2,345	1,483	6,035	3,270	2,765
1933	5,622	1,746	2,376	1,500	5,979	3,159	2,819
1938	5,520	1,696	2,361	1,462	6,028	3,221	2,806
	(Percentage)						
1908	*100.0*	*33.3*	*39.1*	*27.6*	*100.0*	*54.6*	*45.4*
1913	*100.0*	*31.7*	*40.4*	*27.9*	*100.0*	*54.5*	*45.5*
1918	*100.0*	*31.0*	*40.7*	*28.3*	*100.0*	*53.9*	*46.1*
1923	*100.0*	*30.6*	*41.2*	*28.2*	*100.0*	*53.5*	*46.5*
1928	*100.0*	*31.3*	*42.1*	*26.6*	*100.0*	*54.2*	*45.8*
1933	*100.0*	*31.1*	*42.3*	*26.7*	*100.0*	*52.8*	*47.1*
1938	*100.0*	*30.7*	*42.8*	*26.5*	*100.0*	*53.4*	*46.5*

Source: Toyo Keizai Shinposha (1927), p.507; Toyo Keizai Shinposha (1991), p.167, p.173.

Table 2: Tobit estimates of tenancy contract choice in Iwate prefecture, 1929

	Tobit	Tobit	Tobit
	(1)	(2)	(3)
c.v. of rice yield	3.374	3.291	6.295
	(0.489)***	(0.489)***	(0.779)***
paddy-field ratio	-15.826	-13.779	22.665
	(3.296)***	(3.388)***	(9.567)**
landholdings per household		-10.285	-2.876
		(6.565)	(6.343)
total output per household		-0.004	-0.011
		(0.007)	(0.008)
% tenant farmers		-18.247	-6.874
		(17.481)	(16.830)
paddy-field ratio *			-1.693
c.v. of rice yield			(0.431)***
credit association *			-0.202
c.v. of rice yield			(0.215)
rice bank *			-0.084
c.v. of rice yield			(0.507)
% male born in resident village *			0.000
c.v. of rice yield			(0.000)
pestcontrol (%), 1960 *			-1.681
c.v. of rice yield			(0.433)***
shipping (%), 1960 *			-0.548
c.v. of rice yield			(0.506)
machine (%), 1960 *			-0.110
c.v. of rice yield			(0.384)
Constant	-32.771	-4.697	-45.091
	(14.752)**	(20.405)	(22.789)**
Observations	224	224	209
log likelihood	-883.40	-880.94	-792.73

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Tenancy and productivity: Prefecture-level fixed-effect estimates, 1915-1934.

Dependent variable: rice yield (koku/tan)

Years:	1915-37	1915-37	1915-37	1919-37	1915-37 dropped bad years	1915-37 dropped bad years
	full obs.	full obs.	full obs.	full obs.		
	(1)	(2)	(3)	(4)	(5)	(6)
% paddy tenanted	-0.004		-0.002	-0.001	-0.002	-0.001
	(0.002)*		(0.002)	(0.003)	(0.002)	(0.002)
% paddy tenanted * dummy share			-0.031	-0.038		-0.012
			(0.009)***	(0.010)***		(0.008)
% owner-cum-tenant farmer		-0.006				
		(0.006)				
% tenant farmer		-0.008				
		(0.005)*				
Constant	2.071	2.343	2.135	2.446	1.977	2.003
	(0.126)***	(0.337)***	(0.127)***	(0.143)***	(0.107)***	(0.108)***
Observations	1035	1035	1035	900	1023	1023

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Note: "dummy share" is a dummy variable which takes 1 if a prefecture's percentage of share tenancy in paddy was more than 5% in 1941. Prefectures with dummy share=1 are Aomori, Iwate, Akita, Nagano, and Gifu.