Rich Periphery, Poor Center: Myanmar's Rural Economy under Partial Transition to a Market Economy*

Takashi Kurosaki#, Ikuko Okamoto♣, Kyosuke Kurita♦, and Koichi Fujita♠

March 2004

Abstract

This paper looks at the case of Myanmar in order to investigate the behavior and welfare of rural households in an economy under transition from a planned to a market system. Myanmar's case is particularly interesting because of the country's unique attempt to preserve a policy of intervention in land transactions and marketing institutions. A sample household survey that we conducted in 2001, covering more than 500 households in eight villages with diverse agro-ecological environments, revealed two paradoxes. First, income levels are higher in villages far from the center than in villages located in regions under the tight control of the central authorities. Second, farmers and villages that emphasize a paddy-based, irrigated cropping system have lower farming incomes than those that do not. The reason for these paradoxes are the distortions created by agricultural policies that restrict land use and the marketing of agricultural produce. Because of these distortions, the transition to a market economy in Myanmar since the late 1980s is only a partial one. The partial transition, which initially led to an increase in output and income from agriculture, revealed its limit in the survey period.

* The authors are grateful to seminar participants at the North-East Universities Development Consortium Conference, the Japanese Economic Association Annual Meeting, Keio University, the National Graduate Institute for Policy Studies, the Institute of Developing Economies, and Hitotsubashi University for useful comments on earlier drafts of this paper. The authors would like to thank Ralph Paprzycki for editorial help. All remaining errors are the authors.'

Corresponding author. Institute of Economic Research, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8603 Japan. Phone: 81-42-580-8363; Fax.: 81-42-580-8333. E-mail: kurosaki@ier.hit-u.ac.jp.

♣ Institute of Developing Economies - JETRO, Chiba, Japan.

♦ Graduate School of Economics, Hitotsubashi University, Tokyo, Japan.

♠ Center for Southeast Asian Studies, University of Kyoto, Kyoto, Japan.

1 Introduction

The objective of this paper is to investigate the determinants of income disparities across regions and among households in rural Myanmar (formerly Burma). Based on a primary dataset collected from eight agro-ecological regions in 2001, we show two paradoxes. First, the income level is higher in villages far from the center than in villages located in regions that are tightly controlled by the central authorities. This is mainly due to the disparity in the development of commercial agriculture and the availability of non-agricultural employment opportunities. In most developing countries, commercial agriculture and non-agricultural activities prosper in regions close to urban centers, not in peripheral regions. The situation is reversed in Myanmar. Second, farmers and villages that emphasize a paddy-based, irrigated cropping system have lower farming incomes than those that do not. This is in sharp contrast to the experience of other Asian countries where irrigation investment in agriculture contributed to rapid improvements in land productivity and farmers' income (Jimenez 1995). The two paradoxes can be summarized as "rich periphery, poor center."[1]

The cause for these paradoxes, as we will show, are the distortions created by agricultural policies. Myanmar is in a partial transition from a planned to a market economy. Market incentives were first introduced during the late 1980s, initially leading to a substantial increase in agricultural production and farming incomes. Yet, a number of discretionary

[1] It is possible that similar phenomena can be found in other transition economies in Asia, such as China and Vietnam. For example, alone among Asian countries, these two successfully introduced hybrid rice, but this success is partly attributable to the fact that their governments ignored the profitability of hybrid rice relative to non-hybrid varieties (Janaiah and Hossain 2003). If the government forced farmers to adopt non-profitable varieties, the income of farmers located in the center is likely to have been lower than that of farmers located in the periphery. Although a full comparison of China and Vietnam with Myanmar is beyond the scope of this paper, we conjecture that before the transition started in China and Vietnam a situation quite similar to the one in Myanmar, including the two paradoxes found in this paper, prevailed. Rozelle et al. (1999), for example, showed that living conditions in China were higher in the center than in the periphery, while Huang and Rozelle (2002) showed that irrigation led to higher incomes of villagers in China during the 1990s. Therefore, the current case of Myanmar is worth examining.

measures, especially relating to land transactions and marketing institutions for paddy/rice,[2] were maintained.

Myanmar is particularly interesting as a case study of regime transition in rural developing countries because of the country's unique attempts to preserve interventionist policies. However, with the exception of a survey conducted by the International Rice Research Institute in 1996 (Garcia et al. 2000) and a few village surveys conducted by Japanese economists (see below), little research on Myanmar's rural economy is available and the effects of these interventionist policies on household welfare are not well documented. One important contribution of this paper, therefore, is to present a cross-sectional view of the behavior and welfare of rural households based on a primary dataset which is more recent, provides more detailed information, and covers more geographically diverse regions than previous studies.

Our research mainly builds on the work by Takahashi (2000) and Garcia et al. (2000), who analyzed several agro-ecological regions and the whole household economy. Takahashi's (2000) study examined the early stage of transition (1987-95) when the new market incentives were the most effective, and our work picks up where Takahashi (2000) left off, investigating the succeeding period. Garcia et al. (2000) and our own study share the same motivation and arrive at similar results: both show that average income was lower in villages using newly-adopted, high-cost irrigated paddy farming. However, while Garcia et al. (2000) attributed their finding to the fact that the technology had only just been adopted, our results suggest low incomes in these villages persist and therefore cannot be regarded as transitory, associated with the adoption of new technologies. Furthermore, whereas Garcia et al. (2000) focused on the Ayeyarwady Delta, our study includes regions outside the delta, covering several farming systems that are based on non-paddy crops.

[2] In this paper, "paddy" means unhusked paddy and "rice" means husked, cleaned rice for consumption.

Other studies that examine the effects of agricultural policies on Myanmar's village and household economy during the period we are interested in include Okamoto (2004), Fujita and Okamoto (2000), and Fujita (2003).[3] All of these, however, are case studies of paddy villages located close to Yangon, the national capital, and therefore do not allow a regional comparison. Including villages in the periphery as well as villages whose main agricultural activity is based on non-paddy crops, the present study is thus the first of its kind, allowing an examination of regional disparities based on detailed household-level analysis.

The paper is organized as follows. Section 2 provides an outline of Myanmar's agricultural development and policies. Section 3 describes the regions and sample households that are the subject of this study. The remaining three sections analyze the nature and determinants of the observed income disparities: section 4 examines household incomes and briefly discusses the incidence of poverty, section 5 investigates agricultural incomes, and section 6 examines non-agricultural incomes in more detail. Section 7 concludes the paper.

2 Myanmar's Economy and Agricultural Policies

With a population of over 50 million and endowed with bountiful land resources (approximately 0.7 million km^2), Myanmar enjoys a favorable man-land ratio by Asian standards. Industrial development is under way, but currently agriculture remains the dominant sector in the national economy (table 1). Substantial progress has been made in terms of sown acreage, production, and exports, but the achievements fall far short of the country's potential.

The partial success is most clearly shown in paddy/rice production trends. Rice is the staple food in Myanmar, accounting for 20% of urban and 22% of rural consumption

[3] In the political economy literature, Thawnghmung (2001) found results similar to ours based on comprehensive interviews on political issues in various regions in Myanmar. She did not collect detailed household data, though.

expenditure in 1997 (CSO 2002). Paddy production increased rapidly from the late 1980s to the mid-1990s (figure 1). Despite this increase, though, the yield level is still only three tons per hectare, which is considerably lower than that of Asian neighbors such as Vietnam. Two main factors explain the surge in production during the early 1990s. The first is agricultural marketing liberalization in 1987 (followed by the official abandonment of "Burmese Socialism" in 1988) and the second is the introduction of the Summer Paddy Program in 1992/93.

Agricultural policy under "Burmese Socialism," the doctrine pursued by General Ne Win's military government that ruled the country after overthrowing the elected government in 1962, was based on three pillars. First, all farmland belonged to the state and farmers were given a tillage right only. Farmers did not have the official right to exchange, transfer, lease, inherit, or mortgage their land, although children were usually given the right to cultivate their parents' land. Another aspect related to the state ownership of land was the existence of a large pool of landless, non-farm households in rural Myanmar. Under the land reform scheme that started in the late 1950s, land was not distributed to all village residents equally but only to those who owned means of production such as bullocks. The unequal land distribution was institutionalized during "Burmese Socialism": only those households that were given tillage rights were officially registered as farm households. Members of non-farm households, working as agricultural laborers, had to depend on these farm households. The second pillar was the state monopoly of agricultural marketing. Private trade of surplus produce was banned, both domestically and internationally. The state attempted to procure all the surplus from farmers at fixed prices. The third pillar was crop planning. The government told farmers which crop to grow on which parcel of land. If farmers did not follow government directions, their tillage rights could be revoked. Through this threat, the government wanted to prevent farmers

from shifting to more lucrative crops that were not covered by the state procurement system.

The change of government in 1988, when Ne Win was forced to step down and the military regime that is still in power today took over, brought a number of changes in agricultural policy. The system of state ownership of land remained more or less intact, though unofficial transfers of tillage rights have been frequent (Takahashi 2000). To retain their tillage right for paddy fields, farmers are obliged to grow paddy crops and supply a designated amount of paddy to the government procurement system, regardless of the profitability of paddy crops. There has been little change in the unequal distribution of tillage rights and the share of landless, non-farm households in villages typically ranges from 20 to 50%.

As for agricultural marketing, several reforms were introduced.[4] In 1987, compulsory state procurement was abandoned and private trade was allowed. However, the state procurement system was soon restored for paddy and so-called "industrial crops" (sugarcane, cotton, jute, and rubber).[5] Under the system that prevailed during our survey, the state procured from farmers a limited amount of paddy for urban rice consumers (government employees, hospitals, and other social welfare institutions). It also procured industrial crops for state-owned industries. In contrast to the socialist period, once farmers had supplied their required quota to the state, they were free to sell any surplus in private markets. Although rice exports still fell under the state monopoly, there was active domestic paddy/rice marketing by private traders. Since market prices during the late 1980s and early 1990s were usually much higher than the procurement price, the reform gave a substantial incentive to produce a surplus.

The procurement quota for paddy was set as a fixed quantity per acre of land designated as paddy fields. In the main paddy-growing areas, the quota was approximately 20%

[4] For details on the liberalization of agricultural marketing in Myanmar and its consequences, see Okamoto (2004).
[5] In 1999/2000 and 2000/01, the government attempted to extend the procurement system to pulses, the export of which through private traders had grown remarkably during the 1990s. The attempt was abolished, however, after two years of experiments.

of the gross produce, while it was lower in other areas. Since the quota was set irrespective of the actual acreage devoted to paddy or the actual output of paddy, this may seem to be a non-distortionary implicit tax. In reality, however, the system adversely affected paddy production in Myanmar because of the incentive effects it created. The first of these was a disincentive effect on the quality of rice that was supplied to the state, which was so low that it was not accepted in foreign markets. Lower and upper class urban residents sold the quota rice they received to livestock feed dealers. The second effect regards the incentives that influenced farmers' cropping choice. This is discussed in detail further below.

The third pillar of agricultural policy during the socialist period was crop planning. This was officially abandoned in 1987. However, farmers continued to face the threat of seeing their tillage rights revoked if they deviated too much from crop plans formulated by the government, especially with respect to paddy.[6]

Under the institutional setting described above, the government has given high priority to the expansion of paddy production, since it believes that a stable supply of rice is a prerequisite for political stability. For example, the Summer Paddy Program instituted in 1992/93 has promoted the production of so called "summer paddy" (dry season paddy) by investing in irrigation. Traditionally, the main paddy season in Myanmar was the monsoon season, which brings sufficient (and frequently too much) water to paddy crops in rainfed fields. Under the program, numerous small to medium scale dams were constructed in some areas, while private investment in small scale diesel pumps was promoted in others, depending on the topology with respect to water availability during the dry season. The additional output from summer paddy was basically exempted from procurement quotas. As we have already seen, both the area under cultivation and paddy production rose remarkably in the early 1990s (figure

[6] Each parcel of farmland was classified into one of the six categories: paddy fields, dry land for upland crops, alluvial land, garden land, nipa palm land, and shifting cultivation land. The classification is almost permanent,

1). The main driving force behind this expansion was the increased acreage of summer paddy with irrigation (Garcia et al. 2000). The recent development in irrigation is shown in table 1.

Since the end of the 1990s, the impact of the summer paddy drive has weakened due to the exhaustion of easy opportunities for irrigation and low paddy prices for producers (Fujita 2003). Due to the ban on private sector rice exports, the low quality of rice in the public marketing channel, and managerial inefficiency at the state trade agency, rice exports from Myanmar did not increase as fast as output, resulting in lower market prices of paddy for farmers. The market premium over the procurement price fell from the range of 50-120% to approximately 30% in the early 2000s. This implies that the disparity between international and domestic market prices widened. According to Fujita's (2003) estimates, the domestic price in 2001 was almost half the price of Thai rice (25% broken) calculated at the market exchange rate.

Although the rice-centered agricultural policies in Myanmar ensured that the nation's rice demand was met at low prices, we are concerned that this may have been achieved at the expense of farmers' welfare. The increase in paddy production was attained primarily by expanding the area under cultivation (figure 1). The area expansion was more or less forced by the government through the agricultural policies described above. Because of the economic distortions created by these policies, the transition of Myanmar's rural economy from a planned to a market one has been partial. The state-led market economy has been strongly oriented towards the maximization of paddy output, with little consideration for farmers' incomes. It is against this background that we conducted our field surveys to quantify the impact of these policies on rural households' welfare.

---

implying that a plot of garden land remains garden land even if the farmer grows paddy on it, for example.

3 Characteristics of Sample Villages and Households

3.1 Village Characteristics

In June-October 2001, we conducted a survey of sample households belonging to eight selected villages in Myanmar. The characteristics of the villages are shown in table 2.[7]

The first two villages (DELTA1 and DELTA 2) are located in the delta regions of lower Myanmar. DELTA1 was chosen to evaluate the Summer Paddy Program because almost all of the paddy fields have been under summer paddy cultivation using diesel-pumped water since the early 1990s. In DELTA2, summer paddy production was introduced in 1999 when a small dam was built nearby; however, the canal irrigation system was still under construction at the time of our survey.

Three villages were chosen from the dry zone of upper Myanmar. DRY1 is located in the Mandalay Basin, which has been one of Myanmar's centers of commercial crop production due to its long history of canal irrigation dating back to the dynastic period of Burma. In contrast, DRY2 and DRY3 represent villages relying on rainfed agriculture. Complicated crop mixtures of pulses and oilseed crops are observed in both villages. Intercultivation is also popular. DRY2 is more typical as a dry zone village since only rainfed crops and no paddy crops are grown there. In DRY3, paddy crops are grown either under rainfed conditions or using small-scale tank irrigation. A large-scale dam was under construction at the time of our survey, which, once completed, will supply irrigation water to DRY3.

HILL1 and HILL2 represent villages relying on vegetable-based development in hilly regions. HILL1's agriculture includes small-scale vegetable growing on the floating plots of Inya Lake. Tomatoes from this region are famous throughout the country. The cultivation of

[7] The smallest administrative unit in Myanmar is the "village tract," which usually consists of several natural villages. While table 2 refers to "village tracts," in the text and the following tables, we will simply refer to

sugarcane, one of the industrial crops falling under the state procurement system, is also common in HILL1. HILL2 specializes more in vegetables grown on upland fields. Both villages sell their vegetables to major consumption centers such as Yangon and Mandalay, while their paddy cultivation is oriented towards subsistence.

The last village of the study, COAST, lies in the coastal region of southern Myanmar, where tropical agro-forestry (rubber, fruits, cashew nuts, etc.) prevails. Peasant farmers run both small-scale rubber estates and paddy farms. Among the eight villages studied, COAST has the most active non-farm sector, which includes general shops, cycle taxis, and fish processing.

The eight villages chosen are thus quite representative of the diverse agro-ecosystems found in Myanmar. The villages can be classified into two groups in two ways. First, if we focus on paddy versus non-paddy based cropping, the first three (DELTA1, DELTA2, and DRY1) are representative of paddy-based agriculture in Myanmar, while the last five (DRY2, DRY3, HILL1, HILL2, and COAST) are representative of more diversified agriculture. Public investment in agriculture has been concentrated in the first group.[8] Second, in the context of Burma's political history, the first five (DELTA1, DELTA2, DRY1, DRY2, and DRY3) represent the "center," while the last three (HILL1, HILL2, and COAST) represent the "periphery."[9] The former is mostly inhabited by ethnic Burmese and has been under the control of the central authorities throughout Burmese history. In contrast, HILL1 and HILL2 are inhabited by ethnic minorities (like the Inda, the Pao, etc.), while COAST is located farthest from the national capital.

Before choosing the specific villages for this study, one of the authors (Fujita) visited a number of villages in order to ascertain that they would be representative of each region. As far

---

"villages" for convenience' sake.

[8] Existing studies (see introduction) have concentrated on villages comparable to DELTA1 and DELTA2. Only the study by Takahashi (2000) also surveyed villages in the dry zone and the hilly regions.

[9] For an outline of Burmese history, see Adas (1978), Cheng (1968), and Cady (1958), on which this assessment is

as can be judged by the statistics on cropping pattern and land distribution, we achieved our aim. After the survey, however, we found that village DRY2 was better off than the regional average, thanks to the recent introduction of rural development projects, including micro-credit schemes funded by international agencies. With regard to the other seven villages, we do not have such concerns. In the survey year 2001, paddy prices in private markets were at their lowest in recent years. Since then, prices have recovered somewhat, but at the time of writing were still only marginally higher than in 2001. Villages DRY3 and HILL2 were hit by adverse weather during our survey year, so that the farming income we recorded probably fell below that of an average year.

3.2 Survey Methodology

To conduct our survey, we chose sample households from a complete list of households in each of the villages studied. While these households are not strictly a random sample, we used information obtained from village leaders and local administrations to eliminate discretionary elements, so that the sample households are as representative as possible in terms of the distribution of farmland and primary jobs. A total of 521 households were surveyed in the eight villages: 341 households were officially registered as "farm" households and 180 as "non-farm" households (table 3).

Households registered as "farm" households are given official tillage rights. But because of inter-vivo transfers of farmland and tenancy contracts, not all households registered as "farm" households actually cultivate their land, while some households registered as "non-farm" households do cultivate farmland. In the table, we refer to the latter type of households as "non-farm with farmland." In contrast, we make no distinction between "farm" households that

---

based.

do and that do not cultivate their land, because "farm" households' social and economic status remains unaffected by this: they belong to the class of landed farmers in rural Myanmar.

We classify households registered as "non-farm" into three types. The first is the *de facto* farmers: "non-farm with farmland" (the total size of this group in our sample is 14 out of 180, see table 3). The remaining non-farm households are divided into those whose main source of income is agricultural labor ("non-farm, agric. labor" in the table) and those whose main income source is non-agricultural activities ("non-farm, non-agric."). There are 107 "non-farm, agric. labor" households and 59 "non-farm, non-agric." households in our sample.

Among the agricultural laborer households, two types of labor contracts are important in rural Myanmar. Daily-hired laborers are usually paid in cash and hired for a well-specified farm operation. In contrast, seasonally-hired laborers are employed for a cropping season and paid in cash, paddy, clothes, etc. They are responsible for various farm operations, just like family workers. Details of the contracts differ from village to village, from operation to operation, and over time (Takahashi 2000).

A structured questionnaire was used for all households to establish household characteristics, such as the age, sex, education, working status, and earnings of each member; household assets, such as land, livestock, agricultural machinery, and transportation equipment; consumption; and debt and credit, including informal transactions. If households operated farmland, another part was added, asking about cropping patterns, the use of hired labor, the cost of production of major crops, and how much of the output was sold to the state or private merchants on what conditions. Household heads or other relevant persons were interviewed by local research assistants and the information was cross-checked on the spot by the authors to ensure internal consistency and data quality.

3.3 Characteristics of Sample Households

Table 4 shows the demographic characteristics of the sample households. The average household size was 5.5 persons. Almost all households in the sample were nuclear families. Therefore, the variation in household size comes from the variation in the number of co-resident children. The majority of the household heads have received an education, either at a monastery or a modern school. The only exception is village HILL1, where more than 20% of household heads were without any education. The number of average schooling years for those who had attended a modern school was not very high, indicating that most only received primary education. Among children at schooling age, the primary enrollment ratio was almost 100% in all villages.

The sample households did not own many assets (table 5). The most important asset of most households was livestock: the majority of sample farmers owned draft animals and a number of sample households (both farm and non-farm households) kept pigs and poultry. As for agricultural machinery, none of the households owned a four-wheel tractor, but ownership of two-wheel power tillers was spreading. A number of farmers were still dependent on animal power for traction. Bicycles were common among villagers but motorcycles and four-wheel vehicles for transportation were very rare. The highest value of total household assets was found in COAST, where several villagers owned motorcycles and four-wheel vehicles. Because all of the eight villages (as the majority of villages in Myanmar) were not electrified, ownership of TVs or VCRs (using batteries) was very rare. Comparing different household types, total asset values were lowest among non-farm, agricultural laborer households, indicating that they belong to the poorest section in the village economy.

Because farmland is not officially private property, the value of land managed by the household is not summed up in the table. The average holding size among farm households was

8.6 acres, which is large by South-East Asian standards.

These, then, are the assets and the human capital which form the basis of economic life in the villages of Myanmar. The following sections take a closer look at the village economies, with section 4 focusing on income levels and distribution and sections 5 and 6 examining factor allocation and sources of income by type.

4 Level and Distribution of Household Income

4.1 Level of Household Income

We follow the standard definition of household income (Grosh and Glewwe 2000). Household income is defined as the sum of wage/salary receipts including the imputed value of in-kind payment such as meals and rice, non-agricultural self-employment earnings (gross revenue minus actually paid costs), agricultural self-employment earnings (sum of the value of output minus actually paid costs), and net receipts of non-earned income (which is negative in the case of payments such as taxes and for licenses). In the study region, non-cash transfers are frequent. The most important are the paddy produced by farmers and consumed by themselves and in-kind payment to workers. Median market prices within each village were used to impute the value of these transactions.

Table 6 shows the level of household income thus estimated. Overall averages were 184,000 Kyats per household and 36,000 Kyats per person per year.[10] If we convert these figures at the market exchange rate of 650 Kyats/US$, average annual incomes were $283 per household and $55 per person. Incomes thus were indeed low, but not that different from the average village in rural Myanmar. If we convert these incomes using the price of rice in the

[10] To convert figures into per capita terms, we simply used the number of household members. The use of adult equivalence is left for further exercises.

Yangon market (56 Kyats/kg), they are equivalent to 3,300 kg of rice per household and 640 kg per person per year, although we have to be careful in interpreting these figures because the domestic rice price in Myanmar was much below the international price.

Total household income was highest in COAST, followed by DRY1 and DRY2.[11] DRY3 had the lowest income. Incomes in DELTA1 and DELTA2 fell below the overall average. HILL1 and HILL2 were in the middle. The ranking is similar when per capita income is compared. Among household types, "non-farm, agric. labor" households had the lowest income, closely followed by "non-farm, with farmland" households. The highest income per capita was recorded for "non-farm, non-agric." households.

Comparing different villages and household types, farm households in DRY1, DRY2, and COAST were much better-off than in other villages. The income level of farm households in DELTA1 and DELTA2 was again lower than the overall average. Non-agricultural households in DRY1 and COAST were much better-off than in other villages. Agricultural laborer households were worse-off than farm households and than non-agricultural households in general. Exceptions are found in HILL1 where non-agricultural households were worse-off than agricultural laborer households because non-agricultural earning opportunities were limited in this village.

4.2 Income Inequality and Poverty

Inequality measures of total household income are shown in table 7. Among the villages, COAST and DRY2 had the highest inequality. The two villages in the delta, the two in the hilly regions, and DRY3 showed the lowest inequality. DRY1 was in between. Comparing

[11] The sample in COAST includes an exceptionally rich household. This household ran a transport business using its own vehicles. However, excluding this household does not alter the ranking among villages in table 6. Furthermore, since this household was demographically large, the per capita income of this household does not seem to be an outlier.

household types, the incomes of farm and non-farm, non-agricultural households on average were higher than those of other households, but had a larger inter-household variation.

The table suggests a negative correlation between average income at the village level and intra-village variation of income. Takahashi (2000) reported that the liberalization of agricultural marketing improved farm incomes and induced rich farmers to expand self-employed, non-farm business activities, leading to an increase in intra-village inequality. This seems like a good explanation of the patterns observed in villages COAST and DRY1. The high income inequality in DRY2 is attributable to the high risk of dry farming, where idiosyncratic yield shocks amplified the income inequality among villagers.

To estimate poverty indicators in terms of per capita incomes, we adopt our own poverty line at 400 kg of rice per person per year. This is because there is no official poverty line in Myanmar and it is not feasible to apply the World Bank's poverty line of PPP$1/day due to multiple exchange rates and the non-availability of disaggregated household expenditure data. Assuming a per capita consumption of rice of 200 kg (and its equivalents) per person per year, the poverty line here implies that 50% of income is spent on basic food. Our impression is that this poverty line is close to the one used by Garcia et al. (2000) but probably much lower than PPP$1/day.

Based on this poverty line, our estimate for the poverty headcount index for the sample households was 42% (table 7). The village ranking of poverty incidence and the ranking of per capita income shown in table 6 are substantially different. Among the top three high-income villages (DRY1, DRY2, and COAST), only DRY1 and COAST had a poverty incidence lower than the overall average of 42%. In DRY2, because of high inequality, poverty incidence was also high despite the village's high average income. Within the delta, the incidence of poverty in DELTA1 was higher than the average while in DELTA2 it was the lowest among the eight

villages due to the low degree of inequality. DRY3, the village with the lowest average income, had the highest poverty incidence. Other poverty measures such as the poverty gap index and the squared poverty gap index confirm this pattern (not shown).

4.3 Household Income Sources

Table 8 shows household income classified into five major sources: (1) self-employment income from agriculture, (2) agricultural wage income (daily-hired), (3) agricultural wage income (seasonally-hired), (4) non-agricultural income, and (5) unearned income transfers (net receipts of non-earned income). Among household types, by definition, "farm" households had the highest income from agricultural self-employment and "non-farm, agric. labor" households had the highest income from daily-hired farm wages and from seasonally-hired farm wages. More interestingly, non-agricultural income was a major source of income for all types of households. Even "farm" households depended on non-agricultural income for 21% of their total income.

The composition of income is strikingly different among villages. The level of self-employment income from agriculture was highest in villages DRY1 and DRY2 and lowest in DRY3. The share of agricultural self-employment income in total household income was highest in villages HILL2 and DRY1 and lowest in COAST. Seasonally-hired farm labor income was important in DELTA2. In this village, income from this source was as high as the daily-hired farm labor income. The level of non-agricultural income also varied widely among villages.

4.4 Regional Disparity in Income

A comparison of tables 6 and 8 shows that villages with higher agricultural self-

employment incomes and higher non-agricultural incomes have higher per capita incomes overall. Because of this relationship, in the next two sections, we will take a closer look at these two income sources and the impacts of agricultural policies on them.

The comparison also suggests that household incomes are higher in villages in the "periphery" (HILL1, HILL2, and COAST) than in the "center" that is tightly controlled by the central authorities (all other villages). Since commercial agriculture and non-agricultural activities usually prosper in regions close to urban centers, not in peripheral regions (Rozelle et al. 1999), we call this the first paradox. The paradox is most clearly shown comparing DELTA1 and DELTA2 on the one hand and COAST on the other hand. However, the regional disparity is not very clear among other villages: household incomes in HILL2 are low and those in DRY1 and DRY2 are high, for example. The low income in HILL2 is mainly due to crop failures in vegetables in the survey year. From other indicators of the village economy, such as housing, household assets, debt positions, and rural wages, the income level of this village in an average year seems to lie between that in HILL1 and COAST, possibly closer to that in COAST. DRY3 has the lowest household and also farm income among the study villages. This is partly due to crop failures, but even with a normal harvest, we would expect its income level still to be at the bottom of the eight villages. Other indicators also suggest that the welfare level in DRY3 is lowest. The reason for the higher income in DRY1 and DRY2 will be explored in the following sections.

5 Land Allocation and Agricultural Income

5.1 Cropping Pattern of Sample Farmers

Self-employment income from agriculture is the sum of crop income, livestock

income, agricultural machinery rental income, land rent income, and backyard crop income. Since crop income accounted for the largest share (98.6%) of the agricultural self-employment income, we focus on the allocation of land to various crops and the determinants of crop income in this section. In the analysis, we classify the crops grown by the sample households into the following six categories:

(1) Paddy: this is a staple food subject to heavy policy intervention (section 2). It is important to distinguish between summer paddy (which is intensive in input use, but the production of which has expanded recently as irrigation has spread) and other types of paddy (mainly monsoon paddy grown on designated paddy fields).

(2) Pulses: of the different pulses, the production of green gram, black gram, and pigeon pea has expanded rapidly in recent years, driven by price incentives based on exports through private traders (Okamoto 2004).

(3) Oilseed crops: sesame and groundnuts traditionally are the most important oilseed crops; their cultivation is concentrated in the dry zone.

(4) Vegetables: various kinds of vegetables are grown in Myanmar; they are not subject to any direct intervention by the state.

(5) Industrial crops: in the survey villages, sugarcane, cotton, and rubber are grown; farmers are obliged to deliver specified quantities to state-owned enterprises at the official procurement price.

(6) Other crops: other crops grown in the survey villages are non-paddy cereals and fruits.

Table 9 shows the average farm size and cropping patterns. The average size of paddy field per farm household was larger in villages DELTA1 and DELTA2. There were no paddy fields in DRY2. The total farm size was largest in DELTA2, followed by DRY2 and HILL1.

Cropping intensity was quite high, especially in DRY2 where complicated intercultivation was practiced.[12]

Of the major crop groups, paddy occupied more than 60% in three paddy-based villages (DELTA1, DELTA2, and DRY1). Among these villages, DELTA1 had the least diversified cropping pattern: monsoon paddy followed by summer paddy. In contrast, in DELTA2 and DRY1, not all of the paddy fields were cropped with summer paddy but some fields were cropped with pulses (DELTA2) and vegetables (DRY1). The other five villages had a more diversified agriculture. Among these five villages, DRY3 and COAST had higher paddy shares than the other three.

The inter-village variation in cropping patterns reflects not only the agro-ecological conditions of each village, but also differences in the enforcement of the government's crop plan. In DELTA1, which showed little variation in cropping patterns within the village, tillage rights were verified and updated every year by government officials. Farmers in DELTA1 were given directions on the acreage of monsoon and summer paddy and the quantity to be procured. As these directions were written on the tillage right record distributed to each household, the link of tillage rights and the crop plan/procurement was explicit. In DELTA2, tillage rights were not updated every year and only the cultivable acreage, not the actual acreage, of paddy was recorded by officials in a form distributed to each household. Farmers in DRY1 were subject to an annual verification and update of their tillage rights. However, only the acreage of monsoon paddy on paddy fields was investigated, leaving farmers greater freedom in their choices of crops during the dry season.

In DRY2 and DRY3, the link between tillage rights and the cropping pattern was traditionally a weak one. In the late 1990s, however, the government began distributing forms

[12] In calculating crop acreage, we divided the acreage of fields intercultivated with multiple crops proportionally to the number of rows in which the plants were sown.

to farmers on which their cropping patterns were recorded, as in DELTA2. In HILL1 and HILL2, no documents to record tillage rights or cropping patterns were distributed to households. Farmers in COAST were provided with a tillage right record, which only specified the acreage of farmland without directions on crop choices and procurement obligations.

To summarize the differences in the enforcement of the government's crop plan on farmers: strict enforcement along procedures inherited from the socialist period was attempted in the three villages located in the core regions of paddy-based agriculture; this policy was implemented most strictly in DELTA1; at the time of our survey, the procedure was being extended to the other two villages located in the "center" in the political sense but outside the core regions of agricultural development; and the three villages politically at the "periphery" were subject to the weakest enforcement of crop plans.

5.2 Profitability of Crops

Next, we look at the relationship among cropping patterns, per acre farm income, and per acre profitability of individual crops. Table 10 shows that crop income per farm household was highest in DRY2 and lowest in DRY3 and DELTA1. Normalized by farm size, crop income per farm area was highest in DRY1 and HILL2, followed by DRY2, and lowest in DRY3, DELTA2, and DELTA1. A comparison of tables 9 and 10 suggests that per acre income was lowest for paddy and highest for vegetables. Therefore, farm income per acre was lower in villages where paddy cropping was more dominant than in other villages.

To investigate the relationship between cropping patterns and profitability *within* villages, intra-village correlation coefficients between average crop income per acre of a farm (denoted as x) and cropping patterns (share of the acreage assigned to each crop group in the gross cropped area) were calculated (table 11). In all villages, the correlation coefficient

between *x* and the paddy share was negative. It was statistically significant in DELTA2, DRY1, DRY3, HILL2, and COAST. There was no meaningful variation in DELTA1, since most farmers grew monsoon paddy and summer paddy only, while no paddy was grown in DRY2. In DELTA2, the correlation coefficient between *x* and the pulses share was 0.448. In DRY1, the correlation coefficient between *x* and the vegetables share was 0.555. Therefore, in DELTA2 and DRY1, villages located in the major paddy growing regions, farmers who did not grow much paddy on paddy field during the summer season but grew more commercial crops instead were better-off.[13] This indicates that the policy of maximizing paddy output put a heavy burden on farmers in the major paddy-growing regions.

In the other five villages, where agriculture was more diversified, each village had non-paddy crops whose acreage share was positively correlated with *x*. In these villages, it is not always the case that these non-paddy crops directly compete with paddy for land, because these crops are usually grown on farmland not designated as paddy fields. Even then, the allocation of labor and efforts expended on non-paddy crops should be adversely affected when paddy acreage is increased. In DRY3, where such conflicts are the most acute and a new irrigation dam was under construction during the survey period, the correlation coefficient between *x* and the paddy share was -0.529. Therefore, in the minor paddy-producing regions too, the policy of maximizing paddy output put a heavy burden on farmers.

5.3 Structure of Production Costs

Why do some crops deliver a higher income per acre than others? To investigate this, we collected detailed information on the cost of production of major crops from a subset of sample farmers. The questionnaire includes detailed accounting of the use of daily-hired labor,

[13] In DRY1, not all vegetables are grown on paddy fields. When we re-calculated the correlation coefficient using the share of dry chili only, which was exclusively grown on paddy fields, the coefficient became 0.320, still

seasonally-hired labor, family labor, hired and family-owned animals, hired and family-owned machinery, formal and informal credits used for production, and so on. Table 12 summarizes this information for each crop in a village when five or more observations were collected (see also appendix table). Although opportunity costs are not relevant for the calculation of income, they are when evaluating crop profitability, which is calculated by subtracting the opportunity cost of owned factors from crop income. In other words, crop income discussed above is the sum of profits (operator's surplus) and the imputed value of owned factors.[14]

In the case of paddy in the major paddy-producing regions (panel A of table 12), the contrast between summer paddy (SP) and monsoon paddy (MP) is worth mentioning. In DELTA1, although output value per acre was much higher for SP than for MP, value-added, income, and profit per acre for the two were similar.[15] This is because SP in DELTA1 is irrigated by pumps, which is intensive in the use of diesel oil. As a result, SP is not very attractive for farmers, although it is attractive for local administrators because of higher yields per acre (Fujita 2003). In DELTA2, the profitability of MP, late MP,[16] and SP was similar. In DRY1, because the output value per acre was much higher for SP than for MP, value-added, income, and profit per acre were also higher for SP. This is because SP in DRY1 was irrigated by canals, for which farmers paid little. When a sufficient number of observations is available, we calculated the cost of production separately for large-scale farmers and small-scale farmers. In none of the cases did large-scale farmers record higher value-added, income, or profit per acre than small-scale farmers, indicating the absence of positive scale economies (see appendix table).

---

statistically significant at 5%.

[14] We make no attempt at estimating the factor payment to land. This is left for further analyses.

[15] Output was evaluated at market prices for the quantity marketed and consumed, and at the government procurement price for the quantity delivered to the government.

[16] Late MP is a variety of paddy grown after the water level decreases. In DELTA2, the cultivation of late MP starts three months later than that of regular MP.

The final column in table 12 shows figures for profitability when all output was calculated at market prices. The different results of this calculation when compared with the one above show the direct and very short-run effect of the procurement system on paddy income. Because market prices were higher than the procurement price, the figures in the final column are mostly larger than the figures in column (7). Nevertheless, the difference is very small. This is because the survey year was a trough year for domestic market prices of paddy. When we re-calculated profitability using market trend prices, which were much higher than the actually prevailing market prices recorded at the time of the survey, the income and profits per acre from paddy production became much higher (Fujita 2003). Since domestic prices of current inputs such as fertilizer, diesel, and chemicals were close to their international prices during the survey period, we can infer, from the exercise of raising the imputed price of paddy, the direct and very short-run impacts on paddy incomes of the policy of repressing domestic rice prices below the international price level. Since the indirect and long-run impacts are likely to be more important, we do not report the results of this exercise.

Outside the major paddy-producing regions, the cultivation of paddy crops was less profitable (panel B of table 12) than in the major paddy-producing regions (panel A). The paddy income per acre was highest in COAST, comparable to the income in DRY1. This is mainly attributable to higher paddy prices in COAST due to geographic isolation. Yet, the paddy profit per acre was negative in COAST. For a variety of reason, the paddy income per acre in the other three villages was lower than in COAST: the production of monsoon paddy in DRY3 is subject to erratic rainfall; monsoon paddy in HILL1 is grown on marginal lands on the coastal edge of a lake; and in HILL2, monsoon paddy is grown on tiny paddy plots in hill valleys or as an upland field crop. When all output was calculated at market prices, the income and profit of paddy cultivation rose but still fell far short of reaching parity with that of non-

paddy crops.

Panel C of table 12 shows the cost of production per acre for non-paddy crops. For almost all of these crops, per acre income was higher than for paddy crops in the same village. Among these crops, some compete directly with summer paddy, such as pulses in DELTA2 and oilseed crops and vegetables in DRY1, because they are grown on paddy fields. It therefore seems that farmers would be able to earn more if they grew more of these crops instead of growing paddy to the limit.

5.4 Disparity in Crop Income and Irrigation Development

The analysis in this section has shown that farmers and villages that emphasize a paddy-based, irrigated cropping system have lower farming incomes than those that do not. Since irrigation development usually contributes to rapid increases in land productivity and farmers' income in Asia (Jimenez 1995; Huang and Rozelle 2002), we call the situation in Myanmar the second paradox.

Among the villages in the major paddy-producing regions in the "center" (DELTA1, DELTA2, and DRY1), crop income per acre is lowest in DELTA1 and highest in DRY1. The crop income is higher in DELTA2 than in DELTA1 because the summer paddy promotion was introduced more recently, the government's crop plans were not strictly enforced, and a lucrative alternative to paddy, i.e., pulses, existed. Crop income is highest in DRY1 because the enforcement of the government policy to maximize paddy output was weak so that villagers were able to capture the huge agricultural growth potential in the dry zone by growing various commercial crops.

Among the villages outside the major paddy-producing regions, both the crop income per household and per acre are lowest in DRY3. The low income in DRY3 is not only

attributable to crop failures, but is also caused by the paddy output maximization policy extended to marginal regions. The correlation analysis shows that farmers who grew more paddy in DRY3 had a lower farm income than fellow villagers who did not.

Thus, the second paradox is not really a paradox. What was responsible for the low farm income of the paddy-based, irrigated cropping system was not irrigation development *per se*, but the enforcement of the paddy output maximization policy.

6 Labor Allocation and Non-Agricultural Income

6.1 Labor Allocation of Sample Households

In the survey, we collected information on individuals' occupations, which we divided into three categories of agricultural jobs and twenty of non-agricultural jobs. These categories were based on the sector and the employment type of each activity. After a preliminary analysis, we merged the twenty categories of non-agricultural jobs into the following eight:

(1) Self-employed in the primary sector other than agriculture: this category includes those who are self-employed[17] in the primary sector other than agriculture, such as fishermen and collectors of forest products.

(2) Self-employed in rice milling: this category includes those who are self-employed in rice milling; because small-scale rice milling is one of the most common rural industries in Myanmar, we distinguish self-employed rice millers from others in this section.

(3) Self-employed in the secondary sector other than rice milling: this category includes those who are self-employed in the secondary sector other than self-employed rice-millers, such as artisans (carpenter, craftsman) and those running small-scale, agro-based

[17] The self-employed include unpaid family members and those who run a business.

manufacturing units.

(4) Self-employed in trade: this category includes those who are self-employed in trade, such as agricultural brokers, livestock traders, shopkeepers, and vendors.

(5) Self-employed in transportation: this category includes those who are self-employed in transport business using bullock carts, cycle rickshaws, motorcycles, etc.

(6) Daily-hired employees: this category includes those who are regarded as daily laborers; the majority of them work in construction.

(7) Regularly-hired employees: this category includes those who are employed on a regular basis by shops, factories, companies, or by the government.

(8) Others: this category includes those who work in non-agricultural activities that are not included in the above seven categories; examples are those self-employed in rental shops for batteries, speakers, and videotapes, and those who are employed as canal watchmen and private guards.

The main occupation of the majority of the workforce is in agriculture (table 13). The overall percentage of those in non-agricultural employment is 14%. This share is higher in DRY1 and COAST. Non-agricultural jobs are more frequently found as secondary jobs, accounting for 51%, than as main jobs.[18]

6.2 Determinants of Labor Allocation

Table 14 shows non-agricultural income per household and per worker. Non-agricultural income per household was highest in COAST, followed by DRY1, DRY2, and HILL1. In COAST, self-employment in transportation was the most important non-agricultural activity, followed by self-employment in trade. In DRY1, the most important source of non-

[18] The high percentage in DELTA1 and DELTA2 of those who fall in the category "self-employed in the primary sector" for their secondary occupation is due to the prevalence of part-time fishing in the delta, which is common

agricultural income was trade, while in HILL1, it was self-employment in the secondary sector.

The lower part of table 14 shows that among individuals engaged in non-agricultural activities, the self-employed in rice milling and transportation had the highest income per worker, followed by regularly-hired employees and the self-employed in trade. A comparison of tables 13 and 14 shows that villages with higher non-agricultural self-employment income per household are those with more villagers engaged in these categories of lucrative non-agricultural jobs. What then determines the likelihood of an individual to be engaged in these categories?

It has been observed that in many other developing countries individuals working in lucrative and stable non-agricultural jobs have received more education.[19] This general pattern can also be observed in our sample, as shown in table 15 which gives the distribution by completed years of education of those working in the non-agricultural sector. Those engaged in non-agricultural activities were more educated than those engaged in farming activities. Among the individuals engaged in non-agricultural activities, the regularly-hired employees were the most educated, followed by those self-employed in rice milling.

To examine the determinants of whether an individual was likely to be engaged in attractive non-agricultural activities, we estimated a probit model that takes into account both individual human capital and regional differences in the availability of non-agricultural working opportunities.

The explanatory variables include village fixed effects and individual characteristics (age, sex, and schooling). We tried two specifications regarding the choice of the dependent variable. The first model analyzes the probability of an individual to be self-employed in rice milling or transportation, or employed regularly, either as a primary or secondary occupation;

---

but not very lucrative.

[19] See Kurosaki (2001) for the literature on various developing countries and the case of rural Pakistan.

in the second model, self-employed traders are added to the group of individuals working in attractive non-agricultural jobs.

Table 16 shows the regression results when all individuals aged 15 or older are included. The effect of education is positive and statistically significant. The effect of age has an inverted-U shape. Females are disadvantaged in obtaining attractive jobs. All of these effects of individual human capital are statistically significant.

Of the village dummies, COAST has a significantly positive coefficient in both models. In the first model, DELTA2 has a significantly negative coefficient, and in the second model, DRY1 has a significantly positive coefficient.

6.3 Regional Disparity in Non-Agricultural Income

As the probit analysis has shown, there are fewer non-agricultural, lucrative jobs available in the five villages politically in the "center" (from DELTA1 to DRY3) than in the other three villages that are politically at the "periphery" (HILL1, HILL2, and COAST). This finding is another aspect of the first paradox, which was discussed in section 4. The exception to this paradox is DRY1, which is in the "center" and where there is an active non-agricultural sector. As discussed in section 5, DRY1 is an exceptional village in the "center" and in the major paddy-producing regions; here, the overall income level is high thanks to a high crop income, which can be attributed to the weaker enforcement of the paddy output maximization policy.

The probit results thus indicate that in areas strongly affected by the paddy output maximization policy, opportunities for promising non-agricultural activities are limited. This may be attributable to the lack of rural demand for non-agricultural goods and services resulting from low farm incomes and the dearth of industrial linkages for agro-based manufacturing and

trade due to the stagnation of non-paddy farm output.

7 Conclusion

This paper investigated the behavior and welfare of rural households in Myanmar under transition from a planned to a market economy, using cross-section data obtained from a household survey conducted in 2001 covering more than 500 households in eight villages with diverse agro-ecological environments. There are two major findings. First, the income level was higher in villages far from the center than in villages located in regions that are tightly controlled by the central authorities. Second, farmers and villages that emphasized a paddy-based, irrigated cropping system had lower farming incomes than those that did not. Since in most developing countries, living conditions are typically higher in the central, politically dominant regions, and irrigation development usually leads to higher farm incomes through increased land productivity, the situation in Myanmar may seem paradoxical. Garcia et al. (2000) already noted that average income was lower in the irrigated villages with newly adopted, high-cost irrigated paddy farming. This paper showed that even after the initial, unstable stage of the adoption of the new technology, this situation persisted.

The paradoxical situation is most clearly shown by the contrast between the villages experiencing the transformation from a single- to a double-paddy cropping system on the one hand, and a village in the periphery, close to the national boundary where non-agricultural job opportunities were flourishing, on the other. Considering rural demand and industrial linkages, the limited availability of non-agricultural activities in the first group of villages can be attributed to weak demand due to low farm incomes. We have shown that in all the villages where paddy crops were grown, the crop income per acre was lower for farmers who allocated

more land to paddy crops than for farmers who did not. Therefore, the policy to increase the acreage under paddy seems responsible for the paradoxical situation.

However, for such an increase in paddy-acreage to reduce farm incomes, two conditions must be fulfilled: the income per acre must be lower for paddy than for other crops, and the government must have the wherewithal to force farmers to plant paddy rather than other crops. But these were exactly the conditions created by the agricultural policies which restricted land use by farmers and marketing by traders. Because of the distortions created by these policies, the transition to a market economy in Myanmar since the late 1980s has only been a partial one. While initially, this partial transition led to an increase in output and income from agriculture, its limit was revealed in the survey period. As a result, there still is vast room for an expansion of agricultural output and rural income, even without any innovation in technology or further investment in irrigation. All that would be necessary to tap this potential is to give farmers more freedom in land use and liberalize paddy/rice marketing.[20]

This leaves the question why regional and inter-household disparity persist. This is a task that remains for further investigations, requiring a rigorous analysis of the political economy mechanisms underlying the paddy output maximization policy. The formation of physical and human capital was treated as exogenous in this paper but it is important to endogenize it to understand the dynamics of the non-agricultural sector of the economy and their relationship with agricultural development. These issues are left for further research.

[20] In April 2003, the government of Myanmar announced the abolishment of the paddy procurement system and the state monopoly of rice export, beginning from the harvest of 2003/04. What impact of this reform will have, remains to be seen. At the time of writing, however, there are a number of uncertainties regarding the exact design of the reform. For example, private exports were temporarily banned in early 2004.

References

Adas, Michael. 1978. *The Burma Delta: Economic Development and Social Change on an Asian Rice Frontier, 1852-1941*. Madison: The University of Wisconsin Press.

Cady, John F. 1958. *A History of Modern Burma*. Ithaca: Cornell University Press.

Central Statistical Office [CSO]. 2002. *Statistical Yearbook 2001*. Yangon: CSO, Government of Myanmar.

Cheng, Siok-Hwa. 1968. *The Rice Industry of Burma 1852-1940*. University of Malaya Press.

Fujita, Koichi. 2003. "90 Nendai Myanmar no Ine-Nikisakuka to Nogyo-Seisaku Noson-Kinyu: Irawaji-Kanku Ichi-Noson-Chosa-Jirei wo Chushin ni," (Policy-Initiated Expansion of Summer Rice under Constraints of Rural Credit in Myanmar in the 1990s: Perspectives from a Village Study in Ayeyarwaddy Division). *Keizai Kenkyu* 54: 300-314 (in Japanese).

Fujita, Koichi and Ikuko Okamoto. 2000. "myanma kanki-kangai-inasaku-keizai no jittai: yangon kinko-noson Field Chosa yori" (An Economic Study on Irrigated Summer Rice Production in Myanmar: The Case of a Village near Yangon). *Southeast Asian Studies* 38: 22-49 (in Japanese).

Garcia, Yolanda T., Arnulfo G. Garcia, Marlar Oo, and Mahabub Hossain. 2000. "Income Distribution and Poverty in Irrigated and Rainfed Ecosystems: The Myanmar Case." *Economic and Political Weekly* 35: 4670-4676.

Grosh, Margaret and Paul Glewwe (eds.). 2000. *Designing Household Surveys: Questionnaires for Developing Countries---Lessons from 15 Years of the Living Standards Measurement Study*. Washington D.C.: World Bank.

Huang, Qiuqiong and Scott Rozelle. 2002. "Irrigation, Agricultural Performance and Poverty Reduction in China." Unpublished manuscript, University of California, Davis.

Jimenez, Emmanuel. 1995. "Human and Physical Infrastructure." In *Handbook of Development*

Economics, Volume III, ed. Jere Behrman and T.N. Srinivasan . Amsterdam: North Holland.

Janaiah, Aldas and Mahabub Hossain. 2003. "Can Hybrid Rice Technology Help Productivity Growth in Asian Tropics?" *Economic and Political Weekly* 38: 2492-2501.

Kurosaki, Takashi. 2001. "Effects of Education on Farm and Non-Farm Productivity in Rural Pakistan." FASID Discussion Paper Series on International Development Strategies, No.2001-002, Foundation for Advanced Studies on International Development, Tokyo.

Ministry of Agriculture and Irrigation [MAI]. Various issues. *Agricultural Statistics*. Yangon: MAI, Department of Agricultural Planning.

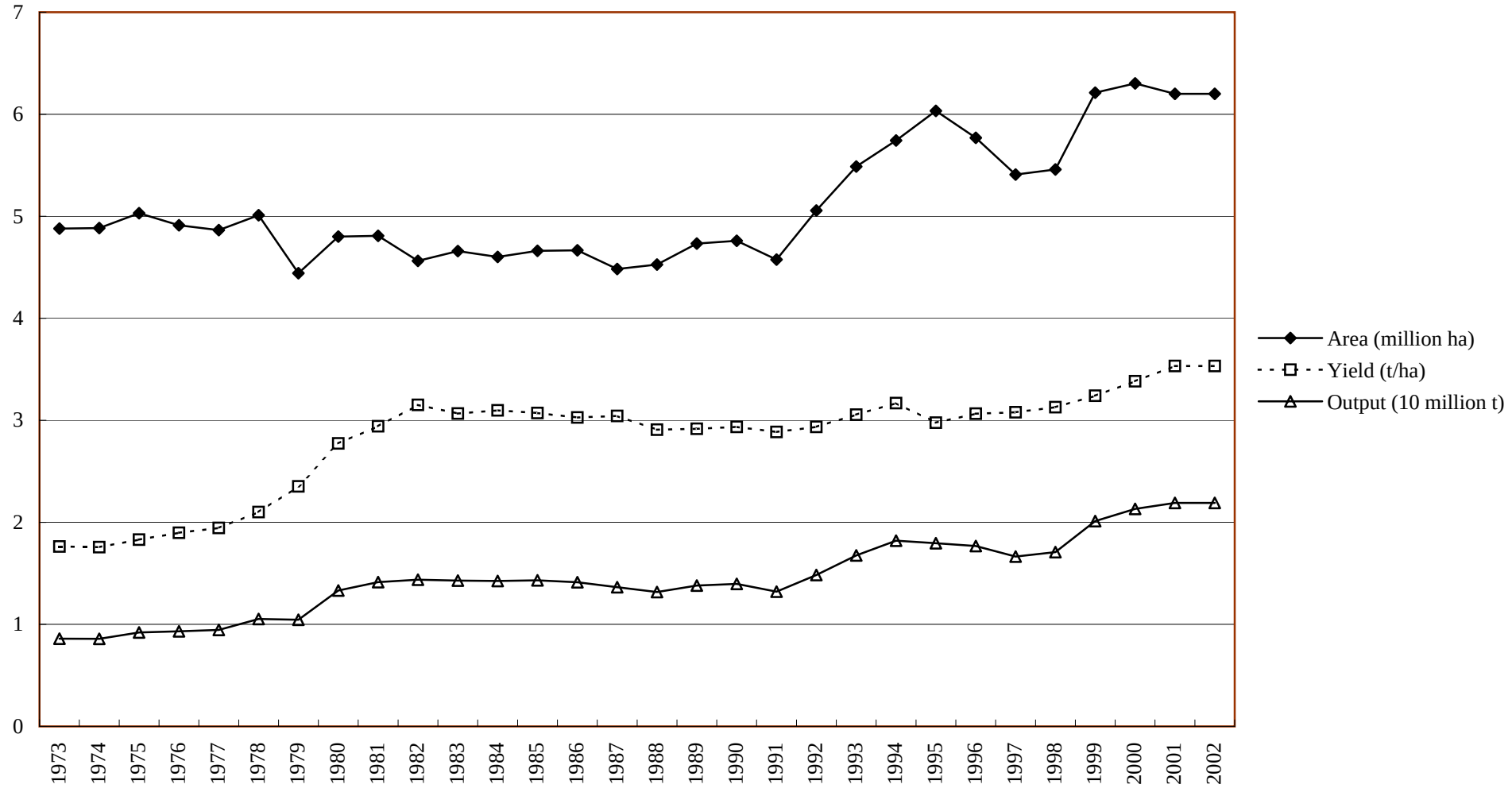
Okamoto, Ikuko. 2004. "Agricultural Marketing Reform and the Rural Economy in Myanmar: A Case Study of a Pulse Producing Area in Lower Myanmar." Paper presented at the 5th GDN Conference, New Delhi, January 28.

Rozelle, Scott, Li Guo, Minggao Shen, Amelia Hughart, and John Giles. 1999. "Leaving China's Farms: Survey Results of New Paths and Remaining Hurdles to Rural Migration." *China Quarterly* 158: 367-393.

Takahashi, Akio. 2000. *Gendai Myanmar no Noson-Keizai: Iko-Keizai-ka no Nomin to Hi-Nomin* (Myanmar's Village Economy in Transition: Peasants' Lives under the Market-Oriented Economy). Tokyo: University of Tokyo Press (in Japanese).

Thawnghmung, Ardeth Maung. 2001. "Paddy Farmers and the State: Agricultural Policies and Legitimacy in Rural Myanmar." Unpublished Ph.D. dissertation, University of Wisconsin, Madison.

Figure 1: Paddy Production Trends in Myanmar



Source: FAOSTAT.

Table 1: Myanmar's Economy and Agriculture

	1985/86	1990/91	1995/96	1996/97	1997/98	1998/99	1999/2000	2000/01
Growth rate of real GDP	2.9	2.8	6.9	6.4	5.7	5.8	10.9	13.6
Growth rate of agricultural sector	2.2	2.0	5.5	3.8	3.0	3.5	10.5	9.5
Agricultural sector's share in GDP	39.7	38.7	37.1	36.2	35.2	34.5	34.4	33.1
Agricultural sector's share in export	42.4	31.8	46.0	36.1	30.3	28.0	17.9	18.9
Agricultural sector's share in workforce			64.1	63.4	62.7			
Total irrigated area (million ha)	3.0	2.9		4.6		5.1		6.0
Share of irrigated area under paddy (%)	70.1	74.8		82.3		76.6		76.5

Note: "Agricultural sector" in this table does not include livestock, fishery, and forestry.
Source: CSO (2002).

Table 2: Survey Villages

Name in the paper	State/Division	Township	Village tract	Topology	Irrigation	Major crops
DELTA1	Ayeyarwady Div	Myaungmya	Kyonethout	Deltaic agric.	Pump	Paddy
DELTA2	Bago Div	Waw	Acarick	Deltaic agric.	Rainfed+Canal	Paddy, pulses
DRY1	Mandalay Div	Kyaukse	Pyiban	Dry zone	Canal	Paddy, vegetables
DRY2	Magway Div	Magway	Kanpyar	Dry zone	Rainfed	Upland crops
DRY3	Magway Div	Taungdwingyi	Wetkathay	Dry zone	Rainfed+Tank	Upland crops, paddy
HILL1	Shan State	Nyaungshwe	Linkin	Hilly region	Rainfed	Vegetables, paddy, sugarcane
HILL2	Shan State	Kalaw	Myinmahti	Hilly region	Rainfed	Vegetables, paddy
COAST	Tanintharyi Div	Myeik	Engamaw	Coastal agric.	Rainfed	Paddy, rubber

Source: Authors' survey (ibid. for the tables below).

Table 3: Sample Households

Village	Total number of households			Number of sample households					
	"Farm"	"Non-Farm"	Total	"Farm"	"Non-Farm"				Total
					With farmland	Agric. labor	Non-agric.	Sub-total	
DELTA1	232	283	515	67	1	17	15	33	100
DELTA2	213	243	456	60	0	30	10	40	100
DRY1	118	101	219	65	6	18	13	37	102
DRY2	326	336	662	24	0	12	4	16	40
DRY3	334	176	510	24	2	12	2	16	40
HILL1	544	298	842	26	0	9	3	12	38
HILL2	422	75	497	34	0	2	4	6	40
COAST	647	520	1167	41	5	7	8	20	61
Total	2836	2032	4868	341	14	107	59	180	521

Table 4: Education and Demographic Characteristics of Sample Households

	Average household size (no. of persons)	Average number of workers per household	Average age of the household head	Education level of household head			
				No education	Monastery education	Modern school education	
						(%)	Average schooling years
By village							
DELTA1	5.1	2.5	42.5	3.0	57.0	40.0	4.2
DELTA2	5.6	2.6	43.6	0.0	36.0	64.0	4.1
DRY1	4.7	2.2	42.5	0.0	18.6	81.4	5.1
DRY2	5.3	3.1	47.6	2.5	22.5	75.0	4.6
DRY3	5.7	2.9	47.6	5.0	7.5	87.5	4.8
HILL1	6.0	3.3	49.2	21.1	44.7	34.2	3.2
HILL2	5.6	2.9	45.0	2.5	17.5	80.0	4.6
COAST	6.7	2.9	51.1	0.0	36.1	63.9	5.4
By household type							
Farm	5.6	2.8	48.0	2.9	32.8	64.2	4.9
Non-farm, with farmland	5.1	1.9	36.9	0.0	64.0	85.7	3.5
Non-farm, agric. labor	5.2	2.5	38.8	4.7	32.7	62.6	3.9
Non-farm, non-agric.	5.3	2.3	42.3	0.0	35.6	64.4	4.9
Total	5.5	2.7	45.1	2.9	32.6	64.5	4.6

Table 5: Average Asset Ownership of Sample Households

	Farmland (acres)	Livestock (number)				Agricultural equipment and machinery (number)			Transportation equipment (number)		Total current value of production assets* (1000 Kyats)
		Bullocks and buffaloes for work	Cows	Pigs	Chicken and ducks	Plow	Power tiller	Irrigation pump	Bullock cart	Bicycle	
By village											
DELTA1	5.97	1.17	0.28	0.78	16.9	0.63	0.21	0.46	0.12	0.22	200.4
DELTA2	7.17	2.88	0.90	1.02	14.2	1.14	0.05	0.06	0.60	0.21	242.4
DRY1	3.32	0.71	0.25	0.67	4.9	0.42	0.05	0.13	0.32	1.08	216.6
DRY2	6.13	1.50	0.15	0.30	3.2	0.80	0.00	0.00	1.18	0.50	244.0
DRY3	6.06	1.75	1.15	0.78	8.8	1.13	0.00	0.03	0.65	0.55	170.1
HILL1	7.06	0.53	0.00	0.03	2.9	0.55	0.16	0.08	0.24	0.87	205.7
HILL2	3.92	1.40	0.05	0.63	0.1	1.20	0.00	0.03	0.50	0.25	160.1
COAST	5.81	1.46	0.25	0.62	15.6	0.72	0.02	0.00	0.13	0.15	549.1
By household type											
Farm	8.56	2.15	0.37	0.76	11.3	1.19	0.11	0.20	0.62	0.60	183.3
Non-farm, with farmland	0.14	0.29	0.50	0.57	1.2	0.07	0.00	0.00	0.07	0.29	60.3
Non-farm, agric. labor	0.00	0.04	0.07	0.20	2.8	0.00	0.00	0.00	0.00	0.00	11.5
Non-farm, non-agric.	0.00	0.03	0.02	0.81	12.6	0.00	0.00	0.00	0.00	0.00	322.2
Total	5.62	1.43	0.27	0.64	9.5	0.79	0.07	0.13	0.41	0.47	243.0

Note:
* The sum of the values of livestock, agricultural equipment and machinery, and transportation equipment, including items not listed in this table.

Table 6: Household Income Level

	Total household income (Kyats)		Income per capita (Kyats/person)				
					Mean for each household type		
	Mean	(Standard deviation)	Mean	(Standard deviation)	Farm households	Non-farm, agric. labor	Non-farm, non-agric.
By village							
DELTA1	134,535	(112,106)	30,065	(27,467)	32,598	19,751	31,375
DELTA2	155,423	(109,022)	29,745	(20,610)	30,002	26,828	36,948
DRY1	209,661	(196,239)	49,378	(54,493)	55,027	22,061	65,903
DRY2	216,482	(272,223)	43,975	(55,297)	60,343	17,390	25,518
DRY3	87,591	(76,341)	17,084	(15,632)	18,421	15,795	19,050
HILL1	194,807	(145,299)	36,447	(27,269)	40,634	29,742	20,280
HILL2	169,477	(140,675)	32,147	(25,250)	32,331	9,198	42,058
COAST	314,478	(583,405)	44,547	(58,844)	44,067	30,953	65,847
By household type							
Farm	207,981	(284,776)	39,337	(40,424)			
Non-farm, with farmland	140,238	(115,305)	28,772	(18,311)			
Non-farm, agric. labor	108,282	(73,120)	22,791	(13,103)			
Non-farm, non-agric.	193,861	(266,087)	43,947	(65,402)			
Total	184,086	(252,911)	36,177	(40,506)			

Table 7: Income Inequality and Poverty Measures

	Inequality measures for total household income			Headcount poverty measures for per-capita household income
	Mean log deviation	Theil coefficient	Gini coefficient	
By village				
DELTA1	0.338	0.269	0.398	0.508
DELTA2	0.237	0.186	0.335	0.294
DRY1	0.374	0.330	0.440	0.326
DRY2	0.659	0.551	0.563	0.539
DRY3	0.278	0.266	0.395	0.677
HILL1	0.269	0.245	0.389	0.411
HILL2	0.271	0.265	0.388	0.475
COAST	0.501	0.678	0.535	0.371
By household type				
Farm	0.434	0.419	0.461	0.391
Non-farm, with farmland	0.363	0.288	0.408	0.386
Non-farm, agric. labor	0.177	0.181	0.326	0.516
Non-farm, non-agric.	0.346	0.445	0.448	0.448
Total	0.402	0.421	0.460	0.421

Table 8: Household Income by Source

	Average income levels (Kyats per household)					Composition excluding "Unearned income transfer" (%)				
	Self-employment income from agriculture	Agricultural wage income (daily hired)	Agricultural wage income (seasonally hired)	Non-agricultural income	Unearned income transfer	Self-employment income from agriculture	Agricultural wage income (daily hired)	Agricultural wage income (seasonally hired)	Non-agricultural income	Total
By village										
DELTA1	82,771	16,896	3,055	31,813	-5,089	61.5	12.6	2.3	23.6	100.0
DELTA2	89,069	21,754	16,641	27,959	-2,757	57.3	14.0	10.7	18.0	100.0
DRY1	128,434	23,179	1,775	56,274	-6,604	61.3	11.1	0.8	26.8	100.0
DRY2	149,335	22,618	0	44,529	400	69.0	10.4	0.0	20.6	100.0
DRY3	53,027	22,655	2,983	8,927	-7,761	60.5	25.9	3.4	10.2	100.0
HILL1	105,061	44,209	0	45,536	-5,667	53.9	22.7	0.0	23.4	100.0
HILL2	118,969	19,770	0	30,739	-3,271	70.2	11.7	0.0	18.1	100.0
COAST	106,330	27,145	3,502	177,502	-1,280	33.8	8.6	1.1	56.4	100.0
By household type						0.0	0.0	0.0	0.0	
Farm	153,094	10,437	299	44,152	-5,891	73.6	5.0	0.1	21.2	100.0
Non-farm, with farmland	32,344	29,980	0	77,914	-2,772	23.1	21.4	0.0	55.6	100.0
Non-farm, agric. labor	802	67,560	20,860	19,061	660	0.7	62.4	19.3	17.6	100.0
Non-farm, non-agric.	14,787	16,258	2,533	160,283	-3,385	7.6	8.4	1.3	82.7	100.0
Total	102,910	23,353	4,767	53,057	-4,178	55.9	12.7	2.6	28.8	100.0

Table 9: Cropping Patterns of Sample Households

	Number of households#	Average farm size (FS) in acres			Average gross cultiv. area (GCA) in acres	Cropping intensity = GCA/FS	Acreage share of major crop groups (%)							
		Paddy fields	Other farmland	Total			Paddy, total	Summer paddy	Other paddy	Pulses	Oilseed crops	Vegetables	Industrial crops	Other crops
DELTA1	67	8.93	0.04	8.97	15.08	1.73	99.5	42.3	57.2	0.1	0.0	0.1	0.0	0.2
DELTA2	60	11.99	0.12	12.10	17.14	1.44	74.0	8.6	65.4	25.5	0.4	0.0	0.0	0.1
DRY1	71	4.38	1.00	5.38	8.75	1.64	62.5	22.5	40.0	1.8	16.2	17.4	0.8	1.3
DRY2	24	0.00	10.45	10.45	21.42	2.00	0.0	0.0	0.0	35.6	46.7	0.2	0.0	17.4
DRY3	26	6.09	3.43	9.51	12.27	1.30	45.6	1.1	44.5	15.9	30.9	2.6	0.2	4.7
HILL1	26	1.42	9.01	10.44	9.18	1.10	15.4	11.4	4.0	9.7	12.2	6.4	22.3	34.1
HILL2	32	1.01	3.53	4.53	5.24	1.41	32.1	0.0	32.1	6.9	9.4	50.6	0.0	1.0
COAST	44	4.21	4.00	8.21	7.77	0.94	51.7	1.0	50.7	0.3	0.0	2.4	33.6	12.0

Only those households with positive crop acreage during the survey year are included.

Table 10: Crop Income per Household by Crop Group

	Average crop income per household				Contribution of major crop groups to total crop income (%)							
	Level in Kyats	(Standard deviation)	Kyats/acre [FS]	Kyats/acre [GCA]	Paddy, total	Summer paddy	Other paddy	Pulses	Oilseed crops	Vegetables	Industrial crops	Other crops
DELTA1	100,607	(92,437)	11,222	10,574	96.3	47.3	49.1	0.2	0.0	0.5	0.0	3.0
DELTA2	156,839	(106,751)	12,958	9,152	60.8	3.9	56.9	38.4	0.6	0.0	0.0	0.2
DRY1	179,207	(182,317)	33,305	20,489	35.3	15.4	19.9	1.5	0.9	57.0	0.3	5.1
DRY2	268,764	(337,769)	25,718	12,547	0.0	0.0	0.0	4.6	84.2	0.0	0.0	11.3
DRY3	91,162	(94,754)	9,582	7,431	21.1	0.6	20.4	16.3	42.7	18.0	0.1	1.9
HILL1	137,780	(123,029)	13,200	15,017	6.4	5.1	1.3	4.2	2.5	28.3	43.9	14.7
HILL2	150,979	(141,289)	33,313	28,820	-0.3	0.0	-0.3	8.8	3.4	87.1	0.0	1.0
COAST	117,067	(120,947)	14,256	15,069	46.0	1.4	44.6	1.3	0.0	13.8	31.0	7.8

Table 11: Correlation Coefficients between Crop Acreage Shares and Per-Acre Crop Income

	Paddy acreage shares	Acreage shares of crop group *i*	(Name of crop group *i*)
DELTA2	-0.443	0.448	(Pulses)
DRY1	-0.385	0.555	(Vegetables)
DRY2	n.a.	0.599	(Other crops)
DRY3	-0.529	0.349	(Oilseed crops)
HILL1	-0.094	0.319	(Industrial crops)
HILL2	-0.364	0.308	(Vegetables)
COAST	-0.473	0.810	(Vegetables)

Note: This table reports bivariate correlation coefficients at the household level between per-acre crop income and crop acreage shares. With the exception of the coefficient on HILL1 (-0.094), all coefficients are statistically significant at 5%. See Table 9 for the number of observations.

Table 12: Production Cost Structure and Profitability of Major Crops

Unit: Kyats per acre

			Number of obser-vations	Acreage under the crop	Gross value of output (1)	Current input costs (2)	Value-added (3)=(1)-(2)	Paid factor costs (4)	Crop income (5)=(3)-(4)	Imputed factor costs (6)	Profits (7)=(5)-(6)	Diesel costs in (2)	Agric. machinery costs in (4) and (6)	Profits evaluated at market prices
A. Paddy in major paddy-producing regions														
	DELTA1	Monsoon	67	8.62	17,615	4,736	12,880	5,754	7,125	6,100	666	293	992	2,269
		Summer	66	6.47	27,526	13,765	13,762	4,739	9,023	8,933	90	2,578	5,017	90
	DELTA2	Monsoon	36	9.37	18,071	2,956	15,116	5,753	9,363	6,166	3,197	61	637	4,193
		Late monsoon	8	8.17	17,156	2,892	14,264	5,074	9,190	4,454	4,735	524	1,009	6,392
		Summer	13	3.12	16,603	3,067	13,537	3,181	10,355	6,965	3,390	627	380	3,390
	DRY1	Monsoon	33	4.06	29,171	10,273	18,898	9,468	9,430	2,396	7,034	271	2,488	9,761
		Summer	25	2.72	42,093	12,686	29,408	13,043	16,365	3,628	12,737	145	3,471	13,044
B. Paddy in other regions														
	DRY3	Total paddy	13	5.16	11,865	3,003	8,862	3,136	5,726	3,562	2,164	0	162	2,296
	HILL1	Total paddy	9	2.43	31,238	12,001	19,237	13,366	5,870	7,711	-1,840	365	1,906	548
	HILL2	Monsoon (paddy field)	7	1.37	27,061	13,600	13,461	11,141	2,320	8,783	-6,463	0	0	-5,142
		Monsoon (upland field)	9	1.97	16,829	11,117	5,713	5,507	205	6,984	-6,778	0	0	-6,222
	COAST	Monsoon	27	4.30	24,842	4,353	20,489	7,479	13,010	14,896	-1,887	34	1,099	1,379
C. Non-paddy crops														
Pulses	DELTA2	Black gram	15	5.58	30,648	5,467	25,181	3,598	21,583	7,047	14,536	165	344	14,693
	DELTA2	Green gram	14	3.73	20,630	4,630	16,000	2,128	13,872	6,803	7,069	0	148	8,397
	DRY2	Green gram	8	4.13	12,052	4,657	7,395	4,822	2,573	1,961	612	0	157	612
Oilseed crops	DRY1	Sesamum	15	4.18	6,468	1,457	5,011	3,205	1,805	2,075	-270	0	167	-270
	DRY3	Sesamum	13	5.49	32,563	9,489	23,074	5,071	18,003	2,833	15,170	0	0	15,170
	DRY2	Groundnut	9	1.91	56,881	12,963	43,919	2,657	41,262	9,038	32,224	0	0	32,224
Vegetables	DRY1	Chili	15	1.63	170,141	15,640	154,500	15,384	139,116	7,310	131,806	2,243	4,061	131,806
	DRY3	Potato	5	0.54	118,000	34,810	83,190	5,194	77,996	8,460	69,536	0	200	69,536
	HILL1	Potato	5	0.44	502,420	213,635	288,785	21,028	267,757	216,272	51,486	630	11,110	51,486
	HILL2	Potato	5	0.98	174,245	90,651	83,595	29,761	53,834	11,850	41,984	0	1,800	41,984
	HILL2	Cabbage	6	1.11	105,619	31,554	74,065	12,365	61,700	10,937	50,763	0	0	50,763
	HILL2	Cauliflower	6	1.01	101,638	32,988	68,649	5,917	62,732	10,159	52,573	0	0	52,573
Industrial crops	HILL1	Sugarcane	11	3.92	58,588	14,529	44,059	11,173	32,886	11,104	21,782	2,108	1,361	24,599
	COAST	Rubber	11	8.62	20,536	1,252	19,284	4,774	14,510	12,632	1,877	0	235	1,877

Notes: (1) Imputed factor costs include the input value of family labor, owned animals, and owned machinery, evaluated at the median village rental rates, but do not include the value of land and the interests on working capital owned by the household.
(2) Paid factor costs include interests paid for the working capital.
(3) See appendix table for more detailed results disaggregated by the size of operation.

Table 13: Labor Allocation by Sample Households

	Agriculture			Non-Agricultural Work									Total number of workers
				Self-employed					Employees				
	Self-employed	Seasonally hired	Daily hired	(1) Primary sector	(2) Rice milling	(3) Secondary sector except (2)	(4) Commerce	(5) Transpor-tation	(6) Daily hired	(7) Regularly hired	(8) Others	Sub-total	
Main occupation													
DELTA1	63.5	3.1	22.0	0.0	0.0	2.8	5.1	1.2	1.6	0.8	0.0	11.5	255
DELTA2	59.7	9.7	19.4	3.0	0.0	1.8	3.7	0.4	0.4	0.7	1.1	11.1	268
DRY1	57.6	2.1	23.7	0.0	0.0	0.8	9.3	1.7	0.4	2.5	1.7	16.4	236
DRY2	54.8	0.0	31.5	0.0	0.0	1.6	2.4	0.8	0.8	4.8	3.2	13.6	124
DRY3	66.4	1.6	25.3	0.0	0.0	0.0	3.4	0.0	0.0	2.5	0.8	6.7	119
HILL1	70.3	0.0	24.2	2.3	0.8	0.0	0.8	0.0	0.8	0.8	0.0	5.5	128
HILL2	85.3	0.0	9.5	0.0	0.0	2.6	0.0	0.0	0.0	1.8	0.9	5.3	116
COAST	52.5	3.3	9.3	1.6	2.2	6.0	8.7	6.0	3.8	6.0	0.5	34.8	183
Total	62.3	3.1	20.6	1.0	0.3	2.0	4.8	1.4	1.0	2.3	1.0	13.8	1429
Secondary occupation (if any)													
DELTA1	9.0	0.8	35.2	32.0	0.8	5.7	7.4	3.3	3.3	0.0	2.5	55.0	122
DELTA2	0.0	1.1	47.7	19.3	0.0	9.1	15.9	1.1	2.3	0.0	3.4	51.1	88
DRY1	7.6	0.0	40.5	1.3	1.3	7.6	26.6	2.5	6.3	0.0	6.3	51.9	79
DRY2	7.4	0.0	35.2	1.9	0.0	14.8	1.9	1.9	31.5	0.0	5.6	57.6	54
DRY3	2.3	2.3	59.1	4.5	0.0	9.1	0.0	2.3	13.6	2.3	4.5	36.3	44
HILL1	11.3	0.0	47.9	9.9	5.6	18.3	4.2	2.8	0.0	0.0	0.0	40.8	71
HILL2	2.4	0.0	56.1	4.8	2.4	14.6	7.3	4.9	2.4	0.0	4.9	41.3	41
COAST	11.5	0.0	23.0	1.6	8.2	16.4	18.0	3.3	6.6	0.0	11.5	65.6	61
Total	6.8	0.5	41.6	12.5	2.1	11.1	11.1	2.7	7.0	0.2	4.5	51.2	560

Note: The figures show the percentage of the workforce engaged in each category.

Table 14: Non-Agricultural Income per Household and per Worker

Unit: Kyats

	Self-employed					Employees			
	(1) Primary sector	(2) Rice milling	(3) Secondary sector except (2)	(4) Commerce	(5) Transpor-tation	(6) Daily hired	(7) Regularly hired	(8) Others	Total
Household average									
DELTA1	6,875	600	6,555	10,301	3,628	2,475	1,180	200	31,813
DELTA2	7,785	0	4,227	11,938	910	710	0	2,389	27,959
DRY1	196	980	2,276	33,926	5,139	4,310	4,736	4,757	56,274
DRY2	85	0	9,403	3,363	6,068	12,109	4,440	9,062	44,529
DRY3	900	0	588	3,143	672	1,266	1,080	1,279	8,927
HILL1	6,000	14,753	16,905	958	2,790	2,426	1,705	0	45,537
HILL2	2,020	0	13,936	4,985	1,613	1,688	1,560	4,938	30,739
COAST	4,708	31,985	25,760	21,615	57,109	13,483	8,804	11,128	174,592
Total	4,072	5,128	8,601	14,393	9,408	4,367	2,852	3,904	52,717
Per-worker average									
DELTA1	17,186	60,000	40,968	46,823	45,350	24,750	118,000	4,000	30,887
DELTA2	21,626	0	30,193	47,750	45,500	8,875	0	34,129	30,390
DRY1	20,002	100,001	25,789	78,647	87,358	73,277	80,504	48,525	69,156
DRY2	3,400	0	37,610	33,625	80,912	25,492	59,200	51,780	37,897
DRY3	18,000	0	5,875	31,425	26,880	6,332	14,400	51,152	15,525
HILL1	22,800	112,120	37,787	9,100	35,334	92,199	64,801	0	42,205
HILL2	40,400	0	55,745	39,880	16,125	67,500	62,400	65,833	45,539
COAST	71,804	216,787	56,120	52,740	267,974	51,403	59,672	61,708	92,610
Total	22,098	157,158	41,491	56,382	122,543	32,975	61,920	46,228	51,724

Table 15: Employment in Non-Agricultural Activities and Years of Completed Education

	Self-employed					Employees			
	(1) Primary sector	(2) Rice mills	(3) Secondary sector except (2)	(4) Commerce	(5) Transpor-tation	(6) Daily hired	(7) Regularly hired	(8) Others	Total
A. Number of workers:									
By main occupation									
No formal education (0 year)	6	0	5	11	3	2	3	4	34
Primary (1-4 years)	6	1	14	39	5	8	5	6	84
Secondary (5-8 years)	2	3	9	13	9	2	7	1	46
Higher secondary (9-10 years)	0	1	2	4	3	3	8	2	23
College and above (11+)	0	0	0	2	0	0	10	1	13
Total	14	5	30	69	20	15	33	14	200
By secondary occupation (if any)									
No formal education (0 year)	33	3	14	12	6	13	0	4	85
Primary (1-4 years)	30	3	28	36	5	18	1	13	134
Secondary (5-8 years)	7	4	18	10	4	4	0	4	51
Higher secondary (9-10 years)	0	2	1	3	0	4	0	4	14
College and above (11+)	0	0	1	1	0	0	0	0	2
Total	70	12	62	62	15	39	1	25	286
B. Average schooling years	2.07	5.29	4.11	3.89	4.11	3.44	7.56	4.15	3.87

Table 16: Determinants of Having an Attractive Non-Agricultural Job

	Probability of an individual to be self-employed in rice milling or in transportation, or employed regularly		Probability of an individual to be self-employed in rice milling, in trade, or in transportation, or employed regularly	
	Coef.	z-stat	Coef.	z-stat
Intercept	-2.560	-6.04 **	-3.148	-9.56 **
Village dummies				
DELTA2	-0.559	-2.28 *	-0.022	-0.15
DRY1	-0.137	-0.68	0.325	2.38 *
DRY2	0.112	0.49	-0.101	-0.55
DRY3	-0.162	-0.63	-0.248	-1.24
HILL1	0.243	1.09	0.009	0.05
HILL2	0.045	0.19	-0.095	-0.50
COAST	0.431	2.32 *	0.487	3.38 **
Individual attributes				
Age	0.071	3.59 **	0.099	6.63 **
Age-squared/100	-0.082	-3.30 **	-0.116	-6.21 **
Sex (male=1, female=2)	-0.567	-4.87 **	-0.083	-1.04
Schooling years	0.077	4.50 **	0.033	2.40 *
Number of observations		1890		1890
Likelihood ratio test statistics for zero slope		99.0 **		105.2 **
Log likelihood		-312.3		-617.0
Pseudo R-squared		0.137		0.079

Notes: (1) Estimated by a probit model using maximum likelihood estimation.
(2) Statistically significant at 1% (**) and 5% (*).

Appendix Table: Production Cost Structure and Profitability of Major Crops

	A. Paddy in Major Paddy-Producing Regions																	
	DELTA1						DELTA2					DRY1						
	MP total	small	large	SP total	small	large	MP total	small	large	Late MP	SP	MP total	small	large	SP total	small	large	
Number of observations	67	34	33	66	35	31	36	18	18	8	13	33	17	16	25	13	12	
Area under the crop (acres)	8.62	4.37	12.99	6.47	3.13	10.24	9.37	5.43	13.30	8.17	3.12	4.06	1.83	6.43	2.72	1.54	4.01	
Output value per acre	17615	17697	17531	27526	26203	29020	18071	20779	15363	17156	16603	29171	27926	30493	42093	46244	37597	
Current input per acre	4736	4537	4940	13765	12716	14948	2956	3381	2530	2892	3067	10273	9169	11446	12686	13403	11908	
Seed	(1558)	(1576)	(1541)	(2375)	(2368)	(2382)	(1224)	(1270)	(1179)	(1376)	(1126)	(2827)	(2932)	(2716)	(2806)	(2946)	(2654)	
Farm yard manure	(144)	(127)	(161)	(39)	(34)	(44)	(741)	(879)	(603)	(385)	(385)	(528)	(272)	(801)	(327)	(287)	(371)	
Fertilizer	(2702)	(2528)	(2882)	(8599)	(7558)	(9774)	(805)	(992)	(619)	(534)	(867)	(6405)	(5551)	(7313)	(8813)	(9343)	(8238)	
Other chemicals	(39)	(33)	(45)	(174)	(185)	(161)	(125)	(195)	(55)	(73)	(62)	(240)	(217)	(266)	(594)	(751)	(424)	
Diesel oil	(293)	(274)	(312)	(2578)	(2571)	(2587)	(61)	(46)	(75)	(524)	(627)	(271)	(197)	(350)	(145)	(77)	(220)	
Value added per acre	12880	13160	12591	13762	13487	14072	15116	17398	12833	14264	13537	18898	18757	19047	29408	32841	25689	
Paid factor costs per acre	5754	5062	6467	4739	4199	5348	5753	5880	5626	5074	3181	9468	10826	8025	13043	15891	9958	
Daily hired labor	(4094)	(3665)	(4535)	(1928)	(1670)	(2218)	(2873)	(3657)	(2089)	(2913)	(1814)	(4874)	(4896)	(4851)	(6875)	(8146)	(5498)	
Seasonally hired labor	(929)	(674)	(1191)	(953)	(525)	(1436)	(2533)	(1904)	(3162)	(1240)	(1164)	(197)	(0)	(407)	(12)	(0)	(24)	
Hired animals	(62)	(122)	(0)	(66)	(122)	(3)	(16)	(0)	(32)	(213)	(0)	(2129)	(3172)	(1020)	(2101)	(3608)	(467)	
Hired machinery	(255)	(297)	(211)	(1329)	(1638)	(979)	(141)	(200)	(83)	(633)	(192)	(2258)	(2740)	(1746)	(3290)	(3005)	(3598)	
Actual payment of interest	(416)	(305)	(530)	(464)	(244)	(712)	(190)	(119)	(260)	(76)	(11)	(10)	(19)	(0)	(766)	(1131)	(370)	
Income per acre	7125	8098	6123	9023	9288	8723	9363	11519	7207	9190	10355	9430	7931	11022	16365	16950	15731	
Imputed factor costs per acre	6100	6932	5243	8933	9028	8825	6166	6806	5526	4454	6965	2396	2621	2157	3628	3624	3632	
Family labor	(2861)	(3684)	(2013)	(3519)	(4563)	(2341)	(2080)	(2334)	(1826)	(1222)	(2973)	(865)	(1048)	(672)	(1292)	(1839)	(699)	
Own animals	(2502)	(2764)	(2231)	(1725)	(2042)	(1367)	(3591)	(3900)	(3281)	(2856)	(3804)	(1301)	(1573)	(1012)	(2155)	(1621)	(2734)	
Own machinery	(738)	(484)	(999)	(3688)	(2422)	(5117)	(496)	(572)	(419)	(377)	(188)	(230)	(0)	(474)	(181)	(164)	(200)	
Profit per acre	666	246	1098	90	259	-101	3197	4712	1681	4735	3390	7034	5310	8865	12737	13326	12099	
All output at market price																		
Value added per acre	14483	14729	14229	13762	13487	14072	16112	18650	13575	15920	13537	21625	21378	21889	29715	33432	25689	
Income per acre	8728	9667	7762	9023	9288	8723	10360	12770	7949	10846	10355	12157	10551	13864	16672	17541	15731	
Profit per acre	2269	1816	2736	90	259	-101	4193	5964	2423	6392	3390	9761	7930	11707	13044	13917	12099	

Notes: (1) Figures in parentheses represent the break-down of the first row in the row group without parentheses.
(2) When the number of observations is larger than 20, observations are divided into "small" (<=median) and "large" (>median) by the size of the area under the crop.
(3) "MP" indicates Monsoon Paddy and "SP" indicates Summer Paddy.

Appendix Table: Production Cost Structure and Profitability of Major Crops (continued)

	B. Paddy in Minor Paddy-Producing Regions						
	DRY3	HILL1	HILL2		COAST		
	Paddy all types	Paddy all types	MP on paddy fields	MP on upland fields	MP total	small	large
Number of observations	13	9	7	9	27	14	13
Area under the crop (acres)	5.16	2.43	1.37	1.97	4.30	2.37	6.38
Output value per acre	11865	31238	27061	16829	24842	26725	22814
Current input per acre	3003	12001	13600	11117	4353	4627	4057
Seed	(1407)	(2009)	(1641)	(707)	(1327)	(1473)	(1169)
Farm yard manure	(891)	(1186)	(5366)	(4202)	(692)	(391)	(1016)
Fertilizer	(640)	(5923)	(6172)	(5759)	(1856)	(2134)	(1557)
Other chemicals	(65)	(2519)	(421)	(449)	(444)	(629)	(244)
Diesel oil	(0)	(365)	(0)	(0)	(34)	(0)	(71)
Value added per acre	8862	19237	13461	5713	20489	22098	18756
Paid factor costs per acre	3136	13366	11141	5507	7479	8819	6036
Daily hired labor	(1813)	(10194)	(5359)	(3240)	(3019)	(3772)	(2209)
Seasonally hired labor	(250)	(0)	(0)	(0)	(2828)	(2892)	(2758)
Hired animals	(649)	(1955)	(5434)	(964)	(466)	(627)	(292)
Hired machinery	(162)	(776)	(0)	(0)	(1005)	(1399)	(579)
Actual payment of interest	(264)	(441)	(348)	(1304)	(162)	(129)	(198)
Income per acre	5726	5870	2320	205	13010	13278	12721
Imputed factor costs per acre	3562	7711	8783	6984	14896	14285	15555
Family labor	(1044)	(5201)	(6371)	(5026)	(8814)	(8341)	(9324)
Own animals	(2517)	(1380)	(2412)	(1957)	(5988)	(5944)	(6036)
Own machinery	(0)	(1130)	(0)	(0)	(94)	(0)	(195)
Profit per acre	2164	-1840	-6463	-6778	-1887	-1007	-2834
All output at market price							
Value added per acre	8994	21625	14783	6269	23755	25132	22272
Income per acre	5858	8259	3641	762	16276	16312	16236
Profit per acre	2296	548	-5142	-6222	1379	2027	681

Appendix Table: Production Cost Structure and Profitability of Major Crops (continued)

	C. Non-paddy crops													
	Pulses			Oilseed crop			Vegetables						Industrial crops	
Crop	Black gram	Green gram		Sesame		Groundnut	Chili	Potato			Cabbage	Cauli-flower	Sugarcane	Rubber
Village	DELTA2	DRY2	DELTA2	DRY1	DRY2	DRY3	DRY1	HILL1	HILL2	DRY3	HILL2	HILL2	HILL1	COAST
Number of observations	15	8	14	15	13	9	15	5	5	5	6	6	11	11
Area under the crop (acres)	5.58	4.13	3.73	4.18	5.49	1.91	1.63	0.44	0.98	0.54	1.11	1.01	3.92	8.62
Output value per acre	30648	12052	20630	6468	32563	56881	170141	502420	174245	118000	105619	101638	58588	20536
Current input per acre	5467	4657	4630	1457	9489	12963	15640	213635	90651	34810	31554	32988	14529	1252
Seed	(4660)	(1798)	(3676)	(888)	(2019)	(8795)	(1751)	(121900)	(16368)	(13300)	(7804)	(19136)	(5279)	(0)
Farm yard manure	(67)	(0)	(72)	(287)	(2093)	(1284)	(1532)	(13402)	(33483)	(7185)	(12200)	(5040)	(1038)	(0)
Fertilizer	(159)	(1808)	(357)	(282)	(4185)	(1338)	(9017)	(22480)	(12330)	(10825)	(7687)	(5899)	(6103)	(0)
Other chemicals	(417)	(1051)	(525)	(0)	(1193)	(1546)	(1096)	(55223)	(28469)	(3500)	(3864)	(2913)	(0)	(1252)
Diesel oil	(165)	(0)	(0)	(0)	(0)	(0)	(2243)	(630)	(0)	(0)	(0)	(0)	(2108)	(0)
Value added per acre	25181	7395	16000	5011	23074	43919	154500	288785	83595	83190	74065	68649	44059	19284
Paid factor costs per acre	3598	4822	2128	3205	5071	2657	15384	21028	29761	5194	12365	5917	11173	4774
Daily hired labor	(1390)	(3991)	(956)	(1053)	(3597)	(2657)	(8802)	(11304)	(19647)	(4354)	(6190)	(2374)	(5945)	(2212)
Seasonally hired labor	(2160)	(0)	(978)	(313)	(136)	(0)	(1257)	(0)	(0)	(0)	(0)	(0)	(0)	(2405)
Hired animals	(0)	(332)	(0)	(1673)	(505)	(0)	(2176)	(225)	(4158)	(640)	(2808)	(1989)	(2399)	(0)
Hired machinery	(48)	(157)	(148)	(167)	(0)	(0)	(3149)	(9030)	(1800)	(200)	(0)	(0)	(906)	(158)
Actual payment of interest	(0)	(342)	(46)	(0)	(833)	(0)	(0)	(469)	(4156)	(0)	(3367)	(1553)	(1923)	(0)
Income per acre	21583	2573	13872	1805	18003	41262	139116	267757	53834	77996	61700	62732	32886	14510
Imputed factor costs per acre	7047	1961	6803	2075	2833	9038	7310	216272	11850	8460	10937	10159	11104	12632
Family labor	(2606)	(844)	(2912)	(454)	(1039)	(3010)	(4155)	(213952)	(7910)	(3120)	(8131)	(9537)	(9778)	(12555)
Own animals	(4144)	(1116)	(3891)	(1622)	(1794)	(6028)	(2243)	(240)	(3940)	(5340)	(2806)	(622)	(871)	(0)
Own machinery	(296)	(0)	(0)	(0)	(0)	(0)	(912)	(2080)	(0)	(0)	(0)	(0)	(455)	(77)
Profit per acre	14536	612	7069	-270	15170	32224	131806	51486	41984	69536	50763	52573	21782	1877
All output at market price														
Value added per acre	25338	7395	17328	5011	23074	43919	154500	288785	83595	83190	74065	68649	46876	19284
Income per acre	21740	2573	15200	1805	18003	41262	139116	267757	53834	77996	61700	62732	35703	14510
Profit per acre	14693	612	8397	-270	15170	32224	131806	51486	41984	69536	50763	52573	24599	1877