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Wages in Kind and Economic Development: Historical and Contemporary Evidence from Asia

Takashi Kurosaki

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Research Project **PRIMCED**
Institute of Economic Research
Hitotsubashi University
2-1 Naka, Kunitatchi Tokyo, 186-8601 Japan
http://www.ier.hit-u.ac.jp/primced/e-index.html

HITOTSUBASHI UNIVERSITY

Wages in Kind and Economic Development: Historical and Contemporary Evidence from Asia*

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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 when markets are underdeveloped. Historical records from Asian countries, including pre-war Japan and colonial India, demonstrate the importance of in-kind wage payment in the initial phase of economic development. However, there is a paucity of theoretical explanations of in-kind wages in terms of their function and rationale in existing literature. This paper therefore develops a theoretical model that explains labor supply under different labor contracts, by incorporating considerations of food security as the main explanation for in-kind wages. The model predicts that when food security considerations are important for workers, owing to poverty and thin food markets, they tend to work more under contracts where wages are paid in kind (food) than under contracts where wages are 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 for work paid in kind when the share of staple food in the workers' household budget is higher and the farmlands on which they produce food themselves are smaller.

JEL classification codes: J33, Q12, O12

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Institute of Economic Research, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8603, Japan. E-mail: kurosaki@ier.hit-u.ac.jp.

1 Introduction

Economic development is a process that is manifest through not only economic growth but also associated changes in production structures and transaction modes. Worldwide, economic development has been facilitated by commercialization of various goods and services among which 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 difficult to empirically investigate the efficiency and surplus distribution in the labor market. One of the reasons for this is the existence of various types of labor contracts. In developing countries today as in developed countries earlier, employer-farmers adopt a variety of compensation policies when hiring labor from outside the family. Contracts differ in terms of incentives (piece rate versus fixed wage), contract periods (daily, seasonal, or lifetime), payment materials (cash, grains, meals, clothing, 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 the complexity associated with labor contracts, the question of what determines which compensation policy is chosen and how the choice of policy affects the efficiency and equity of labor transactions has been discussed extensively in the literature on economic development (Rosenzweig, 1988; Hayami and Otsuka, 1993; Roumasset and Lee, 2007). In particular, the practice of sharecropping, a type of 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 the interlinkage of labor and credit transactions.

On the other hand, there is limited empirical research on the different compensation policies used to hire labor during the process of economic development. Among the few existing studies on this subject, Foster and Rosenzweig (1994) demonstrate that in rural India, the level of moral hazard differed according to the type of labor contract—on-farm employment (family labor), piece-rate payment scheme, share-tenancy contract, or time-wage payment scheme. Further, Fukui (1995) investigates the efficiency of permanent labor contracts in the Philippines where compensation consisted of piece-rate wages paid in kind, and Datta et al. (2004) study the mechanisms responsible for the co-existence of both cash and in-kind wages in rural India. Chiappori and Salanie (2003) state that one of the empirical difficulties surrounding wage policies pertained to the differentiation of the incentive impact of a contract from the selection effect caused by the endogenous adoption of existing institutions by economic agents.

Taking the findings of the above-mentioned studies as the point of departure, this paper focuses on the role of in-kind wages in ensuring household-level food security in the process of

[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).

economic development. Odaka (2004) argues that it is important to understand the economic meaning and impact of the various modes of labor transactions and types of labor contracts in the historical context of each economy. Such an understanding is critical to the design of apposite labor policies in developing countries for rapid poverty alleviation. This paper is an attempt to understand the process of economic development among the rural populace in developing Asian countries by focusing on in-kind wages—an important element in the early stages of economic development that has lost its significance with modern economic growth. Considering in-kind wages as a salient feature relevant for low-income developing countries but one that has not been appropriately analyzed in existing literature, this paper proposes a theoretical model in which in-kind wages can enhance the food security of rural households faced with thin food markets and missing insurance markets. The predictions of the theoretical model are supported empirically with household data from rural Myanmar (formerly Burma). The micro dataset used in this paper is apt because multiple modes of wage payments co-existed within the study village for the same farming operation; such variation is hard to find in other datasets because wage payment modes are usually unique within a village for a farming operation, even when payment modes show considerable variation across villages or farming operations.

Another motivation for this paper is the issue of kind versus cash payment in non-labor transactions. Labor is not the only service that is remunerated in cash or kind. Land rent and credit are other examples. Regarding land rent, the transformation of cash rent into kind rent has been investigated extensively in the context of the economic history of England, because 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] Since an analysis of both labor and land tenancy contracts can complicate the analytical framework, this paper focuses on the issue of kind versus cash payment in labor transactions.

In contemporary Myanmar, farming is practiced through the peasant mode of production without the use of labor-saving machinery. Inequity in land holdings is at a moderate level and land tenancy transactions are rare due to legal restrictions. A combination of these conditions has resulted in active labor transactions that along with the existence of various payment modes make Myanmar an ideal study area for the empirical analysis this paper aims to perform. Analyzing the interaction between labor and labor transactions with in-kind wages is left for further research using different datasets.

The remainder of the paper is organized as follows. Section 2 demonstrates the importance of in-kind wages in the initial phase of economic development by compiling historical records from Asian countries, including pre-war Japan and colonial India. Section 3 reviews the theoretical literature on in-kind wages. Section 4 presents a theoretical model to explain how rural households'

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

labor allocation is decided between cash and kind wages. Section 5 tests the predictions of the model against empirical findings using household data from rural Myanmar, and Section 6 concludes the paper.

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

This section demonstrates the incidence of in-kind wages in agriculture by compiling micro datasets from Asian countries. Although few in number, there are historical sources that offer detailed household-level information on labor transactions. There is no comparison of historical in-kind wages with contemporary micro data in developing countries as yet in existing literature. This paper makes a pioneering attempt in this direction, covering pre-war Japan, colonial India, contemporary India and Pakistan, and contemporary Myanmar.

For the purpose of analysis in this paper, agricultural laborers are classified into three categories: "permanent laborers," who are permanently employed without a specified contract period, also called attached laborers or regular farm servants; "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; and "daily laborers," who are usually employed for a few days at most. Both permanent and seasonal laborers are engaged in various farming operations, including the general management of standing crops; in contrast, daily laborers are employed for specific farming operations.

2.1 Japan

An exceptionally long time series of agricultural wage statistics is available for pre-war Japan, beginning with the first half of 19th century (late Edo period) when labor markets first emerged in rural areas (Saito, 1998; 2005). The standard time series from the start of the Meiji period (1868–) was compiled by Umemura et al. (1966) and published as part of a Japanese research project called Long-term Economic Statistics (*LTES*). In the compilation of the time series, due care was taken to impute the value of meals since 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. Odaka (2004) states that the test for an equilibrium between the wage and the marginal product of farm labor depends on whether the imputed value of meals is included, and if it is, the manner in which it is done. It is possible that the employer-farmer in pre-war Japan subjectively regarded cash wages only as the marginal cost of hiring a daily laborer and saw meal provisions as a social obligation (Odaka, 2004). The share of the imputed value of meals in total wages in Japan during its early stage of economic development appear to be higher than that in China or European countries at that time (Saito, 2005).

In focusing on remuneration through meal provision in pre-war Japan, both historians and governments paid little attention to other forms of in-kind rewards. This is because the main component of wages other than meals was paid in cash from the late Edo period onward in the major agricultural regions in Japan. According to The Survey of Agricultural Laborers conducted in 1920 (Japanese Ministry of Agriculture and Forestry, 1921; 1926), however, there was anecdotal evidence supporting the provision of clothing and footwear to laborers, especially permanent laborers; further, regional variations were reported in the main reward component, which was in cash in the majority of regions but in unhusked rice and wheat in Tohoku Region and in some rice growing areas in Niigata and Hiroshima. However, these cases were noted as exceptions (Japanese Ministry of Agriculture and Forestry, 1926). In addition, the majority of farm work was accomplished by family labor in Japan; only occasionally was farm work supplemented by hired daily labor, implying that in-kind payment to permanent laborers was regarded as unimportant by policy makers in pre-war Japan.

Various reports of *Noka keizai chosa* (The Survey of Agricultural Households) serve as historical records offering household-level information. This survey has been conducted by the Japanese Ministry of Agriculture and Forestry almost every year since the 1920s. It provides detailed information on farm accounting and family budgets of agricultural households, including the amount and mode of wages paid to daily and permanent laborers. In published reports of the surveys from 1925 to 1930, household-level information is available in the appendix. Although the samples do not qualify as random samples of agricultural households in Japan at that time (the sample households were chosen by bureaucrats to represent farming households in each prefecture), the documented micro data are valuable, considering the general scarcity of such data.

The 1925 report contains information on 65 owner-farm households in all prefectures excluding Hokkaido. Among the 65 farmers, 60 employed hired labor. For these 60 employer-farmers, Figure 1 plots the share of in-kind payment (the sum of the value of meals, grains, clothing, etc. provided to laborers) in the total payment (the sum of cash and in-kind payment) against the acreage of paddy fields owned. A positive (although weak) correlation is shown in the figure: farmers with larger paddy fields tended to pay more in in-kind wages.[3] Another point shown in the figure is large variation across regions.

To show these relations more clearly, a regression model is applied to a repeated cross-sectional dataset[4] of owner-farm households in prefectures excluding Hokkaido for the six-year period from 1925 to 1930. The dependent variable is the same as the one plotted on the ordinate of Figure 1. The explanatory variables are the standardized values of the acreage of paddy fields owned by the employer-farmer, the acreage of upland fields, regional dummies, and year dummies.

[3]No correlation was found when the abscissa was replaced by acreage of upland fields or acreage of the sum of paddy 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 years in which the same household was surveyed is small among the panel households, the dataset was used as a repeated cross-section.

Regression results are reported in Table 1. The intercept shows that the average in-kind share was around 23%, which appears slightly lower than the imputed value share of 30% reported by Umemura (1966) for the late 19th century. The coefficient on the paddy field size is statistically significant at the 1% level, showing that the in-kind share increases by around 7.5% 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 a 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 10%, while Kyushu Region has a significantly positive coefficient, indicating that the in-kind share was higher in Kyushu than in Kanto by 14%. The regional contrast observed confirms the established view that economic development and commercialization did not set off at the same time all over Japan—Kinki was the first region to witness agricultural commercialization, while Kyushu was the last. The coefficients on year dummies in specification (i) of Table 1 or the coefficient on a linear trend in specification (ii) are all statistically insignificant, suggesting marginal change during the six-year period.

After World War II, agrarian land reforms were implemented in Japan. The reforms transformed tenant-farm households, once the main provider of hired labor in agriculture, into owner-farm households. This led to a rapid decline in the hiring of agricultural labor. Further, compensation through meals for daily laborers was important only during the first few years after the war when there was a food deficit; it disappeared quickly as the economy recovered from the effects of the war. Currently, in-kind payment is not observed in Japanese agricultural labor markets.

2.2 India and Pakistan

In sharp contrast to Japan where the majority of farm work was done by family labor in a peasant mode of production, hired labor played an important role in South Asian agriculture. Owing in part to the caste-based division of labor, the landlord class did not prefer to perform manual farm work; instead, it concentrated 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 on the decline in both countries. Various factors are responsible for this change: land reform legislation that has imposed ceilings on land holding acreages, equal division of land upon inheritance among children, and increase in non-farm employment opportunities in rural areas. On the other hand, the dependence on hired agricultural labor has not declined as fast as the share of large holdings has. In fact, the share of daily labor in the total hired labor has increased substantially in India and Pakistan. From the perspective of agricultural laborers as well, daily labor may be more attractive than seasonal or permanent labor because it is more compatible with non-farm work and means less social dependence on employers (landlords and rich farmers). The most important contrast between pre-war Japan and the Indian subcontinent is in the

composition of rural households: the majority of rural households in the former were tenant- or owner-farm households, with very few households purely dependent on agricultural labor from outside the family, and rural households in the Indian subcontinent were divided into landed households and landless agricultural laborer households.

Unfortunately, there are limited time-series or historical national data on the modes of compensation to agricultural laborers in India and Pakistan.[5] The incidence of in-kind wages in the subcontinent can be shown in two ways: (1) by the share of in-kind payment in the total payment made to laborers by employer-farmers, as done in the case of pre-war Japan, and (2) by the share of in-kind receipt in the total wage receipt of agricultural laborer households, which is not applicable to pre-war Japan because of its small number of agricultural laborer households. In recent years, household income and expenditure surveys in India and Pakistan have routinely covered rural population in their sampling framework. In several of such surveys, in-kind receipts are distinguishable from cash receipts, enabling us to compile the second index of in-kind wages.[6] Such information, however, is not available in historical records. On the other hand, the first index of in-kind wages can be compiled from available historical records, to which we now investigate.

British Punjab in the 1920s and 30s

Farm Accounts in the Punjab (FAP) is an example of a source of historical record on household-level information mentioned in the previous sub-section. In 1923/24,[7] the Board of Economic Inquiry, Lahore, first conducted farm account surveys in which detailed accounts of selected farms in the British Province of Punjab (roughly corresponding to regions currently in Punjab Province of Pakistan and the two Indian states of Punjab and Haryana) were collected. The initial reports covered 10 farms or thereabouts; later, the coverage increased to approximately 30 farms. Since the Board tried to track the same farms every year, some of the sample farms were re-surveyed over an extended period. Although their small number of observations and subjective choice of "representative" samples have to be carefully considered, the accounts are a valuable source of micro data on British Punjab's agriculture.[8]

The 1925/26 report features the case of an owner-cum-tenant farm household with over 46.5 acres of agricultural land in Lyallpur District (Stewart and Singh, 1927, pp.9-14). This farm belongs to a member of the upper social stratum in the Canal Colony of Punjab. In addition to 28 acres of land owned by the household, it rented 18.5 acres on a fixed cash rent basis. The farmer grew wheat (25 acres), cotton (9.75 acres), chick pea (3.25 acres), and other crops, from which he obtained a gross

[5]Hirashima (1978) notes that the lack of knowledge among planners and scholars in South Asia on the socioeconomic conditions of non-farm households in rural areas is clearly reflected in the development theory and policy they have produced (p.102).
[6]See footnote 10, for example.
[7]This corresponds to the agricultural year, which stretches between July 1 and June 30.
[8]See Kurosaki (2001a) for the farm-level analysis of long-run changes in cropping patterns in Punjab, using the same pre-partition source of FAP.

revenue of Rs.4,654, out of which the farm expenditure came to Rs.2,028, including the cost of hired labor. In addition to family labor, the farmer hired two permanent laborers, one seasonal laborer for seven months, and some 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 a food allowance of wheat and maize (fixed amount of grains per year). The seasonal laborer received Rs. 74.1, of which 54% was in cash and the rest in kind such as meals, footwear, and clothing. The payment to daily laborers for farming operations other than harvesting was made in cash, amounting to Rs.16.9. The harvesting and winnowing laborers received their wages in kind (fixed share of harvested/winnowed amount); at the same time, instances of cash payment (about 13% of the payment) were also observed. Summing up all these payments, it turned out that 11.0% of the total payment was made in cash while 89.0% was made in kind. In addition to the payments to agricultural laborers, the farmer paid four *Kammee* households, such as the barber and carpenter.[9] The total payment made to the *Kammee* households amounted to Rs.53.4, all of which was in kind (grains and fodder). About one-fourth of the gross crop revenue was used as in-kind payment to laborers and artisans. As in-kind payment, 20.7% of the total produce of wheat, the staple crop in the region, was given to agricultural laborers and 1.7% to *Kammee* households.

FAP reports provide micro data 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, decomposed as follows: 28.9% in cash; 40.7% in the form of harvested crops (the imputed value kept by the laborers as fixed share); 25.5% in another form of in-kind payment (the imputed value of meals provided to the laborers or of food allowance (grains) given to the laborers); and 4.9% in clothing 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 [SD] in parentheses). Out of the 27 cases, 14 cases reported no cash payment. The 1934/35 FAP report also offers detailed information on 20 permanent laborers hired by 18 farmers. The average in-kind share was 71.1% including meals and 48.2% excluding meals, showing that the shares of in-kind payments were very stable in the short run.

The variation in the modes of payment to permanent laborers appears to reflect regional and class variations. Over a longer horizon of the 1920s and 30s, minimal change was observed. For example, data of twelve years, from 1925/26 to 1936/37, are available for the Lyallpur farmer described above. The number of permanent laborers increased to three in years when additional land was hired in. Depending on the tasks assigned for each permanent laborer, the sharecropping ratio changed in the range from 1/15 to 1/10. Despite these changes, the basic pattern was very stable:

[9] *Kammee* households are landless households in rural Punjab that 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).

payment to permanent laborers through a combination of sharecropping and 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.

Thus, historical records from British Punjab and pre-war Japan clearly show a contrast: During the 1920s and 30s, in-kind payments were more important in Punjab than in Japan.

Pakistan Punjab in the 1980s and 90s

Surveys for FAP continued in Pakistan Punjab, even after the partition of India and Pakistan in 1947. Random sampling was introduced and the number of observations was increased. FAP reports in the 1980s and 90s show only average figures for each stratum and region. Another change in this period pertained to the inclusion of rural non-farm households into the household income and expenditure survey.

To examine changes in cash versus kind wages in the 1980s and 90s, we extracted micro data of farm households in Sheikhupura District from the FAP survey. This dataset was used by Kurosaki (1998) and Kurosaki and Fafchamps (2002) and covers about 100 households for each of the three years (unbalanced panel) between 1988/89 and 1990/91. Sheikhupura District is close to 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. With regard to wheat, the most important crop and source of staple food in Punjab, 20.5% of the gross output was used as in-kind payment to workers and another 1.2% as payment to *Kammee* households. The sum of the two, which indicates the share of the produce used as in-kind payment, is distributed in the range from 0.008 to 0.518, with an average of 0.220 (SD: 0.081). On the other hand, the share of in-kind wage receipt in the total labor income was distributed between 14% and 53% among non-farm households. Although not directly comparable, these figures indicate that in-kind wages continued to be important in Pakistan Punjab in the 1980s and 90s.

Deccan India from 1970 to 2010

As another example from the Indian subcontinent, two micro datasets from the Deccan Plateau are investigated. The first one is collected by the International Crops Research Institute for the Semi-Arid Tropics, known as the ICRISAT panel data (Walker and Ryan, 1990). It covers 40 households each year between 1975 and 1984 in three villages in India's semi-arid tropics, namely, Aurepalle (Andhra Pradesh), Shirapur (Maharashtra), and Kanzara (Maharashtra). Information on wage receipt in kind is available in this dataset.

Figure 2 shows the ten-year time series for each village, reflecting the trends in in-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 in-kind wage receipt in the total wage receipt in a year, while the lower portion plots the share of households that received part of their wage income in kind in that year. The total wage income includes the non-agricultural income, although its share is low. 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.

Figure 2 provides a number of observations. First, the share of in-kind wage receipt in the total wage receipt differed significantly across villages. Aurepalle had considerably higher shares than did the two Maharashtra villages. According to Walker and Ryan (1990, pp.110-114), daily laborers in Maharashtra villages in the 1970s were paid only in cash and permanent laborers were paid either only in cash or in cash and food grains; in sharp contrast, permanent laborers in Andhra Pradesh villages were paid only in kind (crop harvest) and daily laborers were usually paid in paddy. The second observation is that the share of in-kind wage receipt in the total wage receipt decreased over time. The decrease was the most substantial in Aurepalle. In Kanzara, however, a slight increase in the share of in-kind receipts was observed in the early 1980s. This was reflective of an improvement in the per-acre cotton output, for which labor was paid on a sharecropping basis. In other words, the incidence of in-kind payment did not increase even in this village. Third, the share of households that received part of their wage income in kind reveals no trend or spatial differences. In all three villages, more than half the sample households received kind wages, with a marginal difference across the villages.[10] It can be concluded, therefore, that in-kind payment declined in terms of value but not incidence.

The second dataset from the Deccan Plateau is taken from our 2005 survey of villages in Kurnool district, Andhra Pradesh. The data were collected as part of a project on child labor and intra-household resource allocation (Fuwa et al., 2006). A random sample of about 400 households was chosen from over 32 villages. The dataset contains 840 individuals who reported a positive wage income. The share of in-kind wage receipt in the total wage income for these 840 individuals was 6.2%. Out of 840 individuals, 44 (incidence rate of 5.2%) received positive in-kind wages. The in-kind wage receipt of individuals showed large variation: its standard deviation was almost equal to the average total wage receipt. Therefore, it can be said that in-kind wages were considerably less important for the Kurnool dataset than for the ICRISAT dataset, both in value and incidence. Having said this, Kurnool had some seasonal laborers for whom in-kind wage was critically important. Further, daily laborers were paid in cash only, without any meals. We could not obtain any information as to the practice of paying in-kind wages to daily laborers was discontinued.

[10]Interestingly, a national-level Indian report based on the national sample survey (NSS) in 1993/94 shows that 7.1% of rural Indian households reported receipt of part of the wages or salaries in kind during the 30 days preceding the date of survey (NSSO, 1998: 10). Whether this figure indicates a rapid decline in the dispensation of in-kind wages following the lapse of the ICRISAT survey period or points to severe underreporting owing to the short reference period adopted in the NSS survey is a research question earmarked for further investigation.

2.3 Myanmar (Burma)

Although labor contracts are potentially diverse in terms of incentives, contract periods, and payment materials, only one type of contract is generally observed for a particular farm operation in a particular village. The diversity is usually observed across villages or time or farm operations or crops.

There are some exceptions to this general tendency. Rural Myanmar data analyzed by Kurosaki (2008) reveal different labor contracts for the same farming operation for the same crop in the same village.[11] The sample survey was conducted in 2001, covering eight regions representing different agricultural zones in Myanmar. The sample comprised 341 farm households and 180 non-farm households.[12] Farm households were those that had land tillage rights, while non-farm households were those that did not.[13] As Kurosaki (2008) showed in detail, unpredictable and inconsistent rice procurement policies in Myanmar during the survey period resulted in low income for rice-producing farm households and food insecurity for non-farm households. Food security was thus the principal concern for the households in the Myanmar sample, especially the low-income rural households.

In rural Myanmar, the two categories of daily and seasonal laborers are clearly distinguishable from each other (Takahashi, 2000). In the data used in this paper, the average share of income from daily farm labor in the earned income[14] of all sample households was 12.7%, while that from seasonal farm labor was 2.6%. Farm households that usually employ daily and seasonal laborers sometimes also send family members to perform agricultural labor on others' farms. The share of income from daily farm labor in the income of farm households was 5.0% and that from seasonal labor was 0.1%. In contrast, the income share of farm wages was higher among non-farm households: 34.4% (daily labor) and 9.5% (seasonal labor).

Table 2 shows the characteristics of 223 seasonal labor contracts observed in 521 sample households. The table combines information from seasonal laborers whom we surveyed and information from employers/farmers whom we surveyed and who hired seasonal laborers. The upper half in the table shows the distribution of the 223 observations by means of payment. For about 30%

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

[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 development of land use rights in Myanmar.

[14]Overall, the average annual per capita income was 36,000 kyats. If this figure is converted at the market exchange rate of 650 kyats/US$ prevailing during the study period, the equivalent dollar figure is $55 per person per year. Thus, it can be inferred that income in the sample villages was low, but not very different from the average value in rural Myanmar. If the abovementioned income is converted using the price of rice in the Yangon market (56 kyats/kg) prevailing during the study period, it is equivalent to 640 kg of rice per person per year.

of the contracts, the main wage was paid in cash only. Approximately 70% of these 30% were accompanied by meals. Therefore, only less than 10% of seasonal labor contracts were purely cash contracts involving no in-kind payments.[15] In contrast, in about 60% of the observed contracts, the main wage was a combination of cash and in-kind benefits. More than 80% seasonal laborers were served meals. To correct for differences in significance among all the categories of compensation in the rural economy, the share of each mode of payment in the total compensation was re-calculated in kyats,[16] as reported in the last column of Table 2.

The second half of Table 2 shows the composition of average monthly payment to a seasonal laborer in kyats. The average monthly payment was 7800 kyats per seasonal laborer, implying that 23 man-months of seasonal labor supply were required to earn an amount equal to the average household income of a five-member household. Out of 7800 kyats, 40.9% was given in cash payment, 11.2% in kind payment such as paddy, 3.7% in other in-kind payment such as tobacco and clothing, and 44.3% in meals.[17] The composition reveals a rather high share of in-kind wages paid to seasonal laborers in rural Myanmar.

Table 3 is analogous to Table 2 but covers the characteristics of daily labor contracts, pooling information on approximately 1,700 daily laborers and 1,400 farmers employing daily laborers.[18] The upper half of the table shows the distribution of the 3,100 observations by means of payment.[19] There are four broad categories, each of which includes several sub-categories. First, wages fixed in monetary terms and paid per labor hour (kyats/day) were found most frequently, accounting for 79% of the 3,100 observations of hired labor. The remaining contracts were diverse. Piece-rate contracts in cash, which would prevent workers' shirking by giving them incentives to complete farm operations quickly, accounted for 15% of the 3,100 cases. The last two categories are those associated with the main payment in kind. Fixed wages in kind accounted for 2.5% and piece-rates in kind, such as sharecropping, accounted for 1.8% of the 3,100 cases. About one-third of the daily work contracts had meal provision (usually one meal but in several cases two or three meals).

The bottom half of Table 3 shows the composition of average daily payment in terms of kyats.

[15]This is calculated from the first data row in Table 2 as 29.15*(100.00 – 69.23)/100 = 8.97.

[16]To calculate the total monetary worth of in-kind payment, we converted the quantity information provided by the employer or the employee into monetary figures using village prices.

[17]There is some arbitrariness in converting served meals into money. 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.

[18]Some households reported multiple contracts with members serving both as employees and employers; some reported contracts as employees; some as employers of multiple casual laborers; and the rest neither employed others nor were employed by others.

[19]In addition to those shown in the table, there are other ways in which the wages paid to daily laborers varied. For instance, when the payment was made in cash, such as in 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 (monthly interest rates in the study regions were in the following ranges: around 10% was charged in the informal credit market without collateral; 3–5% by private pawn shops; and 1.25% on agricultural production loans provided by the public sector).

The average daily payment was 184 kyats per daily laborer, implying that 900 man-days of daily labor supply were required to earn an amount equal to 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. However, the average in-kind earnings were far from negligible; in fact, they constituted the main source of living for some households (note that the standard deviation of in-kind daily earnings is 57.1 kyats, which is comparable to a third of the average daily payment). Interestingly, if a daily laborer worked 30 days in a month, his monthly earning came to be larger than that of a seasonal laborer if we ignore the imputed value of meals, whereas the opposite was true if we include the imputed value of meals.

2.4 Summary of the historical and contemporary datasets survey

The incidence of in-kind agricultural wages from historical and contemporary datasets 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, in-kind payment was important in the initial stages of development and it continued to be so though its share declined in the long run. Second, in-kind wages were more evident in harvesting or cultivating food crops, even in contemporary developing countries. Third, there existed considerable geographical diversity. Pakistan's Punjab has the highest incidence of in-kind wages, while in-kind wages ceased to be in effect much earlier in Japan, with Myanmar falling between these two countries. Within each country too, the regional difference was substantial, as shown for pre-war Japan and ICRISAT India. Fourth, the incidence of food grains used as in-kind wages was found more often when the employer was a large-scale farmer and the employee a landless worker, implying class disparity.

3 Theoretical Explanation of In-Kind Wages in the Literature

Despite the significance of in-kind wages as shown in the previous section, there are few theoretical models on in-kind wages in the literature. Five volumes of development economics and four volumes of agricultural economics published by Elsevier as part of the Handbook of Economics series only briefly mention in-kind wages while describing the characteristics of labor markets in developing countries.[20]

In mainstream economics, the dominant view appears to be that in-kind payment in agriculture will be completely eroded during the process of transition of a developing economy to a market economy. This is because in the latter, paying wages in cash is the most efficient way of

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

saving on transaction costs.

However, as shown in the previous section, even in an economy where commercialization has penetrated deeply, labor transactions with in-kind payment continue to exist. Economic anthropological literature interprets such transactions as those that occur primarily in the dispensing of community and religious services (Kasuga, 2007). An implication of this interpretation is that the practice of in-kind wages will survive even in commercialized economies because community or religious services cannot be completely commercialized. Such views from the perspective of economic anthropology find resonance with the views on in-kind wages in development economics, wherein it is held that in-kind wages reflect incompleteness in markets. The following sub-sections collate theoretical explanations for the existence of in-kind wages and classify them into three groups.

3.1 Imperfect market for the good used for in-kind payment

If the market for a good, which is a necessary good for the employee, is so imperfect that the employer can supply it at a cost considerably lower than the market price to the employee, then there occurs efficient resource allocation when the employer provides the employee the good as (a part of) compensation for the latter's labor. As an extreme case, if the food market is missing, the payment should include 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 weighty. High transaction costs imply that the shadow price of food for large-scale farmers who have market surplus is considerably lower than that for marginal farmers who need to purchase food from the market (Key et al., 2000). The price differential between net sellers and buyers is analogous to the fob-cif band referred to in the international economics literature. If a price differential exists, the employer-farmer can reduce his effective payment to workers by paying in kind.

Regarding the provision of meals to workers, one explanation is that it is a time-saving mechanism that precludes the need for workers to go home for meals (see for example, Bliss and Stern, 1982). This explanation can be interpreted as a version of the fob-cif price band theory. Even if the cost of meals in terms of raw materials and cooking fuels is the same for both 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 satisfactorily explains the situation in rural Myanmar, the econometric analysis of this paper is focused on the mode of payment for the main wages and not the provision of meals.

Economies of scale and scope could also explain how the employer can supply various goods and services at costs lower than the market price to the employee (Alston and Ferrie, 1986). In-kind provision of benefits to the employee, through the exploitation of the scale or scope economy, may be an effective means for the employer to ensure that his labor requirement is met, since in-kind

provisions make workers more dependent on the employer (Alston and Ferrie, 1993).

3.2 Imperfection in labor markets

Another explanation for the prevalence of in-kind wages focuses on the imperfection in labor markets. The fundamental problem in hiring labor is information asymmetry: the employer does not know the actual effort level of workers and can neither monitor nor enforce their effort level. Although working hours can be monitored or regulated, they are not the real input in determining the output. Labor effort is the real input. By paying workers in kind, the employer may be able to render such information asymmetry irrelevant.

The first way of combating information asymmetry in an imperfect labor market is based on the nutrition-based efficiency wage theory (Dasgupta and Ray, 1986). The human body has a basic metabolic need for calories, which it uses to perform work. There exists a non-linear, S-shaped relation between nutrition and athletic output. Given such relations and the possibility that malnutrition may be widespread among the low-income labor population, the employer may offer an efficiency wage to workers. The efficiency wage is likely to be much higher than the level that clears the labor market, and rations the employment among similar landless workers. Only the hired workers will receive sufficient nutrition. This is the essence of the efficiency wage model of Dasgupta and Ray. However, since money is fungible, a moral hazard may occur in that a worker will not eat enough, spend his cash income elsewhere, and provide the employer with inefficient labor. To avoid this moral hazard problem, the employer provides meals to daily and seasonal workers and provides the main reward in kind.

The second explanation is related to incentive wages. The orthodox model of sharecropping tenancy justifies its existence as a mechanism required to maintain a healthy balance between the provision of incentive to work and the provision of risk-sharing against fluctuations in crop output (Stiglitz, 1974). By paying the worker proportional to his/her harvest, the worker is incentivized to work hard while bearing part of the risk of failure. For the implementation of this mode of payment, the total harvest needs to be determined and divided among the workers proportionally.

Bardhan (1984) explicitly offered these two explanations (nutrition-based efficiency wage and incentive wage) for the widespread prevalence of in-kind wages in India. However, there is opposition to both theories. Swamy (1997) demonstrated that the existing level of agricultural wages was sufficiently high to allow workers to avoid malnutrition, implying that a simple nutrition-based efficiency wage theory may not be valid empirically. Further, meals are automatically consumed by the worker but any payment in grains may be re-sold and thereby defeat the nutritional objective. 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 him/her the monetary value of the crop. In this sense, the incentive wage explanation cannot prove that in-kind payment is superior to cash payment.

There are cases, however, where the above equivalence breaks down and incentive wages in

kind are shown to be superior to incentive wages in cash. In 1994, the author visited several cotton farms in southern Punjab in Pakistan, a region known as the cotton zone. The eastern side of a main canal was occupied by a large-scale farm, wherein cotton was grown over several hundred hectares of land, while the western side was occupied by many farms of medium size, each around 5–10 hectares. On both sides, female cotton pickers were hired on a daily basis and paid in incentive wages. In the market, the cotton from the eastern farm fetched prices 5–10% lower than the cotton from the western farms. According to a survey by agronomists, both types of farms grew the same variety of cotton and the quality of cotton on both sides of the canal was the same. The reason for the price differential was in the difference in efforts invested by the cotton pickers. On 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 without putting in the effort to sift out sticks and leaves. The monitoring by the employer was not successful in completely avoiding this moral hazard. On the other hand, on the medium-sized farms, cotton pickers were paid in kind, that is, the pile of cottonseeds was divided in front of the farmer-employer and the pickers received one of the divided piles. This gave the cotton pickers the incentive to pick dry cottonseeds only and weed out leaves and sticks. The difference in quality led to a price differential. This case demonstrates that in-kind incentive wages ensure higher quality in produce. Even in this case, however, if incentive wages can be made proportional to the market value of the harvested cottonseeds, there is no difference between in-kind and cash incentive wages. In this sense, incompleteness in agricultural produce markets is required to justify the existence of in-kind wages.

3.3 Imperfection in insurance markets

In developing countries with low per-capita income, like those surveyed in Section 2, poor households have few means to hedge against production fluctuations and price shocks that may put their livelihood at risk (Fafchamps, 2003; Dercon, 2005). Explicit insurance markets rarely exist in villages and informal risk-mitigating arrangements, including informal credit and private transfers, are far from efficient in serving as *de facto* insurance mechanisms (Ligon et al., 2002). This implies that poor households in developing countries attempt to mitigate risk through various income-smoothing measures (Fafchamps, 1992; Kurosaki and Fafchamps, 2002). Among the potential sources of uninsurable risk, food price variability is the most hazardous, since the poor tend to spend primarily on food. Under these conditions, if a worker receives part of his/her wage income is paid in food, the bulk of family consumption of his/her household is stabilized; this in turn improves the household's welfare level. In other words, kind wages can complement existing insurance mechanisms. To the best of my knowledge, Bardhan (1984) was the first to point out this function of kind wages in the literature, noting, "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 did not formally model this idea, recent studies present mathematical models to elucidate this

function (e.g., Datta et al., 2004; Kurosaki, 2006; Ito and Kurosaki, 2009). In this paper, a version of the theoretical models that share the basic ideas of Kurosaki (2006) and Ito and Kurosaki (2009) is presented. In comparison to the model of Datta et al. (2004), the version proposed in the next section is more general in that it depends less on the specification of workers' utility functions, and is more appropriate for the analysis of low-income workers in developing countries in 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 discussed in the previous section presents an interesting perspective for the understanding of in-kind wages. For developing economies in a nascent stage of development and faced with low nutrition levels among the population, the explanations based on incompleteness in crop markets and labor markets may be valid. However, in contemporary developing countries, food markets are developed and the average level of nutrition among the rural populace has improved substantially. The question that remains to be asked then is, why do in-kind wages continue to prevail in such environments?

As probable answers to this question, this section presents a version of the theoretical models based on imperfect insurance markets. The starting point is that thin food markets exist and insurance opportunities are limited, especially for low-income households with a high food budget. In such an environment, laborer households may find wages paid in kind (food) more attractive for reasons of food security. The model presented 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 focus on the trade-off between cash and in-kind wages, the theoretical model in this section assumes away contingent labor contract issues such as the monitoring of workers to prevent shirking and the interlinking of labor contracts with other contracts such as those for credit and land. This section assumes a unitary decision-making process at the household level with respect to labor allocation (Singh et al., 1986). Recent literature has proposed non-unitary household models 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 disregarded. By focusing solely on the trade-off, this model clarifies the significance of laborers' consideration of food security in a straightforward manner.

To reflect the conditions in 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. Owing to thin agricultural produce markets (Fafchamps, 1992) and possible unpredictable interventions by the state in rural marketing (Kurosaki, 2008), the price of food, p, fluctuates; its mean is $\overline{p}$.

For simplicity, we fix the total labor supply at $\overline{L}$, ignoring the labor-leisure choice. Because of the limited available opportunity to cope with risk *ex post*, the worker's household behaves in a risk-averse manner. At the time of deciding on labor allocation, the household's *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 food and 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 following conditions:

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

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, while the fourth implies that for a given income level, the laborer's welfare deteriorates when 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 improves when the correlation between food price and income becomes more positive, with the income mean, price mean, income variance, and food price variance being constant. Since a positive correlation between food price and 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 performed in this paper.

Given the preferences mentioned above, the worker household decides on labor allocation. There are two types of labor contracts to which the household can allocate labor $\overline{L}$ (indicated by subscripts 1 and 2). Since the total labor supply is fixed, the decision variables are the shares of each type of labor (ℓ_j, $j = 1,2$). From each contract, the household obtains a labor return of π_j, which is stochastic and responsive to the level of the worker's human capital. Thus, the household's

[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 $v_{pp} < 0$. In their analysis of contract choice between cash and in-kind wages in low-income economies, Datta et al. (2004) adopted a constant elasticity of substitution (CES) utility function, which includes 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 improves 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 $v_{pp} < 0$.

optimization problem is expressed as[22]

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

subject to the following 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 ($j = 1,2$) is also subject to 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 equations (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 $\psi \equiv -\bar{v}_{yy}\bar{y}/\bar{v}_y$, 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) denotes the *direct profitability effect*. When labor type 1 is associated with higher expected payment than labor type 2 is, the labor supply to type 1 will increase. The third term implies 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 greater 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 food ($s > 0$), the covariance between 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 $v_{yp} > 0$ is equivalent to the assumption $\psi > \eta$ in this approximation, which is likely to be satisfied for low-income households (Fafchamps, 1992). Therefore, when the household has a stronger food security consideration, it prefers a labor type associated with wages that are more positively correlated with food price. This effect is strengthened when the household spends more on food (higher s) and the household's income

[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} and v_{yyp}, is equivalent to assuming unskewed distribution for p.
[24]To derive this expression, Roy's identity is used, resulting in the relation $v_{yp}/v_y = s(\psi - \eta)/p$.

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) demonstrate the theoretical possibility of the consumption preference effect leading to a perverse supply response of agricultural production with respect to production risk (risk-averse farmers increase the production of a more risky crop). Kurosaki and Fafchamps (2002) show that the consumption preference effect is empirically significant in explaining poor farmers' choice of crops in Pakistan. Therefore, it can be supposed that the consumption preference parameters may affect choices in labor supply portfolio as well. However, this hypothesis has not been tested in existing empirical studies, because of which this paper attempts it in the next section. Before conducting 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 the following conditions: $\pi_1 = wp/\overline{p}$, $\pi_2 = w$, and $y = y_0 + \{\ell_1 wp/\overline{p} + (1-\ell_1)w\}\overline{L}$. Inserting these into equation (5), we can explicitly solve for the optimal labor share ℓ_1^*:

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

From this, the following comparative statics can be obtained:

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

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

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

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

Existing literature on wage contracts does not posit the above propositions. Since the propositions above are derived from approximation, approximation errors may exist. Therefore, exact solutions are simulated in numerical examples to determine the robustness of the theoretical propositions, using the specification with a risk-averse linear expenditure system (LES)[25] that satisfies the conditions in equation (1). In numerical simulations, p is assumed to have a uniform or triangular distribution, and the optimal portfolios are calculated for different combinations of risk preferences and consumption preferences. Simulation results, available on request, 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 hiring labor chooses a contract type from the following 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 (2009) theoretically analyze the case where agricultural households decide their labor supply for 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 stated in the previous sub-section. 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 a correlation similar to that in Proposition 1 (e.g., households paid in kind accidentally increased food consumption because food was available abundantly at home). The direct effect of y_0 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 way of testing the propositions could be to structurally estimate preference parameters simultaneously with labor supply determinants, as adopted by Kurosaki and Fafchamps (2002). Since the Myanmar dataset is cross-sectional, it is difficult to apply this approach.[26]

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

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

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

hypothesis:

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

The next section explains how we estimate *S_labor*, the ratio of the worker's average food requirement to his/her expected income. Our basic empirical strategy is to use reduced-form regression models to test whether *S_labor* positively affects ℓ_1^* even after controlling for other factors that should affect households' labor supply. The other explanatory variables include 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 built on the assumption that in-kind wages enhance food security because of missing insurance markets, but also with the theoretical model that assumes that in-kind wages help save on transaction costs (e.g., Key et al., 2000). As an alternative theory that may result in the relation *S_labor* positively affects ℓ_1^*, it can be posited that the shadow price of food for workers who need to purchase food to supplement in-kind wage receipt should be higher (market price + transaction costs) than that for workers who sell food from their stock, including in-kind wage receipt (market price – transaction costs). Under this theoretical model, therefore, workers with higher *S_labor* are more likely to be associated with higher ℓ_1^* in the data since such workers are more likely to a net buyer of food.

To distinguish between the two theories, we perform an additional test using the dummy variable *D_labor*, which is defined as the status of a household wherein the average food requirement exceeds the total wage income from agricultural labor supply. If *D_labor* = 1, the household is a definite purchaser of food to supplement in-kind wage receipt, so that its shadow price for food is the sum of market price and transaction costs. If *D_labor* = 0, there is a high probability of the shadow price being equal to market price minus transaction costs. As shown by Key et al. (2000), under the transaction cost model, a marginal change in purchase/sales has little effect on household behavior as long as the household's status as net purchaser/seller does not change. Therefore, we expect *D_labor* to be a better predictor of ℓ_1^* than *S_labor* is, under the alternative thery. On the other hand, under the food price risk model, *S_labor* should be the better predictor of ℓ_1^* than *D_labor* is. To examine which of the two variables, *S_labor* or *D_labor*, explains ℓ_1^* better, we estimate a reduced-form model by replacing *S_labor* with *D_labor* and a reduced-form model by adding *D_labor* to *S_labor*.

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 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 only daily labor transactions. This is because seasonal labor contracts were mostly predetermined on the basis of long-term relations between the employer and the employee (Takahashi, 2000). Therefore, there was generally little scope for a worker to make adjustments to his/her contract. On the other hand, the daily labor markets were more flexible—worker households were free to decide the amount of labor supply under each type of labor contract. Sample households that did not supply any daily farm labor to the market were excluded 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 contained 219 households.

Table 5 shows the definition and summary statistics of empirical variables. The main dependent variable is *inkind_md*, denoting 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,[27] another dependent variable, *inkind_no*, based on the number of contracts per household, was calculated and used in robustness check. Although *inkind_no*, is less likely to have measurement errors, it is slightly different from ℓ_1^* in the theoretical model; that is, *inkind_md* is a more direct proxy for ℓ_1^*. The correlation coefficient between *inkind_md* and *inkind_no* is 0.942.

The above strategy assumes that in-kind wages are paid in crops whose price is perfectly collinear with food price in the theoretical model. However, in reality, some cases of in-kind payment were observed in rural Myanmar for the harvesting work done for pulses and sugarcane, whose prices were not perfectly collinear with the price of rice. Furthermore, cases with wage payment in the case of pulses or sugarcane were all based on sharecropping arrangements. Since such arrangements stipulate that workers bear part of the output risk, the additional risk may affect their decision making regarding labor supply. To avoid this complexity, we implement another robustness check in which we limit the sample to cases with time wages only and use *inkind_fx*, (labor supply in man-days under daily labor contracts where the main payment was fixed in kind divided by labor supply in man-days under daily labor contracts where the main payment was fixed either in cash or kind).

Two types of explanatory variables are included. The first type includes variables characterizing the worker household. As discussed in the theoretical section, employee characteristics

[27]This is because employer-farmers sometimes do not exactly remember the man-days put in by workers when the work is done under incentive wages.

such as food security considerations, risk aversion, and the incentive to shirk, affect the contract choice. To represent human capital, sex, age, and level of education (in terms of schooling years) of the household head are included. The size of the farmland owned by workers is included as an indication of the extent to which they can secure food from their own farmland. Therefore, a finding that shows that more landed worker households have reduced the labor supply for work paid in kind is consistent with food security considerations. Non-land asset values such as livestock and transportation equipment are also included to control for liquidity effects. Finally, as a direct control for household food security considerations, *S_labor*, indicating 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 monetary value of annual 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 is. With a correlation coefficient of 0.7749 (the linear independence is rejected at the 0.1% level), the variable is highly correlated with the observed value of the food budget share. 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*, is 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—an inevitability considering the small number of survey villages. 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), two-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

5.2.1 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 not high, 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 is estimated by replacing the dependent variable *inkind_md* (in-kind share based on man-days) either with *inkind_no* (in-kind share based on the number of observations), which is less subject to measurement errors, or with *inkind_fx* (in-kind share using only the subsample of fixed wages). The results are reported in the first three upper-block rows in Table 7. The coefficients on *inkind_no* and *inkind_fx* are similar to the one on *inkind_md* and remain statistically significant. Considering that several restrictive assumptions are needed to estimate the Tobit model, we re-estimate the model by employing a linear specification using Huber-White heteroskedasticity-robust standard errors (Table 7, rows 4–6, upper block). Because the non-linearity is ignored, the coefficients on *inkind_md*, *inkind_no*, and *inkind_fx* become smaller but 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 support the view that a laborer whose food expenditure is more rigid will supply more to labor paid in kind, which is consistent with the prediction of the theoretical model of in-kind wages focusing on food security in thin food markets.

Coefficient estimates on other explanatory variables in Table 6 also support this interpretation. The dummy variable for female-headed households (*Female_labor*) has a significantly positive coefficient (the in-kind share rises close to 80% if a household is headed by a female). This is another piece of evidence supporting the theory that households' food security considerations affect labor supply, because in rural Myanmar females are usually responsible for family food management; however, it is also possible that the dummy variable may capture other differences owing to assets or income-earning disparity associated with female headship.

Another interesting result from the analysis is the negative effect of landholding (*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. Owning farmland and growing the food they need on it comprise an effective strategy for poor households wanting to secure food for family consumption; therefore, the above result also appears to support the view that a laborer with higher food security concern will supply more to labor 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-estimate a model where the land ownership dummy (*D_land*) is added to control for the heterogeneity associated with the status of being a farm household in rural Myanmar. The coefficient on *Land_labor* remains very similar to the one reported in Table 6, while the coefficient on *D_land* is insignificant. Therefore, marginal landholding matters while the status of farm household does not, lending credence to the theoretical explanation based on food security in thin food markets.

The fixed effects of villages are jointly significant, implying that the importance of in-kind wages differ across villages. We conjecture that the difference could be associated with an inter-village difference in food price risk and the availability of consumption smoothing measures. See Ito and Kurosaki (2009) for empirical support of this idea in 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 is small, which makes it difficult to identify what characteristics the village fixed effects capture.

Although not reported, full estimation results corresponding to the models reported in Table 7 are similar to those reported in Table 6, with respect to the coefficient estimates on *Female_labor* and *Land_labor*. On trying other specifications with different definitions for household-level education and various types of assets, the results are qualitatively similar to those reported in Tables 6 and 7.

5.2.2 Distinguishing the food price risk model from 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 the prediction of a theoretical food price band model of in-kind wages (Key et al., 2000). To distinguish the two theoretical explanations, we re-estimate the model in Table 6, using *D_labor*, which is meant to capture the discontinuity of the shadow price of 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 is estimated with *D_labor* replacing *S_labor*, the coefficient on *D_labor* is 0.03 (both economically and statistically insignificant). When both *S_labor* and *D_labor* are included as explanatory variables, only the coefficient on *S_labor* is significant. In linear specifications, the coefficient on *S_labor* in a model without *D_labor* is the only significant one for *inkind_md*. Although not reported, regression results with *inkind_no* or *inkind_fx* as the dependent variable are similar to those reported in Table 7.

These results support the food price risk model more strongly than they support the food price band model as the main 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 are also estimated by adding employers' characteristics and crop/farm operation fixed effects as a set of explanatory variables. Preliminary results reported by Kurosaki (2006, Tables 7–9) show that the probability of a wage contract paid in kind increases when the laborer's food expenditure is more rigid and the laborer household has less farmland. On the basis of these results, we can conclude that when food security considerations are important for a worker, because of poverty and/or thin food markets, he/she is more likely to accept a contract with wages paid in kind (food) than a contract with wages paid in cash. The observed regularity can be explained better by a theoretical model focusing on food price risk than by a theoretical model focusing on 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 when markets are underdeveloped. 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 under different labor contracts. This was achieved by incorporating considerations of food security as the main explanation for in-kind wages. The theoretical model predicted that when food security considerations are important for workers, because of poverty and/or thin food markets, they supply more labor for work paid in kind (food) than for work paid in cash; this prediction was consistent with empirical evidence from rural Myanmar. Estimation results of the reduced-form determinants of labor supply robustly showed that workers supply more labor for work paid in kind when the share of staple food in their household budget is higher and the farmlands on which they produce food themselves are smaller. The empirical test results also provided stronger evidence in favor of the theoretical model focusing on food price risk than in favor of the theoretical model focusing on food price band.

Despite the importance of in-kind wage payment in the process of economic development, there are few theoretical and empirical investigations explaining its function and rationale in the literature. We compare historical and contemporary cases of in-kind wages across countries in Asia, and conjecture that in-kind wages disappeared from post-war Japan as soon as marginal farmers, who were the major source of agricultural labor supply, were able to grow food on their own farms, resulting in lower demand for in-kind payment. In the Indian subcontinent where the bulk of agricultural workers remain landless, in contrast, the speed of decline in the incidence of in-kind wages has been slow. These descriptive observations and our econometric investigation using Myanmar data shed light on how market incompleteness affects resource allocation in the process of economic development. As future research, we hope to extend the theoretical model presented in this paper so as to allow substitution or complementarity of in-kind arrangements with other types of informal insurance mechanisms. Implementing empirical investigations on in-kind wages in pre-war Japan and colonial India is another direction for future research.

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

	(i) With year fixed effects		(ii) With linear time trend	
	Coeff.	(Std. error)	Coeff.	(Std. error)
Paddy field acreage (normalized)	0.074 ***	(0.013)	0.076 ***	(0.013)
Upland field acreage (normalized)	-0.008	(0.008)	-0.007	(0.008)
Regional dummies				
Tohoku	0.005	(0.040)	0.005	(0.037)
Hokuriku	-0.030	(0.068)	-0.028	(0.071)
Chubu	0.046	(0.050)	0.052	(0.053)
Kinki	-0.104 ***	(0.038)	-0.102 ***	(0.037)
Chugoku	-0.049	(0.053)	-0.044	(0.048)
Shikoku	0.021	(0.044)	0.023	(0.045)
Kyushu	0.135 **	(0.052)	0.139 ***	(0.051)
Year effects				
1926	-0.010	(0.042)		
1927	-0.004	(0.038)		
1928	0.024	(0.043)		
1929	-0.018	(0.039)		
1930	-0.055	(0.041)		
Linear trend			-0.006	(0.007)
Intercept (reference is Kanto Region in 1925)				
	0.228 ***	(0.041)	0.231 ***	(0.032)
H_0: All slopes=0	F (14,395)	7.21***	F (10,399)	8.74***
H_0: No regional effects	F (7,395)	4.80***	F (7,399)	4.71***
H_0: No year effects	F (5,395)	0.76	F (1,399)	0.64
R^2		0.346		0.338

Source: Estimated by the author using microdata explained in the text (applicable to all 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 0.227 (standard deviation at 0.205), weighted by the total payment amount.

(2) Estimated by a weighted least squares approach (weights are the total payment amount); Huber-White robust standard errors are in parentheses; statistically significant at the 1% (***), 5% (**), and 10% (*) levels.

(3) The number of observations is 410 (60 for year 1925, 62 for year 1926, 65 for year 1927, 68 for year 1928, 77 for year 1929, and 78 for year 1930).

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

1. Distribution by wage types	Number of wage contracts			Distribution in the total monetary value (%)
	Number	Distribution in the total number (%)	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	SD	Minimum	Maximum
Contract period in months	5.20	3.32	0.50	13.00
Monthly payment (in kyats)*				
(a) Cash	3181	1700	0	10000
(b) In-kind payments: Crop harvest and grains	870	3227	0	35000
(c) In-kind payments: Tobacco, clothing, 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 SDs (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 in the total monetary value (%)
	Number	Distribution in 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	SD	Minimum	Maximum
Total labor supply (days per household per year)	239.1	221.0	5.0	1825.0
Daily payment (in kyats)**				
Cash	158.2	64.3	0.0	733.3
In-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 daily laborers is 270 as the data are at the household lebel and households with zero daily laborer wage income and outliers are excluded.
** Means and SDs (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 (SD)			
				Including meals		Excluding meals	
Japan (excluding 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)	1934/35-35/36	In-kind payment by farmers to permanent laborers divided by the total payment	47	0.711	(0.343)	0.468	(0.347)
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 text for data sources. All means and SDs (standard deviations) were weighted by the value amount.

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

Variable	Definition	Mean	SD	Min	Max
Dependent variables					
inkind_md	(Annual labor supply in days under daily labor contracts where main payment was in kind)/(Total annual labor supply in days under daily labor contracts)	0.052	0.171	0.000	1.000
inkind_no	(Number of labor supply contracts where 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 under daily labor contracts where main payment was in kind and fixed in quantity)/(Annual labor supply in days under daily labor contracts where main payment was fixed in value or quantity)	0.044	0.156	0.000	1.000
Explanatory variables					
Female_labor	Dummy variable for a female-headed household	0.073		0	1
Age_labor	Age of the household head	43.406	12.152	20	80
Educ_labor	Completed years of formal schooling of household head (value of 2 years assigned when the head attended monastic school)	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	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) (truncated at 1 if greaer than unity)	0.275	0.233	0.026	1.000
D_labor	Dummy variable for a household where the value of the annual amount of rice consumption required (age-sex specific rice consumption coefficients times the vector of the demographic composition) is greater than the total daily labor supply from the household multiplied by the average daily wage	0.356		0.000	1.000
Assets_labor	Total worth of assets (non-land: transportation equipment, livestock, agricultural machinery, monetary assets, etc.) owned by the employee household (in 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 (considering households with choice between cash and in-kind wages that supplied a positive amount of daily agricultural labor), except for "inkind_fx" where the number is 213 (considering households that supplied a positive amount of daily agricultural labor for which 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 SDs (standard deviations) were weighted to reflect the difference in sampling probability across villages and across farm and 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 two-sided weighted Tobit.
(2) Significant at the 1% (***), 5% (**), and 10%(*) levels.

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 between 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 two-sided Tobit model as in Table 6. "WLS" refers to linear regression results with Huber-White heteroskedasticity-robust standard errors, weighted by sampling probability.
(3) Significant at the 1% (***), 5% (**), and 10%(*) levels.

Figure 1. In-Kind Shares in Agricultural Wage Payment in Japan, 1925
(Source: Drawn by the author using microdata explained in the text [applicable to all other tables])

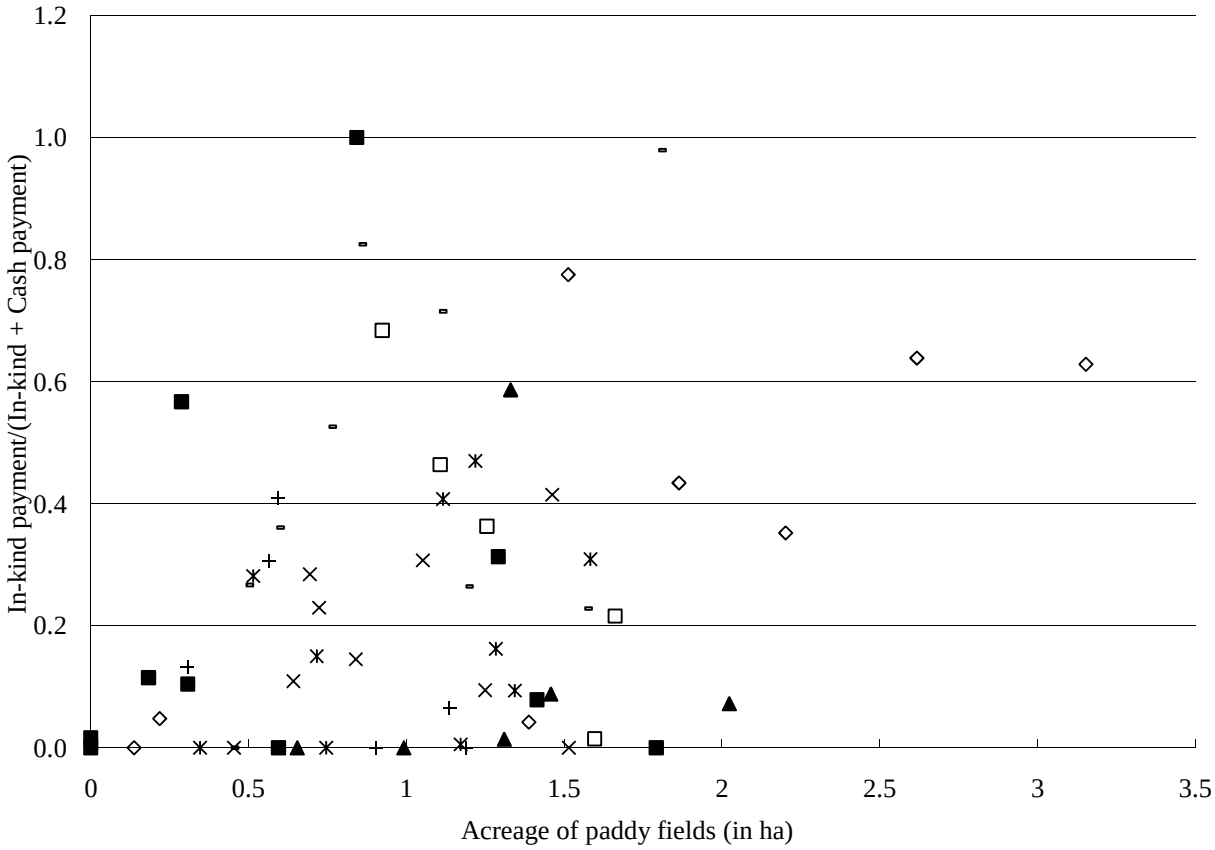
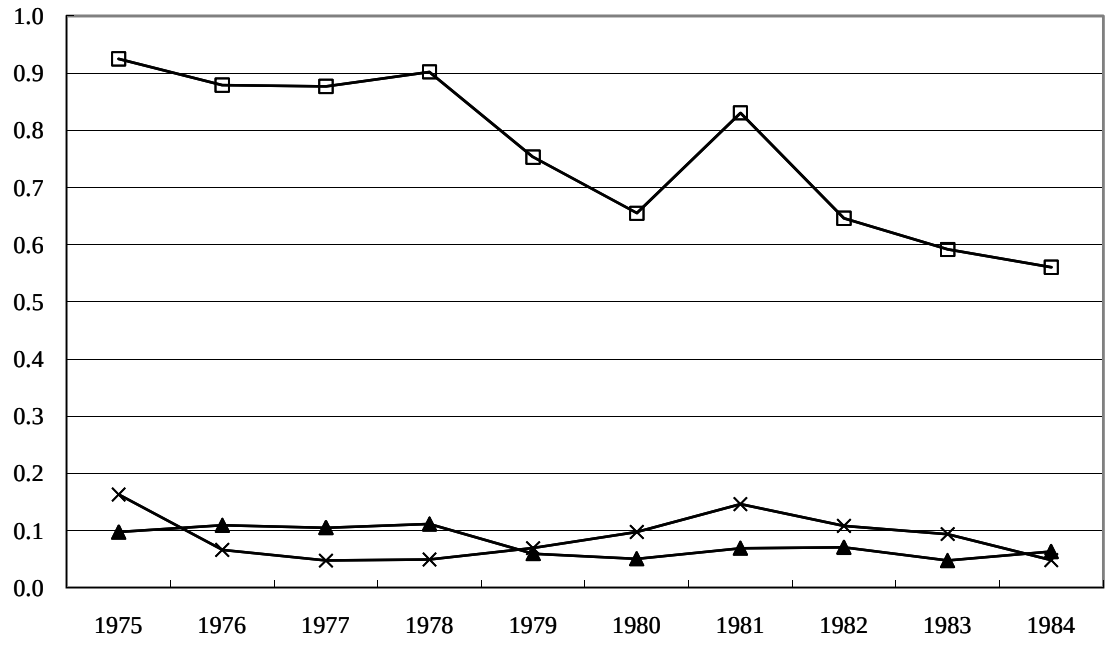


Figure 2. In-Kind Shares in Wage Receipt among ICRISAT Households in India

(a) In-Kind Shares in Total Wage Receipt



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