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Human Capital Investment and Poverty Reduction over Generations: A Case from the Rural Philippines, 1979-2003

Kazushi TAKAHASHI*
Keijiro OTSUKA**

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* Institute of Developing Economies-Japan External Trade Organization, Chiba, Japan
** Foundation for Advanced Studies on International Development, Tokyo, Japan and National Graduate Institute for Policy Studies, Tokyo, Japan.

Abstract This paper attempts to identify a pathway out of poverty over generations in the rural Philippines, based on long-term panel data spanning for nearly a quarter of a century. Specifically, it sequentially examines the determinants of schooling, subsequent occupational choices, and current non-farm earnings for the same individuals. We found that an initial rise in parental income, brought about by the land reform and the Green Revolution, among other things, improves the schooling of children, which later allows them to obtain remunerative non-farm jobs. These results suggest that the increased agricultural income, improved human capital through schooling and the development of non-farm sectors are the keys to reducing poverty in the long run. It must be also pointed out that the recent development of the rural non-farm sector offers ample employment opportunities for the less educated, which also significantly contributed to the poverty reduction.

Keywords: Intergenerational Poverty Dynamics, Child Schooling, Occupational Choice, Non-farm Earnings
JEL classification: I32, J24, J62, O15

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3-2-2, WAKABA, MIHAMA-KU, CHIBA-SHI
CHIBA 261-8545, JAPAN

Ⅰ. Introduction

Despite serious efforts by local governments and donor communities over the past few decades, poverty remains an unresolved global issue. According to estimates by the World Bank, over 1.2 billion people were classified as the extreme poor in 1998, living on less than one dollar a day (World Bank, 2000). Against such pervasive poverty, the United Nations declared as the first of the Millennium Development Goals (MDGs) to halve the proportion of the extreme poor from the 1990 level by 2015. Because poverty is overwhelmingly a rural phenomenon in most developing countries, a major challenge to achieving the target must be to find ways in which rural poverty can be effectively reduced (e.g., Schultz, 1980; IFAD, 2003).

There are potentially three pathways to increasing the income of rural households (Otsuka and Yamano, 2006): the intensification of agriculture, increased rural non-farm activities, and out-migration to cities and abroad. Among them, the first pathway has attracted a great deal of attention in past studies (e.g., Mellor, 1966; Eswaran and Kotwal, 1994; Deininger and Binswanger, 2001). Land and tenancy reforms, which aim to provide the landless or near landless with better access to land, as well as the "Green Revolution", which aims to increase land productivity, are good examples. It is true that these measures contributed significantly to rural poverty alleviation especially when agriculture is a dominant source of livelihoods for the poor. However, recent studies, using long-term panel data at the household level in Asia, consistently show that it is non-farm development rather than agricultural development

that has driven rural income growth and poverty alleviation (Cherdchucha and Otsuka, 2006; Estudillo, Sawada, and Otsuka 2006; Fuwa, 2006). In this development process, the major source of income has shifted from land to human capital. These findings suggest that an agricultural development strategy alone is not sufficient to move the mass of the rural poor out of poverty, and that the expansion of education coupled with the development of non-farm sectors has become increasingly important in the alleviation of the rural poverty.

Investment in human capital through schooling requires a very long term before its returns may be reaped, generally over generations. Thus, an in-depth study of intergenerational income dynamics is clearly needed to identify the causes and consequences of the investment in human capital. The purpose of this study is to find a pathway out of poverty across generations based on the analyses of the determinants of schooling, the occupational choice, and non-farm labor earnings. First, we propose to explore how land reform and agricultural development stimulated the schooling investment of children, through their effects on income and access to credit. If child schooling is critically affected by land reform and agricultural development, undue emphasis on rural non-farm development would not be warranted. Second, we attempt to identify the impacts of education on the occupational choice, ranging from agriculture, rural non-farm jobs, and jobs in urban areas and abroad. Even if children are not well educated, there might be a possibility of upward income mobility for them, if the demand for uneducated labor increases significantly. Thus,

finally, we would like to analyze the extent to which education increases non-farm incomes in various occupations.

In this paper, we will use panel data collected in the rural Philippines in 1979 and 2003. A unique feature of our survey is that we traced the same individuals who were school-aged or younger (0 to 24 years old) in the first survey and were in the labor force (24 to 48 years old) in the latest survey. This enables us to explore the detailed mechanisms underlying intergenerational poverty dynamics. Another unique feature is that the survey collected income data for not only individuals who remained in the original villages but also those who moved to Manila. In this way, the potential biases caused by the sample attrition can be mitigated (Lanzona, 1998; Thomas, Frankenberg, and Smith, 2001: Rosenzweig, 2003).

The remaining part of this paper is structured as follows. Section Ⅱ introduces the data sources and provides descriptive statistics of the sample, while Section Ⅲ presents the estimation strategies and the major hypotheses. The estimation results are discussed in Section Ⅳ. Based on the empirical findings, we draw key lessons and discuss policy implications in Section Ⅴ.

Ⅱ. Data

A. Data sources

The data used in this paper were collected in rice-growing areas in Central Luzon, the Philippines. The first survey, called the Central Luzon Loop Survey, was conducted in 1979

by the International Rice Research Institute (IRRI). The original sample of the survey consisted of rice-growing households located along a loop of the highway across five provinces in Bulacan, Nueva Ecija, Pangasinan, Tarlac, and Pampanga.[1] The survey collected detailed information on household characteristics, including operational landholdings, land tenure status, rice cultivation technology, and agricultural and non-farm incomes, as well as individual characteristics of household members, such as sex, age, and education.

In 2003, a follow-up survey was conducted by IRRI in collaboration with the authors in order to construct an intergenerational data base. The target individuals were those who appeared in the 1979 survey as school-aged or younger children. The Filipino educational system comprises 6 years for the primary, 4 years for the secondary, and 2-5 years for the tertiary levels. Since primary school starts at 6 years old, children can graduate from 5-year universities at the age of 21 if they do not repeat grades and they do not fail entrance exams. However, since repeating and the failing entrance exams are not so uncommon, we consider children below 24 years old in 2003 as the target group. To update information, we first visited the original sample households and asked them to report on the basic socioeconomic conditions of the target children, such as completed years of education, current occupation

[1] The survey excluded the landless agricultural wage laborer class, who are usually the poorest of the poor in agrarian communities. Rice-growing households here include share-tenants, leaseholders, owner-cultivators, and other farm households who are beneficiaries of land reforms.

and contact address. Based on the information gathered, we conducted a detailed household survey by direct interviews with the target children, in both their original provinces and Metro Manila.

B. Characteristics of target children

Table 1 reports the selected characteristics of sample children in 2003. The total sample size is 499. Of the total, the numbers of males and females are almost equal with an average age being 36 years old. The completed years of schooling are 10.7 on average. Because the average education of parents is 6.2 years, the education level improves approximately from primary to secondary school graduation over two generations. Compared with males, females are significantly more educated. In contrast to most developing countries, females are favored in schooling investment in the rural Philippines (Quisumbing, Estudillo and Otsuka, 2004).

About two-third of the individuals remain in their original villages, while the rest moved to either Metro Manila or abroad. It is noteworthy that only 13 % of individuals are engaged in farming in 2003, even though all of them were raised by rice-growing farmers. This indicates that non-farm employment opportunities have significantly expanded across generations. The probability of staying in villages is higher for males, and most of them are engaged in rural non-farm activities, followed by farming. On the other hand, many females in rural areas perform housekeeping. Although in South Asia, it is common to observe that

females are discriminated against in labor markets (e.g., Ahmed, 1980), it is hardly the case in the Philippines. Probably, many females temporarily withdraw from the labor market due to marriage and child-rearing. The share of females who migrate overseas is higher than for males, implying that Filipino females are more active in the international labor market as is also found by Lauby and Stark (1988).

C. Changes in economic characteristics across generations

Next, we will examine the changes in basic economic characteristics across generations (Table 2). The classification of agriculture, rural non-farm, and urban non-farm (Manila) is based on the main occupation of the target children, regardless of whether they are household heads or not in 2003.[2]

Central Luzon was selected as a major target area of the land reforms proclaimed in 1972. The reforms mandated share-tenancy illegal and converted it to leasehold tenancy for land below a landlord's 7 ha retention limit and to amortizing owners who received the Certificate of Land Transfer (CLT) for land beyond the retention limit. Upon the completion of annual amortization payments to the Land Bank, a CLT holder is allowed to receive an Emancipation Patent (EP) and becomes an owner of land. As pointed out by Otsuka (1991), these land reforms were effectively implemented in favorable rice growing areas, where the divergence between land rents or amortization payments, which are fixed at a level lower

[2] Since we could not trace individuals working abroad, they are omitted from Table 2.

than the market rate, and the marginal productivity of land has widened.

The major source of the increased marginal productivity of land was the Green Revolution. Since the first modern variety (MV) of rice was released by IRRI in 1966, the share of sample farmers adopting MVs in the Central Luzon Loop Survey continued to rise and reached 100% in 1979. By this year, 92% of the farmers had replaced the first-generation MVs (MV1) with the second-generation MVs (MV2). Since MV1 was susceptible to pests and diseases, the impact on rice yield was limited. However, there was a jump in yield due to the introduction of MV2, which was more resistant to pests and diseases (Otsuka, Gascon, and Asano, 1994). In fact, the average rice yield of sample farmers per hectare per season was only 2.3 tons in 1966, when traditional varieties (TVs) were cultivated, but increased to 3.7 tons in 1979.

According to Table 2, the irrigation ratio was 67% in 1979 and almost the same in 2003. By contrast, the availability of land declined remarkably across generations. In fact, the average operational landholding of all sample households was 2 ha in 1979, but declined to only 0.5 ha for the all sample children in 2003. A major reason for this is that many children no longer farm land. Yet, the average farm size of farming households is still lower than that of the parental generation, because of a growing population pressure on land (Estudillo and Otsuka, 1999). The land reform was successful; while in 1966, 76% of total cultivated land was under share tenancy, the dominant tenancy contract changed to leasehold

or CLT in 1979. Moreover, more than 50% of the land in 2003 is cultivated by owners and EP holders, suggesting that many children inherited land on which amortization payments had been completed by their parents.

The average household size decreased from 7.6 to 5.5 persons over the generations. Especially, migrants in Manila tend to have the small families. The average education of working adults, those aged between 20 and 65 years old, notably increased from 7.0 to 10.4 years during the same period. The least educated is the farmer household, while the most educated is the migrant household in Manila.

The average real income per capita of children is about 2.6 times greater than that of their parents.[3] It is clear that agricultural income decreased slightly, whereas non-farm income increased remarkably. It is also important to note that while the predominant source of income was agriculture in the parent's generation, it has changed to non-farm in the children's generation. The poverty incidence more than halved from 57% in 1979 to 26% in 2003.[4] This is noteworthy because this satisfies the first target of the MDGs. The poverty incidence is extremely low in rural non-farm households as well as migrants' households in Manila, whose income is generated predominantly from non-farm sources. These findings suggest that the expansion of non-farm employment opportunities significantly contributes to

[3] We use consumption price index as a price deflator. Spatial price differences in the cost of living are also adjusted for, using the rates of difference in the provincial-specific poverty lines, which are set by the National Statistical Coordination Board. The base price group is Manila in 2003.

[4] We define a household as poor if the household' real income per capita is below the poverty line of Manila in 2003, which is equivalent to 16796 peso (US$310) per annum.

the income growth as well as to poverty alleviation over generations.

Importantly, this development process is clearly pro-poor. Figure 1 illustrates the relationship between parental income per capita and the rate of per capita income growth across generations. In addition to plotting the original data, we present a parametric line, which is obtained by a regression of the logged income growth on the logged per capita income of parents and its squared term, and a non-parametric lowess smoothed line. According to this figure, the slope is negative, regardless of the parametric and non-parametric lines. This implies that the rate of income growth tends to be higher when parents were poorer.

D. Education and occupational mobility

Now we investigate who entered into non-farm activities and how the occupational structure has changed over time, while focusing on the role of education in occupational choices and mobility. Table 3 presents the transition probabilities from the first occupation to the current occupation in 2003,[5] while Table 4 presents the average years of education corresponding to each occupational transition.

In Table 3, it is shown that the sum of children off the diagonal, who changed either occupation or working place, accounts for more than half of the total children. A high occupational transition pattern is observed among farmers and workers in Manila, where only

[5] We define "first occupation" as the first job obtained within 5 years after completing schooling and at aged 15 years old or above.

8% (38% of those who choose agriculture as a first job) and 12% (37% of those who choose jobs in Manila first) of the total remain in the same category, respectively. Importantly, the majority of children who changed their occupations are absorbed in rural non-farm activities in 2003. These observations indicate that because employment opportunities of rural non-farm activities are relatively limited in the early stage of career development, at first children tended to choose either agriculture in local areas or non-farm activities in cities. However, the economic development may have expanded non-farm employment opportunities for the rural population over time, which enables many children to participate in rural non-farm activities.

The average education of children who are engaged in non-farm activities is higher than those who are engaged in agriculture or housekeeping (Table 4). Furthermore, migrants have higher education levels than non-migrants. The highest education level is found among overseas migrants. This may be attributable to the fact that high school diplomas are generally required for overseas workers in order to ensure fluent English communication with foreigners (Hayami and Kikuchi, 2000; Kajisa, 2006).

It is also important to emphasize that the educational gap between children, who are engaged in agriculture and rural non-farm activities, has narrowed for the current occupation compared with the first occupation. This may be explained by the increased demand for unskilled labor in the rural non-farm labor market, which allows less educated children who

were in agriculture in their first occupation to transfer to the rural non-farm sector. In fact, the average education of children who shifted their jobs from agriculture to rural non-farm activities is only 8.3 years, which is substantially lower than the others. Moreover, a detailed examination of the data reveals that substantial numbers of children, who have a primary school level of education, participated in agriculture for their first occupation, but engage in rural non-farm activities, such as petty trade, carpenters and welders, for their current occupation. Another important observation is that there is a negligible educational gap between children in rural non-farm jobs and migrants for the first occupation, but the gaps became wider for the current occupation. This may be attributed to a large inflow of children from Manila to rural non-farm activities, whose education levels are low and may not be sufficient to obtain regular and lucrative jobs in cities.

From the findings discussed above, it can be postulated that the major factors underlying the sharp poverty reduction in the areas under study are the increased education of the younger generation as well as the development of non-farm sectors and the integration of urban and international labor markets. An important empirical question is why this process is pro-poor. In order to explore the pathways out of poverty more rigorously, we will conduct regression analyses below.

Ⅲ. Estimation Strategy and Hypotheses

Four different regression functions are estimated: the determinants of (1) parent's income

separately for agricultural and non-farm incomes; (2) investment in children's schooling; (3) children's occupational choices separately for the first and current occupations; and (4) children's non-farm earnings separately for rural non-farm workers and workers in Manila. Throughout the regression analyses, we assume that parents take the major responsibility for a schooling investment decision, while children take the major responsibility for occupational decisions. This means that the completed years of education of children are assumed to be exogenous for them.

The first equation can be specified as

$$Y^{P}_{j,ih} = X^{P}_{j,ih} B_j + \varepsilon_{j,ih}, \qquad (1)$$

where $Y^{P}_{j,ih}$ denotes the real per capita income of child i in the parental family h in 1979 and j is either the agricultural or non-farm income. X^{P} is a vector of the household characteristics of parents, B is a vector of the estimated coefficients and ε is a random error term. Since many households had no non-farm income in 1979, we employ OLS for the agricultural income but Tobit for the non-farm income to avoid potential estimation biases.

From equation (1), we obtain the predicted agricultural and non-farm incomes of the parental family, $\hat{Y}^{P}_{A,ih}$ and $\hat{Y}^{P}_{NA,ih}$, respectively. Then, using these two predicted values, we will estimate the schooling investment equation as follows:

$$\Delta S_i^C = \gamma_1 \hat{Y}_{A,ih}^P + \gamma_2 \hat{Y}_{NA,ih}^P + X_i^C \gamma_3 + X_{ih}^P \gamma_4 + \gamma_5 S_{79,i}^C + v_i , \qquad (2)$$

where the dependent variable ΔS_i^C is the changes in the years of schooling from 1979 for children i; X^C is a vector of children's characteristics; γ_s are a vector of the estimated coefficients; and v is a random error term. To control for the initial education level in 1979, we include a set of schooling year dummies, $S_{79,i}^C$, into the regressors. This variable is likely to be endogenous but we consider it as a pre-determined variable. [6] Since many children do not gain additional education from 1979, we will again employ Tobit here. In addition to equation (2), we also run a reduced-form regression, where the predicted agricultural and non-farm incomes are excluded, to check the robustness of the estimation.

In order to estimate the third equation, we assume that children sequentially decide first whether to work (Choice_1); then if yes, whether to participate in non-farm activities (Choice_2); then if yes, whether to migrate (Choice_3); and finally if yes, whether to migrate abroad (Choice_4). Based on this assumed decision structure, we estimate the determinants of occupational choice by the sequential probit model, separately for the first and current occupations. The probabilities for choosing each occupation type are:

Pr(jobless or housekeeper)=$1 - F(k_1 Z)$

Pr(agriculture)= $F(k_1 Z)[1 - F(k_2 Z)]$

[6] We also attempt to estimate the equation by including age-dummies instead of schooling dummies in 1979. The estimation result remains qualitatively unchanged.

$$\text{Pr(rural non-farm)} = F(k_1 Z)[F(k_2 Z)][1 - F(k_3 Z)] \quad (3)$$

$$\text{Pr(migrants in Manila)} = F(k_1 Z)[F(k_2 Z)][F(k_3 Z)][1 - k_4 Z]$$

$$\text{Pr(overseas migrants)} = F(k_1 Z)[F(k_2 Z)][F(k_3 Z)][k_4 Z],$$

where $F[\cdot]$ denotes the cumulative distribution function of the standard normal distribution, Z is a set of explanatory variables, including household characteristics in 1979 and children's individual characteristics, and k_l is a set of estimated parameters for choice *l*.

Next we estimate the non-farm earnings determination functions of children in 2003 separately for rural non-farm workers and migrants in Manila. Since these samples are a sub-set of the full-sample, we construct the inverse Mills ratios from the estimated probabilities obtained above, and employ a Heckman two-step estimation. Letting λ indicate the inverse Mills ratio, the second-step equation can be specified as

$$\ln Y_{m,i}^{C} = X_{m,i}^{C}\delta_m + \rho_m \lambda_m + u_{m,i}, \quad (4)$$

where $\ln Y_{m,i}^{C}$ is the log of the daily non-farm earnings in place *m*, which is either rural areas or Manila, δ and ρ are the parameters to be estimated, and *u* is an error term.

Our major hypotheses are as follows.

Hypotheses 1 (Parental Income-Child Schooling Hypothesis): *A rise in the household income of parents mainly brought about by the land reform and the Green Revolution induces increased investment in child schooling.*

Hypothesis 2 (Child Schooling-Occupational Choice Hypothesis): *Educated children prefer to work in the non-farm sector in general, and in urban areas or overseas in particular.*

Note that compared with the first occupation, the marginal impact of education on the entry into non-farm activities is likely to become less pronounced for the current occupation due to the development of unskilled-labor intensive, rural non-farm employment opportunities.

Hypothesis 3 (Child Schooling-Non-farm Earnings Hypothesis): *While the effect of education on non-farm earnings is positive and highly significant, its magnitude is relatively lower in rural areas than in cities, because the required education levels are significantly lower in the former than the latter.*

In sum, our basic argument is that the intergenerational development process has been pro-poor not because many children of the poor households go to higher schooling, but because opportunities for improving livelihoods expanded even for less educated individuals in the rural non-farm sector.

Ⅳ. Estimation Results

A. Determinants of income of parental family

Table 5 presents the estimation result of the per capita parental income determination function. As expected, lands under ownership and leaseholder/CLT title have positive and significant impacts on agricultural income. The magnitude of the coefficient is higher for

owned land since an owner does not have to pay rent. Interestingly, land areas under ownership and sharecropping tenancy positively affect non-farm income. One possible reason for the former is that well-to-do farmers can afford to incur set-up and other required investment costs in self-employed non-farm businesses, such as restaurants and *sari-sari* store management, and jeepney and tricycle operations.[7] On the other hand, the reason for the latter may be that the poorer share-tenants compensate for the low agricultural income by participating in non-farm activities, which is reflected in the negative coefficient in the agricultural income determination function. These results clearly show that access to land is an important determinant of parental income and that land reform programs which aim to convert share-tenancy to leaseholding as well as transfer land to tillers significantly contribute to the increased income of parents.

As expected, the ratio of irrigation is positively and significantly associated with per capita agricultural income. As pointed out by Otsuka (1991), the diffusion of MVs is facilitated under irrigated conditions because MV cultivation is more productive when water is controlled adequately. Our sample farmers had completely replaced TVs by MVs by 1979, and hence, we cannot distinguish the impact of MV adoption from that of irrigation on income generation. Therefore, the coefficient of the irrigation ratio captures the effects of MVs under irrigation compared with the rainfed conditions.[8]

[7] Further investigation suggests that the probability of entry into such self-employed non-farm activities increases with the size of owned land.

[8] Note that the effect of irrigation on rice yield was small when only TVs were grown (Otsuka et al.,

The coefficient of the number of adult members has a negative and significant impact on per capita agricultural income, but a positive and significant impact on per capita non-farm income. The former result seems intuitively plausible considering that the land-labor ratio decreases with the increase in adult members, which reduces the marginal labor productivity in farming. Since such constraints do not exist for non-farm income, the increased adult members are positively related to non-farm income. The positive and significant coefficient of the ratio of male adults in both agricultural and non-farm income functions indicates that employment opportunities are limited for females at that time. The proportion of adult members with secondary schooling is insignificant in both functions, but tertiary schooling is positive and highly significant only in the non-farm income function. These results indicate that highly educated people tend to work not in agriculture but in non-farm activities to obtain higher returns to education. Besides, the distance from Manila is positively associated with agricultural income, but negatively associated with non-farm income, which would imply that households in remote areas tend to have less non-farm employment opportunities, thereby relying largely on agriculture for their livelihoods.

B. Determinants of schooling investment

We now turn to the estimation of the schooling investment function to examine the validity of Hypothesis 1 (Parental Income-Child Schooling Hypothesis). According to

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1994).

Table 6, both agricultural and non-farm incomes significantly increase the investment in children's schooling. While the magnitude of the coefficients of agricultural income is slightly higher, the difference between the two component incomes is statistically insignificant. This is probably because money is fungible, so that one peso generated from any income source has the same impact on an investment decision. Given the fact that the dominant source of parental household income is agriculture as shown previously, there is no doubt that agricultural income has played a critically important role in schooling investment, rendering strong support for Hypothesis 1.

Column (2) uses land variables instead of the predicted incomes. Owned land has a positive and statistically significant impact on schooling investment, while leasehold land (including CLT land) and share-tenant land have insignificant impacts. These results indicate that owned land is not only an important source of income, but also an important source of collateral to finance schooling investments.[9] Because the collateral value of leasehold and share-tenant land is generally low, better access to these lands would have negligible impacts. In addition, the positive and significant coefficient of the irrigation ratio shows that the increased parental income brought about by the improvements in agricultural productivity is important for schooling investment, which is consistent with Hypothesis 1.

The coefficient of the birth year of children is positive and that of its squared term is

[9] While not presented, we run a regression by including owned land in addition to the other explanatory variables in column (1). The result shows that even after controlling for the effects of incomes, owned land still has a positive impact on child schooling.

negative, which indicates that schooling investments are made in favor of younger cohorts. The male dummy is negative and significant, even after controlling for other effects, implying that parents favor females when investing in child schooling. Father's education has a positive and significant impact on schooling investment. In particular, judging from its interaction term with dummy for male children, the father's education increases the schooling of males more significantly. In contrast, the mother's education has an insignificant impact. In addition, the death of household heads between 1979 and 2003 is found to be a significant constraint on child schooling progression.

The number of male siblings has an insignificant impact, while the number of female siblings has a negative and significant impact. Since females receive higher education than males, having many sisters may intensify resource competition more than having many brothers. The negative and significant coefficient of the proportion of younger siblings indicates that the education of an elder brother/sister is lower than a younger one, even after controlling for cohort effects. The sign of the distance from Manila is negative, but its coefficient is statistically insignificant.

Overall, the regression results indicate that the improvement in the access to land through the land reform implementation and the increase in land productivity due to the Green Revolution result in significant improvements of the schooling of children.

C. Determinants of occupational choices

Columns (1) to (4) in Table 7 summarize the estimation results of the choice of the first occupation, while columns (5) to (8) show the results for the current occupation. The numbers in this table show the marginal effects of the regressors, evaluated at their means, on the probability of choosing each category.

Column (1) is the labor participation equation. The positive and significant coefficient of the male dummy shows that the probability of the labor participation of males is higher than that of females. Education does not significantly affect whether they work or not. Somewhat unexpectedly, the probability of labor participation decreases with the irrigation ratio. This may be because farmers who own irrigated rice fields are richer, so that their children can afford to spend more time to find suitable jobs.

According to column (2), females prefer to engage in non-farm activities compared to males. This may reflect the different comparative advantages between genders, in which males are relatively suited to farming which requires physical strength, while females are relatively suited to non-farm activities (Quisumbing et al., 2004). It appears that the contribution of females to income generation increases with the development of the non-farm sector. Education is positively associated with the probability of participation in non-farm activities, which supports Hypothesis 2. The negative and significant coefficient of the irrigation ratio indicates that the opportunity cost of non-farm work is higher in the case of irrigated farming because of greater labor productivity, which, in turn, lowers the probability

of participation in non-farm activities. The coefficient of the distance from Manila is negative and significant, indicating that access to the non-farm labor market is lower in more remote areas.

Consistent with Hypothesis 2, education increases the probability of out-migration as shown in column (3). Apart from own education, the father's education also facilitates out-migration, while the mother's education has an opposing effect. Distance from Manila is positive and significant, implying that children in remote areas tend to seek jobs outside the villages presumably because of the limited non-farm employment opportunities in local areas.

According to the overseas work equation in column (4), younger cohorts and females are more likely to choose to work overseas. In addition, the coefficients of leasehold land and the ratio of irrigation are positive and significant, which are consistent with the argument by Estudillo et al. (2006) as well as our field observations that land is often mortgaged in informal credit schemes to pay for placement fees when children go abroad. Finally, children living far from Manila are more likely to choose overseas work instead of work in Manila.

Turning to the current occupational choices shown from columns (5) to (8), it can be confirmed that individual characteristics have similar effects as the first occupation. For example, males are more likely to choose to work than females, and given the labor market participation, females are more likely to choose non-farm jobs. Education has positive

impacts on the probability of choosing non-farm work in general and out-migration in particular. Compared with the first occupation, however, the marginal impact of education on the entry into non-farm activities becomes weaker, while it becomes stronger on out-migration in the current occupation. Such evidence suggests that the role of education as a selection device for the choice between agriculture and the non-farm sector has weakened over time, which may result from the increased demand for unskilled jobs in the rural non-farm sector.

Another conspicuous change from the choice of the first occupation is that the statistical significance of the family background variables generally disappears except for the labor market participation decision. In column (5), the coefficient of the father's education is negative and that of share-tenanted land is positive. This may be because a household is poorer if the father is less educated and a share-tenant, which compels the children to work outside the household. In column (6) to (8), all the family background variables are statistically insignificant, indicating that the effects of the original household tend to fade away over extended periods as children acquire their own experience. This may reflect the development process of children becoming independent from their parents.

D. Determinants of non-farm earnings

The remaining question is regarding the validity of Hypothesis 3 (Child Schooling-Non-farm Earnings Hypothesis). Column (1) in Table 8 shows the estimation

results of the daily labor earnings function for rural non-farm workers, using the years of education and work experience as the major explanatory variables,[10] while column (2) uses age and its squared term instead of the experience variables. Columns (3) to (4) are counterparts for migrants in Manila. Columns (5) to (8) correspond to (1) to (4), but the categorical educational levels are used as explanatory variables in order to examine the non-linear effects of education.

According to columns (1) to (4), education positively affects non-farm income. It is important to note that the average rates of the returns to education are substantially higher in Manila than in rural areas, judging from the difference in the coefficients. Moreover, columns (5) to (8) show that only the effect of tertiary schooling is significantly positive in rural areas, while those of secondary and tertiary schooling are both significantly positive in Manila, with the magnitudes being greater for the latter. These findings may indicate that the disadvantage of primary school graduates compared with secondary school graduates is relatively small in rural areas. These results together provide supporting evidence for Hypothesis 3.

It is interesting to observe that the coefficients of experience and its squared term as well as age and its squared term are significant only in rural areas, which highlights the importance of occupation-specific human capital in rural areas. Thus, even for the less educated, a person may be able to increase non-farm labor earnings through accumulating

[10] Work experience is equal to the years in the same occupation with that of 2003.

their own job experience. The same story does not hold in Manila: As is clear from the insignificant coefficients of experience and age, specific human capital does not seem to be valuable in this large city.

Ⅴ. Conclusions

Using intergenerational panel data from the Philippines, this study investigates the long-term mechanism by which rural poverty can be reduced over generations. From the descriptive analyses, we found that the real per capita income of children is about 2.6 times larger than that of their parents which is accompanied by a sharp reduction of poverty during the 1979-2003 period. In this process, the share of non-farm income in total household income increased substantially from 41% to 78%. Regression analyses demonstrate that landholdings and irrigation of the original household are critical factors underlying the income growth of parents, which leads to the improvement in human capital of children through schooling investment. The improved human capital of children, in turn, increases the probability of obtaining lucrative non-farm jobs especially in cities and abroad. In addition, the increased schooling is a decisive determinant of non-farm income, especially in cities. These findings suggest that the increased income of parents contributes to poverty alleviation for the children in the long run through its effect on improvements in human capital of children.

One may think that, given such a virtuous circle, inequality is intergenerationally

persistent or gets worse because children of richer families are able to obtain greater chances to increase their earning capacity. An important finding in this paper, however, is that this development process is clearly pro-poor with the rate of income growth higher for the initial poor. This is not because opportunities for schooling significantly increased regardless of the parental income level, but because opportunities for improving livelihoods have increased for the less educated individuals. A major factor underlying the latter is the development of the rural non-farm sector. In fact, the majority of uneducated children who worked in the agricultural sector or in cities as their first occupation moved into rural non-farm activities in 2003. The development of this rural non-farm sector may enable children born in a poor family, and are thus less educated, to generate decent income and thereby move out from poverty.

The current slow progress of rural poverty reduction in many developing countries calls for urgent and unprecedented commitments from the international community. A major lesson drawn from this study is that policies to facilitate improvements in human capital of children and the development of non-farm sectors are among the two most effective ways to achieve the main goals of the MDGs. Such positive impacts would be stronger if the labor-intensive industries are developed in rural areas. It is, however, critically important to recognize that such efforts should not leave the agricultural sector behind. Our analysis clearly demonstrates that the agricultural transformation, through land reform programs and

the Green Revolution that enhanced farmer's incomes at the outset, triggered the whole process of changes leading to the massive poverty reduction in rural areas of the Philippines.

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Table1

Basic Characteristics of Sample Children, 2003

		All	Male	Female
No. of Sample		499	254	245
Age		35.6	35.7	35.6
Education		10.7	10.5	10.9
Occupation and Place of Work （%）				
Rural	Housekeeper*	18.4	2.8	34.7
	Agriculture	13.0	21.7	4.1
	Non-farm	35.5	45.3	25.3
Migration	Manila	19.4	20.9	18.0
	Abroad	13.6	9.4	18.0
All		100.0	100.0	100.0

Note. * Including jobless.

Table 2

Changes in Selected Economic Characteristics over Generations, 1979-2003

	Parents (1979)	Children (2003)			
	Total	Total	Agriculture	Rural Non-farm	Work in Manila
% Irrigated Land	66.9	66.7	57.9	73.3	57.1
Farm Size (ha)	2.0	0.5	0.8	0.5	0.3
Farm Size if growing rice (ha)	2.0	1.3	1.2	1.3	0.9
% under ownership or EP†	6.3	54.3	47.8	55.8	82.1
% under leasehold or CLT†	83.7	17.7	34.9	31.8	0.0
Household Size	7.6	5.5	5.4	5.7	5.0
Average Education of Adults	7.0	10.4	9.7	10.3	11.7
Real Per Capita Income: (' 000 Peso)§	19.7	52.0	29.7	54.2	75.3
Agricultural income (〃)§	11.2	9.3	15.1	9.9	0.7
Non-farm Income (〃)§	8.5	42.8	14.6	44.3	74.6
% Non-farm Income	40.7	78.4	48.8	83.1	98.4
Poverty Incidence (%)	56.7	25.5	49.1	21.6	8.0

Note . † EP and CLT denote Emancipation Patent and Certificate of Land Transfer, respectively.

§ We use consumption price index as a price deflator. Spatial price differences in the cost of living are also adjusted for, using the rates of difference in the provincial-specific poverty lines, which are set by the National Statistical Coordination Board. The base price group is Manila in 2003.

Table 3
Percentage Distribution of the First and the Current Occupation

	Current Occupation（2003）					
	Housekeeper	Agriculture	Rural Non-farm	Work Manila	Work Overseas	Total of First Occupation
First Occupation						
Housekeeper	4.8	0.2	2.6	0.4	0.4	8.4 (42)
Agriculture	1.0	7.8	8.8	2.6	0.4	20.6(103)
Rural Non-farm	5.2	1.4	16.4	4.2	4.2	31.5(157)
Work Manila	5.2	3.6	7.4	11.6	3.6	31.5(157)
Work Overseas	2.2	0.0	0.2	0.6	5.0	8.0(40)
Total of Current Occupation	18.4 (92)†	13.0 (65)	35.5 (177)	19.4 (97)	13.6 (68)	100 (499)

Note. † The number of sample children is in parentheses.

Table 4
Occupation Transition and Years of Education

	Current Occupation（2003）					
	Housekeeper	Agriculture	Rural Non-farm	Work Manila	Work Overseas	Overall Average of First Occupation
First Occupation						
Housekeeper	9.8	13.0	11.4	8.0	13.0	10.4
Agriculture	9.2	8.9	8.3	9.0	9.5	8.7
Rural Non-farm	9.5	12.0	11.1	11.3	12.8	11.1
Work Manila	10.2	10.4	11.3	12.3	12.3	11.5
Work Overseas	11.1	n.a.	14.0	10.7	12.0	11.7
Overall Average of Current Occupation	9.9	9.7	10.5	11.5	12.3	10.7

Table 5
Determinants of Per Capita Income of Parents, by Source, 1979

	Agriculture	Non-farm
Owned Land (ha)	4.239***	4.427**
	(3.87)	(2.40)
Leasehold Land or CLT (ha)	2.528***	-0.759
	(4.28)	(1.20)
Share-tenant Land (ha)	-1.400***	2.171**
	(4.45)	(2.21)
Irrigation Ratio	10.505***	0.686
	(11.04)	(0.47)
No. Adults	-0.973**	2.763***
	(2.47)	(6.17)
Ratio of Male Adults	12.337**	9.336*
	(2.00)	(1.96)
Ratio of Adults with Secondary Schooling †	0.373	-3.505
	(0.22)	(1.44)
Ratio of Adults with Tertiary Schooling †	-2.276	12.267***
	(0.94)	(4.03)
Distance from Manila (km)	0.021**	-0.072***
	(2.29)	(4.88)
Constant	-5.903	0.381
	(1.17)	(0.10)
R-squared	0.22	
LR Chi(2)		139.3

Note. Robust *t*-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

† Reference group is Ratio of Adults with Primary Schooling.

Table 6
Determinants of Investment in Schooling of Children

	(1)	(2)
Predicted Agricultural Income	0.050**	
	(2.38)	
Predicted Non-farm Income	0.042**	
	(1.99)	
Owned Land in 1979 (ha)		1.151***
		(3.23)
Leasehold Land or CLT in 1979 (ha)		-0.04
		(0.31)
Share-tenant Land in 1979 (ha)		0.283
		(1.48)
Irrigation Ratio in 1979		0.543**
		(2.10)
Year of Birth	12.009***	11.817***
	(8.25)	(8.25)
Year of Birth Squared	-0.080***	-0.079***
	(8.08)	(8.07)
Male (=1)	-1.370**	-1.170*
	(2.02)	(1.73)
Father's Education	0.143**	0.156**
	(2.07)	(2.30)
Mother's Education	0.102	0.083
	(1.30)	(1.06)
Father's Education*Male	0.218**	0.200**
	(2.14)	(1.99)
Mother's Education*Male	-0.15	-0.162
	(1.47)	(1.60)
HH Head Died Between 1979-2003 (=1)	-1.249***	-1.299***
	(4.65)	(4.89)
No. Male Siblings	-0.079	-0.038
	(1.28)	(0.59)
No. Female Siblings	-0.196***	-0.177**
	(2.67)	(2.42)

Table 6（'Cont）		
Ratio Younger Siblings	-0.812*	-0.791*
	(1.71)	(1.72)
Distance from Manila	-0.002	-0.004
	(0.65)	(1.60)
Constant	-426.433***	-420.097***
	(8.36)	(8.37)
Pseudo R-squared	0.33	0.33
F-Test on Equality of Coefficients (Predicted Ag Inc=Predicted Non-farm inc)	0.09	

Note. Robust *t*-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Dummies for the initial years of education in 1979 are also included. These dummies can be endogenous, but we treat them as pre-determined variables.

Table 7

Determinants of Occupation and their Changes, First and Current Occupations

	First Occupation				Current Occupation			
	Work	Nonfarm	Migrate	Abroad	Work	Nonfarm	Migrate	Abroad
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individual Characteristics								
Year of Birth	0.007	-0.007	0.135	0.313***	0.047	0.017	0.105	0.036
	(0.20)	(0.14)	(1.55)	(2.65)	(0.94)	(0.32)	(1.11)	(0.25)
Year of Birth Squared	0.000	0.000	-0.001	-0.002***	0.000	0.000	-0.001	0.000
	(0.18)	(0.18)	(1.54)	(2.62)	(0.99)	(0.26)	(1.04)	(0.32)
Male (=1)	0.105***	-0.232***	-0.086	-0.129**	0.376***	-0.151***	-0.103*	-0.239***
	(4.69)	(6.25)	(1.56)	(2.27)	(10.42)	(3.76)	(1.74)	(2.75)
Education	0.004	0.044***	0.019*	0.015	0.022***	0.019***	0.044***	0.027
	(1.10)	(6.21)	(1.68)	(1.33)	(3.75)	(3.04)	(4.09)	(1.50)
Family Background (1979)								
Owned Land (ha)	0.083	0.666	-0.063	0.027	-0.026	-0.222	-0.299	0.683
	(0.55)	(1.22)	(0.19)	(0.10)	(0.14)	(1.16)	(0.90)	(0.99)
Leasehold Land/CLT (ha)	0.020	0.088	0.066	0.198**	-0.020	0.004	-0.217	0.054
	(0.41)	(1.07)	(0.59)	(2.05)	(0.32)	(0.04)	(1.54)	(0.32)
Share-tenant Land (ha)	-0.128	-0.282	0.563	-1.023	0.666**	-0.047	-0.275	-1.147
	(1.26)	(1.20)	(1.24)	(1.29)	(2.13)	(0.27)	(0.89)	(1.46)
Irrigation Ratio	-0.055**	-0.073*	-0.007	0.106*	0.051	0.019	0.022	0.083
	(2.08)	(1.87)	(0.12)	(1.83)	(1.47)	(0.50)	(0.34)	(0.82)
Father's Education	-0.003	0.007	0.030**	-0.003	-0.017**	-0.006	0.005	0.006
	(0.71)	(0.87)	(2.30)	(0.28)	(2.34)	(0.65)	(0.35)	(0.29)
Mother's Education	-0.001	0.012	-0.052***	-0.003	0.007	0.004	-0.017	-0.005
	(0.23)	(1.44)	(3.76)	(0.24)	(0.95)	(0.52)	(1.26)	(0.24)
Other Factors								
Distance from Manila	0.000	-0.001***	0.002***	0.001**	0.000	-0.001***	0.000	0.001
	(0.03)	(3.09)	(3.37)	(2.17)	(0.50)	(3.50)	(0.26)	(0.94)
Constant	-0.086	0.109	-4.752	-11.279***	-1.612	-0.38	-4.086	-1.296
	(0.08)	(0.06)	(1.64)	(2.82)	(0.97)	(0.21)	(1.29)	(0.26)
Pseudo R-sq	0.10	0.27	0.06	0.14	0.30	0.13	0.07	0.12

Note. z-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8
Determinants of Non-Farm Earnings, Rural and Manila, 2003

	Rural		Manila		Rural		Manila	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education (years)	0.066***	0.069***	0.139***	0.140***				
	(3.75)	(3.68)	(3.03)	(3.05)				
Secondary School (=1) †					-0.126	-0.127	0.665**	0.557*
					(0.88)	(0.92)	(2.03)	(1.90)
Tertiary School(=1) †					0.438***	0.423***	0.735***	0.684**
					(3.02)	(2.92)	(2.72)	(2.59)
Experience (years)	0.073***		0.029		0.076***		0.040	
	(3.61)		(0.33)		(3.95)		(0.45)	
Experience Squared	-0.002**		-0.001		-0.002**		-0.002	
	(2.25)		(0.27)		(2.51)		(0.39)	
Age in 2003		0.221**		0.375		0.200**		0.351
		(2.49)		(1.59)		(2.36)		(1.24)
Age Squared		-0.003**		-0.006		-0.003**		-0.005
		(2.48)		(1.56)		(2.41)		(1.18)
Male (=1)	-0.251*	-0.136	-0.053	-0.110	-0.275**	-0.166	-0.282	-0.361
	(1.85)	(0.97)	(0.25)	(0.52)	(2.04)	(1.15)	(1.21)	(1.46)
Lambda	0.348	0.366	-1.038	-0.933	0.472	0.502	-0.196	0.106
	(1.03)	(1.08)	(1.38)	(1.20)	(1.36)	(1.37)	(0.28)	(0.14)
Constant	3.914***	0.243	5.987***	-0.284	4.233***	1.044	5.798***	-0.419
	(5.83)	(0.13)	(5.76)	(0.07)	(7.13)	(0.63)	(5.28)	(0.09)
R-squared	0.18	0.12	0.24	0.28	0.24	0.16	0.13	0.17

Note. Robust *t*-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

† Reference group is Primary School.

Figure 1

Initial Income of Parents and Income Growth over Generations, 1979 and 2003