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Empirical Study of Growth and Poverty Reduction in Indonesian Farms: The Role of Space, Infrastructure and Human Capital and Impact of the Financial Crisis

Human Capital, Mobility, and Income Dynamics: Evidence from Indonesia

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Reno Dewina* and Futoshi Yamauchi**

Abstract

This paper examines the effects of household formation on income dynamics using panel data from Indonesia. The focus of our analysis is to explore the determinants of household income dynamics in 1995-2007 when we change the definition of household. Empirical results show that intergenerational gap in education (i.e., education growth) as well as the number of young and prime-age members in the household play important roles in determining income dynamics, especially when we include out-migrants. This is consistent with individual migration behavior: the young and educated tend to move out of their villages over the 12 years. We also found that out-migration increases net-remittances to the household. The results indicate the importance of human capital as well as endogenous migration (attrition) in rural household income dynamics.

Keywords: Income Dynamics, Human Capital, Migration, Split, Indonesia

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Introduction

Income and human resource mobility are interlinked in situations where agricultural growth faces a limitation due to scare land, and high-return activities are concentrated in urban areas and the non-agricultural sector. Under such a circumstance, potential efficiency gains from mobilizing resources from rural to urban areas is large, particularly when the gap in economic growth between agriculture and non-agriculture is large.

In this situation, migration to urban sectors has a direct implication for income dynamics in rural households as the migrants tend to remit a substantial portion of their income to their rural origins or play an important role to pool income shocks between extended families (e.g., Lucas and Stark 1985; Rosenzweig and Stark 1989). Therefore, whether migrants are included in the computation of household incomes (even though they live in urban areas) makes a difference in the dynamic analysis of household income and mobility, given that individual mobility is an endogenous decision. In this paper, we examine mechanisms that govern individual migration behavior with a clear linkage to household income dynamics using panel data from Indonesia.

Labor markets are likely to be segmented by schooling levels. According to Otsuka and Yamano (2006), educated workers in rural Asia tend to find lucrative non-farm jobs, whereas uneducated workers tend to engage in relatively low-paying jobs including hired labor in the agricultural sector. Also, it is important to note from their panel studies in Asia that increased agricultural income, mostly generated from the Green Revolution, was likely to be a major source of funds to invest in children's education in the early years, which later led to the choice of nonfarm occupations by children. The modern agricultural technology and human capital acquired through schooling are two important factors that affected the growth of household income and poverty reduction in rural areas (Cherdchuchai and Otsuka 2006). A question arises as to what will occur to rural households once such technological opportunities cease.

Our empirical study comes from panel data in Indonesia. In this country, the limited supply of natural resources such as land has often been seen as a major constraint of farm income growth. The majority of farmers are smallholders or agricultural laborers, especially in Java. The scarcity of land, particularly on Java, forces household members to seek off-farm work opportunities. Moreover, when employment opportunities in non-agricultural sectors are growing in general, it creates large incentives for rural households to out-migrate and/or supply their labor to non-agricultural sectors. From data that we collected in 7 provinces in 2007, we found that the average cultivated land sizes in Java and non-Java are 0.37 and 0.73 hectares respectively.[1] This shows the difficulty with relying solely on the agriculture sector in the long run, since agricultural growth depends heavily on land availability. Based on the 1993 Agriculture Census, the average land size in the country was 0.86 hectares, where 49 percent of households had less than 0.5 hectares in land holdings (Supadi and Susilowati 2004).[2] Under the circumstance, investment in human capital is an important element to alleviating poverty in rural areas.

Using the same sample used in this study, Yamauchi (2008) shows that there has been significant growth in educational attainment in the rural population, promoting transitions from agriculture to non-agriculture over time. Intergenerational gap in education within the household changes household's income prospects. In this paper, we investigate the implications of education growth on household income growth and split/migration behavior. To capture incomes of out-migrants, we simulated their incomes using the information on individual characteristics such as age, gender and education. The analysis shows that higher education growth (more years of schooling in the young generation against the old generation) increases the total household income growth with more out-migrants moving out of their villages.

[1] These figures are based on our sample (discussed in Section 3).

[2] For example, the average land sizes are smaller than those of the Philippine and Thailand studies cited above (Estudillo et al, 2006; Cherdchuchai and Otsuka, 2006). In the Philippines the average farm size was 1.3 and 1.0 hectare in 1985 and 2004 respectively while it was 6.3 and 5.8 hectares in 1987 and 2004 respectively in Thailand (two provinces).

Our approach also addresses attrition bias in panel analysis (e.g., Rosenzweig 2003; Thomas et al. 2001). Household composition is endogenous because household members decide their locations over time. Moreover, the division of the household has implications on the division of household public goods and income dynamics (Foster and Rosenzweig 2002). Therefore, the computation of household income also depends on who (we think) are members of the household. We do not directly try to correct attrition bias in the analysis of income dynamics, but we compare estimated returns to the initial assets such as schooling and land by changing the definition of household composition, by including split members and out-migrants.

In the analysis below, we have two overlapping issues. First, household members dynamically decided whether they stay or move out of the household. Second, in research, we also must define the household, taking into account both data limitations and research objectives. In this paper, we will check how such decisions, made by agents and researchers, affect empirical estimates of income dynamics.

The paper is organized as follows. The next section discusses our empirical approach. In Section 3, we describe our survey and data.

Section 4 summarizes empirical results. First, the intergenerational gap in education in the household increases household income if we include simulated incomes of out-migrants. Land shows diminishing returns in the rural areas, but increases the above-mentioned dynamic effect of education growth on income growth. The number of household members, especially prime-age groups, also significantly increases income growth. Therefore, both the quality and quantity of human capital in the initial period have dynamic returns.

Second, the analysis of individual mobility supports the above findings - the more educated and young are more likely to move out of the village. Land also helps agents migrate. Females tend to split from the household (staying in the same village), while males tend to migrate out of the village. Third, net remittance increases as the number of out-migrants increases. Overall, these results from income dynamics, mobility and remittances are consistent.

2. Empirical method

We estimate growth equations with income growth as the dependent variable regressed on initial conditions. In our exercise, we explicitly take into account the endogenous nature of income growth as a function of demographic dynamics. That is, income growth depends on changes in household composition over time. In particular, migration and household split are important in our analysis.

The equation we estimate is as follows.

$$\Delta y_i(z_{it}) = X_{i1}\beta + \Delta\varepsilon_i \qquad (1)$$

where Δy is income growth, X is a set of the initial conditions, and z is demographic conditions. Income growth as a function of demographic conditions is

$$\Delta y_i(z_{i2}, z_{i1}) = y_{i2}(z_{i2}) - y_{i1}(z_{i1}). \qquad (2)$$

We construct different measures of income growth by using different definitions of the household: household members residing in the original households, plus household members who split from the original households but reside in the same villages, plus out-migrants who moved out of the original households and not residing in the villages. Returns to household characteristics depend on migration behavior and the definition of household in period 2.

To provide micro-foundations for the above income dynamics, we also analyze individual-level dynamic mobility: staying in the original households, split or out-migrate. Below k is the index to define individual location; $k=1$ original, $=2$ split, and $=3$ out-migrate. By definition, in the initial period, $k=1$ for all.

$$z_{i1} = [k_{1i1}, k_{2i1}, ...k_{ni1}] \\ = [1,1,1,....1] \quad (3)$$

In the second period, individuals decide their locations.

$$z_{i2} = [k_{1i2}, k_{2i2}, ...k_{ni2}] \quad (4)$$

We estimate a probabilistic mobility decision rule by Probit as follows (t=2):

$$\Pr\left(k_{ijt} = type \mid x_{i1}, \phi_i\right) = \alpha' + x_{ij1}\gamma + \phi_i + v_{ijt} \quad \text{for all } i \quad (5)$$

where *x* denotes the set of individual characteristics in the initial period.

Findings from the mobility equation will explain the dynamics of *z*, which in theory are associated with the observed income dynamics and the dynamic returns to the initial conditions (assets) such as landholding and human capital.

3. Data

3.1. Survey

The study uses two household surveys. The first is the 1995 Patanas survey of the Indonesia Center for Agriculture and Social Economic Policy Study (ICASEPS) focused mainly on agricultural production activities. We built panel data based on this survey by conducting the 2007 IMDG survey. The 1995 Patanas survey captured the structure of agricultural production and all sources of income in 1574 households in 48 villages (7 provinces) representing Indonesia's agro-climatic zones. For our income panel data, 34 villages in 6 provinces were available after we detected some data problems in South Kalimantan, Aceh and some fishery villages.

The 2007 IMDG was a general household survey designed to capture a variety of household activities. We planned to expand the sample by adding 51 new villages in the 7 provinces. In the revisited villages, we resampled 20 households per village from the original 1995 Patanas sample (proportionally with their landholding size) and tracked their split households. In the new villages, we sampled 24 households from two main hamlets in each village to proportionally represent landholding distribution. Since we were not able to revisit one of the original Patanas villages in NTB for safety reasons, in 2007, we had 47 revisited and 51 new villages. Thus, the total sample consists of 2,266 households from 98 villages in 7 provinces.

3.2. Income construction in 2007

Income is calculated in both surveys as the sum of net earnings from agriculture and non-agriculture sources. In our analysis, we do not include transfer incomes as our focus is on (labor) earnings. However, we include the imputed out-migrant incomes when the definition of income requires so. The sources are from the following sources: crop production, livestock production, non-agriculture employment, self employment, agriculture employment and other incomes.

The crop production covers the three crop seasons and a non season during the past one year. It is calculated from different sources: food crops, sugar cane and estate plant/home garden. The value of production is obtained by multiplying the total production quantities with the selling price per unit of each crop. We also include the production value if households market their produce through Ijon and Tebasan systems[3]. Crop production cost includes seeds, fertilizer, pesticides, supporting materials, irrigation, land rental, land tax, marketing, transportation and

[3]Ijon is a method by which farmers obtain loans from buyers (traders). The farmer sells his crop long before harvest at a price that is usually quite low relative to the regular market price at harvest time. The buyer is responsible for protecting the crop from pests and thieves, and bears the costs of harvesting and transportation. The method is similar to Tebasan, except for the fact that in Ijon, farmers sell much before harvest.

others. After aggregating the crop production values and crop costs by household, we calculated the net income by deducting production costs from production value.

Livestock is differentiated into poultry, quail and duck, broiler, ruminant and dairy. The livestock revenue includes the value of livestock sold, home consumption of the animal meat and by-products such as egg and milk. The net income is obtained by deducting the input costs (seeds, feed, medicine and supplements, and labor cost) and marketing costs (processing and transportation cost).

Aquaculture income covers the fish pond from three different cycles and marine fishery from peak, normal and slack seasons. The net income is obtained by calculating the sales of products and by products minus the production costs and marketing cost.

The non-farm employment income is calculated from the non-agriculture employment section in the questionnaire. The module captures employment incomes from the past one year, both in-cash and in-kind. The net income is calculated by deducting the expenses from the gross revenue.

Other sources of non-farm income are self-employment work. This reflects any earnings of household members who involved in the self employed business activities monthly. The net income from self-employment by nonfarm enterprises can be directly calculated as the total of gross revenue minus expenses.

The agriculture employment section excludes the work on own farm. The net income is the agricultural labor income minus expenses (transportation costs). For other non-employment sources, since we only consider household earnings, we exclude transfer income.

As we confirm later in individual migration equations, with better income prospects the young and educated are likely to move out of the sample villages. Therefore, in our hypothesis, we conjecture that returns to human capital will be biased downward if we omit this group of household members who moved out in 1995-2007.

The 2007 survey collected information on out-migrants' activities, but not their incomes.

From the survey, we know their main activity, occupation, industry, marital status and location. To simulate their incomes, we use a standard log-wage equation[4] with the estimates: 0.067 for years of schooling, 0.0425 for male indicator, 0.0811 for age, and 0.008 for age squared. For the constant term, we used log of 700,000 so that the mean of simulated wage distribution is matched to the average earnings in West Java (including Jakarta) in 2006.[5]

For the purpose of analysis, we categorized individual members into three different groups, which are (i) stayers (for members who stay in the original household), (ii) splitters (for members who moved into different house but still in the village; and (iii) out-migrants (members who left the original household and migrated).

We can compute per capita income growth in three cases: households in 2007 include only (i) Group 1: stayers, (ii) Group 2: stayers and splitters, and (iii) Group 3: stayers, splitters and out-migrants. To compute per capita income, we identify the number of household members between ages of 15 to 65. The mean per-capita income growth in 1995-2007 is 1.55, 1.60, and 2.01 for Groups 1, 2 and 3, respectively. Table 1 shows summary statistics of key demographic variables for each group.

Table 1. Age, schooling and gender among stayers, splitters and out-migrants

	Stayers	Splitters	Out-migrants
Age	28.0	23.4	17.6
Years of schooling	4.8	5.9	5.8
HH member age 15 or less	2.8	3.7	4.4
HH member age 15-29	7.2	10.7	8.7
HH member age 30-44	5.3	4.4	5.5
HH member age 45-64	4.4	3.7	3.9
HH member age 65 or older	2.4	1.2	2.4
Gender Male	0.5	0.5	0.4

[4] Mincer equation: $\log y = a + bS + cX + dX^2 + e$, S for schooling and X for experience

[5] We used Nominal Wage of Manufacturing Workers by Region, 2004-2006 (September'06 average), available in Statistics Indonesia (http://www.bps.go.id/sector/wages/table2.shtml)

Source: IMDG 2007 and 1994/95 Patanas

Out-migrants have very different characteristics in term of their age and years of schooling than other two groups. The out-migrants, on average, show the lowest age among them and similar level of years of schooling with splitters. This implies that these young people with higher education tend to seek better opportunities by migrating from their home village. Another interesting finding is that the splitters have the lowest education and highest average age. In terms of gender, females are more dominant among out-migrants, but males are the majority among stayers. When we break down the age of household members, we can see that in almost all age-category the years of schooling of out-migrant are dominant compared to other two groups, but in age group 15-30 and 45-64.

4. Empirical results

4.1. Income dynamics

This section summarizes empirical results on income dynamics. Our interest is to compare returns to household assets, mainly human capital and land, when we change the definition of household composition, including only original household members, also split members, and out-migrants. For this purpose, we constructed income measures depending on the household definition. For the analysis, we focus on per-capita income growth, in order to include changes in the total income and household compositions.

Table 2a. Per-capita income growth
Dependent variable: Per capita income growth

	Original/Stayers	Original/Stayers+Splitters	Original/Stayers+Splitters + Out-migrants
	(1)	(2)	(3)
Land size	-0.0169	-0.0154	-0.0518
	(0.22)	(0.19)	(0.70)
Education gap	0.0385	0.0385	0.0421
	(2.29)**	(2.30)*	(3.17)***
Household size	0.0227	0.0211	0.1286
	(0.46)	(0.42)	(2.66)**
Head age	-0.0159	-0.0162	-0.0116
	(3.20)***	(3.26)***	(2.28)**
Male	-0.4149	-0.4173	-0.0448
	(1.18)	(1.18)	(0.16)
constant	4.0228	3.0407	3.0070
	(10.36)***	(10.39)***	(7.75)***
Village fixed	yes	yes	yes
effects	0.13	0.13	0.13
R-squared	570	570	586
Number of obs			

Numbers in parentheses are absolute t values, using robust standard errors with village clusters
Source: IMDG 2007 and 1994/95 Patanas

In Table 2a, Columns 1 to 3 show determinants of per-capita income growth respectively for cases: (i) household members including only original stayers, (ii) original stayers and split members (who live in the village), and (iii) original stayers, split members and out-migrants.

Land has no significant effect on per-capita income growth in all cases. The result implies that land has diminishing returns, by which per-capita income growth is lower when landholding is large. Education gap, defined as the maximum years of schooling achieved in the household minus the head's years of schooling, has positive significant effects on per-capita income growth in all cases, but it is the strongest in group 3. Household size is not significant for groups 1 and 2, However, household size has a positive significance effect on per-capita

income growth for group 3. Having large household size gives two impacts, static and dynamic effects. In the static setting, the larger household size will lower per-capita income growth since it would increase the denominator. The dynamic effect is quite different, as a large family can send more members to activities outside the village. Our findings show that household size seems to have a positive dynamic effect on per-capita income growth.

Household head's age is significantly negative in all cases. This implies that older cohorts, defined by the head's age, do not increase per-capita income growth.

Table 2b. Per-capita income growth
Dependent variable: Per capita income growth

	Original/Stayers	Original/Stayers+Splitters	Original/Stayers+Splitters + Out-migrants
	(1)	(2)	(3)
Land size	0.1001	0.1013	0.0482
	(1.76)*	(1.79)*	(0.87)
Education gap	0.0427	0.0427	0.0461
	(2.85)***	(2.86)***	(4.07)***
Household size	-0.0329	-0.0344	0.0845
	(0.66)	(0.69)	(1.81)*
Head age	-0.0070	-0.0072	-0.0037
	(1.30)	(1.34)	(0.73)
Male	-0.4957	-0.4978	0.0785
	(1.54)	(1.54)	(0.29)
Per-capita income	-0.0006	-0.0006	-0.0005
1995	(5.78)***	(5.77)***	(4.26)***
	4.1742	4.1917	2.8977
constant	(11.16)***	(11.21)***	(7.07)***
	yes	yes	yes
Village fixed effects	0.26	0.26	0.28
R-squared	570	570	586
Number of obs			

Numbers in parentheses are absolute t values, using robust standard errors with village clusters
Source: IMDG 2007 and 1994/95 Patanas

We expand table 2a by adding initial per-capita income as an explanatory variable to see income convergence/divergence. The result suggests that land now has positive marginal

effect for group 1 and 2, but not for group 3. Initial per capita income has negative significant effects for all three groups. This implies that the higher the initial per capita income the smaller the income growth.

Table 3a. Per-capita income growth
Dependent variable: Per capita income growth

	Original/Stayers	Original/Stayers+Splitters	Original/Stayers+Splitters + Out-migrants
	(1)	(2)	(3)
Land size	-0.0213	-0.0194	-0.0465
	(0.30)	(0.27)	(0.74)
Education gap	0.0445	0.0446	0.0517
	(2.65)***	(2.67)***	(3.83)***
HH member age 15 or less	0.0930	0.0741	-0.4973
	(0.32)	(0.24)	(1.49)
HH member age 15-29	0.0492	0.0462	0.1862
	(0.50)	(0.48)	(1.86)*
HH member age 30-44	0.1230	0.1208	0.1980
	(2.44)**	(2.41)**	(5.01)***
HH member age 45-64	0.2078	0.2036	0.2766
	(1.99)**	(1.96)**	(2.92)***
HH member age 65 or older	-0.2952	-0.3000	-0.1485
	(3.06)***	(3.12)***	(1.67)*
Head age	0.0011	0.0010	0.0032
	(0.21)	(0.19)	(0.72)
Male	-0.4749	-0.4792	-0.0859
	(1.32)	(1.33)	(0.29)
Constant	3.2454	3.2665	2.3813
	(6.54)***	(6.57)***	(5.06)***
Village fixed effects	yes	yes	Yes
R-squared	0.18	0.18	0.19
Number of obs	570	570	586

Numbers in parentheses are absolute t values, using robust standard errors with village clusters
Source: IMDG 2007 and 1994/95 Patanas

In Table 3a, we disaggregate household members by age groups. Other specifications are the same as in Table 2. Household members are grouped into less than 15, 15 to 29, 30 to 44,

45 to 64, and above 65. We found that prime-age groups, those of ages 30 to 64 in 1995, significantly contribute to the per-capita income growth. The effects become larger in Column 3 (i.e., we include out-migrants). The effect of members aged 15 to 29 is also significantly positive when we include out-migrants. The elderly group, which is group of age 65 and older, has negative significant effect on per capita income growth. The effect for group 3 is less significant compared to other groups though. This makes sense since the contribution from older people in urban area is assumed much smaller than the prime age group. This is because the nature of work in urban area is usually suited for prime age group with adequate skills and education. These findings are consistent with our hypothesis that household size has a dynamic effect on income growth through migration, and such effects are supposed to be largest if they have prime-age adult members.

Our previous results on education gap and land remain the same. Interestingly, the effect of education gap is the largest in Column 3. That is, educational attainment in the young generation relative to the head has the largest effect on income growth if they have migration opportunities.

Table 3b. Per-capita income growth
Dependent variable: Per capita income growth

	Original/Stayers (1)	Original/Stayers+Splitters (2)	Original/Stayers+ Splitters+ Out-migrants (3)
Land size	0.0759	-0.0765	0.0344
	(1.34)	(1.36)	(0.70)
Education gap	0.0418	0.0420	0.0494
	(2.76)***	(2.80)***	(4.15)***
HH member age 15 or less	0.1428	0.1337	-0.4288
	(0.41)	(0.37)	(1.13)
HH member age 15-29	-0.0689	-0.0701	0.0759
	(0.75)	(0.78)	(0.79)
HH member age 30-44	0.0215	0.0196	0.1175
	(0.40)	(0.36)	(2.94)***
HH member age 45-64	0.1448	0.1406	0.2372
	(1.51)	(1.48)	(2.82)***
HH member age 65 or older	-0.1691	-0.1736	-0.0338
	(1.99)**	(2.05)**	(0.44)
Head age	-0.0013	-0.0011	0.0033
	(0.23)	(0.20)	(0.74)
Male	-0.5115	-0.5522	0.0622
	(1.54)	(1.54)	(0.22)
Per-capita income 1995	-0.0005	-0.0006	-0.0005
	(5.15)***	(5.13)***	(4.24)***
Constant	3.6686	3.6832	2.5218
	(8.20)***	(8.25)***	(5.50)***
Village fixed effects	yes	yes	Yes
R-squared	0.27	0.27	0.30
Number of obs	570	570	586

Numbers in parentheses are absolute t values, using robust standard errors with village clusters
Source: IMDG 2007 and 1994/95 Patanas

We again expand the model to include initial per capita income as explanatory variable. Interestingly, the cohorts of the prime-age groups (30-64) which previously had positive significant effect for all Groups, are now found only significant for Group 3. Also, the cohort with age 65 or older contributed negatively only in the first two groups, but not in the Group 3. The effect of education gap remains the same, with the largest effect if we include splitters and out-migrants in Group 3.

To sum, we have confirmed that intergenerational gap in education attainment (i.e., education growth) previously analyzed in Yamauchi (2008), has a significant positive impact on

income growth, and its effect is augmented if we include out-migrants in the definition of household. Also household size shows a significant effect on per-capita income growth dynamics. The size plays an important role in influencing the per-capita income growth, and more importantly the household composition matters. An increase in the proportion of members aged 15 to 64 significantly increases the household income growth, and its effect becomes larger if we include out-migrants. In the next section, we investigate factors determining the likelihood of household division and migration.

4.2. Mobility and household division

In this section, we estimate individual-level mobility equations to identify determinants of household division and migration. The estimation adopts multinomial logit, using the original household stayers as the omitted benchmark case. Explanatory variables are taken from the 1995 Patanas survey[6]. Preliminary analysis shows a small number of splitters who set up new households in the sample villages, which implies that they are likely to merge with other new members to start new households (such as marriage). Out-migrants head to urban labor markets. The proportion of male is slightly dominant in stayers and splitters (52.1%), not for out-migrants (46%). The average age is quite close between the first and second member type (stayers and splitters) which is 29 and 31 years, respectively, but it is much younger (18 years) for the third type (outmigrants). Years of schooling is highest among out-migrants (9 years), followed by splitters and stayers, at 8 and 6 years respectively. For the equation estimating individual level mobility, we specifically change the definition of education gap, which is now defined as the own years of schooling achieved from individual member minus the head's years of schooling, we define it as education gap (own)

[6] We calculated age of schooling in 1995 using 2007 information on schooling history that contains age started and completed schooling, years of schooling completed and details on each education level and grade. Thus, we were able to recover information on schooling in 1995 (which was only available in terms of categorical variable such as unfinished primary school, primary school graduate etc.).

Table 4. Individual mobility

	Splitters (2)	Out-migrants (3)
Land size	0.1567	0.1496
	(0.87)	(2.00)**
Age	-0.0520	-0.1049
	(3.71)***	(14.60)***
Head years of school	0.0256	0.1720
	(0.33)	(5.53)***
Male	0.0732	0.5045
	(0.35)	(3.79)***
Education gap	0.2071	0.2791
	(1.96)**	(12.95)***
Constant	-0.0663	-0.7974
	(0.15)	(3.00)***
Village dummies	Yes	
Log pseudolikelihood	-1116.412	
Pseudo R2	0.2776	
Number of obs	2431	

Numbers in parentheses are absolute z values, using robust standard errors with village clusters.
Source: IMDG 2007 and 1994/95 Patanas

Table 4 summarizes our empirical results. The findings show that (i) the young tend to split and migrate, and (ii) education gap has a larger effect on the migration probability than household split. Experience (age) and intergenerational gap in human capital (education) seem important in explaining household dynamics. Especially, the result on education gap is consistent with that of income growth, i.e., intergenerational gap in education promotes out-migration, which significantly increases the total income for the household.

The age effect in household split suggests that marriage is one of important reasons for individual member to leave their parent house. The results also shows that males tend to split and migrate more than females. After a certain age, sons/daughters will get married and most likely will move from their parent house. However, sons are more likely to leave their parents house and set up a new household.

Land size significantly increases the probability of household out-migration. It implies

that large landholding enables the original household to support out-migration probably because a large landholding makes it easier to finance migration (including study outside the village).

It is worth mentioning that young age and educational attainment are connected with out-migration, as confirmed in other studies (e.g., Schultz 1982; Schwartz 1976). The reason for the young to leave the village is not only for entering a labor market but also in order to complete their schooling. The young people look for opportunities in non-agricultural sector where they seek income prospects that are better than agriculture. Investment in schooling is a rewarding method to have this transition. Better education offers other opportunities that they otherwise cannot find in the village. Although land is one of the most important assets in rural areas (particularly in agricultural production), land does not necessarily keep them to stay in the village but actually encourages out-migration. The diminishing returns to land in the Indonesian agriculture (especially, in Java) might be one of the reasons. These results provide the foundation for income dynamics analyzed in the previous section.

We assume that spatial connectivity in the local area would have an effect on migration/mobility. Therefore, in order to observe whether our assumption is correct or not we have expanded the model in Table 4 and integrated a spatial connectivity variable, which is represented by change of asphalt road in the local area from 1996-2006, in our explanatory variables. We added a spatial connectivity variable and interaction of that spatial connectivity variable with characteristics variables using province dummies to control the bias. The results of expanded models are shown in Column (2) and (3) of Table 5 respectively.

Table 5. Individual mobility

	(1)	(2)	(3)
SPLITTERS			
Land size	0.2218	0.3259	0.5307
	(1.22)	(0.60)	(0.69)
Age	-0.0890***	-0.0874***	-0.0881***
	(6.96)	(5.71)	(6.72)
Head years of school	0.0613	0.1078	0.0763
	(0.73)	(0.67)	(0.71)
Male	0.0967	0.1714	0.0499
	(0.60)	(0.53)	(0.27)
Education gap (own)	0.2333**	0.2728**	0.2331**
	(2.35)	(2.02)	(2.21)
Change in asphalt road 96-06		-0.2161	
		(0.16)	
Head years school*land size		-0.0193	-0.0333
		(0.39)	(0.48)
Education gap (own) *land size		-0.0124	0.0071
		(0.50)	(0.28)
Age*Change in asphalt road 96-06		-0.0056	-0.0073
		(0.60)	(0.32)
Education gap (own) *Change in asphalt road 96-06		-0.1080	-0.0995
		(0.87)	(0.84)
Head yrs of school*Change in asphalt road 96-06		0.0072	0.0524
		(0.03)	(0.23)
Male*Change in asphalt road 96-06		-0.1224	0.1273
		(0.17)	(0.26)
Constant	-2.0663	-2.6574	-0.1249
	(0.15)	(2.32)**	(0.16)
OUT-MIGRANTS			
Land size	0.1360	0.0821	0.1191
	(1.81)*	(0.78)	(0.64)
Age	-0.0959***	-0.0926***	-0.0958***
	(14.12)	(11.05)	(14.14)
Head years of school	0.1609***	0.1361***	0.1506***
	(5.25)	(2.98)	(4.19)
Male	0.5011***	0.3807**	0.4403***
	(3.83)	(2.35)	(3.49)
Education gap (own)	0.2694***	0.2625***	0.2761***
	(12.62)	(6.88)	(9.71)
Change in asphalt road 96-06		-1.8426**	
		(2.45)	
Head years school*land size		-0.0035	-0.0032
		(0.22)	(0.18)
Education gap (own) *land size		-0.0082	-0.0073
		(0.51)	(0.49)
Age*Change in asphalt road 96-06		0.0010	-0.0029
		(0.09)	(0.17)
Education gap (own) *Change in asphalt road 96-06		-0.0214	-0.0127
		(0.39)	(0.30)
Head yrs of school*Change in asphalt road 96-06		0.0793	0.1010
		(0.63)	(1.11)
Male*Change in asphalt road 96-06		0.8086*	0.8416**
		(1.64)	(2.49)
Constant	-0.8496***	-0.8952***	0.4619
	(3.17)	(3.61)	(1.55)
Village dummies	Yes	Yes	Yes
Province dummies			
Log pseudolikelihood	-1157.8502	-1227.8387	-1118.03
Pseudo R2	0.3572	0.2993	92
Number of obs	2585	2529	0.3620
			2529

Numbers in parentheses are absolute z values, using robust standard errors with village clusters.
Source: IMDG 2007, 1994/95 Patanas, 1996 & 2006 PODES

Basically, spatial connectivity has two different effects on mobility, on one side it spurs mobility and it stops mobility on the other side. Road quality explains that development of localized spatial connectivity is important in opening access to greater economic opportunities. People react on this improvement in two ways, first, better road quality will let people have easy access moving out from the village considering the opportunities they have outside the village. Secondly, the improvement of road quality would speed up their trip and people could manage to commute and remain in the same location. These two different effects might cancel each other as shown in the regression results. Columns (2) and (3) show that spatial connectivity has no effect on household division and migration. However, one thing that needs to be noted is that the interaction of change of the asphalt road and gender is significant for migrants (but not for splitters). It implies that male members tend to migrate out due to the improvement of the road.

4.3. Remittances

The empirical results in this section report on net remittances. In the analysis, we expect average net remittances at the household level to be determined by out-migrants characteristics such as number of out-migrants, land size, household head years of school, average age of out-migrant, average years of schooling of out-migrant and proportion of male in out-migrant household. Since we assume that out-migrants who remit are in labor markets, for their characteristics we include only productive out-migrants (age 15 to 64 years) with working status (exclude students). Data on remittances include transfers (in/out) in the forms of cash and in-kind (food and non-food). Most remittances (about 86 percent) are in the form of cash. For this purpose, we calculated net remittances as remittances received minus the remittances sent by the households.

About 44.3 percent of household samples are recipients of remittances. The flows of remittances are mainly among core family members and relatives, accounting for more than 90 percent and small portion going to/from neighbors or friends. The average amount of annual net remittances is about 700 thousand Rupiahs, which is about 4 percent of average household

income. When only focusing on remittances received, this percentage almost doubles. The main use of remittances are for child support, education, medical, wedding, funeral and investment, although the proportion of respondents who respond for investment is quite small (less than 5%). Thus, remittances are usually for consumption smoothing, insurance and alleviation of liquidity constraints.

Table 6. Net remittance
Dependent variable: Net remittance

	(1)	(2)	(3)	(4)
Number of migrant	325,033	401,490	459,461	362,119
	(2.18)**	(2.25)**	(2.49)**	(1.67)*
Land size			-326,958	-622,434
			(1.25)	(2.49)**
Head years of school			-11,365	-1,692
			(0.29)	(0.03)
Average age of migrant				-19,532
				(0.63)
Average years of school of migrant				73,691
				(1.17)
Proportion of males				60,899
				(0.11)
Village fixed effects	Yes	Yes	Yes	Yes
R-squared	0.09	0.12	0.16	0.22
Number of obs	1,066	693	672	279

(1) All Patanas sample (including South Kalimantan)
(2), (3) Panel sample (Patanas but excluding South Kalimantan and fishery villages)
(4) Panel data with out-migrant observations
Numbers in parentheses are absolute t values, using robust standard errors with village cluster
Source: IMDG 2007 and 1994/95 Patanas

In Table 6, Columns 1 to 4 show determinants of net remittances for the following cases: (1) full Patanas samples, including South Kalimantan province, (2) and (3) panel samples (exclude South Kalimantan and other samples who were not surveyed in 1995), and (4) panel and out-migrants. Differences between (2) and (3) are due to some missing observations in land size and head's education. In (4), we restrict our sample to households who have out-migrants in 2007. Those who have no out-migrants are omitted from the sample.

In all specifications, the number of out-migrants is significantly and positively correlated with net remittances. For the full Patanas sample, the net remittance is predicted to increase by almost third of million Rupiahs when the number of out-migrant increases by one. Land has negative effects on net remittances in Columns (3) and (4), respectively, i.e., an increase in the recipient household's landholding size reduces the average net remittances that they receive.

Conclusions

This paper analyzes the mechanisms that govern individual migration behavior with a clear linkage to household income dynamics. First, we compared returns to household assets, mainly human capital and land when we change the definition of household composition. Second, we examined individual mobility to identify the determinants of household division and migration. Third, we analyzed the determinant of net remittances related to out-migration.

Using household survey panel data from 1995 Patanas and 2007 IMDG surveys conducted in Indonesia, we identified household members within three categories (i) original stayers, (ii) split members (who live in the village), and (iii) out-migrants. We expanded the definition of household by including members from (i) to (iii). In all cases, landholding does not contribute to income growth. On the other hand, education gap between the maximum level in the household and that of the head has significantly positive effects on income growth, and the effect is the largest when we include out-migrants in the household definition. We also confirmed that prime-age and young groups significantly increase income growth, which is consistent with our finding that the young and educated tend to move out of their villages.

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Abstract (in Japanese)

要約

本稿では、1995年から2007年の期間の家計パネルデータを用い、インドネシア農村部における家計のメンバー構成の変化と家計所得水準の変遷について分析する。家計メンバー構成の変化としては、分家（split household）及び出稼ぎ（migration）に注目する。家計レベルの出稼ぎ選択は、家計の長と次世代との教育水準の差（education growth）、若くかつ労働年齢にある家計メンバーの数に影響される。個人レベルでは若くかつ教育水準の高いメンバーが出稼ぎ選択をしている。また、メンバーが出稼ぎをしている家計では、純送金受取額が増加している。すなわち、インドネシアの農村家計の所得水準決定には、教育投資及び内生的な出稼ぎ選択が大きく関与していることが示唆される。

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