Wages in Kind and Economic Development: Their Impacts on Labor Supply and Food Security of Rural Households in Developing Countries *

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Abstract

This paper investigates the function of various modes of wage payment, focusing on the role of in-kind wages in enhancing household food security in developing countries. It first demonstrates the importance of in-kind wage payment in the initial phase of economic development through compiling historical records from Asian countries including pre-war Japan and colonial India. This section is followed by a survey of theoretical explanations of in-kind wages. As a relatively unexplored explanation, this paper then develops a theoretical model of labor supply to different labor contracts, incorporating considerations of food security as the main explanation for in-kind wages. The theoretical model predicts that when food security considerations are important for workers, possibly due to poverty and thin food markets, they work more under a contract with wages paid in kind (food) than under a contract with wages paid in cash. This prediction is supported by empirical evidence from rural Myanmar. Estimation results of the reduced-form determinants of labor supply show that workers supply more labor to a job whose wages are paid in kind when the share of staple food in workers' budget is higher and the farmland on which they produce food themselves is smaller.

JEL classification codes: J33, Q12, O12.

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1 Introduction

Economic development is a process in which not only economic growth is observed but also changes in production structures and transaction modes are associated with the growth. Throughout the world, economic development has been facilitated by commercialization of various goods and services. Among the goods and services, production factors especially labor and land were the last to be commercialized (Hicks, 1969). Even in an economy where labor has become a market commodity, it is not a straightforward task to empirically investigate the efficiency and surplus distribution in the labor market. One of the reasons for the difficulty is the existence of various labor contracts. In developing countries today or in developed countries before their modern economic growth, a variety of compensation policies are observed when workers are employed from outside the family. Contracts differ in terms of incentives (piece rate versus fixed wage), contract periods (daily, seasonally, or life-time), payment materials (cash, grains, meals, clothes, etc.), and interlinkage with other contracts such as those for credit and land use (Roumasset and Lee, 2007). Under this heterogeneity, calculating "wage" as the price of labor is not a simple task.[1]

Considering this complexity, the question of what determines which policy is chosen and how does the choice of compensation policy affect the efficiency and equity of labor transactions has been discussed intensively in development economics (Rosenzweig, 1988; Hayami and Otsuka, 1993; Roumasset and Lee, 2007). Especially, the practice of sharecropping, a contract in which a land-use right and labor are transacted in an interlinked way, has been investigated in detail. There are also a number of studies on interlinkages of labor and credit transactions.

On the other hand, the empirical research on the existence of different compensation policies for hired workers in developing countries has been limited. Among the few existing studies, Foster and Rosenzweig (1994) demonstrated that in rural India, the level of moral hazard differed depending on the type of labor contract whether it consisted of on-farm employment (family labor), a piece-rate payment scheme, a share-tenancy contract, or a time-wage payment scheme; Fukui (1995) investigated the efficiency of permanent labor contracts in the Philippines where compensation consisted of piece-rate wages paid in kind; and Datta et al. (2004) investigated the mechanisms responsible for the co-existence of both cash and in-kind wages in rural India. One of the empirical difficulties is how to distinguish the incentive impact of a contract from the selection effect arising from the fact that existing institutions are endogeneously adopted by economic agents (Chiappori and Salanie, 2003).

[1] When labor transactions are interlinked with credit or land-lease transactions, it does not make sense to define "wage" separately from rewards to land or credit. The set of wage and land rent (or interest rate) needs to be investigated in analyzing the efficiency and equity outcome of the interlinkage (Basu, 1983).

Taking these as the point of departure, this paper focuses on the role of wages in kind in facilitating the household-level food security in the process of economic development. Odaka (2004) argues that it is important to understand the economic meaning and impacts of various modes of labor transactions and contracts in the historical context of each economy. This paper is an attempt in this direction, choosing wages in kind as an interesting institution, which was important in the early stage of economic development but fading away during the process of modern economic growth. As a salient feature relevant for low-income developing countries but not analyzed in the existing literature, this paper proposes a theoretical model in which in-kind wages can enhance the food security of rural households who are faced with thin food markets and missing insurance markets. Another contribution of this paper is to show that the predictions of the theoretical model are supported empirically from household data from rural areas of Myanmar (formerly Burma). The micro dataset from Myanmar used in this paper is suitable for this exercise because various modes of wage payments co-existed within a village for the same farming operation. This source of variations is hard to find from other datasets because wage payment modes are usually unique within a village for a farming operation, even when the payment modes have huge variation across villages or across farming operations.

One note on the motivation of this paper is the issue of kind versus cash payment in other transactions. Labor is not the only factor service whose reward can be paid in cash or in kind. Land rent is another example of such choice. In the context of economic history of England, the transformation of cash rent into kind rent has been investigated intensively, because of the fact that inflation reduced the real value of cash rent and improved the profitability of tenant farmers, thereby contributing to the establishment of capitalistic tenant farming.[2] In the context of development economics, the focus in the land tenancy research has been on the fixed vs. share rents. For this reason, it is desirable to investigate the issue of kind vs. cash payment in land tenancy and labor transactions in contemporary developing economies. However, simultaneously analyzing labor and land tenancy contracts makes the analytical framework too complicated. The reason why this paper analyzes the issue of kind vs. cash payment in labor transactions is that very few land tenancy transactions are observed in Myanmar, so that we can have a clear-cut understanding of the function of in-kind wages. Analyzing the cash vs. kind rents for land transactions or analyzing the interaction between labor and labor transactions with in-kind payments is left for further research using different datasets. In contemporary Myanmar, farming is conducted in a peasant mode of production without labor-saving machinery, there exists a moderate level of inequality in land holding, and land tenancy transactions are rare due to institutional reasons. The combination of

[2]For example, see Otsuka et al. (1962-64).

these three conditions results in active transactions of labor. The active labor transactions together with the co-existence of various payment modes make the Myanmar case ideal for the empirical analysis for this paper.

The remainder of the paper is organized as follows. Section 2 demonstrates the importance of in-kind wage payment in the initial phase of economic development through compiling historical records from Asian countries including pre-war Japan and colonial India. Section 3 reviews the existing literature on explaining in-kind wages theoretically. Section 4 presents a theoretical model to explain how rural households' labor allocation between cash and kind wages is decided. The predictions of the model are tested using household data from rural Myanmar in Section 5. Section 6 concludes the paper.

2 Wages in Kind: Their Incidence from Historical and Contemporary Datasets

This section shows the incidence of in-kind wages in agriculture, compiled from micro datasets in Asian countries. Although limited, there are several historical sources that have household-level, detailed information on labor transactions. The comparison of in-kind wages found in these historical records with the picture drawn from contemporary micro data in developing countries is an exercise not attempted in the existing literature. This paper attempts this, covering pre-World War II Japan, colonial India, contemporary India and Pakistan, and contemporary Myanmar.

In the following, agricultural laborers are classified into three categories. The first is "permanent laborers," who are permanently employed without a specified contract period, also called "attached laborers" or "regular farm servants". The second category is "seasonal laborers," who are employed for a specific period in a year, usually during the agriculturally busy season, ranging from a few months to a year. Both permanent and seasonal laborers are engaged in various farming operations including the general management of standing crops. In contrast, the third category of "daily laborers" corresponds to those who are casually employed for a specific farming operation, usually for a day or a few days.

2.1 Japan

An unusually long time series of agricultural wage statistics is available for the pre-World War II Japan, beginning from the late Edo period, when labor markets emerged in rural areas (Saito, 1998; 2005). The standard time series since the Meiji period (1868-) was compiled by Umemura et al. (1966) and published in the so-called "LTES" (long-term economic statistics) of Japan. In their compilation, they paid due care in imputing the value of meals because meals occupied a large share of the total cost borne by farmers hiring daily workers.

According to Umemura et al. (1966), the imputed value of meals was roughly 30% of the cash wage paid to a daily laborer. Whether the imputed value of meals is included or not and if yes, how they are imputed, would affect the test for an equilibrium between the wage and the marginal product of farm labor (Odaka, 2004). It is possible that the employer-farmer in the pre-war Japan subjectively regarded the cash wage only as the marginal cost of hiring a daily laborer, interpreting the meal provision as a social obligation (Odaka, 2004). The share of the imputed value of meals in total wages in Japan during the early stage of economic development seems to be higher than in China or European countries at that time (Saito, 2005).

On the other hand, in the pre-war Japan, both historians and the government paid amazingly low attention to other in-kind rewards. This is because of the dominance of cash payment in agricultural labor markets in Japan since the late Edo period. According to *The Survey of Agricultural Laborers* conducted in 1920 (JMAF, 1921; 1926), anecdotal evidence was reported for the provision of clothes and sandals to laborers, especially to permanent laborers, and regional variation was reported regarding the main reward, which was in cash in the majority of regions but in unhusked rice or wheat in Tohoku Regions or in some rice growing regions in Niigata and Hiroshima. The point is that these were noted as exceptions (JMAF, 1926). In addition, the majority of farm work was done by family labor in Japanese agriculture, sometimes supplemented by hired, daily laborers, implying that in-kind payment to permanent laborers was regarded as unimportant by policy makers in the pre-war Japan.

As a historical record that provides household-level information, we can refer to various reports of *Noka keizai chosa (The Survey of Agricultural Households).* This survey was conducted by the JMAF almost every year since the 1920s. Very detailed information on farm accounting and family budgets of agricultural households was collected. The collected information includes the amount and mode of wages paid to hired laborers distinguished by daily and permanent laborers. In published reports for the surveys conducted from 1925 to 1930, household-level information is available in the appendix. Although the sample is not the random sample of agricultural households in Japan at that time (the sample households were chosen by bureaucrats to represent the farmers in each prefecture), the micro information is valuable, considering the general scarcity of historical micro data.

For example, the 1925 report contains information of 65 owner farm households in prefectures excluding Hokkaido. Among the 65 farmers, 55 employed hired labor. For these 55 employer-farmers, the share of in-kind payments (the sum of the value of meals, grains, clothes, etc. provided to laborers) in the total payments (the sum of cash payments and the in-kind payments thus calculated) was calculated, and plotted in Figure 1 against the horizontal axis of the acreage of paddy fields owned by the employer-farmer. A positive

(although weak) correlation is shown in the figure, implying that farmers with larger paddy fields tended to pay more in wages in kind.[3] Another point shown in the figure is regional variation. To show these relations more clearly, a regression model was applied to a repeated cross section dataset[4] of owner farm households in prefectures excluding Hokkaido, covering the period from 1925 to 1930.[5] The dependent variable is the same as the one plotted on the vertical axis of Figure 1. The explanatory variables are the standardized value of the acreage of paddy fields owned by the employer-farmer, that of the acreage of upland fields, regional dummies, and year dummies. Regression results are reported in Table 1. The coefficient on the paddy field size is statistically significant at the 1% level, showing that the in-kind share increases by 8.3% when the paddy field size increases by one standard deviation. The coefficient on the upland field size is not significant, suggesting that cash crops mostly cultivated on upland fields in Japan were not preferred as the commodity for in-kind payment. Among regional dummies, Kinki Region has a significantly negative coefficient, showing that the in-kind share was lower in Kinki than in Kanto by 11.2%, while Kyushu Region has a significantly positive coefficient, showing that the in-kind share was higher in Kyushu than in Kanto by 10.7%. The regional contrast corresponds to the difference in the history of economic development and commercialization — Kinki is the region where agricultural commercialization took place for the first time in Japan while Kyushu is the last region in this regard. Year dummies show a weakly declining trend but statistically insignificant.[6]

After World War II, agrarian land reforms were implemented in Japan, which converted tenant farm households, who were once the main provider of hired labor in agriculture, into owner farm households. Therefore, the incidence of agricultural hired labor was declining very rapidly. Meals in rewards to daily laborers were important only during the first few years after the war when the food was in deficit, but then disappeared very rapidly as the economy recovered from the war. Currently, in-kind payment is not observed in Japanese agricultural labor markets.

2.2 India and Pakistan

In sharp contrast to Japanese agriculture where the majority of farm work was done by family labor in a peasant mode of production, hired labor played a more important role in

[3]No correlation was found when the horizontal axis was replaced by the acreage of upland fields or the acreage of the total of paddy fields and upland fields.

[4]Some of the sample households were surveyed repeatedly. Therefore, the dataset is an unbalanced panel dataset, to be precise. However, because the number of periods for repeatedly surveyed households is not long, the dataset was used as a repeated cross-section.

[5]Because of missing original reports for some years, years 1925, 1927, 1928, and 1930 are included in the analysis.

[6]Replacing the year dummies by a year trend did not affect the regression results for other explanatory variables and the coefficient on the year trend was not statistically significant.

South Asian agriculture. Partly due to caste-based division of labor, the landlord class did not prefer to conduct manual farm work but to concentrate on farm management, resulting in the prevalence of active labor transactions, even among peasant households (Bardhan, 1984).

Since the partition of India and Pakistan in 1947, the share of large holdings dependent on permanent and seasonal laborers has been declining both in India and Pakistan. Various factors could be responsible for the change, such as land reform legislation to restrict absent landlords and to put ceilings on land holdings, equal division of land upon inheritance, and increasing non-farm employment opportunities in rural areas. On the other hand, the dependence on hired labor in agriculture did not decline as fast as the decline of the share of large holdings. In other words, the share of daily labor in the total hired labor increased substantially in recent years in India and Pakistan. From the perspectives of agricultural laborers as well, daily labor may be more attractive than seasonal or permanent labor because it can be more compatible with non-farm works and it implies less social dependence on employers (landlords and rich farmers). The most important contrast between the pre-war Japan and the Indian Subcontinent could be the composition of rural households: the majority of rural households in the pre-war Japan were tenant or owner farm households, with very few households purely dependent on agricultural labor work for others, while rural households in the Indian Subcontinent were divided into landed households and landless, agricultural laborer households, where the latter also occupied a high proportion in the village economy.

Unfortunately, the statistics are very limited regarding time-series data or historical national data on the modes of wage payment to these laborers in India and Pakistan. The incidence of in-kind wages can be shown in two ways. One is the share of in-kind payments in the total payments to laborers by employer-farmers, as investigated for the pre-war Japan. The other is the share of in-kind receipts in the total wage receipts obtained by agricultural laborer households, which does not make sense in the pre-war Japan because of the small number of agricultural laborer households, while it makes perfect sense in the analysis of agriculture in South Asia. In recent periods, household income and expenditure surveys are routinely conducted with the total rural population as the population for sampling in India and Pakistan. If in-kind receipts are distinguished from cash receipts in such surveys, the second index can be calculated. From historical records, however, such information is never available. Instead, data obtained from farm account surveys are available from historical records as well, enabling us to calculate the first index.[7]

[7]Hirashima (1978) notes that the lack of knowledge on the part of planners and scholars in South Asia on socioeconomic conditions of non-farm households in rural society is shown very well in the development

British Punjab in 1920-30s

As an example of such historical records, household-level information is taken from *Farm Accounts in the Punjab*. Since 1923/24,[8] the Board of Economic Inquiry, Lahore, conducted farm account surveys, in which detailed accounts of selected farms in the British Province of Punjab (corresponding to regions currently in Punjab Province of Pakistan and two Indian states of Punjab and Haryana) were collected. Initially, reports covered ten farms or more; later the coverage was increased to approximately 30 farms. Since the Board tried to follow the same farm every year, some of the sample farms were re-surveyed over an extended period. Although a care has to be taken of their small number of observations and their subjective choice of "representative" samples, the reports are a valuable source of micro information on Punjab's agriculture before independence.[9]

From the 1925/26 report, the case of a owner-cum-tenant farm household in Lyallpur District cultivating 46.5 acres of land is drawn (Stewart and Singh, 1927, pp.9-14). This farm represents the upper stratum in the Canal Colony of Punjab. In addition to 28 acres of land owned by the household, it rented in additional 18.5 acres on a fixed cash rent basis. The farmer grew wheat on 25 acres of land, which yielded gross revenue of Rs. 2349, and cotton (9.75 acres), chick pea (3.25 acres), etc. In addition to family labor, he hired two permanent laborers, one seasonal laborer for seven months, and daily laborers. The payment to the two permanent laborers was imputed at Rs.457.6, all of which was made in kind: Each permanent laborer received 1/12 of the gross output of crop harvests, supplemented by the food allowance of wheat and maize (fixed amount of grains per year). The seasonal laborer was paid Rs. 74.1, of which 54% was in cash and the rest was in kind such as meals, shoes, and clothes. The payment to daily laborers for farming operations other than harvesting was in cash, amounting to Rs.16.9. The harvesting and winnowing laborers were mostly paid in kind (fixed share of harvested/winnowed amount), but instances of cash payment (about 13% of the payment) were also observed. Summing up all these payments to laborers, it turned out that 11.0% of the total payment was in cash while 89.0% was in kind. In addition to the payments to agricultural laborers, this farmer paid to four *Kammee* households, such as barber and carpenter.[10] The total payment to the *Kammee* households amounted to Rs. 53.4, all of which was in kind (grains and fodder). Looking from a different angle, about

theory and policy they have produced (p.102).

[8] This corresponds to the agricultural year, which is a period from July 1 to June 30.

[9] See Kurosaki (2001a) for the farm-level analysis of long-run changes in cropping patterns in Punjab, using the same source of *Farm Accounts in the Punjab* before the Partition.

[10] *Kammee* households are landless households in rural Punjab who provide artisan services to landed (*Zamindar*) households. Analogous to the *Jajmani* system in India, the *Kammee-Zamindar* relationship was regarded as a typical patron-client relation. See Hirashima (1978, Chap.8).

one third of the gross crop revenue was used as in-kind payment to laborers and artisans. Regarding wheat, the staple crop in the region, 20.7% of the total produce was paid to agricultural laborers and 1.7% was paid to *Kammee* households as in-kind payment.

Farm Accounts in the Punjab provide micro-level information until the mid 1930s. The 1935/36 report shows detailed information on 27 permanent laborers hired by 24 farmers (Singh and Singh, 1938, p.33). The average annual earnings of permanent laborers was Rs.91, which was decomposed into: 28.9% in cash; 40.7% in kind (the imputed values of crop harvests kept by the laborers as the fixed share); 25.5% in another form of in-kind payment (the imputed values of meals provided to the laborers or food allowance (grains) given to the laborers); and 4.9% in clothes and others. The average share of in-kind payments including meals, weighted by the total payment value, was 71.1% (34.4%) and that of in-kind payments excluding meals was 45.6% (32.6%) (standard deviations in parenthesis). Out of the 27 cases, no cash payment was observed in 14 cases.

The variation in the modes of payment to permanent laborers seems to reflect regional and class variation. Over time, very little change was observed. For example, twelve years data can be obtained for the Lyallpur farmer described above from 1925/26 to 1936/37. The number of permanent laborers increased to three in years when additional land was hired-in. Depending on the responsibility for each permanent laborer, the sharecropping ratio also changed in the range from 1/15 to 1/10. Despite these changes, the basic pattern was very stable: paying permanent laborers by the combination of sharecropping and the food allowance in grains (no cash payment to permanent laborers); cash payment to daily laborers for farming operations other than harvesting; and fixed share of harvested/winnowed amount for harvesting/winnowing laborers.

Historical records from British Punjab and the pre-war Japan thus clearly shows a contrast that in-kind payments were more important in Punjab than in Japan during the 1920-30s.

Pakistan Punjab in 1980-90s

Surveys for *Farm Accounts in the Punjab* were continued in Pakistan's Punjab, after the partition of India and Pakistan in 1947. Random sampling was introduced later and the number of observations was increased. *Farm Accounts* reports then show only average figures for each stratum and each region. Another change in recent years was the inclusion of non-farm households in rural areas into the household income and expenditure survey.

To examine recent changes regarding cash versus kind wages, micro data of farm households in Sheikhupura District are extracted from the farm accounts survey. This dataset was used by Kurosaki (1998) and Kurosaki and Fafchamps (2002), covering about 100 households

each in three-years (unbalanced panel) from 1988/89 to 1990/91. Sheikhupura District is a neighbor of Lyallpur District mentioned above, and the two districts have similar agro-ecological conditions. Unfortunately, the information on total wage payment distinguishing cash and kind is not available from the dataset. Instead, detailed information on output disposal is available. In the case of wheat, which is the most important crop in Punjab agriculture and the staple food of people, 20.5% of gross output was used as kind payment to workers and another 1.2% was used as payment to *Kammee* households. The sum of the two, which shows how much of the produce is used as kind payment, is distributed in the range from 0.008 to 0.518, with its average at 0.220 (standard deviation at 0.081). On the other hand, the share of kind wage receipt in the total labor income was distributed in the range from 14 to 53% among non-farm households. Although not directly comparable, these figures indicate that kind wages were still very important in Pakistan Punjab in 1980-90s, although their shares declined slightly.

Indian Deccan from 1970s to 2000s

As another example from the Indian Subcontinent, micro datasets from Deccan Plateau are investigated. The first one is the so-called ICRISAT panel data (Walker and Ryan, 1990). The ICRISAT panel data cover three villages of India's semi-arid tropics, namely Aurepalle (Andhra Pradesh), Shirapur (Maharashtra), and Kanzara (Maharashtra), from 1975 to 84, about 40 households in each village, each year. Information on wage receipt in kind is available in this dataset.

Figure 2 shows ten-year time series for each village regarding the importance of kind wages. Two indicators are calculated for the balanced panel (35 households in Aurepalle, 33 in Shirapur, and 36 in Kanzara analyzed by Kurosaki, 2001b). The upper portion of Figure 2 plots the share of kind wage receipts in the total wage income receipts, while the lower portion plots the share of households who received some portion of their wage income in kind. The total wage income contained non-agricultural income, although its share is low. Some part of the non-agricultural income was paid in kind during this period in India. To investigate the overall importance of in-kind wages, the figure reports the sum of agricultural and non-agricultural wage income.

First, the share of kind wage receipts in the total wage income receipts differed significantly across villages. Aurepalle had much higher shares than the two Maharashtra villages. According to Walker and Ryan (1990, pp.110-114), in Maharashtra villages in the 1970s, daily laborers were paid in cash only and permanent laborers were paid either in cash only or in cash and food grains; in Andhra villages, in sharp contrast, permanent laborers were paid in kind (crop harvest) only and daily laborers were usually paid in paddy. Second,

the share of kind wage receipts in the total wage income receipts decreased over time. The decrease was the most substantial in Aurepalle, indicating that cash payment to agricultural labor was increasing in this village. Exceptionally in Kanzara, a slight increase in the share was observed in the early 1980s. This reflected an improvement in per-acre output of cotton, whose labor was paid on the sharecropping basis. In other words, the incidence of in-kind payment did not increase even in this village. Third, if we look at the share of households who received some portion of their wage income in kind, no trend and no spatial difference are found. In all three villages, more than half of the sample households received kind wages and the difference across the three villages was marginal. It can be concluded, therefore, that the importance of kind payment declined in terms of value but not in terms of incidence.

The second example from Deccan Plateau is from our survey of villages in Kurnool District, Andhra Pradesh, in 2005. The data were collected in the ongoing research project on child labor and intrahousehold resource allocation (Fuwa et al., 2006). A random sample of about 400 households was chosen, scattering over 32 sample villages. The dataset contains 840 individuals who reported a positive amount of wage income. The share of kind wage receipt in the total wage income for these 840 individuals was 6.2%. The number of individuals who obtained a positive amount of kind wages was 44 out of 840. Kind wage receipt of each individual had large variance: its standard deviation was almost equal to the average total wage receipt. Therefore, on average, the in-kind wages are much less important in Kurnool in 2005 than in the ICRISAT dataset, both the value and its incidence. However, there existed a few seasonal laborers in Kurnool in 2005 for whom the in-kind wage was critically important. In the field survey, we found that daily laborers were paid in cash only, without meals. We could not obtain the information when kind wages for daily laborers disappeared.

2.3 Myanmar (Burma)

Although labor contracts are potentially diverse in terms of incentives (piece rate versus fixed wage), contract periods (daily, seasonal, or permanent), and payment materials (cash, grains, meals, clothes, etc.), we usually observe only one type of contract for a particular farm work in a particular village. The diversity is usually observed across villages or across time or across farm operations or across crops.

There are some exceptions to this general tendency. In the rural Myanmar data analyzed by Kurosaki (2008), different labor contracts co-existed for the same crop, doing the same farming operation, and in the same village.[11] The sample survey was conducted in 2001,

[11] For instance, in paddy-transplanting in one village in Ayerawardy Division, uprooting daily workers (usually males) were paid either 250 Kyats/day or 1 kyat/bundle (a bundle of uprooted seedlings of paddy). In sugarcane harvesting in one village in Shan State, harvesting workers were paid either 200 Kyats/day, a fixed amount of husked rice per day, or a fixed share of harvested cane.

covering eight regions representing various agricultural zones in Myanmar. The sample size was 341 farm households and 180 non-farm households.[12] "Farm" households were those who had land tillage rights, while "non-farm" households were those who had no tillage rights. [13] As Kurosaki (2008) shows in detail, unpredictable and inconsistent rice policies in Myanmar during the survey period resulted in low income of rice producing farm households and insecure food availability for non-farm households. Thus the food security was the real concern for the Myanmar households in the sample, especially low-income rural households.

In rural Myanmar, two categories of *daily laborers* and *seasonal laborers* are strictly distinguished (Takahashi, 2000). The average share of income from daily farm labor in the earned income[14] of all sample households was 12.7%, while the share of income from seasonal farm labor was 2.6%. Farm households who usually employ daily and seasonal laborers sometimes also send family members to wage work. The share of daily farm labor in the income of farm households was 5.0% and that of seasonal labor was 0.1%. In contrast, the income share of farm wages is higher among non-farm households: 34.4% (daily labor) and 9.5% (seasonal labor).

Table 2 shows characteristics of 223 seasonal labor contracts observed from the 521 sample households, either hired by the sample households or supplied by the sample households. The first half of the table shows the distribution of the 223 observations by the means of payment. In about 30% of them, the main wage was paid in cash only. However, about 70% of them were associated with meals. Therefore, only about 10% of seasonal labor contracts were purely cash contracts. In contrast, in about 60% of the observed contracts, the main wage was in combination of cash and in-kind benefits. More than 80% of them were served with meals. To correct for differences in the importance of each category of compensation policy in the rural economy, the share of each mode in the total was re-calculated using total Kyats,[15] reported in the last column of Table 2.

In the second half of Table 2, the composition of average monthly payment in terms of Kyats is shown. The average payment was 7800 Kyats per month per seasonal laborer, implying that 23 man-months of seasonal labor supply were required to earn the average household income if a household has 5 members. Out of 7800 Kyats, 40.9% was paid in cash,

[12] See Kurosaki et al. (2004) for details of the sampling procedure, the characteristics of the sample households, and farming conditions.

[13] See Kurosaki (2008) for a brief review of the land use rights development in Myanmar.

[14] Overall, the average income was 36,000 Kyats per person per year. If this figure is converted at the market exchange rate of 650 Kyats/US$ prevailing during the study period, it was equivalent to $55 per person per year. Incomes in the sample villages thus were indeed low, but not that different from average villages in rural Myanmar. If this income is converted using the price of rice in the Yangon market (56 Kyats/kg) prevailing during the study period, it was equivalent to 640 kg of rice per person per year.

[15] In calculating the total monetary values of payment in kind, we converted the quantity information provided by the employer or the employee into a money term using village prices.

11.2% in kind such as paddy, 3.7% in other in-kind benefits such as tobacco and clothes, and 44.3% in meals.[16] The composition shows that the in-kind shares are indeed quite high among seasonal laborers in rural Myanmar.

Table 3 is analogous to Table 2 but covers characteristics of daily labor contracts, pooling information on about 1,700 cases for those employed as daily laborers and approximately 1,400 cases for farmers employing daily laborers.[17] The first half of the table shows the distribution of the 3,100 observations by the means of payment.[18] There are four broad categories, each of which includes several sub-categories. First, wages fixed in money terms and paid per labor hour ("Kyats/day") were found most frequently, accounting for 79% of the 3,100 observations of hired labor. The rest of contracts were diverse. Piece-rate contracts in cash, which should be superior if shirking is potentially a problem and the farm operation requires quick completion, accounted for 15% out of the 3,100 cases. The last two categories are those associated with main payment in kind. Fixed wages in kind accounted for 2.5% and piece-rates in kind, such as a fixed proportion of harvested output paid to laborers (sharecropping), accounted for 1.8% out of the 3,100 cases. About one third of daily work contracts were with meals (usually one meal but several cases with two or three meals).

In the second half of Table 3, the composition of average daily payment in terms of Kyats is shown. The average payment was 184 Kyats per day per daily laborer, implying that 900 man-days of daily labor supply were required to earn the average income for a five-member household. Out of 184 Kyats, 85.9% was paid in cash, 5.7% in kind such as paddy, and 8.4% in meals. Compared with seasonal laborers, daily laborers earned more in cash. Nevertheless, the earnings in kind were not negligible on average, and they were major source of income for some households (note that the standard deviation of in-kind earnings per day is 57.1 Kyats, comparable to a third of the average daily payment). Interestingly, if a daily laborer works 30 days in a month, his monthly earning is larger than that of a seasonal laborer if we ignore the imputed value of meals while the opposite relation holds if we include the imputed value of meals.

[16] There is some arbitrariness in converting meals served into monetary values. In this paper, meals were imputed using standard coefficients based on the cost of rice. When the quality of meals was higher than the standard, the imputed values were adjusted upward.

[17] Some households reported several cases for such contracts both as employee and employer, some reported cases of having being employed, some reported cases of having employed several casual laborers, and the others neither employed others nor were employed by others.

[18] In addition to those shown in the table, there are other dimensions in which the wages paid to daily laborers varied. For instance, when the payment was in cash, such as Kyats/day (fixed wage) or Kyats/acre (piece rate), some workers were paid a month or two in advance. In such cases, the wage rate was often reduced by 20 to 33%. Such a large discount suggests the severity of credit constraints faced by poor laborers (interest rates in the study regions were in the following range: around 10% per month in the informal credit market without collateral, 3 to 5% per month charged by private pawn shops, and 1.25% per month charged on agricultural production loans provided by the public sector).

2.4 Summary of the historical and contemporary datasets survey

The above survey on the incidence of in-kind wages in agriculture is summarized in Table 4. The table shows the averages and standard deviations of the share of in-kind wages calculated from micro datasets introduced so far.

Several findings emerge from the table. First, payment in kind was important in the earlier stage of development and it remained to be important though its share was declining over a long period. Second, in harvesting or in producing food crops, kind wages are more popularly found, even in today's developing countries. Third, the spatial diversity is large. Across countries, Pakistan's Punjab has the highest incidence of in-kind wages while in-kind wages disappeared earlier in Japanese agriculture, with Myanmar in between. Within each country, the regional difference was also very large, as shown in Japan and India's ICRISAT data. Fourth, the incidence of food grains used as kind wages is found more frequently when the employer is a large scale farmer and the employee is a landless worker, implying a class disparity.

3 Theoretical Explanation of In-Kind Wages in the Literature

In spite of the importance of in-kind wages shown in the previous section, there are not many theoretical models on in-kind wages in the literature. For example, four volumes of development economics and three volumes of agricultural economics in the Handbook of Economics Series by Elsevier only briefly mention about in-kind wages when characteristics of labor markets in developing countries are described.[19]

In the mainstream economics, the dominant view seems to assume that payment in kind in agriculture will disappear completely during the process of transition to a market economy. This is because under complete markets, paying wages in cash is the most efficient in saving transaction costs since cash is the means of exchange.

However, as shown in the previous section, it is common to observe labor transactions with payment in kind even in an economy where commercialization has proceeded deeply. The economic anthropology literature interprets such transactions as those with a primary function to strengthen community ties or to provide religious services (Kasuga, 2007). An implication of this interpretation is that in-kind wages will survive in commercialized economy because community ties or religious services cannot be completely commercialized. Such views in economic anthropology have many in common with the views on wages in kind in development economics. In development economics, in-kind wages are interpreted as showing some incompleteness in markets. In the followings, these views are classified into three.

[19] See for example, Roumasset and Lee (2007, p.2716).

3.1 Market imperfection for the good used in kind payment

If the market for some good, which is a necessary good for the employee, is so imperfect that the employer can supply it at a cost much cheaper than the price the employee has to pay in the market, then the resource allocation can be made more efficient when the employer provides the employee with the good as (a part of) reward for the employee's labor. As an extreme case, if the food market is missing, the payment should include the food. However, it is not realistic to assume the complete absence of food markets in developing countries today. In every corner of the developing world, foods are sold and purchased.

As a more realistic case, suppose that food transactions are subject to high transport costs, because food is bulky. The existence of such transaction costs implies that the shadow price of the food for large farmers who have market surplus is much lower than the shadow price of the food for marginal farmers who need to purchase the food from the market (Key et al., 2000). This is analogous to the f.o.b.-c.i.f. band in the international economics literature. If the price differential exists, the employer-farmer can reduce his effective payment to workers by paying in kind.

Regarding the provision of meals to the workers, one explanation is that it is a mechanism to save time for the workers to go home for lunch (see for example, Bliss and Stern, 1982). This explanation can be interpreted as a version of the f.o.b.-c.i.f. price band theory. Even if the cost of meals in terms of raw materials and cooking fuels is similar between the employer and the employee, the shadow price of meals should include the value of opportunity costs for two way trips between the field and the worker's home. Since this explanation well explains the situation in rural Myanmar, the econometric analysis of this paper focuses on the mode of payment for the main wage and des not discuss the provision of meals.

Another reason why the employer can supply various goods and services at costs cheaper than the employee could be the economies of scale and scope (Alston and Ferrie, 1986). In-kind provision of benefits to the employee, exploiting the scale or scope economy, may be an effective way for the employer to make sure that his labor requirement is always satisfied, since the in-kind provision makes workers more dependent on the employer (Alston and Ferrie, 1993).

3.2 Imperfection in labor markets

Another strand of explanation focuses on the imperfection in labor markets. The fundamental problem in hiring labor is the asymmetric information problem that the employer can neither monitor nor enforce the effort level of workers. Working hour is more easily monitored or enforced but labor hour is not the real input in determining the output. Labor effort is the real input. By paying the workers in kind, the employer may be able to reduce

this asymmetric information problem.

The first route is based on the calorie-based efficiency wage theory (Dasgupta and Ray, 1986). Due to the basic metabolic requirement of calorie, there exists a non-linear, S-shaped relation between nutrition and athletic output. Given such relations and the widespread malnutrition, the employer may offer the efficiency wage to workers, which is much higher than the level that clears the labor market, and rations the employment among similar landless workers. The hired workers will have sufficient nutrition through eating enough from their wage income. This is the essence of Dasgupta and Ray's efficiency wage model. However, since money is fungible, a moral hazard may occur that a worker does not eat enough, spends the money elsewhere, and provides the employer with inefficient labor. To avoid this moral hazard problem, the employer provides meals to daily and seasonal workers and pays the main reward in kind. This is the logic to explain the existence of in-kind wages based on the efficiency wage theory.

The second explanation is related with incentive wages. The orthodox model of sharecropping tenancy justifies its existence as the mechanism to maintain a good balance between the provision of incentive to work and the provision of risk-sharing against crop output fluctuations (Stiglitz, 1974). By paying the worker proportional to his harvest, the worker has incentive to work hard while bearing not all of the risk of harvest failure. In order to pay the worker proportional to his harvest, both the employer and the employee should observe the total harvest. Checking the harvested amount and then dividing it immediately into the worker's and the employer's share are the easiest way in the field to implement a sharecropping contract. As a result, the workers are paid in kind.

Bardhan (1984) explicitly gave these two reasons (nutrition-based efficiency wage and incentive wage) to explain the widespread institutions of kind wages in India. On the other hand, Swamy (1997) showed that the ongoing level of agricultural wages was sufficiently high to allow workers to avoid malnutrition, implying that the simple nutrition-based efficiency wage theory may not be valid empirically. Furthermore, meals are automatically consumed by the worker but the payment in grains may be re-sold and do not contribute to higher calorie intake by the worker. Also in the sharecropping case, if the agricultural produce market is perfect, paying the worker the fixed proportion of crop in kind is equivalent to paying her the monetary value of the crop. In this sense, the incentive wage explanation cannot show that the in-kind payment is superior to cash payment.

The author once came up with an interesting case where the above equivalence broke down and the incentive wage in kind was superior to the incentive wage in cash. In 1994, the author visited several cotton farms in southern Punjab of Pakistan, known as the cotton zone. The eastern side of a main canal was occupied by a large-scale farm cultivating several

hundred hectares of land to grow cotton. The western side was occupied by many farms of medium size, cultivating around 10 hectares of land. On both sides, women cotton pickers were hired on daily basis and they were all paid incentive wages. In the market, the cotton from the eastern farm fetched prices 5 or 10% lower than the cotton from western farms. According to the survey by agronomists, both types of farms grew the same variety of cotton and their quality of cotton in the field was exactly the same. It turned out that the reason for the price differential was in different efforts paid by cotton pickers. In the large-scale farm, cotton pickers were paid in cash, proportional to the weight of cotton picked by them. This gave the cotton pickers incentive to pick wet cottonseeds and not to be careful in picking sticks and leaves. The monitoring by the employer was not successful in completely avoid this. On the other hand, in the medium scale farms, cotton pickers were paid in kind, dividing the pile of cottonseeds in front of the farmer-employer. This gave the cotton pickers incentive to pick dry cottonseeds only and to be careful in not picking leaves and sticks. The price differential reflected this difference in quality. In this case, incentive wages should be paid in kind for higher quality.[20]

3.3 Imperfection in insurance markets

In low-income developing countries like those surveyed in Section 2, poor households have few means to hedge against the vagaries of production and price shocks that may put their livelihood at risk (Fafchamps, 2003; Dercon, 2005). Explicit insurance markets rarely exist in the villages and informal arrangement to cope with risk including reciprocity-based transfers is far from efficient in providing *de facto* insurance mechanisms (Ligon et al., 2002). This implies that poor households in developing countries attempt to reduce their exposure to risk using various income-smoothing measures (Fafchamps, 1992; Kurosaki and Fafchamps, 2002). Among the potential sources of uninsurable risk, food price variability is likely to affect the poor's welfare adversely, since the poor tend to spend more on food.

Under these conditions, if a part of wage income is paid in food regularly, the core part of family consumption of the worker household is stabilized so that its welfare level may increase. In other words, kind wages can complement the existing insurance mechanisms. As far as the author finds, Bardhan (1984) pointed out this function of kind wages for the first time in the literature, noting that "Another explanation of kind payment to workers is related to foodgrain price uncertainty and differential risk aversion on the part of employers and workers" (p.69). While Bardhan (1984) did not formally model this idea, recent studies

[20]Even in this case, however, if incentive wages can be made proportional to the market value of the harvested cottonseeds, paying the incentive wage in kind or in cash becomes equivalent. In this sense, the incentive wage argument requires the incompleteness in agricultural produce markets to justify the existence of in-kind wages.

show mathematical models for this function (e.g., Datta et al., 2004; Kurosaki, 2006; Ito and Kurosaki, 2007). In this paper, a version of theoretical models that share the basic ideas of Kurosaki (2006) and Ito and Kurosaki (2007) is presented. As shown in the next section, it is more general than the model by Datta et al. (2004) in the sense that it depends less on the specification of utility functions of workers and it is more appropriate for the analysis of poor workers in developing countries than the model by Datta et al. (2004) in the sense that the aversion to food price variability is captured explicitly.

4 A Theoretical Model of In-Kind Wages to Enhance Food Security

Each of the theoretical explanations surveyed in the previous section presents an interesting point to understand in-kind wages. Especially for economies in the earlier stage of development with low standard of nutrition, the explanations based on incompleteness in crop markets and labor markets may be valid. However, in contemporary developing countries, food markets are developed everywhere and the average level of villagers' nutrition has been improved substantially. Why in-kind wages still prevail in such situations?

As an answer to this question, this section presents a version of theoretical models based on imperfect insurance markets. The starting point is that food markets exist but thin and insurance opportunities are limited, especially for low income households with high food budget share. Laborer households in such environment may find wages paid in kind (food) more attractive due to food security reasons. The model below will show that the in-kind wage system is a rational one even in an economy with well-developed markets for agricultural produce and labor.

4.1 Basic settings

To shed light on the trade-off between cash and in-kind wages, the theoretical model in this section assumes away other labor contract issues, such as monitoring workers to prevent shirking and interlinking labor contracts with transactions in other factors. Throughout the section, we assume a unitary decision making process at the household level with respect to labor allocation (Singh et al., 1986). Recently, non-unitary household models have been proposed, in which bargaining among members within a household is modeled explicitly. Since bargaining issues are less important in South Asia than in Sub-Saharan Africa (Ueyama, 2006), these issues are also assumed away. By focusing on the trade-off, we can clarify the significance of laborers' consideration of food security in a straightforward way.

To reflect the conditions of low-income developing countries, the commodity "food," which is the main output in production and the main item in consumption, is introduced

into the model. To simplify the model, there are only two consumption items: food and "non-food." The price of "non-food" is normalized at one. Due to thin agricultural produce markets (Fafchamps, 1992) and possibly due to unpredictable interventions by the state in rural marketing (Kurosaki, 2008), the price of food, p, fluctuates; its mean is $\bar{p}$.

For simplicity, we fix the total labor supply at $\bar{L}$, ignoring the labor-leisure choice. Because of the limited opportunity to cope with risk *ex post*, the worker household behaves in a risk-averse manner. At the time when the household decides on labor allocation, its *ex ante* payoff is given by $E[v(y,p)]$, where $E[.]$ is an expectation operator and $v(y,p)$ is an indirect utility function from consuming y, which is allocated between the food and the non-food after the price risk and farming risk are revealed (i.e., $y = c_{nonfood} + pc_{food}$). The indirect utility function $v(y,p)$ is assumed to satisfy the followings:

$$v_y > 0, \quad v_p < 0, \quad v_{yy} < 0, \quad v_{pp} < 0, \quad v_{yp} > 0, \quad v_{yyy} > 0. \tag{1}$$

The first two properties are required for a valid indirect utility function. The third guarantees that the laborer is risk-averse in the Arrow-Pratt sense, and the fourth implies that, for a given income level, the laborer's welfare decreases when the food price variability increases. The fourth property is especially appropriate for a poor worker in a developing country who is vulnerable to food insecurity.[21] The condition $v_{yp} > 0$ implies that the laborer's welfare increases when the correlation between the food price and income becomes more positive, with the income mean, the price mean, the income variance, and the food price variance being held constant. Since a positive correlation of the food price and the income level means that real income is more stable, this assumption is also justifiable for a poor laborer in a developing country. The last assumption, $v_{yyy} > 0$, corresponds to "risk prudence" (Kimball, 1990). Since prudent risk preferences guarantee that the welfare cost of consumption fluctuations decreases with the level of expected consumption, the assumption is appropriate for the analysis of this paper.

Given the preference above, the worker household decides on labor allocation. There are two types of labor contracts to which the household can allocate labor $\bar{L}$ (indicated by subscript 1 and 2). Since the total labor supply is fixed, the decision variables are the shares of each type of labor ($\ell_j, j = 1, 2$). From each contract, the household obtains a labor return

[21] However, $v_{pp} < 0$ is not always satisfied in popular utility functions used in the literature. For instance, when the utility function is Cobb-Douglas with constant relative risk aversion, i.e., $v(y,p) = (y/p^{\beta})^{1-\psi}/(1-\psi)$, $\psi > 0$, the risk aversion should be sufficiently high ($\psi > 1 + 1/\beta$), for $v_{pp} < 0$. Datta et al. (2004) in their analysis of contract choice between cash and in-kind wages in low-income economies adopted a constant elasticity of substitution (CES) utility function, which nests Cobb-Douglas as a special case. Because they assumed a relatively low value for ψ, their analysis turned out to be a case with $v_{pp} > 0$. In other words, they implicitly assumed that the worker's welfare increases when the food price becomes more variable. Since this is not appropriate for modeling poor workers' behavior, this paper adopts a utility function that is associated with $v_{pp} < 0$.

of π_j, which is stochastic and responsive to the level of the worker's human capital. Thus, the household's optimization problem is expressed as:[22]

$$\max_{\ell_j} \quad E[v(y,p)],$$

subject to the budget and time constraints

$$y = y_0 + \sum_j \pi_j \ell_j \bar{L}, \tag{2}$$

$$\ell_1 + \ell_2 = 1, \tag{3}$$

where y_0 is non-stochastic unearned income, and ℓ_j $(j = 1, 2)$ are also subject to the non-negativity conditions.

The first order condition for the interior solution to this optimization problem is as follows:

$$E[v_y(\pi_1 - \pi_2)] = 0, \tag{4}$$

Solving the system of two equations comprising (3) and (4) implicitly, the optimal labor portfolio (ℓ_1^*, ℓ_2^*) is obtained. To characterize the optimal solution, we apply the first-order Taylor approximation of $v_y(y,p)$ in (4),[23] obtaining

$$E[\pi_1 - \pi_2] + s(\psi - \eta)E[(\pi_1 - \pi_2)(p - \bar{p})/\bar{p}] - \psi E[(\pi_1 - \pi_2)(y - \bar{y})/\bar{y}] \approx 0, \tag{5}$$

where ψ is the Arrow-Pratt measure of relative risk aversion, defined as $\psi \equiv -\frac{\bar{v}_{yy}}{\bar{v}_y}\bar{y}$, s is the budget share of food (Engel's coefficient), and η is the income elasticity of food demand (all evaluated at $y = \bar{y} = y_0 + \sum_j \bar{\pi}_j \ell_j \bar{L}$ and $p = \bar{p}$).[24]

The first term in equation (5) shows the *direct profitability effect*. When labor type 1 is associated with higher expected payment than type 2, the labor supply to type 1 will increase. The third term shows the *direct portfolio effect*. When the household is risk-averse ($\psi > 0$), the labor type less correlated with the total household income will become more attractive and its share will increase. This effect is strengthened when the household is more risk-averse (higher ψ) and the household is faced with larger risk (higher variance of π_j).

The second term is unique to this class of models. When the household spends a certain share of its budget on the food ($s > 0$), the covariance between the food price p and wage π_j becomes an important determinant of the labor supply portfolio. The direction of the covariance effect depends on the sign of $\psi - \eta$. From Roy's identity, it can be shown that the assumption of $v_{yp} > 0$ is equivalent to the assumption of $\psi > \eta$ in this approximation,

[22] This is an application of the crop portfolio model by Fafchamps (1992) to the case of labor supply.

[23] Higher order terms may matter as well. Ignoring terms involving the third-order derivative of $v(y,p)$, such as v_{yyy}, v_{yyp}, etc., is equivalent to assume unskewed distribution of p.

[24] To derive this expression, Roy's identity is used, resulting in the relation $\frac{v_{yp}}{v_y} = \frac{1}{p}s(\psi - \eta)$.

which is likely to be satisfied for low-income households (Fafchamps, 1992). Therefore, when the household has a stronger food security consideration, it prefers the labor type associated with wages more positively correlated with the food price. This effect is strengthened when the household spends more on food (higher s) and the household's income elasticity of food demand is low (lower η). The situation with a higher food budget share and inelastic food demand corresponds to rigid food consumption. Households with rigid food demand thus have a serious concern about their food security. Since these effects depend on parameters characterizing household consumption demand, the second term in equation (5) is called the *consumption preference effect*.

Finkelshtain and Chalfant (1991) and Fafchamps (1992) show the theoretical possibility that the consumption preference effect leads to an perverse supply response of agricultural production with respect to production risk (risk-averse farmers increase the production of a more risky crop), while Kurosaki and Fafchamps (2002) show that the consumption preference effect is empirically significant in explaining poor farmers' cropping choice in Pakistan. Therefore, it is expected that the consumption preference parameters may affect choices in labor supply portfolio as well. However, this test has not been applied in the existing empirical studies. This is the reason why this paper attempts it in the next section. Before empirical tests, we extend the simple model above to fit the empirical settings in rural Myanmar.

4.2 Choice between cash and kind wages

Labor type 1 is associated with fixed wages in kind (staple food) and type 2 with fixed wages in cash. For simplicity, we assume that employers are risk-neutral and competitive with other employers outside agriculture who offer fixed wages in cash at w. This assumption results in $\pi_1 = wp/\bar{p}$, $\pi_2 = w$, and $y = y_0 + \{\ell_1 wp/\bar{p} + (1-\ell_1)w\}\bar{L}$. Inserting these into equation (5), we can explicitly solve for the optimal labor share, ℓ_1^*:

$$\ell_1^* = \frac{y_0 + w\bar{L}}{w\bar{L}} \frac{s(\psi - \eta)}{\psi}. \tag{6}$$

From this, the following comparative statics can be obtained:

$$\frac{\partial \ell_1^*}{s} > 0, \qquad \frac{\partial \ell_1^*}{\psi} > 0, \qquad \frac{\partial \ell_1^*}{\eta} < 0, \qquad \frac{\partial \ell_1^*}{y_0} > 0, \tag{7}$$

where we assume $\psi > \eta$ (i.e., $v_{yp} > 0$). The intuitive meaning of the relations in (7) are summarized in the following propositions:

Proposition 1. *A laborer whose food expenditure is more rigid will supply more to work paid in kind. The laborer's food expenditure is more rigid when it occupies a larger share*

in her family budget (i.e., Engel's coefficient is higher) or when its income elasticity is lower.

Proposition 2. *A laborer who is more risk averse in the Arrow-Pratt sense will supply more to work paid in kind.*

Proposition 3. *A laborer who has more non-labor, non-stochastic income in cash will supply more to work paid in kind.*

These propositions are not found in the existing literature on wage contracts (e.g., Datt et al., 2004). Since the propositions above are derived from approximation, approximation errors may exist. Therefore, exact solutions are simulated in numerical examples to investigate the robustness of the theoretical propositions, using the specification with a risk-averse linear expenditure system (LES)[25] that satisfies assumptions of (1) such as $v_{pp} < 0$. In numerical simulations, p is assumed to have a uniform or triangle distribution, and the optimal portfolios were calculated for different combinations of risk preferences and consumption preferences. Simulation results are available on request, which support the three propositions above.

Although only two types of work are considered in deriving the three propositions above, a proposition similar to Proposition 1 can be derived when other types of labor supply opportunities are available. Kurosaki (2006) shows this for the case when an employer in hiring labor chooses the contract type from four choices: (1) fixed wages in cash, (2) fixed wages in kind (paid in food), (3) piece rates in cash, and (4) piece rates in kind (paid in food). Ito and Kurosaki (2007) theoretically analyze the case where agricultural households decide their labor supply to various types of work, including agricultural work on their own farm (unpaid family labor).

4.3 Empirical strategy

Using data from developing countries, it may not be a straightforward task to test the three propositions above. Under reduced-form approaches, only s (Engel's coefficient) and y_0 are observable among parameters for which comparative statics were derived. Income elasticity η and risk preference ψ are not directly observable. Furthermore, s is likely to be endogenous so that reverse causality might result in the correlation similar to Proposition

[25]The LES has the appealing property that the number of parameters is small and it provides a plausible prediction of poor households' response to avoid starvation. With the LES specification, the situation of starvation is described as income (y) being so low that it is close to the total value of the subsistence needs in consumption (Atkeson and Ogaki, 1996; Kurosaki and Fafchamps, 2002). LES utility functions require smaller values of risk aversion to assure that $v_{pp} < 0$ than Cobb-Douglas or CES utility functions.

1 (e.g., households who were paid in kind accidentally increased food consumption because the food was available abundantly at home). Regarding y_0, its direct effect on the labor portfolio may have a positive impact on ℓ_1^* (Proposition 3) but higher y_0 may imply a lower ψ, resulting in a negative impact on ℓ_1^* through Proposition 2. One approach could be to structurally estimate preference parameters simultaneously with labor supply determinants, as adopted by Kurosaki and Fafchamps (2002). Since the Myanmar dataset is a cross-section, it is difficult to apply this approach.[26]

Considering these difficulties, we replace the three propositions by the following empirical hypothesis:

Empirical hypothesis. *A laborer whose food expenditure is more rigid will supply more to work paid in kind. The laborer's food expenditure is more rigid when the ratio of her average food requirement to her expected income is higher.*

The next section explains how we estimate *S_labor*, the ratio of the worker's average food requirement to her expected income. Our basic empirical strategy is to test through reduced-form regression models whether *S_labor* positively affects ℓ_1^* even after controlling for other factors that should affect households' labor supply. The other explanatory variables include various assets owned by the household, demographic characteristics, and village fixed effects that control regional environments including market conditions.

However, the empirical evidence that *S_labor* has a positive impact on ℓ_1^* may be consistent not only with the theoretical model of in-kind wages to enhance food security due to missing insurance markets but also with a theoretical model of in-kind wages to save transaction costs (e.g., Key et al., 2000). Under the alternative theory, the shadow price of food for workers who need to purchase food to supplement in-kind wage receipt should be higher (market price + transaction cost) than that for workers who sold the food from their stock including in-kind wage receipt (market price - transaction cost). Under this theoretical model, therefore, workers with higher *S_labor* are more likely to be associated with higher ℓ_1^* if we pool all sample observations.

To distinguish the two explanations, we implement an additional test using the dummy variable *D_labor*, which is defined as the status of a household that its average food requirement is larger than the total wage income from agricultural labor supply. If *D_labor* = 1, the household is definitely a purchaser of food to supplement in-kind wage receipt, so that its

[26] Kurosaki and Fafchamps (2002) controlled household-specific heterogeneity in preferences using household fixed effects and estimated only a few parameters that characterize the common part of preferences in a structural way. Without controlling for household fixed effects, a structural estimation with only a few parameters may not be justifiable.

shadow price for the food is market price + transaction cost. If $D\_labor = 0$, the probability is high for the shadow price to be equal to market price - transaction cost. As shown by Key et al. (2000), under the transaction cost model, the marginal change in purchase/sale has little effect on household behavior as long as the household's status of net purchaser/seller does not change. Therefore, we expect D_labor to be the better predictor of ℓ_1^* than S_labor. On the other hand, under the food price risk model in this section, S_labor should be the better predictor of ℓ_1^* than D_labor. In the additional test, we estimate a reduced-form model replacing S_labor by D_labor and a reduced-form model adding D_labor in addition to S_labor, and examine which of S_labor and D_labor explains ℓ_1^* better.

5 Estimation Results from Rural Myanmar

5.1 Data

Based on the theoretical model in the previous section, a reduced-form model of labor allocation is estimated, using the household data from rural Myanmar collected in 2001. Although the dataset contains information on both daily and seasonal laborers, as described in Section 2, the econometric exercise investigates daily labor transactions only. This is because seasonal labor contracts were mostly predetermined, based on long-term relations between the employer and the employee (Takahashi, 2000). Therefore, the room for the worker to adjust the contract marginally is small in general. On the other hand, the daily labor markets are more flexible — worker households are free to choose how much labor to supply to which types of labor contracts. Sample households who did not supply any daily farm labor to the market were deleted from the regression analysis below. In the empirical analysis, the sample village without variation in cash versus kind wages was also excluded. The resulting sample contains 219 households.

Table 5 shows the definition and summary statistics of empirical variables. The main dependent variable is *inkind_md*, i.e., the share of in-kind labor man-days in the total household daily farm labor supply. In aggregating contract-level information shown in Table 3 into a household-level variable, alternative weights are possible. Since the information on man-days may contain measurement errors (because the employer-farmer sometimes do not exactly remember the man-days worked by workers, when incentive wages were adopted), another dependent variable was calculated and used in robustness check — *inkind_no*, based on the number of contracts per household. Although *inkind_no* is less subject to measurement errors, it is slightly different from the variable of ℓ_1^* in the theoretical model. *inkind_md* is a more direct proxy for ℓ_1^*. The correlation coefficient between *inkind_md* and *inkind_no* was 0.942.

The above strategy assumes that in-kind wages are paid in crops whose price is perfectly collinear with the food price in the theoretical model. In reality in rural Myanmar, some cases of in-kind payment were observed in the harvesting work of pulses and sugarcane, whose prices were not perfectly collinear with the price of rice. Furthermore, cases with wage payment in pulses or sugarcane were all based on sharecropping arrangements. Since the sharecropping arrangements imply that workers bear some portion of output risk, the additional risk may affect workers' decision making regarding labor supply to sectors paid in fixed wages in kind. To avoid this complexity, we implement another robustness check in which we limit the sample to the cases with time wages only and use $inkind\_fx$ (the labor supply in man-days to daily labor contracts whose main payment was fixed in kind divided by the labor supply in man-days to daily labor contracts whose main payment was fixed).

Two types of explanatory variables are included. The first type includes variables characterizing the worker household. As discussed in the theoretical section, employee characteristics such as food security considerations, risk aversion, and the incentive to shirk, should affect the contract choice. To represent human capital, sex, age, and the level of education (in terms of schooling years) of the household head are included. The size of the farmland workers possess is included as an indication of the extent to which they can secure food from their own farmland. Therefore, if it is found that the worker's farmland reduces the labor supply to work paid in kind, such a finding is consistent with the food security considerations. Non-land asset values such as livestock, transportation equipment, etc., are also included to control for liquidity effects. Finally, as a direct control for household food security considerations, S_labor, the relative importance of rice in the family budget is included.

To control for the endogeneity of s (the food budget share in the theoretical model), the empirical model uses S_labor, the value of the annual amount of rice consumption required (age-sex specific rice consumption coefficients times the vector of the demographic composition of household members) divided by the expected household income (asset-specific income coefficients times the vector of asset holdings) as a proxy for the importance of rice in the family budget. S_labor is more exogenous to households' short-run decision making than the observed value of the food budget share. It is highly correlated with the observed value of the food budget share with the correlation coefficient of 0.7749 (the linear independence is rejected at the 0.1% level). Furthermore, the regression results of models replacing S_labor by the observed food budget share are qualitatively very similar to those reported in this paper. A related variable, D_labor, was calculated similarly. In addition to these variables, demographic characteristics are included to control for other differences in preferences.

The second type of explanatory variables includes the fixed effects of villages. Because the mode of wage payments tends to be similar within a village, it is better to control for

these effects to obtain reliable estimates for the effects of household characteristics on the choice of contract. A drawback of this approach is that the effects of village-level variables, such as weather risk, cannot be inferred. Considering the small number of survey villages, this is inevitable. The main empirical test thus concerns whether household characteristics that are proxies for Engel's coefficient and risk aversion affect the contract choice in a way predicted by the theoretical model.

In running regressions, weighted regressions are adopted to control for the different sampling probability between farm and non-farm households in each village. Since the dependent variable is truncated (it has a range from 0 to 1), 2-sided tobit models are employed as the main specification and linear specifications are adopted to check the robustness of regression results.

5.2 Regression and test results

Impact of food requirement on the in-kind share

The main estimation results are reported in Table 6. The coefficient on *S_labor* in the regression of *inkind_md* is 0.69, implying that the share of in-kind contracts increases as the share of rice consumption increases, with an elasticity around 0.7. Although its statistical significance level is low, the coefficient is large and supports the prediction of the theoretical model.

To investigate whether the finding of a positive coefficient on *S_labor* is robust, a similar model was estimated, replacing the dependent variable *inkind_md* (in-kind share based on man-days) by *inkind_no* (in-kind share based on the number of observations), which is less subject to measurement errors, or by $inkind\_fx$ (in-kind share using only the subsample of fixed wages). The results are reported in the first three rows of Table 7. The coefficients on *inkind_no* and $inkind\_fx$ were similar to the one on *inkind_md* and remained to be statistically significant. Considering that we need several restrictive assumptions to estimate the tobit model, the model was re-estimated using a linear specification using Huber-White heteroscedasticity-robust standard errors (Table 7, the 4-6th rows). Because the non-linearity was ignored, coefficients on *inkind_md*, *inkind_no*, and $inkind\_fx$ became smaller but they became statistically more significant.

These results robustly show that *S_labor* has a positive impact on the in-kind share (*inkind_md*, *inkind_no*, or $inkind\_fx$). Econometric results thus supports the view that a laborer whose food expenditure is more rigid will supply more to work paid in kind, which is consistent with the theoretical model of in-kind wages focusing on food security under thin food markets.

Coefficient estimates on other explanatory variables in Table 6 also support this interpre-

tation. The dummy variable for female-headed households ($Female\_labor$) has a significantly positive coefficient (the in-kind share became close to 80% if a household is headed by a female). This is another piece of evidence that households' food security considerations affect labor supply because in rural Myanmar females are usually responsible for family food management, although it is also possible that the dummy variable may capture other differences due to assets or income earning disparity associated with the female headship.

Another interesting result is the negative effect of land holding ($Land\_labor$). The tobit results indicate that conditional on it being strictly positive, the share of in-kind contracts decreases by 12% as the land owned by the worker household increases by 1 acre. Since owning farmland and growing food they need are an effective strategy for poor households to secure food for family consumption, this result also seems to support the view that a laborer with higher food security concern will supply more to work paid in kind. Considering the possibility that land ownership affects the labor supply through other routes such as difference in occupational structure and credit access, we re-estimated a model where the land ownership dummy (D_land) was added to control for the heterogeneity associated with the status of being a farm household in rural Myanmar. The coefficient on $Land\_labor$ remained very similar to the one reported in Table 6 and the coefficient on D_land was insignificant. Therefore, marginal landholding matters while the status of farm household does not, providing another support to the theoretical explanation based on food security under thin food markets.

The fixed effects of villages were jointly significant, implying that the importance of kind wages differ from village to village. We conjecture that the difference could be associated with a difference across villages in food price risk and the availability of consumption smoothing measures. See Ito and Kurosaki (2007) for an empirical support of this idea for the case of North India. For the current case of Myanmar, however, our conjecture cannot be supported by empirical evidence because the number of surveyed villages was small, making it difficult to identify what aspects the village fixed effects capture.

Although not reported, full estimation results corresponding to the models reported in Table 7 were similar with respect to coefficient estimates on $Female\_labor$ and $Land\_labor$. We also tried other specifications with different definitions for the household-level education and various types of assets. The results were qualitatively similar to those reported in Tables 6-7.

Distinguishing the food price risk model and the food price band model

It is possible that the empirical evidence that S_labor has a positive impact on $inkind\_md$ (or $inkind\_no$ or $inkind\_fx$) may be consistent with a theoretical model of in-kind wages with

the food price band (Key et al., 2000). To distinguish the two theoretical explanations, we re-estimated the model in Table 6, using D_labor, which is meant to capture the discontinuity of the shadow price of the food for the worker household.

As shown in the latter half of Table 7, when $inkind\_md$ is the dependent variable and a tobit model was estimated with D_labor replacing S_labor, the coefficient on D_labor was 0.03 (both economically and statistically insignificant). When both S_labor and D_labor were included as explanatory variables, only the coefficient on S_labor was significant. In linear specifications, the coefficient on S_labor in a model without D_labor was the only significant predictor of $inkind\_md$. Although not reported, regression results with $inkind\_no$ or $inkind\_fx$ as the dependent variable were similar to those reported in Table 7.

These results thus support the food price risk model stronger than the food price band model as the determinant of in-kind wages in rural Myanmar. Since our dataset has detailed information on contract characteristics, contract-level regression models for the determinants of contract choice were also estimated, adding employers' characteristics and crop/farm operation fixed effects as another set of explanatory variables. Preliminary results reported by Kurosaki (2006, Tables 7-9) show that the probability of a wage contract paid in kind increased when the laborer's food expenditure was more rigid and the laborer household had less farmland. Judging from these results, we can conclude that when food security considerations are important for a worker, possibly due to poverty and thin food markets, a contract with wages paid in kind (food) is adopted more widely than a contract with wages paid in cash, and this contrast can be explained better by a theoretical model focusing on the food price risk than by a theoretical model focusing on the food price band.

6 Conclusion

This paper investigated the function of various modes of wage payment, focusing on the role of in-kind wages in enhancing household food security in developing countries. To explain the importance of in-kind wage payment in the initial phase of economic development, shown through historical records and contemporary survey data from Asian countries, this paper developed a theoretical model of labor supply to different labor contracts, incorporating considerations of food security as the main explanation for in-kind wages. A prediction of the theoretical model that when food security considerations are important for workers, possibly due to poverty and thin food markets, they work more under a contract with wages paid in kind (food) than under a contract with wages paid in cash was robustly supported by empirical evidence from rural Myanmar. Estimation results of the reduced-form determinants of labor supply showed robustly that workers supply more labor to a job whose wages are paid in kind when the share of staple food in workers' budget is higher

and the farmland on which they produce food themselves is smaller. The empirical test results also suggested that the theoretical model focusing on the food price risk is supported stronger than a theoretical model focusing on the food price band.

Despite the importance of in-kind wage payment in the process of economic development, theoretical and empirical investigations for its function and rationale have been rare in the literature. To explain in-kind wage payment, the previous research focused more on imperfections in agricultural produce markets or in labor markets. Since both of these markets have been developed and the average nutritional conditions are much better than the calorie-based efficiency wage theory can be directly applied in contemporary developing countries, more focus should be put on the limited ability of rural households to smooth consumption against price and output risk. The current paper is an attempt in this direction. Extending the theoretical model in this paper to allow substitution or complementarity of in-kind arrangements with other types of informal insurance mechanism is left for further research. Implementing empirical investigations on in-kind wages for other cases covered in this paper, namely, pre-war Japan and colonial India is another direction for future research. Our conjecture for the pre-war Japan is that in-kind wages quickly disappeared in Japan because the major source of agricultural labor supply was marginal farmers, who were able to grow food on their farm, resulting in lower demand for in-kind payment. By comparing historical and contemporary cases of in-kind wages, we hope to shed new light on how market incompleteness affects resource allocation in the process of economic development.

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Table 1. In-Kind Shares in Agricultural Wage Payment in Pre-World War II Japan

	Coeff.		(Std.error)
Paddy field acreage (normalized)	0.083	***	(0.009)
Upland field acreage (normalized)	-0.011		(0.009)
Regional dummies			
Tohoku	-0.048		(0.033)
Hokuriku	-0.004		(0.063)
Chubu	0.046		(0.048)
Kinki	-0.112	**	(0.045)
Chugoku	-0.073		(0.056)
Shikoku	0.065		(0.042)
Kyushu	0.107	**	(0.048)
Year dummies			
1927	-0.002		(0.028)
1928	0.026		(0.028)
1930	-0.043		(0.032)
Intercept (reference is Kanto region in 1925)			
	0.240	***	(0.030)
No. of observations			271
F(12,259) for all slopes=0			12.92***
R2			0.375

Source: Estimated by the author using microdata explained in the text (same for other tables).
Notes: (1) The dependent variable is "In-kind payment by the owner farmer to laborers"/"Cash payment and in-kind payment by the owner farmer to laborers". "In-kind payment" includes the imputed value of meals. The sample mean of the dependent variable is 0.230 (standard deviation 0.208), weighted by the total payment amount.
(2) Estimated by a Weighted LS (weights are the total payment amount). Statistically significant at 1%=***, 5%=**, 10%=*.

Table 2. Characteristics of Seasonal Laborers in Rural Myanmar, 2001

1. Distribution by wage types	Number of wage contracts			Distribution to the total in terms of payment amount (%)
	Number	Distribution to the total (%)	The ratio with meals (%)	
Only cash (a)	65	29.15	69.23	25.33
Only in kind				
(b)	14	6.28	7.14	4.94
(b)+(c)	17	7.62	100.00	6.35
Subtotal	31	13.90	58.06	11.30
Mix of cash and kind				
(a)+(b)	1	0.45	0.00	0.30
(a)+(c)	117	52.47	95.73	55.87
(a)+(b)+(c)	9	4.04	100.00	7.21
Subtotal	127	56.95	95.28	63.38
Grand total	223	100.00	82.51	100.00
2. Characteristics of contracts	Mean	Std.Dev.	Minimum	Maximum
Contract period in months	5.20	3.32	0.50	13.00
Per-month payment (in Kyats)*				
(a) Cash	3181	1700	0	10000
(b) Kind payments: Crop harvest and grains	870	3227	0	35000
(c) Kind payments: Tobacco, clothes, etc.	289	332	0	1900
(d) Meals	3446	1781	0	4500
Total payment（a+b+c+d)	7786	3224	1111	35000

Note: * The means and standard deviations were weighted by the total payment amount.

Table 3. Characteristics of Daily Laborers in Rural Myanmar, 2001

1. Distribution by wage types	Number of wage contracts			Distribution to the total in terms of payment amount (%)
	Number	Distribution to the total (%)	The ratio with meals (%)	
(a) Time wage in cash				
Kyats/day	2437	78.61	38.70	77.68
Other	71	2.29	18.31	1.01
Subtotal	2508	80.90	38.12	78.69
(b) Piece-rate wage in cash				
Kyats/acre	154	4.97	12.34	6.94
Kyats for the whole operation	100	3.23	19.00	2.73
Kyats/unit of farm work	152	4.90	46.05	4.19
Kyats/unit of crop output	52	1.68	9.62	1.74
Subtotal	458	14.78	24.67	15.60
(c) Time wage in kind				
Cleaned rice/day	65	2.10	52.31	1.99
Unhusked paddy/day	12	0.39	50.00	1.02
Subtotal	77	2.49	51.95	3.01
(d) Piece-rate wage in kind				
Sharecropping	4	0.13	25.00	0.15
Crop output/acre	21	0.68	0.00	1.18
Crop output for the whole operation	30	0.97	10.00	1.33
Other	2	0.06	50.00	0.03
Subtotal	57	1.84	8.77	2.69
Grand total	3100	100.00	35.94	100.00

2. Characteristics of contracts*	Mean	Std.Dev.	Minimum	Maximum
Total labor supply (days per household per year)	239.1	221.0	5.0	1825.0
Per-day payment (in Kyats)**				
Cash	158.2	64.3	0.0	733.3
Kind payments: Crops and grains	10.5	57.1	0.0	900.0
Meals	15.5	20.2	0.0	150.0
Total payment	184.2	84.7	30.0	950.0

Notes: * The number of observations for this part is 270, because this is a household-level data, excluding households with zero daily laborer wage income and outliers.
** Means and standard deviations were weighted by the amount of daily laborer wage income received by the household.

Table 4. In-Kind Shares in Agricultural Labor Markets in Asia (Summary)

Country (Region)	Period	Item	NOB	Average in-kind shares (Std.dev.)			
				Including meals		Excluding meals	
Japan (excl.Hokkaido)	1925-30	In-kind payment by the owner farmer to laborers divided by the total payment (Table 1)	271	0.230	(0.208)		
British India (Punjab)	1935/36	In-kind payment by farmers to permanent laborers divided by the total payment	27	0.711	(0.344)	0.456	(0.326)
India (ICRISAT, Aurepalle)	1975-84	In-kind receipt in total wage receipt by rural households (Figure 2)	225	0.739	(0.338)		
India (ICRISAT, Shirapur and Kanzara)	1975-84	In-kind receipt in total wage receipt by rural households (Figure 2)	633	0.085	(0.120)		
India (Andhra Pradesh, Kurnool)	2005	In-kind receipt in total wage receipt by rural households	840	0.062	(0.236)	0.062	(0.236)
Myanmar	2001	In-kind payment divided by total payment to seasonal laborers (Table 2)	223	0.591	(0.229)	0.149	(0.275)
Myanmar	2001	In-kind payment divided by total payment to daily laborers (Table 3)	270	0.141	(0.182)	0.057	(0.161)

Note: See the text for each data source. All means and standard deviations were weighted by the value amount.

Table 5. Variables Used as Determinants of In-Kind Shares in Rural Myanmar

Variable	Definition	Mean	Std. Dev.	Min	Max
Dependent variables					
inkind_md	(Annual labor supply in days to daily labor contracts whose main payment was in kind)/(Total annual labor supply in days to daily labor contracts).	0.052	0.171	0.000	1.000
inkind_no	(Number of labor supply contracts to those whose main payment was in kind)/(Total number of labor supply contracts).	0.046	0.157	0.000	1.000
inkind_fx	(Annual labor supply in days to daily labor contracts whose main payment was in kind and fixed in quantity)/(Annual labor supply in days to daily labor contracts whose main payment was fixed in value or quantity).	0.044	0.156	0.000	1.000
Explanatory variables					
Female_labor	A dummy variable for a female-headed household.	0.073			
Age_labor	Age of the household head.	43.406	12.152	20	80
Educ_labor	Completed years of formal school education of the household head. When the employee attended a monastic school, a value of 2 years was assigned.	2.785	2.450	0	10
Land_labor	Size of farmland holding in acres managed by the employee's household.	2.996	4.479	0	22
S_labor	Indicates the importance of rice in the family budget. Defined as "the value of the annual amount of rice consumption required (age-sex specific rice consumption coefficients times the vector of the demographic composition)" divided by "the expected household income (asset-specific income coefficients times the vector of asset holding)". When the value was greater than unity, it was truncated at one.	0.275	0.233	0.026	1.000
D_labor	Dummy variable for a household with "the value of the annual amount of rice consumption required (age-sex specific rice consumption coefficients times the vector of the demographic composition)" greater than the total daily labor supply from the household multiplied by the average daily wage.	0.356			
Assets_labor	Total amount of assets (non-land: transportation equipment, livestock, agricultural machinery, etc.) owned by the employee (million Kyats).	0.143	0.112	-0.115	0.674
hsizemc2	No. of male children in the household (under 15).	0.932	0.986	0	4
hsizema2	No. of male adults in the household (15 to 60).	1.598	0.959	0	5
hsizefc2	No. of female children in the household (under 15).	0.922	0.976	0	3
hsizefa2	No. of female adults in the household (15 to 60).	1.676	1.075	0	6

Notes: (1) The number of observations is 219 (those households in villages with potential choice between cash and in-kind wages and who supplied a positive amount of daily agricultural labor), except for "inkind_fx" whose NOB is 213 (those households who supplied a positive amount of daily agricultural labor whose main payment was fixed).
(2) In addition to the variables in this table, village fixed effects are included in regression models.
(3) All means and standard deviations were weighted to reflect the difference in sampling probability across villages and across farm vs. non-farm households.

Table 6. Determinants of the In-Kind Share in Household Labor Supply in Myanmar (1)

	Dependent var.=inkind_md	
	Coeff.	(Std.error)
Female_labor	0.7883 ***	(0.256)
Age_labor	-0.0038	(0.006)
Educ_labor	0.0097	(0.019)
Land_labor	-0.1234 ***	(0.036)
S_labor	0.6885 *	(0.360)
Assets_labor	0.4705	(0.630)
hsizemc2	-0.0144	(0.051)
hsizema2	0.0401	(0.068)
hsizefc2	-0.0659	(0.054)
hsizefa2	0.1099 *	(0.058)
Village fixed effects: jointly significant at the 1% level		
NOB		219
chi2(16) for zero slope		93.25***
Pseudo R2		0.409
Log likelihood		-67.30

Notes: (1) Estimated by a 2-sided weighted tobit.
(2) Significant at 1% (***), 5% (**), and 10%(*).

Table 7. Determinants of the In-Kind Share in Household Labor Supply in Myanmar (2)

Dependent var.	Estimation methodology	Proxy variable for the rigidness of food demand	Coeff.	(Std.error)
(1) Robustness check with respect to dependent variables and estimation methodology				
inkind_md	Tobit	S_labor	0.6885 *	(0.360)
inkind_no	Tobit	S_labor	0.5822 *	(0.330)
inkind_fx	Tobit	S_labor	0.6975 *	(0.369)
inkind_md	WLS	S_labor	0.1292 **	(0.066)
inkind_no	WLS	S_labor	0.1065 **	(0.042)
inkind_fx	WLS	S_labor	0.1281 *	(0.075)
(2) Distinguishing two models: Incomplete insurance markets vs. Food market price bands				
inkind_md	Tobit	S_labor	0.6885 *	(0.360)
inkind_md	Tobit	D_labor	0.0274	(0.132)
inkind_md	Tobit	S_labor	0.8009 *	(0.411)
		D_labor	-0.0924	(0.151)
inkind_md	WLS	S_labor	0.1292 **	(0.066)
inkind_md	WLS	D_labor	0.0455	(0.036)
inkind_md	WLS	S_labor	0.1075	(0.076)
		D_labor	0.0313	(0.040)

Notes: (1) In all regression models, the explanatory variables listed in Table 6 are included. In this table, coefficient estimates on S_labor and D_labor are reported. Full results are available on request from the author.
(2) "Tobit" in the "Estimation methodology" column means a weighted 2-sided tobit as in Table 6. "WLS" means a linear regression results with Huber-White heteroscedasticity-robust standard errors, weighted by sampling probability.
(3) Significant at 1% (***), 5% (**), and 10%(*).

Figure 1. In-Kind Shares in Agrlucutural Wage Payment in Japan, 1925
(Source: Drawn by the author using microdata explained in the text [same for other figures])

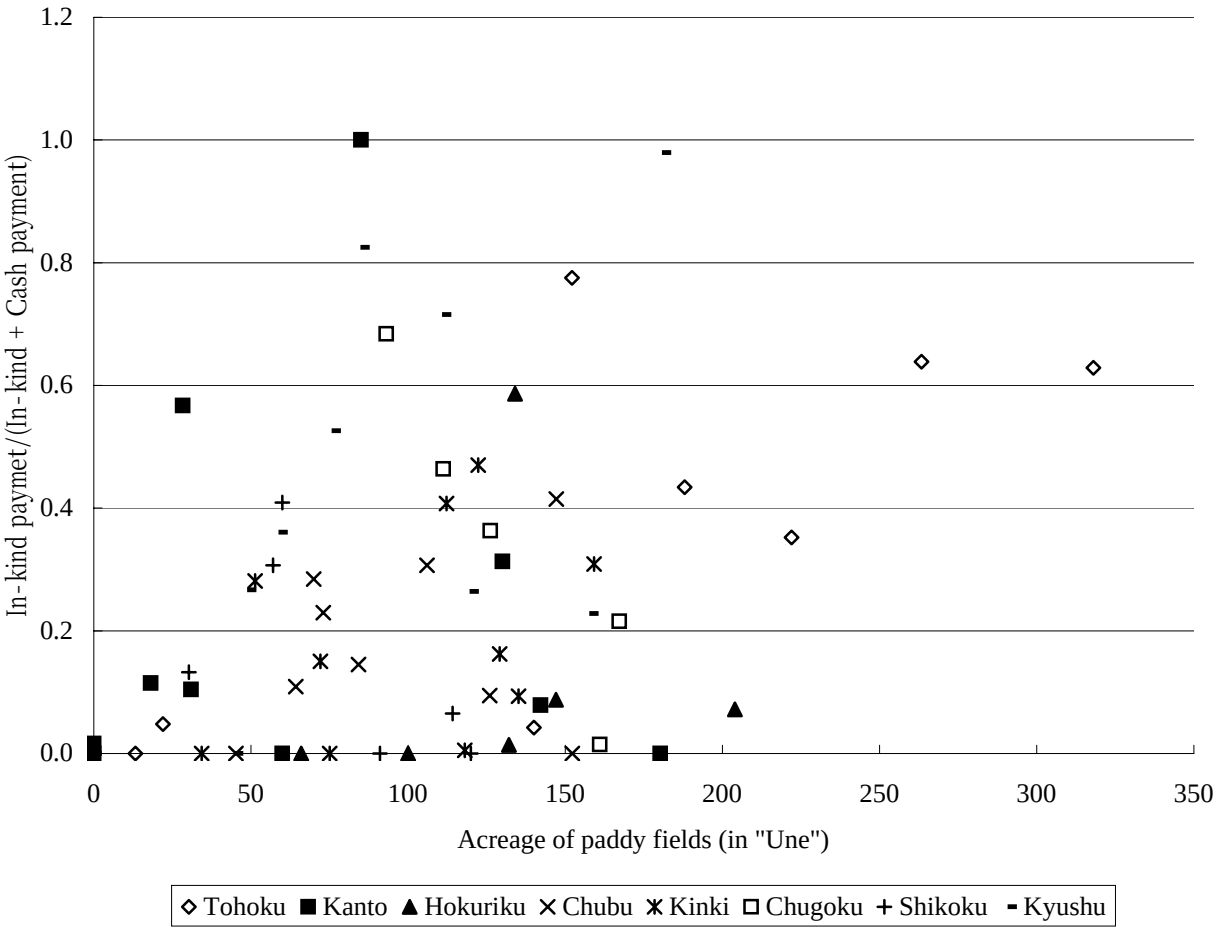
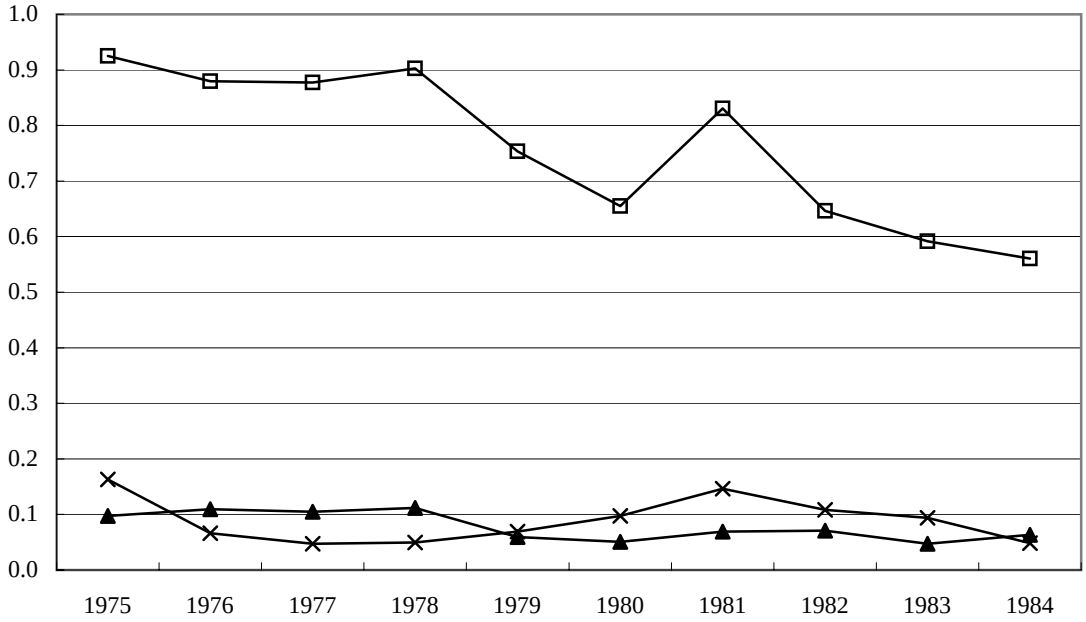


Figure 2. In-Kind Shares in Wage Receipt among ICRISAT Households in India

(a) In-Kind Shares in Total Wage Receipt



(b) Share of Sample Households Who Received a Positive Amount of In-Kind Wages