THE IMPACT OF MIGRATION ON THE RICE HOUSEHOLD ECONOMY: A CASE STUDY IN CENTRAL JAVA, INDONESIA

Dampak Migrasi terhadap Ekonomi Rumah Tangga Petani Padi: Studi Kasus di Jawa Tengah, Indonesia)

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ABSTRAK

Penelitian ini bertujuan untuk mempelajari dampak migrasi pria dan wanita terhadap kehidupan dan pemberdayaan wanita. Survei formal dilakukan pada 12 desa dari 4 kabupaten dan mencakup 7 desa sawah tadah hujan dan 5 desa sawah irigasi. Responden yang diwawancarai dalam survei terdiri dari 297 orang. Hasil penelitian menunjukkan bahwa migrasi jangka panjang kebanyakan dengan tujuan luar negeri dan migrasi musiman kebanyakan dengan tujuan kota atau desa terdekat. Migran kebanyakan berasal dari rumah tangga dengan kepemilikan sawah kurang dari 0,25 hektar. Migran jangka panjang didominasi oleh anak laki-laki dan migran musiman didominasi oleh suami dan anak laki-laki. Tujuan dari migrasi jangka panjang adalah luar negeri sedangkan migrasi musiman adalah kota-kota di Jawa. Migran jangka panjang maupun musiman kebanyakan bekerja sebagai buruh bangunan. Penghasilan dari migran jangka panjang dan musiman berkisar 30-50 persen dari pendapatan rumah tangga. Migrasi berdampak negatif terhadap produksi padi di lahan irigasi berupa kelangkaan tenaga kerja. Akan tetapi, migrasi sangat penting bagi peningkatan pendapatan rumah tangga karena kontribusinya cukup besar. Ukuran rumah tangga, usia istri, dan aset rumah tangga berpengaruh positif terhadap kejadian migrasi, sedangkan usia suami, pendidikan suami, kepemilikan lahan, dan tenaga kerja upahan berpengaruh negatif terhadap kejadian migrasi.

Kata kunci: *migrasi, pendapatan, padi*

ABSTRACT

This study aimed at assessing the impact of male and female migration on women empowerment and livelihood. Formal survey was conducted at 12 villages in four districts including 7 villages of rainfed and 5 villages of irrigated lowland areas. Two hundred and ninety seven of respondents were interviewed during the survey. Results of the study showed that prevalent migration is mostly long-term for international and seasonal for rural to rural/city migration. Distribution of household with migrant is dominated by those with land ownership size less than 0.25 hectare. Long-term migrants are mostly son of the family while seasonal migrants are both son and husband. Destination of permanent migrant is foreign countries while seasonal migrant works in cities of Java. Occupation of permanent and seasonal migrant is mostly as construction worker. Remittances of permanent and seasonal migrant is ranging from 30-50 percent of

total household income. Migration has more prevalent negative effect on the production in irrigated environment because of the scarcity of labor. However, migration is important in household income because of the contribution of remittances. Household size, age of wife and household durables have positive effect on migration while age of husband, education of husband, size of land holding and hired labor have negative effect.

Key words: *migration, income, rice*

INTRODUCTION

Recently, international migration has become a world phenomenon. It is estimated that 120 million people were living abroad (McFalls, Jr., 1998). In the last decade, population mobility within South East Asian countries and the countries has been increasing. This phenomenon has also influenced socio-economic and cultural changes (Firdausy, 1998).

International migrations from Indonesia are mostly overseas contract workers who work in many rich countries such as Saudi Arabia in the middle-east, and the Asia Pacific countries (i.e. Hong Kong, Malaysia, Singapore, and Taiwan). These laborers work by contract for around two years, with possibility of an extension if there is an agreement between workers and their employers. Recent global trends indicate that more women migrate, not only as their spouses' dependent, but also migrating independently, for economic reasons.

The significant of women in international migration lies not only in their increased numbers, but also through their contributions to economic and social life in receiving and sending countries. There is also evidence that women's ability to earn and send home remittances has increased their social status. Hence, there are actually economic and non economic factors that influence women's decision to migrate. Although migration can be associated with women's empowerment, it does not necessary follow that women who migrate will be empowered. In fact the opposite may be the case (Hugo, 2000).

In the other hand, the unemployment rate in Indonesia is estimated to exceed 10 percent or about 20 million labor force in 2006 (CBS, 2007). Income in the informal sector is falling with weaker domestic demand and higher input prices. Moreover, labor force from informal sector is expanding with the entry of unemployed people from formal sector resulting in sharply lower earning per worker. Agriculture is likewise adversely affected by higher input prices, restricted credit and weaker domestic demand. The agricultural work force is swelling with the return of urban workers who have lost their job, resulting in diminished agricultural income per capita.

Declining levels of income and consumption per capita will lead to more immediate increases in poverty incidence and intensity. This is probable in countries where a sizeable proportion of the population is close to the poverty threshold such as Indonesia. With the deepest contraction in gross domestic

product (GDP) during the financial crisis, Indonesia is experiencing the largest increase in poverty. Farm workers as opposed to self-employed farmers are typically represented among the poor. They have to compete for work with unemployed worker from other sectors. Many farmers move to urban areas to live with relatives and work for a few months in order to supplement their farm incomes.

The study of labor migration from rice farming villages was aimed:

a. to determine the factors which lead to outmigration of male and female labor from rice farming villages in rainfed and irrigated lowland areas.
b. to assess the impact of male and female labor migration from rice based agriculture on rice production and household income.

METHODOLOGY

Conceptual Framework

Prevalence of migration can be analysed based on physical, demographical, cultural, economical, and social aspects (Todaro, 1985). Only the last two aspects will be discussed in this article. The economical aspect of rural-urban migration flow per unit of time and number of employed urban workers which involved urban-rural wage differential and probability of getting job has intensively discussed by scientists (Todaro, 1969; Todaro, 1976). Furthermore, Suharso (1976) showed that unavailability of sufficient job in rural areas was the major factor contributed to outmigration. It was also found that if the major source of farmer's income from agricultural sector was not sufficient and the alternative sources of income was not available, then the farmers would migrate from rural to urban (Erwidodo *et al*., 1992; Syafaat *et al*., 1998). Todaro (1985) and Pernia (1993) indicated that the job opportunities and better income was the major factors contributed to the decision of migration. Modern sector was the pull-factors of educated labor to migrate to the city. However, the uneducated labor was also found in migration since the informal sectors were available for their sources of income.

Besides the economical aspect, the flow of rural-urban migration and out-migration can also be analyzed by social aspects. Migration seems to be inter-related with the decision-making power of women within the family and the level of migrant education.

The increasing number of women involved in international labor migration in Indonesia has increased the women's economic contribution to the family and enhanced her status within the family. This has led to an increase in women's independence and decision-making power in their family. In addition, migrants' wages provided the investment capital for rural commodity production, while the experience of migrant was a conduit for the flow of new ideas and

social practices into rural areas. Hence, this condition will improve the gender role balance and source of livelihood in rural areas. Diversified livelihoods may involve combining farming with wage labor, trading, selling services, and producing commodities for sale. They also involve all the help, transfers, exchanges and information that people get access to through social networks.

However, migration will also affect the level of intensification program in rice-based agriculture and will reduce the productivity of rice and household welfare in the long run. Therefore, the prevalence to and factors affecting migration (pull and push factors) need to be studied. This study will be useful for reorientation of agricultural development strategy to maintain the high performance of agricultural sector.

Selection of Site and Respondent

Four districts were selected purposively, as the sites for this study, based on agro-ecological systems and the coverage of rainfed lowland areas in Central Java. Blora and Rembang districts were selected to represent rainfed lowland while Pati and Demak districts were selected to represent irrigated lowland. Selection of sites was also based on the prevalence of out-migration data from Central Java province. Thirty two villages (8 villages for each district) were selected purposively representing diversity of out-migration prevalence (low and high).

Formal survey was conducted in 2002 to assess the prevalence of out-migration. A number of 297 household were selected randomly representing household with migrant and without migrant members. The respondent of this study could be either husband or wife as head of household.

Data

Data collected during the survey includes primary data and secondary data. The primary data covers respondent characteristics, tenure, assets and durable goods, source of income, remittances, farm's inputs and outputs, and labor allocation. While the secondary data covers the prevalence of migration obtained from village head and other key informants.

Method of Analysis

Probit model was used to find out the determinants of migration. This procedure is useful for situation where the model have a dichotomous outcome that is thought to be influenced or caused by some independent variables. It assumes that the categorical dependent reflects an underlying quantitative variable and it uses the cumulative normal distribution. The maximum likelihood estimation procedure was used to obtain the function. The function is expressed in the following form:

$P\,[Y = 1] = F(a + b_i'X_i)$, i=1…13 ..... (1)

where

F = normal cumulative distribution function

Y = household with migrant (1-with migrant, 0-without migrant)

a = intercept

X_1 = Household size

X_2 = Age of husband (years)

X_3 = Age of wife (years)

X_4 = Education of husband (years)

X_5 = Education of wife (years)

X_6 = Tenure (0=owner operator, 1=leaseholder)

X_7 = Farm income (US$/year)

X_8 = Household durables (US$)

X_9 = Size of landholdings (ha)

X_{10} = Ecosystem (1=irrigated, 0=rainfed)

X_{11} = Family labor days (days/ha)

X_{12} = Hired labor days (days/ha)

X_{13} = Production (kg)

b_1- b_{13} = regression coefficient.

The expected sign of b_1, b_5, b_6, b_8, b_{10}, $b_{11} > 0$ and b_2, b_3, b_4, b_7, b_9, b_{12}, $b_{13} < 0$.

A positive sign of b_1, b_5, b_6, b_8, b_{10}, b_{11} means that a bigger size of household tends to have higher migrated member because of excess labor for farm activities, a household with better educated wife tends to have higher migrated member due to higher expectation to their children to have a better work out of agriculture in city or abroad, lease holder household tends to have member migrated due to land unavailability for farming and higher wages for non agriculture work, household with more durable goods tends to have member migrated due to more capital available to finance the migration costs, irrigated lowland household tends to have member migrated due to more capital available, household with higher family labor days tends to have member migrated to have higher productivity of their labor.

A negative sign of b_2, b_3, b_4, b_7, b_9, b_{12}, b_{13} means that household with younger husband, younger wife, lower educated husband, lower farm income, lower size of land holding, and lower hired labor days tends to have member migrated due to lower capital available for farming.

The case $Y = 1$ stands for household default on having migrant, and X_i are the vector of household characteristics. Given a data set of household with and without migrant, together with their socio economic variables and their characteristics X_i, we can estimate the parameters a and b, and then use $F(a + b' X_i)$ to predict the probability that a household with characteristics X_i default on having migrant. The significance of a probit model is tested using scaled deviance also known as log likelihood. With a significant likelihood ratio we know that the improvement in the likelihood that we get by adding the variables in the model is sufficiently large. It is not due to chance alone.

The Cobb-Douglas production function was used to model the impact of migration on rice production and technical efficiency. The following equation is the specification of the model:

$$Y = a\prod_{i=1}^{5} X_i^{b_i} \quad \text{..... (2)}$$

where

Y = production (kg)

a = intercept

x_1 = land (ha)

x_2 = labor (day)

x_3 = capital (thousand Rp)

x_4 = dummy for ecosystem (1-irrigated, 0-rainfed)

x_5 = dummy for migrant (1-with migrant, 0-none)

b_1- b_5 = regression coefficient.

The expected sign of b_1, b_2, b_3, $b_4 > 0$ and $b_5 < 0$.

A positive sign of b_1, b_2, b_3, and b_4, means that yield will increase if land size increases, labor allotted to rice farming increases, capital spent for rice farming increases and yield of irrigated lowland higher than that of rainfed lowland, respectively. A negative sign of b_5 means that the yield of household without migrant is higher than that of with migrant.

Efficiency can be considered in terms of the optimal output that could be produced given a set of inputs. Cobb-Douglas stochastic production frontier model was computed using Frontier Version 4.1. The stochastic frontier model assumes an error term with two additive components – asymmetric component that accounts for pure random factors (v_i), and a one-sided component, which captures the effects of inefficiency relative to the stochastic frontier (u_i). The following is the specification of the model:

$$Y = a\prod_{i=1}^{3} X_i^{b_i} + (v_i - u_i) \quad \text{..... (3)}$$

where

Y = production (kg)

a = intercept

x_1 = land (ha)

x_2 = labor (days)

x_3 = capital (thousand Rp)

v_i = random error

u_i = inefficiency error

b_1- b_3 = regression coefficient

The expected sign of b_1, b_2, $b_3 > 0$.

A positive sign of b_1, b_2 and b_3 means that production will increase if land size, labor, and capital allocated to rice farming increases.

Ordinary Least Square (OLS) was used as the initial set of parameters. After generating the primary index of the model, it is followed by a series of iterations leading to the final set of parameters (MLE). Technical efficiency is defined as:

$$TE_i = \exp(-u_i)$$

It is predicted using the conditional expectation of $\exp(-u_i)$, given the composed error term in the previous model. The software Frontier Version 4.1 was also used to compute estimates of efficiency. Technical efficiency index ranges from 0-1 (inclusive). This means that high technical efficiency index of household's production has achieve the maximum of its potential. Technical efficiency estimates was computed for the two ecosystems because of different environmental factors between irrigated and rainfed lowland.

OLS was used to identify the impact of migration and other socio-economic factors of influencing household income. The function is expressed in the following form:

$$Y = a + \sum_{n=1}^{8} b_n X_n + e \quad \text{..... (4)}$$

where

Y = household income (thousand Rp)

a = intercept

X_1 = Education of husband (years)

X_2 = Tenure (1-owner operator, 0-leaseholder)

X_3 = Type of household (1-nuclear, 0-extended)

X_4 = Total size of landholdings (ha)

X_5 = Ecosystem (1-irrigated, 0-rainfed)

X_6 = Migration (1-with migrant, 0-without migrant)

X_7 = Years in farming of husband

X_8 = Years in farming of wife

$b_1 – b_8$ = regression coefficients

The expected sign of b_1, b_2, b_4, b_5, b_6, b_7, $b_8 > 0$ and $b_3 < 0$

e = error term.

A positive sign of b_1, b_2, b_4, b_5, b_6, b_7, b_8, means that higher income was obtained by household with more educated husband, land owner operator, nuclear family, larger land size, irrigated farm, migrated members, more experience in farming, better educated wife. Moreover, a negative sign of b_3 means that higher income was obtained by extended household.

Multivariate model (OLS) is also used to identify the impact of migration and other significant factors in determining agricultural income. The model is based on the following specification:

$$Y = a + \sum_{n=1}^{7} b_n X_n + e \quad \text{..... (5)}$$

where

Y = agricultural income (thousand Rp)

a = intercept

X_1 = Education of husband (years)

X_2 = Education of wife (years)

X_3 = Tenure (1-owner operator, 0-leaseholder)

X_4 = Type of household (1-nuclear, 0-extended)

X_5 = Total size of landholdings (ha)

X_6 = Ecosystem (1-irrigated, 0-rainfed)

X_7 = Migration (1-with migrant, 0-without migrant)

$b_1 – b_7$ = regression coefficients.

The expected sign of b_1, b_2, b_3, b_5, $b_6 > 0$ and b_4, $b_7 < 0$

e = error term

A positive sign of b_1, b_2, b_3, b_5, and b_6 means that a higher agricultural income was obtained by household with more educated husband, more educated wife, land owner operator, nuclear family, larger land size, irrigated farm and have migrated members. Moreover, a negative sign of b_4 and b_7 means that higher income was obtained by extended household.

RESULTS AND DISCUSSION

Characteristics of Study Area

Based on agroclimatic zone, Central Java is categorized as wet area. On the average, it has more than 2000 mm of rainfall per year. This amount of rainfall is generally suitable for agricultural activities. Based on rainfall pattern, Central Java can be divided into northern areas, middle areas, and southern areas. The middle upland plain has a higher average rainfall than those of the northern and southern lowland plains.

Average geographical area of the sample villages was 450 hectare, in which rainfed area was less than irrigated area. The area of rainfed and irrigated villages was 379 and 522 hectare, respectively. The distances from the rainfed and irrigated villages to the nearest city were not different but the distances to the bus station were different. As consequence the cost of transportation was quite different (table 1).

Table 1. Biophysical and Demographical Characteristics of Sample Villages, Central Java

Characteristics	Rainfed	Irrigated	Average
Distance to the nearest city (km)	19.6	21.6	20.6
Distance to bus station (km)	16.8	11.8	14.3
Cost of transportation to the nearest city (Rp)	1421	2078	1750
Population:			
• Adult male	899	1351	1125
• Adult female	924	1323	1124
• Adult Female/Male Ratio	1.01	0.98	1.01
Geographical area (ha)	379	522	450
Total cultivated area (ha)	247	388	318
Total rice area (ha)	157	330	243

The population of irrigated lowland villages was higher than that of rainfed lowland villages both male and female. On the other hand, the

female/male ratio in the rainfed lowland villages was higher than that of irrigated lowland villages. This indicates that labor supply from rainfed was dominated by female labor.

The cultivated portion of land in the study area consisted of irrigated lowland, rainfed lowland, and upland. These were used by farmers to grow grains, vegetables, and perennial crops. The cropping pattern can be grouped into rice-rice-fallow; rice-rice-secondary crops (palawija), and rice-secondary crops. Farmers practiced different cropping patterns based on availability of water. Rice was the main crop in the study area and legumes (mungbean, peanut, soybean), corn, tuber crops (cassava, sweet potato) and vegetables were the secondary crops. Feed crops (sesbania, king and elephant grasses) are found only in the rainfed lowland since number of cattle was relatively high. Crops were grown during two distinct seasons: the wet season (October-February) and the dry season (March-September).

In general, the average number of migrant from farming household was higher than landless household, both from rainfed and irrigated lowland. Approximately, 27 percent of farming household had member migrated while landless household had only 9 percent, both from irrigated and rainfed lowland. Proportion of male migrant (husband or male other than husband) was higher than female migrant for both rainfed and irrigated lowland areas (table 2).

Table 2. Number of Migrant from Farming and Landless Household, Central Java, 2002

Migration	Rainfed		Irrigated	
	Farming	Landless	Farming	Landless
Average number of household (hh)	523	101	916	130
Average number of hh migrated[1)]	173 (27.7)	50 (8.0)	276 (26.4)	110 (10.5)
Average number of hh with male migrated[1)]	121 (19.4)	41 (6.6)	200 (19.1)	92 (8.8)
Average number of household with female migrated[1)]	52 (8.3)	9 (1.4)	76 (7.3)	18 (1.7)

[1)]Figures in parenthesis are percentages of total household (farming and landless)

Husband or male migrant tends to be migrated after crop establishment for earning additional income while women and other family members were responsible to daily farming activities such as weeding and other crops and animals care activities. Male migrant would come back to their village for harvesting and threshing rice crop during the harvest time. Most of them also worked as harvesters at the surrounding villages since income from those activities were comparable to the job in the city. After harvesting time, they

looked for another job in the city until the second rice or secondary crop planting season started. They went to the city to get higher income opportunities.

Migration pattern for male was seasonal. Male migrants did not work or manage their farm but worked elsewhere for one crop season. The male migrant usually come back during land preparation and crop establishment. Migration pattern for female was mostly long-term or at least for one year term. Female migrants usually return home during the Ramadhan. This fact occurred for both rainfed and irrigated lowland (table 3).

Table 3. Proportion of Male and Female Migrants from Farming Household, Central Java, 2002

Pattern of migration	Male migrants		Female migrants	
	Number	%	Number	%
Rainfed				
Seasonal	70	57.9	22	42.3
Long-term	51	42.1	30	57.7
Total	121	100.0	52	100.0
Irrigated				
Seasonal	129	64.5	14	31.9
Long-term	71	35.5	62	68.1
Total	200	100.0	76	100.0

Characteristics of Sample Household

Migrants from both irrigated and rainfed lowland are dominated by male labor. The proportion of male migrant tends to be higher for short-term migrant's group since they need to be returned home for farm works (table 4).

Table 4. Socio-economic Characteristics of Sample Household by Agro-ecosystem, Central Java, 2002

Characteristics	Irrigated			Rainfed		
	LTM n=59	STM n=26	NM n=48	LTM n=52	STM n=56	NM n=56
Sex of family member migrated (%):						
Male	49	65	0	56	70	0
Female	32	19	0	33	28	0
Both	19	16	0	11	2	0
Size of land holding (%):						
≤0.25 ha	42	65	22	44	64	20
0.26-0.50 ha	22	12	35	33	20	29
0.51-1.00 ha	20	23	25	17	11	30
≥1.00 ha	16	0	18	6	5	21
Household size (%):						
Less than 6 person	85	89	96	89	97	98
More than 6 person	15	11	4	11	3	2

Note: LTM=long term migrant (permanent); STM=short term migrant (monthly and seasonal); NM=non migrant; n=number of respondent.

Size of landholding likely influenced the probability of migration. As shown in table 4, the lower size of landholding the higher rate of migration. This fact was consistent both for rainfed and irrigated lowland. About 65 percent of short term migrant came from the household with land of less than 0.25 hectare, but for long term migrants about 42-44 percent of them came from the same land size. This figure indicated that the short-term migrant came mostly from the household with lower land ownership.

The household size of migrant were mostly less than 6 persons. There was no evidence that bigger size of family tended to have more members to migrate. It seems that working age group influenced the tendency to migrate. Migrants tended to be young males and females between 15-34 years of age. Migrants between the ages of 35-49 from the irrigated lowland were found to be doubled than from the rainfed lowland. This is consistent with various studies in Asia and Africa that provided quantitative evidence of this phenomenon such as in the Philippines, Thailand, India, and Tanzania (Todaro, 1985).

Migration Pattern

About 63 percent of migrant had a previous work as farmer. Only about 11 percent of them have a temporary work as farm and industrial laborer. About 27 percent of them are jobless (table 5). However, they did other jobs after migrated that different from their previous job. Construction sectors were the main choice of male migrants. The same pattern has also been found in Laguna, Philippines (Kikuchi *et al*., 1983). Male migrants mostly worked in building and road constructions, while female migrants mostly worked as sales person, and house keeper or maids. Male migrants also had other job as car drivers or car conductors. Agricultural and product sale activities were done by both male and female migrants.

In general, most of long-term migrants were working in foreign country. However, short term migrant usually works in Jakarta or other cities in Java. The cosmopolitant cities were chosen by migrants as the best destinations for both male and female labor from rainfed and irrigated lowland. The interesting fact showed that female labor from irrigated lowland tend to migrate far away from their village (abroad) compared to female from rainfed lowland. It may be caused by the availability of capital needed for migrating and the higher responsibility of female in the rainfed to their farm work.

Most of migrants (62%) have working experience about 1-3 year. Only 34 percent of them have been working for more than 3 years. This figure indicates that the prevalence of migration happened when the economic crisis in Indonesia. People migrated to neighboring countries for their family survival because the income from rice based farming could not support their needs.

Table 5. Characteristics of Migration Pattern, Central Java, 2002

Characteristics	Irrigated		Rainfed		Average
	LTM n=59	STM n=26	LTM n=52	STM n=56	
Pre occupation (%):					
Farmer	49	54	65	84	63
Farm and industrial labor	17	11	12	2	11
Job less	34	35	23	14	27
Occupation of migrant (%):					
Construction worker	44	62	46	52	62
Household helper	17	12	11	13	13
Sales and services	15	12	11	14	13
Industry	8	7	17	11	11
Agriculture laborer	10	0	11	5	7
Transport worker	6	7	4	5	6
Place of work (%):					
Foreign country	64	19	50	16	37
Jakarta	12	69	17	27	31
Other city in Java	4	4	27	43	20
Other city out Java	20	8	6	14	12
Duration (%):					
Less than 1 year	0	4	4	7	4
1-3 year	64	69	63	52	62
More than 3 years	36	27	33	41	34

Farm and Household Assets of Migrant

In general, households with long-term migrant have higher total value of non land assets than those household with short-term migrant and without migrant both in irrigated and rainfed lowland (table 6). Most of migrant from farm household in the irrigated lowland migrated after crop establishment, while migrant from farm household in the rainfed lowland did not do the same thing since the farm activities in the rainfed lowland needed more labor including animal raising. As indicated in table 6 household without migrant have a higher total value of animal than those household with migrant.

Source of Income

Total annual income of household with migrant is higher than those without migrant. However, household without migrant have higher agricultural or farm income. It is caused by the share of income from livestock higher compared to that from crops (table 7).

Table 6. Farm and Household Assets Owned by Respondents (in US$), Central Java, 2002

Item	Irrigated			Rainfed		
	LTM n=59	STM n=26	NM n=48	LTM n=52	STM n=56	NM n=56
Farm and household assets:						
Building	2544	1865	2267	1771	1226	1386
Farm machinery	13	16	13	11	13	4
Durables goods	127	97	76	99	65	74
Transportation	262	143	287	89	104	167
Total value	2946	2121	2643	1970	1408	1631
Livestock:						
Cow/buffalo	527	288	646	375	413	685
Sheep/goat	13	30	7	30	19	17
Poultry	13	8	3	32	9	10
Total value	553	326	656	437	441	712

Table 7. Source of Income of Respondents (in US$ y^{-1}), Central Java, 2002

Source of income	Irrigated			Rainfed		
	LTM n=59	STM n=26	NM n=48	LTM n)=52	STM n=56	NM n=56
Farm	710 (26)	593 (35)	1084 (82)	350 (16)	414 (37)	499 (64)
Off-farm	99 (3)	110 (7)	113 (9)	90 (4)	89 (8)	100 (13)
Non farm	752 (27)	534 (32)	123 (9)	224 (10)	273 (24)	178 (23)
Migration	1217 (44)	435 (26)	0 (0)	1528 (70)	346 (31)	0 (0)
Total	2778 (100)	1672 (100)	1320 (100)	2192 (100)	1122 (100)	777 (100)

Figure in parenthesis is percentages of total income

Determinants of Migration

Results show that age of husband, education of husband, size of landholdings and hired labor days have a negative and significant effect on migration. This seems to be logic since household with small size of landholding, inexperienced husband, and inefficient family work force cannot compete with other household with better socio-economical and environmental conditions. Moreover, household size, age of wife and household durables have a positive and significant effect on migration (table 8). Household size has the largest probability contributed to migration and the poor households are more prone to migration. It also shows that household with experienced wife are left to operate the farm due to absence of husband.

Table 8. Probit Analysis on the Determinants of Migration

Parameter	Coefficient	Standard Error	P[|Z|>z]	Probability
Intercept	0.1216	0.5702	0.8311	0.53
Household size	0.2708	0.0740	0.0003***	0.57
Age of husband (years)	-0.0130	0.0067	0.0541*	0.50
Age of wife (years)	0.0160	0.0081	0.0483**	0.50
Education of husband	-0.0652	0.0382	0.0883*	0.48
Education of wife	0.0598	0.0423	0.1578	0.51
Tenure (0=owner operator, 1=leaseholder)	-0.3216	0.2512	0.2005	0.42
Farm income (US$/year)	0.0001	0.0003	0.9843	0.50
Household durables (US$)	0.0033	0.0010	0.0007***	0.50
Size of landholdings (ha)	-0.5363	0.2122	0.0115**	0.37
Ecosystem (1=irrigated, 0=rainfed)	-0.1844	0.2208	0.4036	0.45
Family labor days (days/ha)	0.0002	0.0012	0.8807	0.50
Hired labor days (days/ha)	-0.0037	0.0017	0.0307**	0.50
Production (kg)	-0.0001	0.0001	0.1141	0.50

Dependent Variable: migration (1-with migrant, 0-without migrant); Log Likelihood = -132.77***; *** significant at 1%; ** significant at 5%; * significant at 10%

Impact of Migration on Production

From the Cobb-Douglas production function analysis, the estimated F value indicates that the model is quite appropriate for the analysis undertaken. Moreover, the R^2 of all models is 0.569, indicating that 56.9 percent of the variation in production can be explained by the model (table 9). Examining the individual variables, it can be seen that land, capital, and ecosystem have positive and statistically significant effect on rice yields, which is consistent with economic theory. Household in irrigated environment also achieves more production than household in rainfed ecosystem.

A separate model for irrigated and rainfed environment was also done. Result shows that production can be increased by using less labor in irrigated environment. Although household with migrant can contribute to higher production because of the added remittances, the result shows that it can also be source of declining in production. The absence of migrated member might caused less attention to rice crop care given by household head due to overloaded work.

Table 9. Cobb-Douglas Production Function of with Migrant Household

Ecosystem	Parameter	Unstandardized coefficients		Standardized coefficients	t	Sig.
		Beta	Std. Error	Beta		
Rainfed[a]	Intercept	6.386	.582		10.973	.000***
	Land area (ha)	.525	.112	.471	4.703	.000***
	Capital (thousand Rp)	.125	.067	.198	1.855	.067*
	Labor (days)	.222	.121	.173	1.835	.070*
	Migration (1-with migrant, 0-without)	.058	.158	.035	.364	.717
Irrigated[b]	Intercept	8.572	.677		12.663	.000***
	Land area (ha)	.912	.122	.740	7.454	.000***
	Capital (thousand Rp)	.208	.072	.222	2.888	.005***
	Labor (days)	-.247	.125	-.198	-1.976	.051*
	Migration (1-with migrant, 0-without)	-.221	.118	-.140	-1.869	.065*
Irrigated and Rainfed [c]	Intercept	7.157	.446		16.053	.000***
	Land area (ha)	.665	.082	.549	8.069	.000***
	Capital (thousand Rp)	.152	.048	.211	3.153	.002***
	Labor (days)	.055	.085	.041	.640	.523
	Ecosystem (1-irrigated, 0-rainfed)	.155	.084	.097	1.843	.067*
	Migration (1-with migrant, 0-without)	-.033	.094	-.020	-.355	.723

[a] Dependent Variable: production in kg; R^2 = 48.3%; F = 20.37; n= 141
[b] Dependent Variable: production in kg; R^2 = 60.9%; F = 39.46; n= 155
[c] Dependent Variable: production in kg; R^2 = 56.9%; F = 50.71; n= 296
*** significant at 1%; * significant at 10%

Impact of Migration on Technical Efficiency

Technical efficiency explains why farmers differ in the same ecosystem and the same inputs in production. The “F-value” of the data sets is sufficiently large to indicate that the model is significant and quite appropriate to explain the factors that determine the production of rice. Likewise, irrigated and rainfed ecosystem have large R^2 on non-migrant model. This means that about 70-80 percent of the variation of rice production can be explained by variation in land, labor and capital. The results for irrigated and rainfed ecosystem are quite similar. As expected, the parameters maintain the same sign across the data sets. In both ecosystems, land, labor and capital have positive effect on rice yields. This implies that yield increases with more land, labor and capital.

Inspecting the regression coefficient in OLS and MLE give us some idea on the trend of the parameters (table 10).

Technical efficiency estimates are calculated from the production function. Mean technical efficiency of household with migrant is lower than household without migrant household on both irrigated and rainfed environment (table 11). This might be caused by less attention and crop care due to less family labor.

Table 10. Model Estimates: OLS and MLE Results for Irrigated and Rainfed Ecosystem

Ecosystem	Parameter	Household with migrant		Household without migrant	
		Regression coefficient in OLS	Regression coefficient in MLE	Regression coefficient in OLS	Regression coefficient in MLE
Irrigated	Constant	8.29***	9.14***	8.67***	8.96***
	Land (ha)	0.90***	0.96***	0.92***	0.88***
	Labor (days)	0.17	0.04	0.25****	0.08***
	Capital (thousand Rp)	0.20	-0.12	0.31	0.12*
	F-value	19.29		40.05	
	R^2	50.3		72.6	
	N	61		45	
Rainfed	Constant	7.02***	8.50***	2.04	2.43
	Land (ha)	0.49***	0.68***	0.07	0.09
	Labor (days)	0.11*	0.04	0.54	0.52
	Capital (thousand Rp)	0.06	-0.3	0.80***	0.79***
	F-value	9.92		26.09	
	R^2	32.0		78.8	
	N	67		25	

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

Table 11. Distribution of Technical Efficiency Estimates by Household

% Efficiency	Irrigated		Rainfed	
	With migran	Without migrant	With migran	Without migrant
< 20	8	2	12	0
20 – 40	8	7	21	4
40 – 60	28	16	15	0
60 – 80	33	36	39	72
> 80	23	40	13	24
Total	100	100	100	100
N	61	45	67	25
Mean	0.61	0.73	0.55	0.74
t-test	2.79***		3.82***	

*** significant at 10%

Impact of Migration on Household Income

The regression coefficient for education of husband, total size of landholdings, ecosystem, migration and farming experience of husband are positive and statistically significant which is consistent with our hypothesis (table 12). Household with better-educated husband has higher income because he has knowledge in new technologies and also he can seek other works. Household with larger land holding has more income than household with smaller land holding and household in irrigated ecosystem has more income than that of rainfed ecosystem. Household with migrant produces higher income through contribution of remittances. In addition, household with more experience husband in farming and extended household have higher income.

Table 12. Impact of Migration and Other Socio-economic Factors on Household Income

Parameter	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Intercept	-1697.835	3163.623		-.537	.592
Education of husband (years)	398.906	229.351	.097	1.739	.083*
Tenure (1-owner operator, 0-leaseholder)	2351.609	1846.743	.075	1.273	.204
Type of household (1-nuclear, 0-extended)	-3645.409	1747.204	-.113	-2.086	.038**
Total size of landholdings (ha)	4713.798	1560.357	.181	3.021	.003***
Ecosystem (1-irrigated, 0-rainfed)	6288.591	1482.538	.230	4.242	.000***
Migration (1-with migrant, 0-without migrant)	9417.957	1669.709	.323	5.640	.000***
Farming experience of husband (years)	128.161	53.945	.143	2.376	.018**
Farming experience of wife (years)	-23.949	64.216	-.024	-.373	.709

Dependent Variable: household income (thousand Rupiah); R^2 = 43.5%; F=8.38;
***significant at 1%; ** significant at 5%; *significant at 10%, n=296.

Impact of Migration on Agricultural Income

Migration has negative and statistically significant effect on agricultural income (table 13). The result confirms that migration has more prevalent negative effect on the production thus decreasing the agricultural income. Although migrant contribute to household income through added remittances, the result shows that it can also be the source of decline in production because of less attention and less labor allocated to rice intensification. Tenure, total size of landholdings and ecosystem has positive and significant affect on agricultural income, which is consistent with our hypothesis.

This means that a higher agricultural income can be generated through improvement on agrarian reform. Owner-operated farms and larger size of landholdings in irrigated ecosystem has higher agricultural income. Although remittance from migrant has positive effect on household income, it can affect negatively on agricultural income due to less intensification on rice production.

Table 13. Impact of Migration and Other Socio-economic Factors on Agricultural Income

Parameter	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Intercept	1089.697	766.752		1.421	.156
Education of husband (years)	100.446	75.149	.082	1.337	.182
Education of wife (years)	57.690	87.070	.041	.663	.508
Tenure (1-owner operator, 0-leaseholder)	1696.883	499.888	.184	3.395	.001***
Type of household (1-nuclear, 0-extended)	353.160	473.312	.037	.746	.456
Total size of landholdings (ha)	1506.915	421.159	.195	3.578	.000***
Ecosystem (1-irrigated, 0-rainfed)	3175.388	396.605	.391	8.006	.000***
Migration (1-with migrant, 0-without migrant)	-1177.611	444.915	-.136	-2.647	.009***

Dependent Variable: agricultural income (thousand Rupiah); R^2=32.0%; F=19.44; ***significant at 1%, n=296.

CONCLUSION AND POLICY IMPLICATION

Age of husband, education of husband, size of landholdings and hired labor days has a negative and significant effect on migration. Moreover, household size, age of wife and household durables has positive and significant effect.

Migration has more prevalent negative effect on rice production in irrigated lowland but it has positive contribution to the household income because of the added remittance.

Household with more educated husband, larger farms, irrigated ecosystem, extended family type and more experienced husband in farming have higher.

Implication of this findings is that we need to impose more development programs to rural areas in order to reduce the rate of outmigration. The appropriate programs such as integrated rice crop and resources management

in irrigated lowland, micro-finance credit scheme for small farmers to solve cash scarcity for farming and small scale industry are needed to be developed.

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