The Impact of Rural Infrastructure and Agricultural Support Services on Poverty: The Case of Agrarian Reform Communities in the Philippines

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Abstract

Rural poverty remains one of the biggest challenges in development. It is generally recognized that land reform, in combination with complementary support services and infrastructure development, is effective in reducing rural poverty; however, empirical evidence on the extent of the impacts is limited as are the pathways by which the impacts reach the beneficiaries.

This study assesses the impacts of rural infrastructure and supported services provided by the Agrarian Reform Communities Project (ARCP) and financed jointly by the Government of the Philippines and the Asian Development Bank (ADB). Using data from the same 2,290 agrarian reform beneficiaries' households from two periods, 2001 and 2003, the study found that average annual income increased by 12%. Ownership of both household and production assets increased significantly.

Among the project interventions, farm-to-market roads appeared to have the most significant impact on the communities. The benefits of the project interventions, however, were disproportionately captured by the wealthier households, resulting in worsened income distribution in the communities. In the transformation from labor use to more mechanized modes of production and transportation, the poor, i.e., the wage laborers, generally lose out, at least temporarily. Future interventions in rural infrastructure provisions should include measures to assist the poor to increase their capacity to capture the new employment opportunities generated by development interventions.

JEL Classification: I32, Q15, R41

Contents

I. INTRODUCTION

Agrarian reform is recognized as a prerequisite for growth with equity in developing countries as evidenced in Japan, Republic of Korea, Taipei,China, and People's Republic of China, which have successfully implemented this reform (Morales, 1999). The redistribution of land helps reduce poverty by granting full ownership and control to the farmer-beneficiaries and providing the necessary support services and infrastructure to make the land productive, while laying the foundation for broad-based development. Through successful implementation of land reform programs, these countries have achieved sustained economic growth and successfully reduced absolute material poverty among their populace.

Rural poverty is a serious problem in the Philippines, and the Agrarian Reform Communities (ARC) are among the most disadvantaged population groups. Baseline studies conducted in 1997 by the University of the Philippines Los Baños determined that more than 70% of agrarian household members lived below the poverty line. In US equivalents, the average agrarian household annual income was US$792.72 compared with the national poverty threshold of US$1378.36. Recognizing that poverty is most prevalent among landless farm workers and sharecroppers, the government's dominant way of addressing poverty has been to transfer ownership and control of land assets to such agricultural reform beneficiaries. An integral component of land distribution is the provision of rural infrastructure and support services to complement agricultural productivity and enhance welfare of impoverished farm workers and sharecroppers.

Jointly funded by the Asian Development Bank (ADB) and the Government of the Philippines and commenced under the umbrella of the government's ARC development strategy, the Agrarian Reform Community Project (ARCP), begun in 2000, aims to alleviate poverty through the provision of rural infrastructure and other support services. The investment project was a loan of about US$72.6 million, 72% of which is allocated for rural infrastructure. The project also enhances community participation in the transition from subsistence to commercial farming.

This paper attempts to determine the impacts of the ARCP, in particular the rural infrastructure, on ARC households after two years of implementation. The paper also evaluates how project benefits are distributed among different population groups.

A. Poverty in the Philippines

Thirty percent of the 2003 population lived below the poverty line; this translates to 3.96 million families living below the poverty line.[1] A majority of the poor are in Mindanao, where more than 40% of families have difficulty providing for everyday needs. According to De Dios (1993), the incidence of poverty is highest among landless farm workers, then coconut and maize farmers, fishermen, rice farmers, and, lastly, orchard growers. Table 1 shows that while overall poverty has declined in the country since 1985, the decline is more in urban than in rural areas.

Table 1: Population Below Poverty Line (%)

	1985	1997	2000	2003*
Philippines	44.2	31.8	33.7	30.4
Urban	33.6	17.9	19.9	
Rural	50.7	44.4	46.9	

*Urban and rural poverty incidences are not calculated due to sampling design changes in the 2003 Family Income and Expenditure surveys.
Source: National Statistical Coordination Board of the Philippines, 2004

[1] The National Statistical Coordination Board (NSCB) defines the poverty line as the cost of basic food and non-food requirements (valued in pesos). In the Philippine official methodology, the poverty line may be viewed as the minimum income required to meet the food requirements and other non-food basic needs (NSCB, 1997).

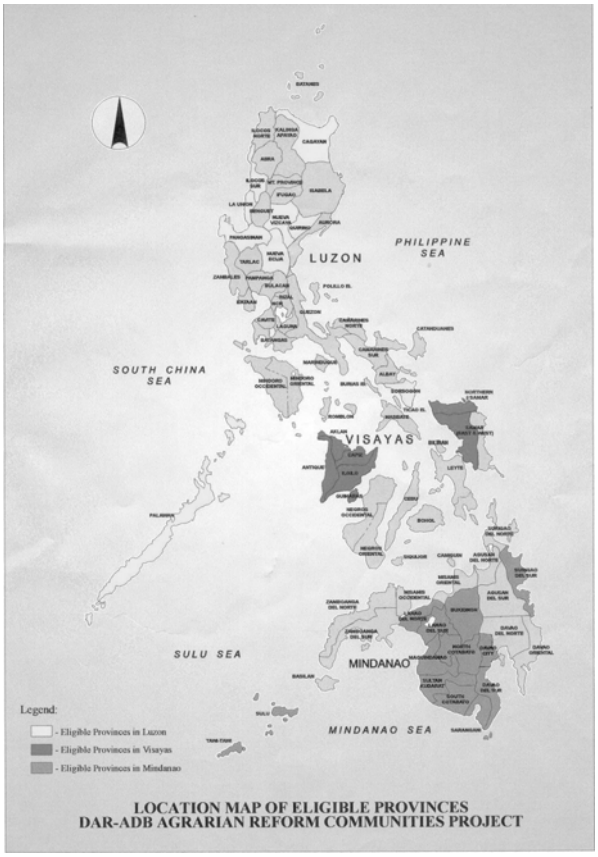
B. The Agrarian Reform Community Project and Its Interventions

With the aim of reducing poverty among the most disadvantaged communities in the Philippines, the government has launched a number of projects. The ARCP is one such project design based on the ARC development strategy and the overarching goal of poverty reduction of the ADB (ADB, 1999).

Previously, agrarian reform in the Philippines failed since land distribution was not complemented by support services and infrastructure development. Under the present ARCP, many beneficiaries have already received land titles. ARCs, however, remain without much-needed infrastructure, e.g., farm-to-market roads, potable water, communal irrigation, and supported services.

The ARCP is aiming to reduce the poverty of around 200,000 people in 140 ARCs in 35 provinces with specific emphasis in Mindanao (50% of total investment) and Visayas (21.5%), where the incidence of poverty is remarkably high (Figure 1). The ARCP aims to reduce poverty by providing infrastructure and by developing support services for agricultural enterprises and a capability-building program for Department of Agrarian Reform (DAR) staff, local government units, and ARC organizations (ADB, 1998).

Figure 1: Areas under the ARCP



Source: ARCP Project File

In 2000, the project began with the provision of rural infrastructure as its largest component. The project's three major development interventions include:

1. **Rehabilitation/construction of approximately 1,500 km of farm-to-market roads (FMR) including bridges**, the majority of which are barangay roads connecting production areas in the ARCs to major market centers;
2. **Rehabilitation/construction of approximately 6,500 hectares of communal irrigation systems** to augment productivity and land quality by increasing cropping intensity; and
3. **Development of about 900 potable water supply (PWS) systems** to cut morbidity rates in half and decrease the time it takes to obtain water, benefiting a total of 37,600 households (225,600 persons).
4. **Community Strengthening and Introduction of Income Earning Activities** to support community organizations such as cooperatives and to introduce income earning activities such as production of high-value crops.

Table 2 provides information of project progress for the time when the study took place.

Table 2: Summary Status of Approved and Completed Subprojects by Category as of 31 December 2003

	Approved Subprojects (count)	% Implemented	% Completed	Completed (in units)	
FMR/Bridge	274	74%	45%	365.12	Kms
Irrigation	27	41%	22%	689.30	Has
PWS	43	60%	51%	42	Units
Total	344	70%	44%		

Source: DAR, 2004

C. Data Background

In 2001, a baseline survey collected information on 13,000 rural agrarian households in the ARCP area. A survey revisited 2,290 households in 2003. A subset of households with data for both 2001 and 2003 was extracted for this study. Forty percent of the sample is from Mindanao and the Autonomous Region of Muslim Mindanao (ARMM), while 30% each came from Luzon and Visayas. Table 3 shows the geographical distribution of respondents.

Table 3: The 2003 Sample Distribution per Area Project Office (APO)

	Luzon	Visayas	Mindanao	ARMM	Total
Count	683	683	756	168	2,290
Percent (%)	29.8	29.8	33.0	7.4	100

D. Methodology

To assess project impacts on households in the project area, the study examines the changes in key household characteristics before and after project interventions, using simple statistical analysis. It then assesses the probability of a household moving into a non-poor category in 2003, given its attributes in 2001, in order to identify key characteristics which affect the move.

The Empirical Model

Using a binary response model (a logit model) a household is classified as poor or non-poor in 2003. The logit model takes the following form:

$$\text{logit}(p_i) = \ln\left(\frac{p_i}{1-p_i}\right)$$

$$\ln\left(\frac{p_i}{1-p_i}\right) = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_j x_{ji} \quad (1)$$

$$\text{where } i = 1, ..., n.$$

The dependent variable Y_i denotes household income and enters the equation through p_i such that $p_i = \Pr(Y_i = 1)$. The independent variable, x_i, pertains to household characteristics such as age and education of household head, the household's production system, its asset ownership, and transportation access.

II. POVERTY IN AGRARIAN REFORM COMMUNITIES IN 2001 AND 2003

This section provides a descriptive analysis of the agrarian households included in the 2001 and 2003 surveys. It describes the differences in household incomes, asset holdings, expenditures, and agricultural practices, among others, between the two periods.

ARC households are smallholder households with agriculture as their main source of income. The average household head in the ARCP area in 2001 was 49.1 years of age, owned 1.15ha of land, and had 5.2 people in his/her family. In terms of education, a total of 95% completed elementary-level education, and 48% attended high school or had higher-level education. These characteristics did not change over the period of the project's intervention.

To review the household welfare characteristics that changed between the two periods, we first examined the household income. All income indicators in 2003 are expressed in real terms of constant market prices in 2001. Net annual household income was 66,029 pesos in 2001. After two years of the ARCP implementation, total household income increased by 12% to 73,904 pesos in 2003. The on-farm income increased by 39% during this timeframe, while the non-farm and the off-farm income decreased by 23% and 11%, respectively. Notable is the immediate increase in on-farm income, reflecting the importance of agriculture as the main income-generating activity for the ARCP households (Table 4).

Table 4: Household Profile in 2001

Land holding (ha)	1.15
Age of household head	49.1
Family size	5.2
Education - College/Vocational	17%
- High school	31%
- Elementary school	47%
- None	5%

The increase in on-farm income is most likely a direct result of the ARCP's interventions. Along with improvement of infrastructure, the ARCP introduced high-value vegetable production for local markets. The new income-earning opportunities in agriculture allowed household members who used to work as wage laborers to refocus on on-farm activities (Figure 2 and Table 5.)

Figure 2: Household Income (2001–2003)

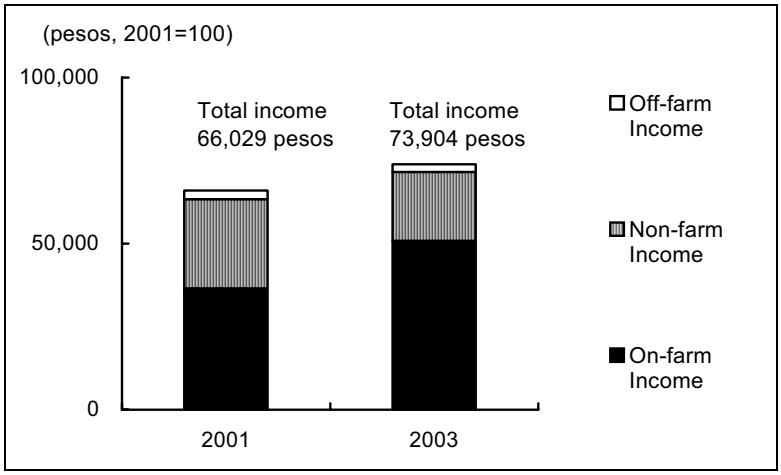


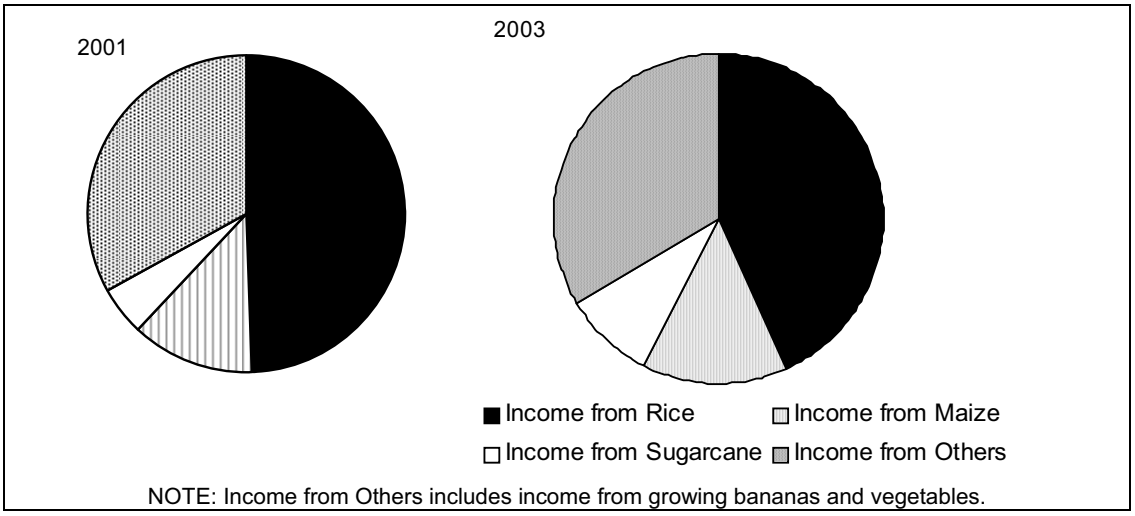
Table 5: Income Indicators (pesos, 2001=100)

	2003	2001
On-farm income	50,900	36,550
Non-farm income	20,654	26,829
Off-farm income	2,350	2,650
Total household income	73,904	66,029

A. Change in Agriculture Practice Between Two Periods

In agrarian reform, change in agricultural practices has strong impact on income change (Evenson, 1986). In the households surveyed, most households in Luzon grew rice while households in Visayas grew sugar cane and maize. Of the on-farm income in 2001 and 2003, the share of income from rice decreased by 5% while the share of income from sugar cane, maize, and other crops increased. It is possible that the decrease in the share of income from rice was brought about by the slight decrease in the average price per kilogram of unprocessed rice. Additionally, the areas of maize, sugar cane, and cash-crop production expanded. Concurrently, average prices for maize and cash crops increased in 2003 (Figure 3).

Figure 3: Share of On-farm Income in 2001 and 2003



NOTE: Income from Others includes income from growing bananas and vegetables.

While the total area and number of croppings increased for all crops except for maize, production costs decreased for all crop types. Major production cost items that have been reduced are: rental land, seedlings, hired labor, and equipment rental, and also certain reductions in the shares of harvesters, threshers, and “other costs” (including transportation and hauling and other incidental expenses). Average reduction in “other costs,” for instance, ranged from 55% (for rice) to 100% (for bananas). The reduction in seedling costs ranged from 69% to 99% for unprocessed rice, maize, sugar cane, and bananas. Better road access not only reduced transportation costs of inputs but also allowed for increased competition among suppliers of inputs. In many cases, community organizations, e.g., cooperatives, utilized the improved roads to purchase inputs in bulk, further lowering input costs.

1. Rice

Rice is the basic staple in the Philippines—a total of 1,507 of the households sampled (58%) produce rice. The average area planted with rice increased by 25%, and the number of croppings increased by 8% between 2001 and 2003. Notably, the total rice yield per area (in multi-croppings) increased by 14%, which contributed partly to the 44% increase in net income from rice. The expansion of rice production area is due to improved irrigation systems, which allow for dry-season cropping. There was also a 19% decrease in the cost of production due to the lower cost of seedlings, hired labor, and "other costs," particularly, transportation and hauling (Table 6).

Table 6: Characteristics of Rice Production

	2001	2003	% change
Area planted (ha)	1.2	1.5	25%
No. of croppings	1.6	1.7	8%
Total yield per area*	6,255	7,145	14%
Net income from rice	22,260	32,066	44%
Cost of production	25,876	20,846	-19%

*Total yield of multiple croppings.

2. Maize

Maize is the second most important crop, particularly in the rain-fed areas of Visayas and Mindanao. Of the 667 households (26%) that farmed maize in the surveyed group, the average area used for planting maize increased by 5%. The number of croppings decreased, reflecting the change in land use. The yield per area (in multi-croppings) increased by 10%, leading to a 57% increase in net income. There was also a 10% decrease in the cost of production during the period due to reduction in the cost of seeds, "other costs," and hired labor. The increased maize yield, net income, and reduction in cost of seeds may have benefited from the Department of Agriculture's hybrid corn production program, launched nationwide in 2002, which propagates the use of drought- and nitrogen-stress-resistant corn varieties (Table 7).

Table 7: Characteristics of Maize Production

	2001	2003	% change
Area planted (ha)	1.1	1.2	5%
No. of croppings	1.5	1.4	-1%
Total yield per area*	5,335	5,869	10%
Net income from maize	14,760	23,175	57%
Cost of production	15,032	13,589	-10%

* Total yield of multiple croppings

3. Sugar Cane

Of the surveyed households, 140 were engaged in sugar cane production. The area of sugar cane production increased by 0.7ha (46%), while the number of croppings increased 4%. The yield per area (in multi-croppings) increased by 12%, contributing to a net income increase of 134%. Due to lower seed cost, "other costs," irrigation fees, reduced harvest costs, rental land, and equipment rental, the cost of production dropped 23% (Table 8).

Table 8: Characteristics of Sugar Cane Production

	2001	2003	%change
Area planted (ha)	1.5	2.2	46%
No. of croppings	0.8	0.9	4%
Total yield per area*	83	93	12%
Net income from sugarcane	28,937	67,571	134%
Cost of production	41,285	31,856	-23%

*Total yield of multiple croppings

4. Bananas

Bananas are the main Mindanao export crop, accounting for 336 of the surveyed households. The average area increased by 53%, and the number of croppings increased by 6%. The banana yield per area (in multi-croppings) increased by 112%, while the net income from banana cultivation increased by 247%. A 46% decrease in production costs decreased due to reductions in "other costs," seeds, and rental land (Table 9).

Table 9: Characteristics of Banana Production

	2001	2003	% change
Area planted (ha)	0.4	0.6	53%
No. of croppings	4.7	5.0	6%
Total yield per area*	1,759	3,735	112%
Net income from bananas	4,219	14,650	247%
Cost of production	9,096	4,899	-46%

*Total yield of multiple croppings

B. Movements In and Out of Poverty

To assess the project's impact on poverty, we disaggregated the household data into "poor" and "non-poor" households. Poor households are those with a net income below the 2001 poverty line.[2] On average, non-poor households in 2001 possessed slightly more land holdings and had larger families than the poor. The non-poor also have 72% higher total household income, and the household heads have a higher level of education than the poor (Table 10).

Table 10: Household Profile of Poor and Non-poor in 2001

		Poor	Non-poor
Land holding (ha)		1.04	1.33
Age of household head		48.7	49.8
Family size		5.1	5.5
Education	- College/Vocational	14%	22%
	- High school	31%	31%
	- Elementary school	50%	42%
	- None	5%	4%
Household Income (pesos)		46,820	80,580

Source: DAR-ADB

Table 11 shows that from 2001 to 2003 on-farm income of poor households increased by 46%, while the non-farm and the off-farm income of poor households decreased by 6% and 32%, respectively. For non-poor households, the on-farm income increased by 49%, while the non-farm and the off-farm income decreased by 9% and 11%, respectively. Both household categories experienced substantial increases in household incomes, while off-farm incomes decreased significantly in poor households and to a much lesser extent in non-poor households.

Table 11: Income Indicators of Poor and Non-poor (pesos, 2001=100)

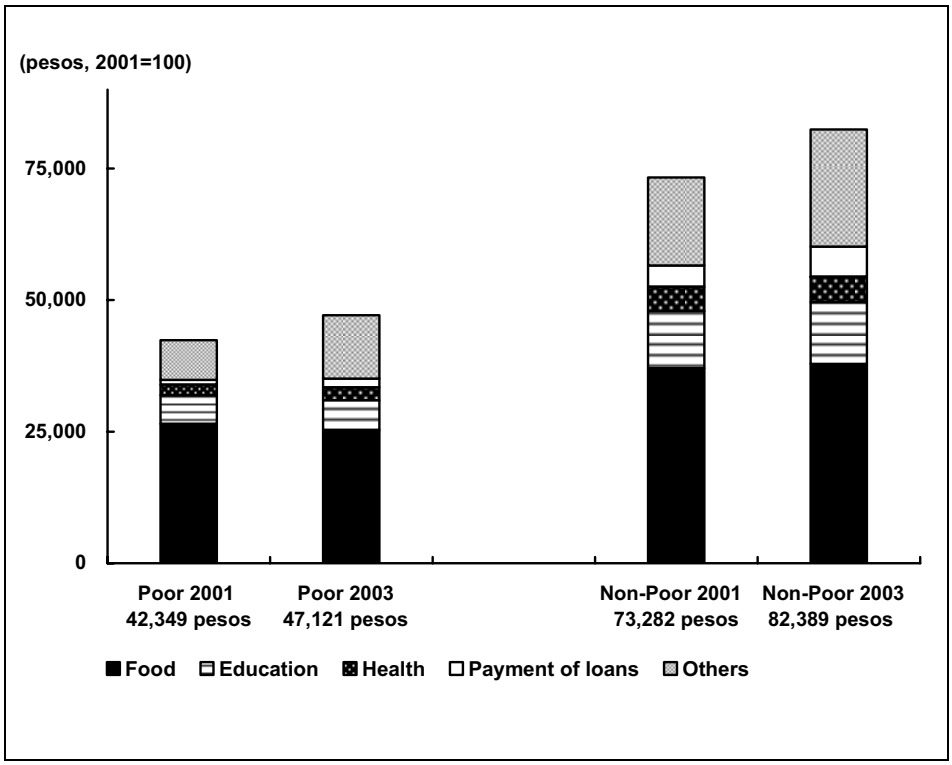
	2003		2001	
	Poor	Non-poor	Poor	Non-poor
On-farm income	41,786	64,943	28,560	43,475
Non-farm income	13,662	31,476	14,514	34,796
Off-farm income	2,530	2,339	3,746	2,309
Total household income	57,978	98,758	46,820	80,580

Source: DAR-ADB

[2] The annual per capita rural poverty line in the Philippines in 2001 was 11,255 pesos (NSCB, 2004).

Since expenditure data is known to be a better measure of welfare changes, changes in household expenditures merited examination (Figure 4). In poor households, total expenditure increased by 4,772₱ (11%) while their food expenditure share declined by 9%. In non-poor households, total expenditure increased by 9,107₱ (12%), while their food expenditure declined by 5%.

Figure 4: Change in Household Expenditures



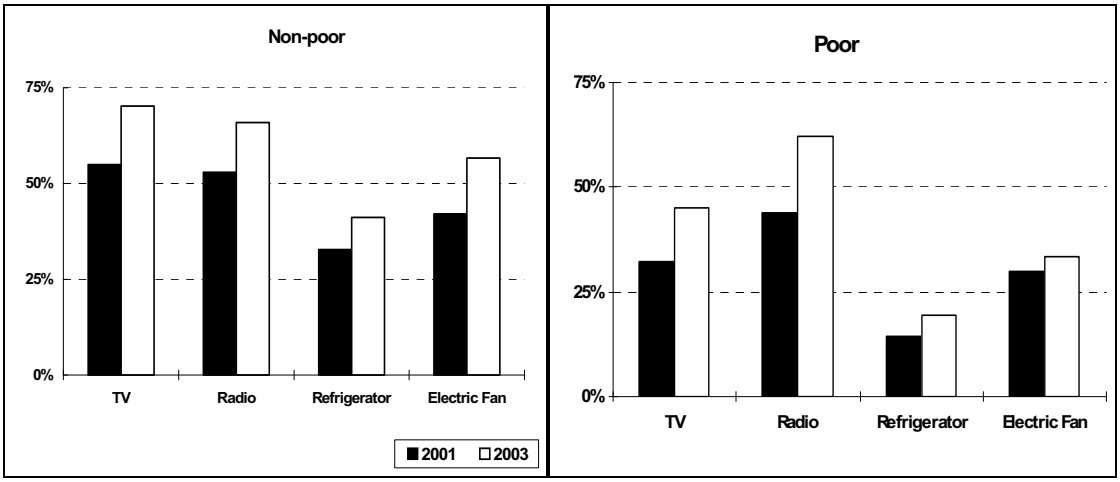
These changes are consistent with Engel's Law, which suggests that the share of expenditure for food products declines when a family's income increases. Between the two groups, the poor have spent a lesser proportion of their income increase on food and more on health, payment of loans, and others (items not classified as basic necessities and possibly including materials for production and consumer durables). Notable is the decline in the proportion of education expenses. For non-poor, the increase was primarily spent on others and payment of loans. The proportion of education and health expenses declined slightly by 0.5% in the non-poor group. For both groups, the increase in income produced overall increases in the proportion of expenditure for "others." The expenditure by the poor on "others" increased significantly at 8%, while the increase for the non-poor for the same category increased by 4%.

C. Change in Asset Holdings

1. Household Assets

Change in wealth status can also be based on change in ownership of household assets. Figure 5 displays the change in ownership of selected household durables, e.g., TVs, radios, refrigerators, and electric fans.[3] Both poor and non-poor households showed significant increases in the ownership of the selected household assets. The incremental change in the assets of non-poor households is larger than that of the poor households, except for radios.

Figure 5: Ownership of Selected Household Assets

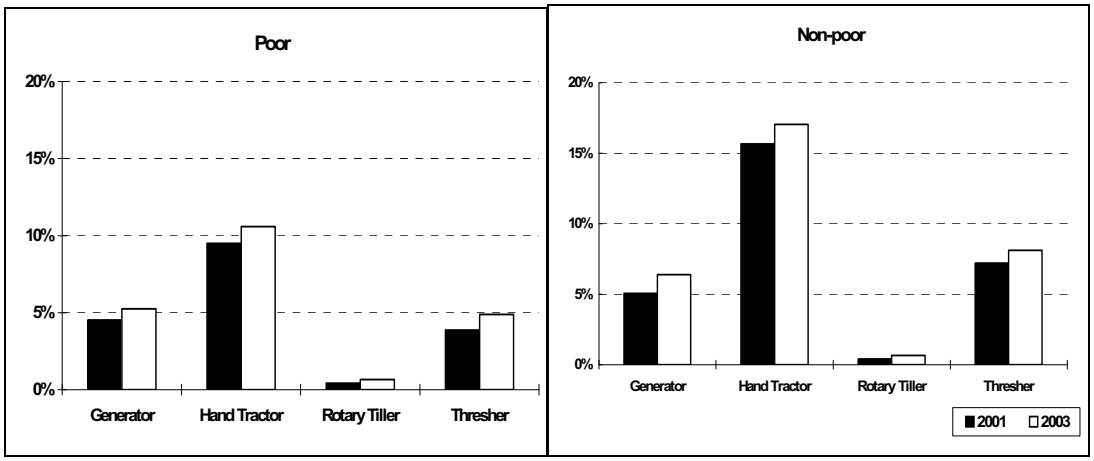


[3] Refer to Appendix 2 for more detailed information on changes in household assets.

2. Production Assets

Another indicator of welfare change is investment in agriculture systems. Figure 6 indicates the level of ownership of selected production assets, such as generators, hand tractors, rotary tillers, and threshers, and the corresponding changes in ownership after two years. Unlike the magnitude of change in household assets, the increase in the ownership of production assets among both poor and non-poor households is negligible. The change in the ownership of hand tractors among the non-poor was the highest at 1.4%, but even this increase is insignificant compared to the changes in household assets.

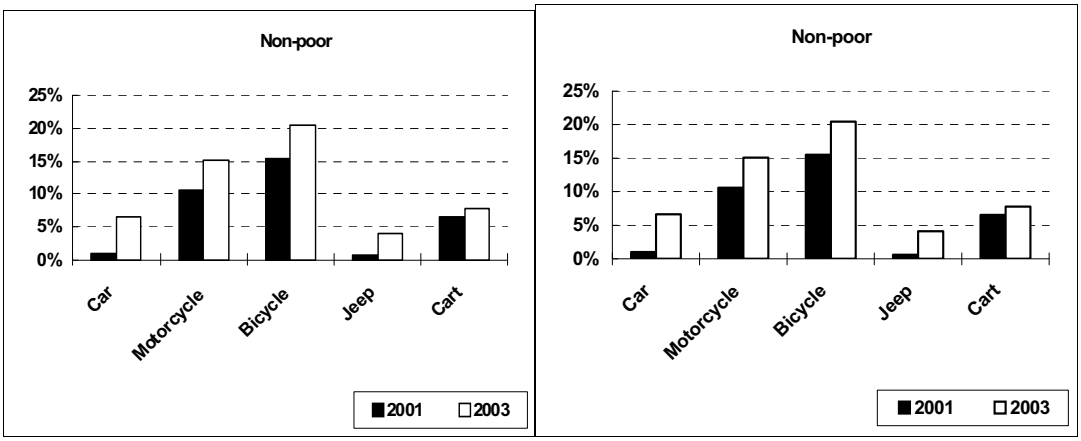
Figure 6: Ownership of Selected Production Assets



3. Transportation Assets

With rural infrastructure in place, one would expect households to invest more in transportation assets. Figure 7 displays the change in ownership of selected transportation modes, including cars, motorcycles, bicycles, jeeps, and carts. In general, non-poor households can afford more jeeps, motorcycles, and bicycles than poor households. The incremental change in car ownership is the greatest for both poor and non-poor, although the ownership rate was under 10%.

Figure 7: Ownership of Selected Transportation Assets (%)



D. Change in Poverty Level

Particularly striking is the decrease in poverty levels in the ARCP areas while the national poverty level increased. Between 2001 and 2003, rural poverty at the national level increased by 9%, climbing from 46.9% to 55.9%. In contrast, the poverty incidence declined slightly from 60.5% to 59.7% in the ARCP areas. About 489 poor households moved above the poverty line, while 468 non-poor households moved below the poverty line.

Changes in the magnitude and the direction of poverty within poor households differ among regions (Table 12). From 2001 to 2003, the number of households falling below the poverty line increased in Luzon and ARMM, while decreasing in Visayas and Mindanao. The incremental change of 7% in Mindanao was the largest, while more households in Luzon became poor during the period.

Table 12: Sample Households Below Poverty Line (%)

	Luzon	Visayas	Mindanao	ARMM	Total sample
Baseline, 2001	51%	74%	60%	63%	61%
Resurvey, 2003	57%	71%	53%	64%	60%

E. Change in Income Distribution

Although increases in average income levels have been observed, this does not necessarily indicate that income levels proportionately increased in all household categories. The Gini coefficient of total household incomes was calculated (Table 13). The income distribution deteriorated for all of the samples, including poor and non-poor categories, for the period 2001–2003. This finding suggests that income distribution slightly worsened as a result of project interventions.

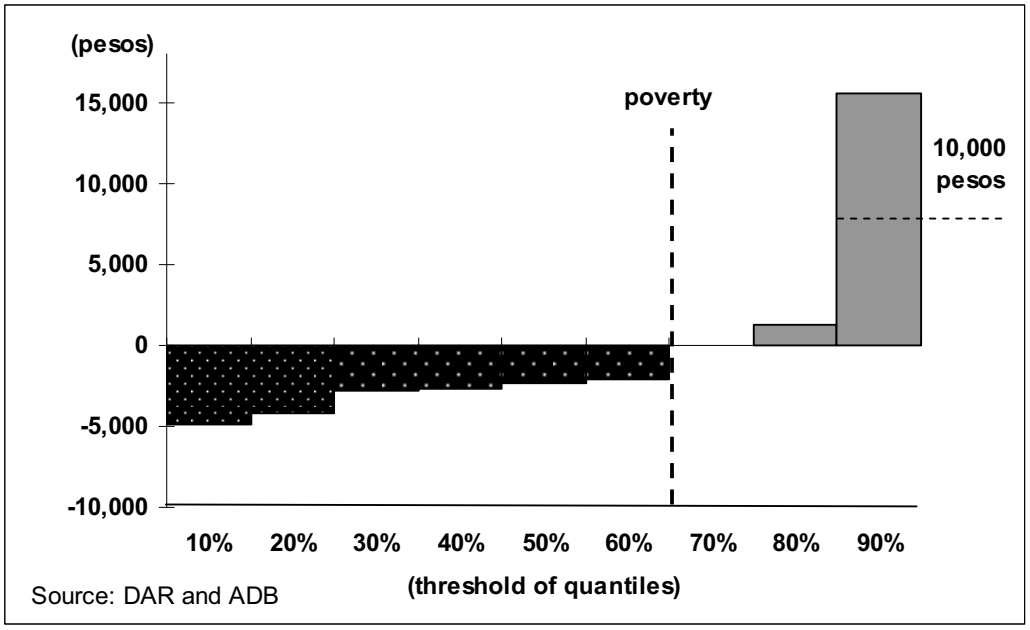
Table 13: Income Distribution (Gini Coefficient) for 2001–2003

	All Samples (n=2,290)	Poor (n=1,370)	Non-poor (n=920)
2001	0.517	0.386	0.316
2003	0.563	0.553	0.540

F. Change in Expenditures

Figure 8 displays the difference in household expenditures by the expenditure deciles for the period 2001–2003. Approximately 60% of poor households experienced a decrease in expenditures, while those at the top 20% had an increase in expenditure levels. Note that the poverty line roughly coincides with the threshold of 60% deciles. The households that fell within those deciles suffered a decline in household expenditures. This implies that only the non-poor households possessing incomes above the poverty line enjoy a higher or at least the same level of expenditures after two years of the ARCP intervention.

Figure 8: Difference in Household Expenditures by Expenditure Decile (2001–2003)



In summary, as a result of the ARCP implementation, there were increases in:

- Total household income
- On-farm income
- Share of income from products other than rice
- Proportion of expenditure for items not classified as basic necessities
- Ownership of the selected household assets

and decreases in:

- Production costs for all crop types
- Poverty incidence

Since this kind of univariate analysis does not cover underlying relationships between variables, the analysis is extended using a binomial logit model.

III. REGRESSION ANALYSES

The descriptive analyses presented in sections II and III of this paper point out significant differences between poor and non-poor households, which prompts research into the factors that determine the poverty status of households in 2003 given the endowments they had in 2001. A logit model was estimated to answer this question. The explanatory variables in 2003 were (Appendix 3):

- Age and education of the household head
- Household size
- Place of residence
- Poverty status in 2001
- Farming area planted with rice
- Cash crop area
- Other crop area
- Credit availed
- Transportation asset ownership
- Production asset ownership
- Access to rural infrastructure
- Main crop planted

As outlined in the methodology section, a logit model is estimated where the probability of being non-poor is estimated by:

$$p_i = \Pr(Y_i = 1 \mid X) = \frac{e^{\alpha+\beta_1 x_{1i}+\beta_2 x_{2i}+\ldots\beta_j x_{ji}}}{1+e^{\alpha+\beta_1 x_{1i}+\beta_2 x_{2i}+\ldots\beta_j x_{ji}}} \quad (2)$$

To test the fit of the model, the Hosmer and Lemeshow test was performed. The probability of 0.3972 suggests that the null hypothesis of the model being inadequate cannot be rejected. The 26 independent variables of the model also adequately explain the probability of households being poor or non-poor as evidenced by the likelihood ratio chi-squared.

Thirty-two percent of the actual poor were classified falsely as non-poor while 28% of non-poor were considered as poor in the model. Overall, the model correctly classified 69.74% of the sample into their actual poverty status in 2003 (Table 14). Details of the summary statistics and regression results are include in Appendix III (Tables A3.2 and A3.3.).

Table 14: Model Prediction

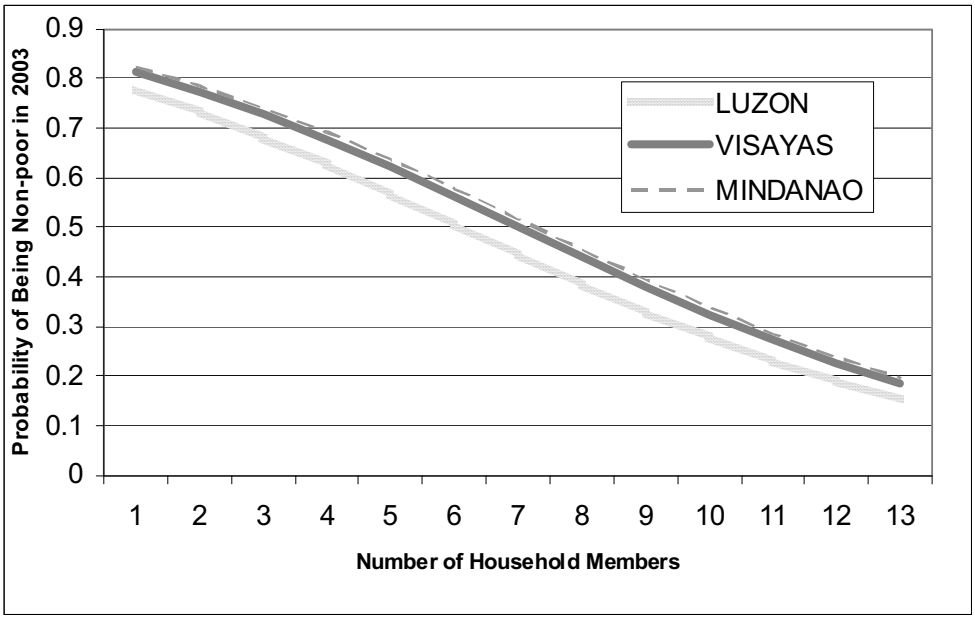
	Non-poor (actual)	Poor (actual)	Total (actual)
Non-poor (predicted)	625	299	924
Poor (predicted)	371	919	1,290
Total (predicted)	996	1,218	2,214
Correctly classified: 69.74%			

A. Interpretation of Results

Age and Education of Household Head. It appears that age is not a very important determinant of poverty status in agrarian communities, possibly due to household heads' passing on tasks to younger members of the household. Living conditions and personal characteristics associated with poverty risks are often shared among members of the family. The less educated the household head, the lower the probability of being non-poor in 2003.

Household Size. Consistent with most studies, the larger the family, the lower the chances of being non-poor. On average, predicted probabilities of households that were poor in 2001 were 0.21 percentage points lower than those of the non-poor households. The rate of change in probabilities for those above the poverty line in 2001 peaked at six household members, then tapered off as household size increased. For those below the poverty line, the biggest decrease occurred at one to three household members, but, as the family size grew, the probability of being non-poor in 2003 decreased (Figure 9).

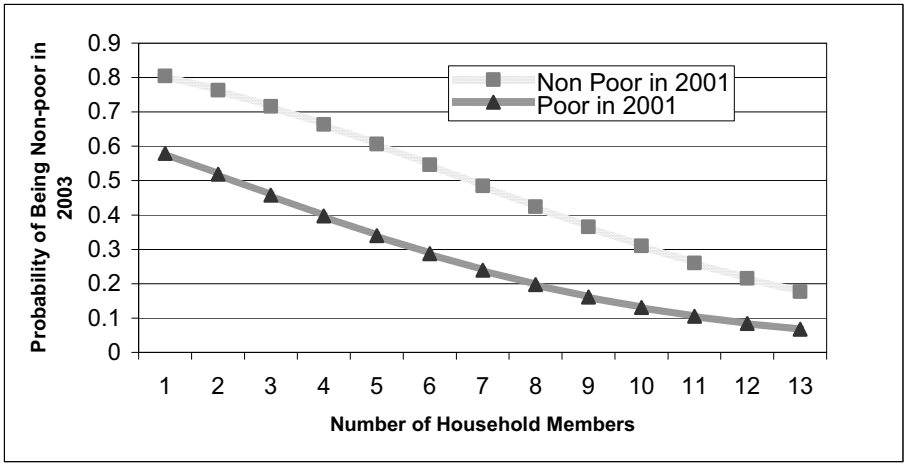
Figure 9: Predicted Probability of Being Non-Poor and Number of Household Members



Place of Residence. Agricultural households in the ARMM have the lowest chance of being non-poor in 2003. Households from Visayas and Mindanao (excluding the ARMM) have very similar predicted probabilities while farmers in Luzon are significantly poorer. A possible explanation is that farmers in Luzon find it more difficult to earn high income due to the existence of natural calamities such as typhoons. Aside from being in mostly upland areas, the soil quality in Central Luzon is acidic due to the eruption of Mt. Pinatubo and receives little assistance from the government. In contrast, farmlands in Mindanao are rarely plagued by typhoons, and local governments receive ample assistance from foreign donors and the government.

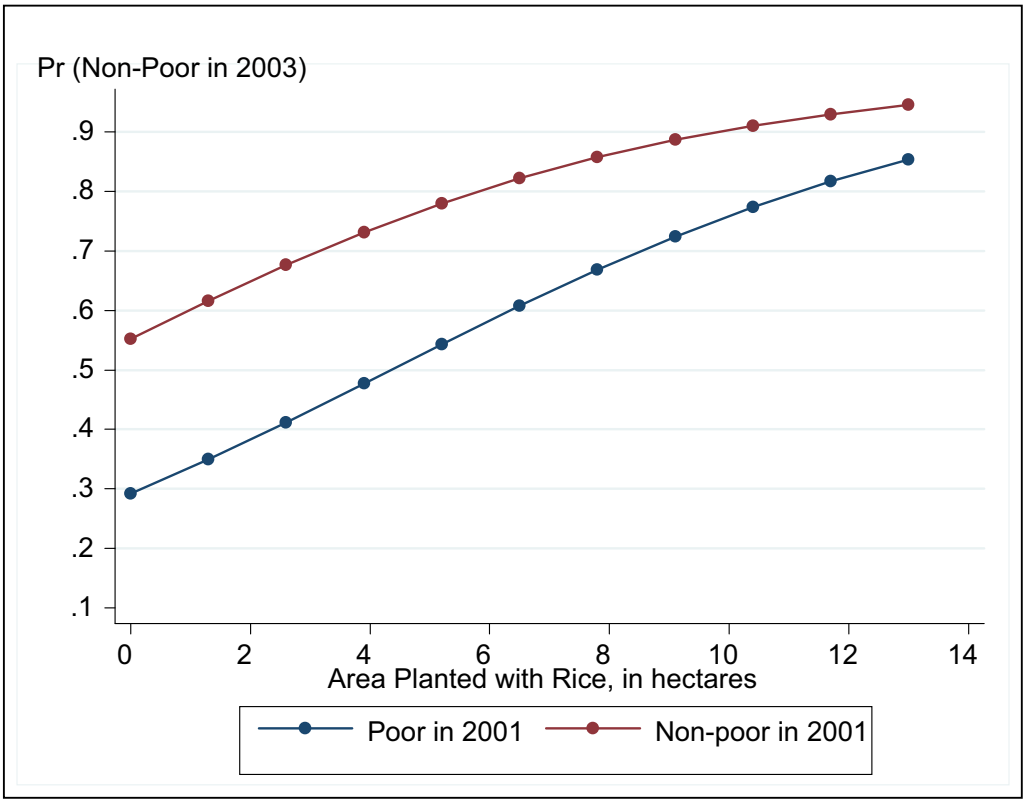
Poverty Status in 2001. Fifty-four percent of the sample was classified as poor in 2001. All else held at the mean, the predicted probability of being non-poor in 2003 was 0.59 when the household was non-poor in 2001. If the household income was below the poverty line in 2001, the probability decreased to 0.33 (Figure 10).

Figure 10: Predicted Probability of Being Non-Poor and Area of Residence



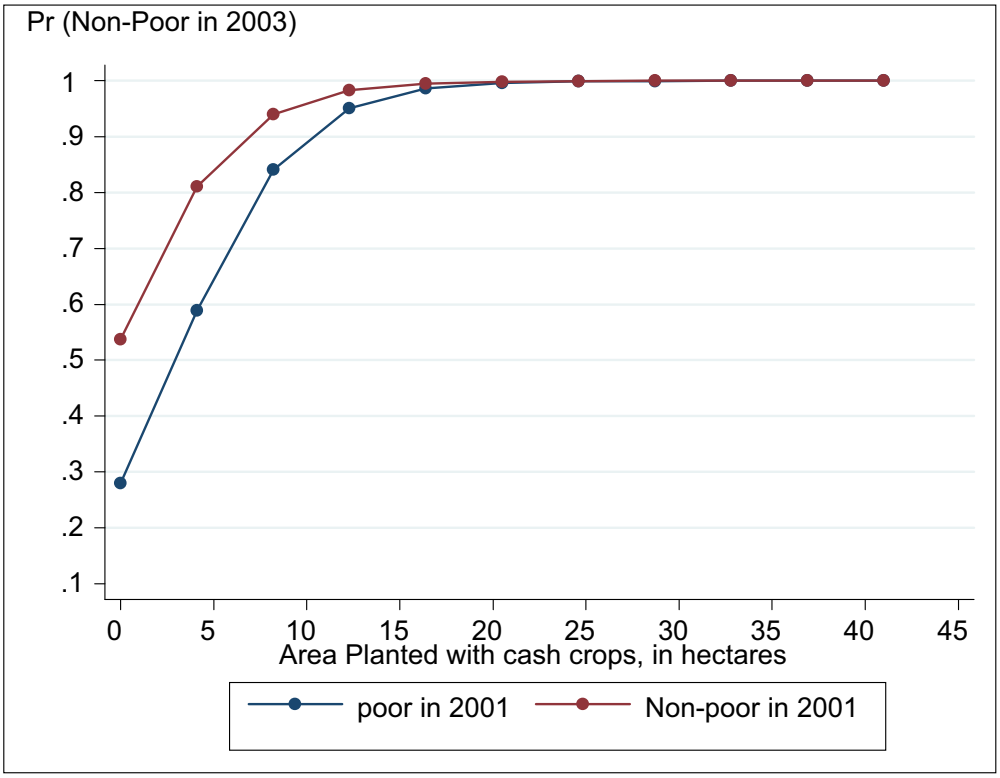
Farming Area Planted with Rice The larger the area planted, the higher the probability of being non-poor. An additional hectare planted with rice increased the likelihood of being non-poor by 0.23 points. All else held at the mean, a farmer who did not plant rice had 0.40 predicted probability while a farmer who planted rice in 13 hectares had 90% chance of being non-poor in 2003. As expected, the larger amount of land tilled, the higher the probability of being non-poor. The gap in probabilities between the two groups also decreased as the planted area increased (Figure 11).

Figure 11: Predicted Probability of Being Non-Poor and Area Planted with Rice



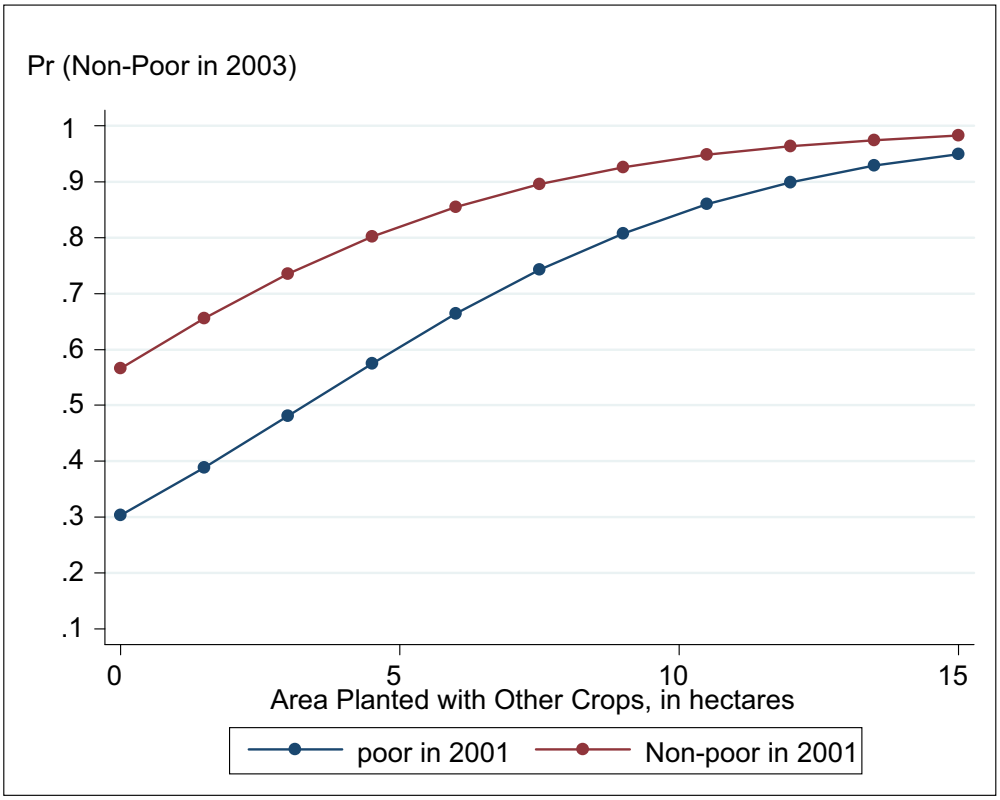
Cash Crop Area. Cash crops are composed of maize, sugar cane, and coconut. Of all crops, the cash crop group leads to the highest probability of being non-poor. For each additional hectare devoted to cash crops, the odds of being non-poor increased by a factor of 1.37, all else held constant (Figure 12).

Figure 12: Predicted Probability of Being Non-Poor and Area Planted with Cash Crops



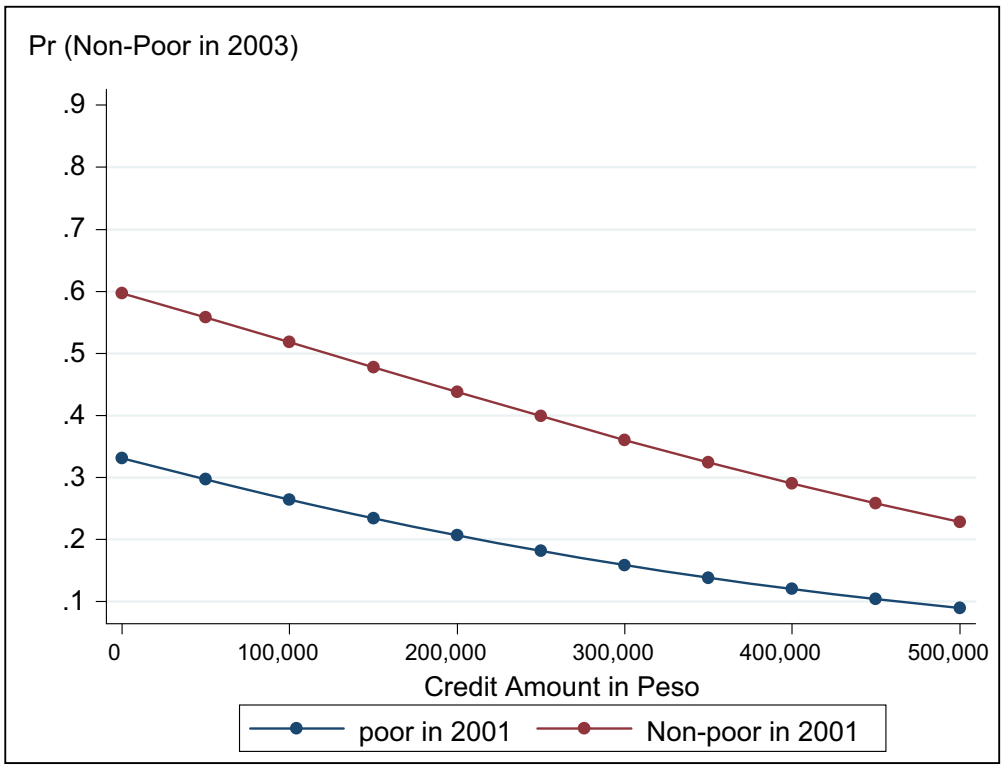
Other Crop Area. This pertains to land area planted with crops other than rice, maize, sugar cane, and coconut. These crops are mostly fruits (especially bananas) and vegetables. A one-hectare increase in areas planted with other crops will increase the odds of being non-poor by a factor of 1.27, roughly similar to rice areas (Figure 13).

Figure 13: Predicted Probability of Being Non-Poor and Area Planted with Other Crops



Credit Availed. Although credit is not statistically significant, it is interesting to note that the higher the credit availed in 2001, the lower the probability of being non-poor in 2003. High credit amounts are particularly debilitating for households below the poverty line. A closer examination of the data shows poor households tend to obtain credit from informal sources (Figure 14).

Figure 14: Predicted Probability of Being Non-Poor and Credit



Transportation Asset Ownership. While ownership of trucks and jeepneys does not significantly affect poverty incidence, ownership of tricycles increases the odds of being non-poor by a factor of 1.48. The difference in predicted probabilities for tricycle and non-tricycle owners, however, is only 0.096 points.

Production Asset Ownership. Ownership of generators, tractors, and threshers increases the likelihood of being non-poor by 35 points. Similar to transportation asset ownership, the difference between predicted probabilities among owners and non-owners is not very high. Non-owners are 43% likelier to be classified as non-poor while owners have a 50% likelihood.

Access to Rural Infrastructure. Access to FMRs and bridges in 2001 increased the chances of being non-poor by 0.34 points. It appeared, however, that access to irrigation did not have that much effect on poverty incidence.

Main Crop Planted. Coconut farmers are the most marginalized among all farmer groups. This is consistent with the findings of De Dios, 1993. Banana growers have the highest probability of being non-poor, followed by growers of other crops such as maize, rice, and sugar cane.

IV. CONCLUSIONS AND RECOMMENDATIONS FOR THE PROJECT AND IMPLICATIONS FOR FUTURE PROJECT DESIGN

Among the different ARCP interventions, it appears that rural infrastructure—roads, in particular—has the strongest impact on poverty. Developing rural infrastructure has improved commodity transfer to markets and the inflow of production inputs to farms. Improved mobility of production inputs and outputs to and from farms has decreased the prices of inputs and increased income from agricultural produce. This finding is consistent with Balisacan's 2001 contention that "public investments in infrastructure, especially rural transport, generate economic linkages and externalities critical to sustained growth and development of the economy." Balisacan et al. (2002) also assert: "Road access can improve the well being of the poor provided they have sufficient human capital to take advantage of [such access]".

In contrast with a 9% increase in national poverty between 2001 and 2003, project interventions in the ARCP areas resulted in a 0.8% decline in poverty in the same period. After two years of project implementation, the average annual income in the ARCP areas increased by 12%. There were significant increases in ownership of assets (household and production), and there was better access to various services brought about by increases in transport assets and services. The findings suggest that there have been significantly positive changes in the socio-economic indicators in ARCP-area households.

The economic activity that immediately benefited from the access infrastructure interventions is agriculture. Of all income sources, on-farm income increased most (39%). There was, however, limited non-farm employment generated by the project. In fact, the expansion of the agriculture sector fueled by the project appeared to have caused the shift from non-farm wage labor to farm labor, resulting in an overall decrease of 23% in total non-farm income. It is important to note that one employment opportunity for the poor, the manual carrying or hauling of agriculture products from farm to market, may have been replaced by the use of trucks or other means of mechanized transport once the rural roads were completed.

Benefits derived from the positive effects of access infrastructure were, however, disproportionately captured by the non-poor over the poor households. The non-poor households have more land, own more production assets (7% more hand tractors and 3% more threshers than the poor), have better access to credit (non-poor credit access increased by 22%, while that of the poor declined by 12%), and are generally better educated than the poor households. Therefore, the non-poor were better equipped to take advantage of the project interventions. The findings showed that the non-poor households initially owned and acquired new transport assets during the two-year period. This allowed the non-poor to gain more income than the poor based on the opportunities brought about by the project.

In contrast, the extreme poor may have lost some income-generation opportunities. This is supported by the findings on the changes in expenditures in which poor households fell below the bottom 60% income deciles and suffered decreases in expenditures. This is also consistent with the results of the Gini coefficient, which showed that income distribution deteriorated between the two periods. The poor benefited more, however, from the use of labor in the construction of the access infrastructure than the non-poor.

In conclusion, this study on the initial impact of the ARCP access infrastructure on the well-being of rural households confirms and reinforces the various yet similar assertions that public investments in infrastructure create opportunities in the rural areas and help reduce poverty as long as certain conditions are met. These conditions revolve around the capacity and capability of the rural households, particularly the poor, to take advantage of the benefits brought about by these investments. The results of the empirical examination show that while access infrastructure has led to improvements in the overall welfare of the rural households, non-poor households benefit more than their poor counterparts. Poor

households, while on the whole benefiting from the improvements in access, tend to have lesser share in the benefits, with the poorest of the poor manifesting exclusion from the whole process.

A. Recommendations

The following recommendations are proposed:

1. The project implementers and partners, particularly the local government units overseeing the project sites, should pay particular attention to the growing income disparity and the exclusion of the poorest of the poor from the development process since this may lead to social tensions;
2. Institute necessary processes to allow the inclusion of all the poor in community consultations and also their participation in community organizations;
3. Promote a regulatory environment for competitive transport services;
4. Improve interventions in the provision of credit and development of microenterprises by supporting local microfinance institutions' extending their services in the ARC areas;
5. Identify measures to minimize the interventions' negative impacts on the poor and women.

B. Considerations in Future Projects

The following are considerations for the design of future similar projects:

1. The design and implementation of access infrastructure projects should include targeting project beneficiaries with special bias for the poorest of the poor;
2. Operations and maintenance of access infrastructure should be integral to the project design and operations; infrastructure users—particularly the households who hold most of the benefits (i.e., transport operators)—should be required to bear a larger share of facility maintenance and upkeep;
3. The packaging of access infrastructure projects should be accompanied by other support interventions that ensure the inclusion of the poor and help enhance their capacities and capabilities. Some of these interventions are: provision of credit, microenterprise development services, agricultural technology transfer, social capital formation, and gender integration.

In project design and operations, measures that minimize the negative impacts of access infrastructure projects on the extreme poor and women should be integral even beyond the project's construction duration. As transport infrastructure development often replaces the manual mode of transporting agriculture products with mechanized forms, attention should be paid to minimizing job displacement impact for the poor who work in hauling commodities. A development project may assist in identifying new employment opportunities for that particular group of poor wage laborers or providing a training program for them to work as mechanics in the transport sector.

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APPENDIX I: CURRENCY EQUIVALENTS AND ABBREVIATIONS

CURRENCY EQUIVALENTS

(as of December 2006)

Currency Unit - peso (₱)

₱1.00 = US$0.02027

US$1.00 = ₱49.3340

ABBREVIATIONS

ADB	–	Asian Development Bank
ARC	–	Agrarian Reform Communities
ARCP	–	Agrarian Reform Communities Project
ARMM	–	Autonomous Regions of Muslim Mindanao
DAR	–	Department of Agrarian Reform of the Philippines
FMR	–	Farm-to-market roads
NSCB	–	National Statistical Coordination Board
PWS	–	Potable water supply systems

APPENDIX II: HOUSEHOLD ASSETS IN 2001 AND 2003

Table A2.1: Ownership of Selected Household Assets (%)

Poor	TV	Washing Machine	Radio	Refrigerator	Electric Fan	VCR
Before	32.2%	7.6%	43.8%	14.4%	29.8%	8.0%
After	45.0%	9.7%	62.1%	19.4%	33.3%	13.1%
Non-poor	**TV**	**Washing Machine**	**Radio**	**Refrigerator**	**Electric Fan**	**VCR**
Before	55.0%	20.3%	52.9%	32.8%	42.0%	21.0%
After	70.2%	27.3%	65.9%	41.1%	56.6%	30.9%

Note: 'Before' stands for owning the asset in CY2001 or earlier; 'After' refers to owning the asset after CY2001.

Source: DAR and ADB.

Table A2.2: Ownership of Transportation Assets

Ownership of transportation assets for poor (number)

	Truck	Car	Jeep	Tricycle	Motorcycle	Bicycle	Carabao	Cart	Sled	Others
Before	6	8	14	52	75	195	439	83	100	37
After	4	106	4	14	31	71	88	28	57	9
Total	10	114	18	66	106	266	527	111	157	46
Incremental change after Baseline	67%	1325%	29%	27%	41%	36%	20%	34%	57%	24%

Note: 'Before' stands for owning the asset in CY2001 or earlier; 'After' refers to owning the asset after CY2001.

Ownership of transportation assets for non- poor (number)

	Truck	Car	Jeep	Tricycle	Motorcycle	Bicycle	Carabao	Cart	Sled	Others
Before	12	12	48	94	128	187	306	79	60	32
After	5	68	8	24	54	60	50	15	31	13
Total	17	80	56	118	182	247	356	94	91	45
Incremental change after Baseline	42%	567%	17%	26%	42%	32%	16%	19%	52%	41%

Note: 'Before' stands for owning the asset in CY2001 or earlier; 'After' refers to owning the asset after CY2001.

Table A2.3: Ownership of Production Assets

Ownership of production assets for poor (number)

	Generator	Hand Tractor	Plow	Rotary Tiller	Sprayer	Thresher	Others
Before	62	130	511	6	409	53	84
After	10	15	50	3	48	14	18
Total	72	145	561	9	457	67	102
Incremental change after Baseline	16%	12%	10%	50%	12%	26%	21%

Note: 'Before' stands for owning the asset in CY2001 or earlier; 'After' refers to owning the asset after CY2001.

Ownership of production assets for non-poor (number)

	Generator	Hand Tractor	Plow	Rotary Tiller	Sprayer	Thresher	Others
Before	61	189	363	5	391	87	72
After	16	17	33	3	67	11	14
Total	77	206	396	8	458	98	86
Incremental change after Baseline	26%	9%	9%	60%	17%	13%	19%

Note: 'Before' stands for owning the asset in CY2001 or earlier; 'After' refers to owning the asset after CY2001.

Ownership of production assets for poor (%)

Total sample- 1,369	Generator	Hand Tractor	Plow	Rotary Tiller	Sprayer	Thresher	Others
Before	5.3%	10.6%	41.0%	0.7%	33.4%	4.9%	7.5%
After	4.5%	9.5%	37.3%	0.4%	29.9%	3.9%	6.1%

Note: 'Before' stands for owning the asset in CY2001 or earlier, 'After' refers to owning the asset after CY2001.

Ownership of production assets for poor (%)

Total sample- 1,208	Generator	Hand Tractor	Plow	Rotary Tiller	Sprayer	Thresher	Others
Before	5.0%	15.6%	30.0%	0.4%	32.4%	7.2%	6.0%
After	6.4%	17.1%	32.8%	0.7%	37.9%	8.1%	7.1%

Note: 'Before' stands for owning the asset in CY2001 or earlier, 'After' refers to owning the asset after CY2001.

Table A2.4: Sources of Credit

	Poor				Non-poor				Average of Samples			
	2001		2003		2001		2003		2001		2003	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Cooperative	180	44	188	52	158	49	193	49	338	46	382	50
Private bank or governmental bank	83	20	67	19	67	21	82	21	150	20	148	20
Relatives / Friends	55	13	48	13	34	10	63	16	89	12	111	15
Traders / Investors	27	7	26	7	24	7	24	6	51	7	50	7
Others	66	16	32	9	41	13	33	8	107	15	65	8
Total	411		361		324		395		735		756	

Table A2.5: Amount of Credit and Savings

	Poor				Non-poor				Average of Samples			
	2001		2003		2001		2003		2001		2003	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Cooperative	180	44	188	52	158	49	193	49	338	46	382	50
Private bank or governmental bank	83	20	67	19	67	21	82	21	150	20	148	20
Relatives / Friends	55	13	48	13	34	10	63	16	89	12	111	15
Traders / Investors	27	7	26	7	24	7	24	6	51	7	50	7
Others	66	16	32	9	41	13	33	8	107	15	65	8
Total	411		361		324		395		735		756	

APPENDIX III: REGRESSION ANALYSIS

Table A3.1: Summary Statistics
Number of Observation =2,288

Variable	Mean	Standard Deviation	Mini-mum	Maxi-Mum
Non-poor in 2003	0.4650	0.4989	0	1
Age	49.1456	12.7753	17	93
Square of Age	2,578.42	1,306.08	289	8,649
No Education	0.0730	0.2602	0	1
Some Primary School	0.1849	0.3883	0	1
Primary School Graduate	0.2732	0.4457	0	1
Some High School	0.1163	0.3206	0	1
High School Graduate	0.1858	0.3890	0	1
Household Size	5.2254	2.1863	1	13
Resides in Luzon	0.2985	0.4577	0	1
Resides in Visayas	0.2976	0.4573	0	1
Resides in Mindanao	0.3304	0.4705	0	1
Poor in 2001	0.5402	0.4985	0	1
Rice Area	0.8074	1.1083	0	13
Cash Crop Area	0.7087	1.7036	0	40.8
Other Crop Area	0.4319	1.1371	0	15
Credit Availed	6,374.55	23,520.66	0	500,000
Jeep and Truck Ownership	0.0337	0.1804	0	1
Tricycle Ownership	0.0634	0.2437	0	1
Production Assets Ownership	0.1897	0.3921	0	1
Access to FMR and Bridge	0.8686	0.3379	0	1
Access to Irrigation	0.0533	0.2247	0	1
Rice is main crop	0.4917	0.5000	0	1
Sugar is main crop	0.0402	0.1965	0	1
Maize is main crop	0.1425	0.3496	0	1
Bananas are main crop	0.0284	0.1662	0	1
Other crop is main crop	0.1429	0.3501	0	1

Table A3.2: Determinants of Being Non-Poor in 2003
(n=2213)

Variable	Coefficient	Standard Error	Z	P>z
Age	0.0014	0.0265	0.0500	0.9580
Square of Age	0.0000	0.0003	0.0300	0.9790
No Education[1]	0.2772	0.2566	1.0800	0.2800
Some Primary School[1]	-0.7679	0.1702	-4.5100	0.0000
Primary School Graduate[1]	-0.7061	0.1555	-4.5400	0.0000
Some High School[1]	-0.1962	0.1830	-1.0700	0.2840
High School Graduate	-0.4066	0.1609	-2.5300	0.0120
Household Size	-0.2461	0.0254	-9.6900	0.0000
Resides in Luzon[2]	0.6380	0.2541	2.5100	0.0120
Resides in Visayas[2]	0.9692	0.2419	4.0100	0.0000
Resides in Mindanao[2]	1.1087	0.2291	4.8400	0.0000
Poor in 2001	-1.0948	0.1024	-10.6900	0.0000
Rice Area	0.2037	0.0573	3.5600	0.0000
Cash Crop Area	0.3183	0.0505	6.3000	0.0000
Other Crop Area	0.2520	0.0553	4.5600	0.0000
Credit Availed	0.0000	0.0000	-1.2800	0.2020
Jeep and Truck Ownership	0.3647	0.2984	1.2200	0.2220
Tricycle Ownership	0.3890	0.2075	1.8700	0.0610
Production Assets Ownership	0.3011	0.1465	2.0600	0.0400
Access to FMR and Bridge	0.2933	0.1727	1.7000	0.0890
Access to Irrigation	0.0669	0.2234	0.3000	0.7650
Rice is main crop	0.5909	0.1639	3.6100	0.0000
Sugar is main crop	0.2872	0.2750	1.0400	0.2960
Maize is main crop	0.4777	0.1878	2.5400	0.0110
Bananas are main crop	1.1392	0.3167	3.6000	0.0000
Other crop is main crop	1.1360	0.2004	5.6700	0.0000
Constant	-0.2423	0.6820	-0.3600	0.7220

1. Household heads with some college and above are the dropped variable.
2. Households residing in ARMM are the dropped variable.

Table A3.3: Determinants of Being Poor in 2003
(n=2213)

Variable	Odds Ratio	Changes in Predicted Probabilities		
		x=min	x=max	Difference
Age	1.0014	0.4295	0.456	0.0264
Square of Age	1.000	0.4367	0.4512	0.0144
No Education[1]	1.3195	0.4372	0.5062	0.069
Some Primary School[1]	0.464	0.4767	0.2971	-0.1796
Primary School Graduate[1]	0.4936	0.4896	0.3213	-0.1683
Some High School[1]	0.8219	0.4465	0.3986	-0.0478
High School Graduate	0.6659	0.4598	0.3618	-0.098
Household Size	0.7819	0.6908	0.1044	-0.5864
Resides in Luzon[2]	1.8927	0.3948	0.5525	0.1577
Resides in Visayas[2]	2.6358	0.3709	0.6084	0.2376
Resides in Mindanao[2]	3.0303	0.3528	0.6229	0.2701
Poor in 2001	0.3346	0.5922	0.3270	-0.2652
Rice Area	1.2259	0.4007	0.9042	0.5035
Cash Crop Area	1.3748	0.3864	1.000	0.6136
Other Crop Area	1.2866	0.414	0.9687	0.5547
Credit Availed	1.000	0.4458	0.1386	-0.3072
Jeep and Truck Ownership	1.4401	0.4377	0.5285	0.0908
Tricycle Ownership	1.4755	0.4348	0.5317	0.0968
Production Assets Ownership	1.3513	0.4266	0.5013	0.0747
Access to FMR and Bridge	1.3408	0.3775	0.4485	0.071
Access to Irrigation	1.0692	0.4398	0.4563	0.0165
Rice is main crop	1.8057	0.3708	0.5155	0.1447
Sugar is main crop	1.3327	0.4378	0.5093	0.0715
Maize is main crop	1.6123	0.4241	0.5428	0.1187
Bananas are main crop	3.1243	0.4328	0.7045	0.2717