THE IMPACT OF PRICE AND INCOME SUPPORT POLICIES ON SMALL RICE FARMERS IN THE PHILIPPINES

By

Robert W. Herdt and Mark W. Rosegrant*

This paper will evaluate the impact of government policies and programs on small rice farmers in the Philippines. Attention is focused on price and income policies, including government-supported prices, input subsidies, and integrated credit-production programs. These are all essentially short to medium-run policies, with longer term policies affecting land tenure and irrigation. Fertilizer is assumed to be available and its use attractive. Policies that might change the balance between the agricultural and nonagricultural sectors of the economy are not considered. In a sense, the analysis in this paper includes only a narrow range of the total possible set of agricultural development policies. Nevertheless, these are the main policy tools used, in addition to land reform.

It is our belief that farm size *per se* is not a major factor conditioning agricultural progress in the Philippines. This is so because unlike some other countries, most farms in the Philippines tend to be small — 61 per cent are below 3 hectares, and 99.9 per cent are below 25 hectares (Table 1). Thus, all rice land is virtually on small farms, and any policy affecting rice production mainly affects small farmers.

Tenure is also not particularly associated with farm size. There are slightly more share tenant farmers in the less than 5 hectare category than other tenure groups, but the difference is minor (Table 1). Land reform has been a major program of the Philippine government since 1972. In the process nearly 200,000 tenants were issued certificates of land transfer (CLT) giving them permanent rights to land for a fixed yearly fee. After 15 years they are given full ownership status of that land (Table 2). Each land reform beneficiary has received an average of 1.8 hectares, almost equal to the area of the average rice farm in the country. The continuing nature and the recent origin of land reform make it impossible to accurately des-

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*Agricultural Economist, International Rice Research Institute (IRRI) and Economist, Integrated Agricultural Production and Marketing Project, Ministry of Agriculture, Philippines, respectively. The views expressed are those of the authors and not of their agencies. The asssistance of Policarpio Masicat and Violeta Cordova is appreciated.

TABLE 1

Distribution of All farms By Size and Tenure and Distribution of Rice Farms By Size, Philippines 1971, National Census and Statistics Office (NCSO)

	Total	<1.0	1 to <3	3 to <5	5 to <25	25 to <50	50 and over	Total number
	% of all farms							
Full owners	100.0	12.6	43.3	25.0	18.5	0.4	0.2	1,364,[illegible]
Part owners	100.0	13.6	48.8	24.1	13.0	0.3	0.2	208,[illegible]
Share tenants	100.0	16.0	56.2	20.1	6.7	0.1	a/	569,[illegible]
Other tenants	100.0	12.5	48.7	25.7	12.9	0.1	0.1	112,[illegible]
Others	100.0	10.8	49.5	22.4	14.6	0.9	1.8	39,[illegible]

a/ less than 0.1%.

cribe the prevailing size and tenure situation for the country. But clearly, most farmers have small farms. Many have even recently become either amortizing owners or leasehold tenants.

In this context, the impact of price and income policies on small farmers cannot be evaluated in isolation. Instead, the range of farm sizes and how the farm characteristics differ are considered to understand the impact of price and income policies. The major price and income policies of the Philippine government are being outlined first, then a description of rice farms in the Philippines follows. The apparent effect of these policies on the rice farmers is also included. In the final section, a simulation model is used to isolate the effects of particular policies.

Important Current Rice Price and Income Policies

The dominant policy tool affecting rice production in the Philippines since 1973 has been the Masagana 99 program. Masagana means bountiful harvest, and 99 sacks of 50 kilograms is the per hectare production goal of the program.

TABLE 2

Area Transferred (hectare) and Number of Tenant Recipients By Land Size Category as of August 31, 1976. (1977 Philippine Statistical Yearbook)

Land Size Category	Estimated Total Tenanted ha (pre 1973)	Area Transferred to Tenants a/	No. of Tenant-awardees	Average Area per Tenant-awardee
Total	1,422,988	359,377	201,024	1.78
7.00 & below	663,973	—	—	—
7–23.99	361,685	40,945	25,754	1.59
24–49.99	97,994	65,833	38,830	1.70
50–99.99	86,007	75,879	43,264	1.75
100 and above	213,329	176,720	93,176	1.90

a/ Area transferred to tenants in relation to the estimated total tenanted area based on CLTs issued. Tenanted areas are agricultural lands devoted primarily to rice or corn, worked by tenant-farmers either under sharecropping or leasehold.

The program combined low interest, non-collateral credit with a technological package. Complementing Masagana are government fertilizer and rice price intervention policies.

Masagana 99

In 1972, floods and drought heavily reduced Philippine domestic rice production. Consumption suffered because imports could not be obtained immediately to meet domestic rice requirements. In addition to poor crops in 1972-73, the implementation of land reform left many farmers without the traditional credit from their landlords. The pressure on agriculture to increase production was heavy but many farmers, especially those with small farms and had suffered disasters did not have sufficient funds for the next growing season.

Recognizing the problem of limited capital and the importance of using fertilizer and other purchased inputs to increase rice yields, the Philippine government embarked on an accelerated rice produ tion and credit program called Masagana 99. Phase I of the progra covered December 1972 to May 1973. Each six-month period sinc then has been designated as a Phase. To date, the program has reac ed Phase X.

The Masagana 99 program grants loans to qualified farmers cash or kind, to enable them to obtain high yielding seeds, fertiliz herbicides, pesticides and other production inputs under a supe vised credit program. The Masagana-99-supervised-farmer utiliz production credit can borrow up to ₱1,200 per hectare for 6 month at low commercial interest rates from participating banks. Approx mately 50 per cent of the loan is expected to be spent for fertiliz and farm chemicals. These are made available in kind by dealers quantities appropriate for farmers at recommended rates. The ba lance of the loan is in cash for land preparation, transplanting a other costs.

Initial acceptance of the program was rapid and widespre By the second wet season (Phase II) nearly one-fourth of the na tion's rice area participated in the program (Table 3). Repaymen exceeded 80 per cent for the first 4 phases, but gradually fell. 1977 (Phase VIII), the area financed decreased to about one-six its peak, and many "participating" farmers were no longer receivi loans. The 1978 nationwide study of Masagana 99 by the Nation Food and Agriculture Council of the Philippines (NFAC) show that lack of credit and water were the main problems affecting ri production. This was reported by participating farmers in the Ma gana 99 program in 59 provinces (Table 4).

Fertilizer Pricing and Subsidy

In addition to the Masagana 99 program, the Philippine gove ment has supported rice producers by subsidizing fertilizer pri Prior to 1973, fertilizer prices were largely determined by mar conditions. They were however sold at lower prices established f distribution through cooperatives, not private distributors and fe lizer dealers.

The Fertilizer Industry Authority (FIA), was established 1973 when fertilizer supplies in the international market were gr ing tight and prices were rapidly increasing. The FIA establishe two-tier pricing system for fertilizers with a subsidized price f Priority I (food) crops, including rice, corn, feedgrains, and veget bles; and a higher, non-subsidized price for Priority II (expo crops, including sugar, bananas and pineapples.

TABLE 3

Masagana 99 Total Country Program, Phase I-X, 1973-78, Philippines.

Phase	Year/Season	Total Loans Granted (000₱)	Area Financed (hectare)	Farmers Served (no.)	Average Loan Granted (₱/ha)	Average Loan Granted (₱/borrower)	Repayments (000₱)	%
I	1973 wet	369.5	620,928	401,461	595	920	347.4	94
II	1974 dry	230.7	355,397	236,116	649	977	214.6	93
III	1974 wet	716.2	866,552	429,161	826	1,353	601.6	84
IV	1975 dry	572.3	593,624	354,901	964	1,612	463.6	81
V	1975 wet	573.0	558,335	301,828	1,026	1,898	424.0	74
VI	1976 dry	255.6	255,884	150,464	999	1,699	201.9	79
VII	1976 wet	275.1	244,467	144,265	1,125	1,907	209.1	76
VIII	1977 dry	164.4	148,801	89,623	1,105	1,834	123.3	75
IX	1977 wet	251.8	221,522	131,590	1,136	1,914	157.2	62
X	1978 dry	175.1 a/	—	—	—	—	—	—
Total b/		3,408.6	3,865,510	2,339,409	936 c/	1,568 c/	2,742.6	76 c

a/ As of May 1978. b/ Excluding Phase X. c/ Average.
A dash (—) means not available.

Source: National Food and Agriculture Council
Ministry of Agriculture
Diliman, Quezon City, Philippines.

TABLE 4

Problems Affecting Rice Production at the Program Target Areas as Reported By 59 Provinces Participating in Masagana 99, July 31, 1978

Reported Problem	Target Ar Affected (Per cent)
Credit	43
Water	43
Labor	28
Weather	24
Pests/Diseases	18
Marketing/Pricing	13
Fertilizer	9
Weedicides	7
Pesticides	7
Seeds	7

Source: National Food and Agriculture Council, Ministry of Agri-culture, Diliman, Quezon City, Philippines, July 31, 197 (mimeo).

Table 5 shows the ex-warehouse prices for four major typ fertilizer during the 1970-78 period. Priority I prices were set by th FIA, and its successor, the Fertilizer and Pesticide Authority (FP in consultation with the Ministry of Agriculture and its affiliat agencies. The primary objective of the Priority I prices was to contr the production costs for food crops, particularly rice. The gover-ment maintained the reduced price level for food crops throu subsidies paid to fertilizer dealers to reimburse them for import production costs.

Priority II prices were computed to reflect actual import co and a reasonable profit margin. Additional indirect governme subsidies were granted through exemptions on payments of custo duties, import taxes and wharfage fees for imported fertilizer.

Actual retail prices of fertilizer for each province are comput by adding to the FPA-approved ex-warehouse prices the actual a necessary handling and trucking charges, local taxes, and a reaso-able markup at the retail level.

TABLE 5

Average Fertilizer Prices Ex-warehouse, (₱/50 kg) Established By Government Policy During Three Recent Periods, Philippines. (Fertilizer and Pesticide Authority)

	1970–1972		1973–1975		1976–1978
Fertilizer	Private Distributors	Cooperative Sector	Food Crops	Export Crops	
Urea	30.25	27.70	71.20	117.65	76.70
Ammonium sulphate	21.20	18.50	38.77	68.43	39.31
16-20-0	34.43	23.60	57.82	92.23	66.55
14-14-14	26.40	23.60	54.96	94.49	61.55

In 1976, with world fertilizer prices declining and the Philippine sugar industry in a distressed state, the two-tier pricing system was ended by reducing prices. The adoption of the single pricing system also eliminated black-marketing and diversion of fertilizer from the food crop to the export crop sector.

The actual amount of government subsidy on fertilizer varied with the difference between the world fertilizer price and the subsidized domestic price. Government subsidy payments peaked in 1975, and have since declined rapidly with the lowering of the world price of fertilizer. According to FPA estimates during the 1973-77 period, the government subsidized 40 per cent of the actual cost of every bag of fertilizer bought by rice and other food crop farmers.

Fertilizer consumption is estimated from withdrawals made by dealers from company warehouses. Consumption increased by about 46 per cent between 1970 and 1977.

The major gains were in nitrogen and phosphorous use, with little change in the use of potassium. The FPA estimates that rice farmers used about 126 kilograms of fertilizer per hectare in 1976 to 1978. The fertilizers used by rice farmers have an average nutrient composition of 36 per cent. The equivalent nutrient usage on rice farms then is approximately 45 kilograms per hectare.

A related policy affecting rice production has been intervention in the market to establish floor prices for paddy at the farm level. Comparison of government support prices and those actually received by farmers during the 1970-77 period indicates that market forces generally prevailed over government efforts to maintain floor prices at the farm level. The farm prices dropped below the official level in better than average production years and rose above it in poorer years (Table 6). However, the government has rapidly expanded storage facilities and palay procurement activities in recent years, enhancing its capability to significantly influence the farm price of palay.

TABLE 6

Official and Actual Farm Prices of Paddy in the Philippines, 1970-1977 (₱/kg.) (Bureau of Agricultural Economics)

Crop Year	Government Support Price for Palay	Farm Price Palay Ordinario
1970	.348 – .391	.356
1971	.348 – .435	.554
1972	.435 – .540	.611
1973	.540 – .600	.678
1974	.600 – .800	.890
1975	.800 – 1.000	.922
1976	1.00 – 1.100	.964
1977	1.100	1.000

Philippine Rice Farm Characteristics

To evaluate the impact of policies on the various categories of rice farmers in the Philippines, a description of those farmers not available at a national level is needed. For that purpose, information from a series of sample surveys over the past several years in three important rice producing provinces was used.

The surveys were part of the "Constraints Project." The latter was a study in which institute agronomists placed experiments in farmers' fields according to the farmers' willingness to cooperate (IRRI, 1977). Study farms were selected in villages in Laguna, Nueva

Ecija and Camarines Sur provinces near rice research stations located in those provinces. In each province, 3 to 6 villages were studied. Table 7 shows the number of farmers interviewed in each province for each of the study seasons. In 1975 and 1976, approximately 150 farmers were interviewed in the three provinces. In the 1977 wet season, the sample was increased to nearly 200.

TABLE 7
Total Farmers Interviewed By Year and Location, Constraints Survey, 1975-77

Season/Year	Laguna	Nueva Ecija	Camarines Sur	Total
		No. of farms reporting		
Wet season				
1975	40	70	40	150
1976	50	50	51	151
1977	61	70	66	197
Dry season				
1976	49	71	44	164
1977	60	60	59	179

Table 8 shows the distribution of sample farms by size compared to the distribution of all rice farms by size. Between 7 and 22 per cent of the sample farms were below one hectare, approximately 60 per cent were between 1 and 2.5 hectares and 17 to 34 per cent were larger than 2.5 hectares. The sample farms seem to have higher proportion of small farms than the total population of rice farms in the provinces studied. Table 9 presents the distribution of sample farms by tenure. There were relatively few owner-operator farms in the sample. These are very rare in the study areas. Tenure was predominantly leasehold. Some share tenants though were also found despite the land reform program. Few farmers reported mixed tenure.

Water control is a major factor affecting farmer's capacity to use technology. The type of water control for the sample farms is shown in Table 10. Farms were categorized as rainfed, one-crop irrigated and two-crop irrigated. All sample farms in Laguna province grew two crops of rice a year with irrigation. (The rainfed areas of Laguna province are quite remote, so they were excluded in the study). In the other two provinces, about 30-40 per cent of the farms were either rainfed or irrigated with only one crop in a year.

TABLE 8

Distribution of All Price Farms in 1971 and Constraints Sample Rice Farms in 1975-77 By Size, Three Philippine Provinces[a]

	Per Cent of Farms by Size		
	Laguna	Nueva Ecija	Camarines Sur
		sample rice farms[a]	
less than 1.0 ha	17.8	6.8	22.2
1.0 to 2.5 ha	58.2	59.4	60.4
over 2.5 ha	24.0	33.8	17.4
		rice farms in the province[b]	
less than 1.0 ha	20.0	2.0	15.6
1.0 to 3.0 ha	51.3	50.3	57.7
over 3.0 ha	28.7	47.7	26.7

a/Wet season sample distribution. Dry season is similar.

b/Distribution of all rice farms from NCSO 1975.

TABLE 9

Number of Constraints Sample Farms By Tenure, Three Philippine Provinces, 1975-77

Tenure Category	Laguna	Nueva Ecija	Camarines Sur
Owner operator	20	29	43
Leasehold tenant	168	268	135
Share tenant	66	11	80
Mixed tenure	6	13	12

TABLE 10

Number of Sample Farms By Type of Irrigation and Location, Constraints Survey, 1975-77

Location	Rainfed	One-crop Irrigated	Two-crops Irrigated	Total
	3 wet seasons			
Laguna	0	0	151	151
Nueva Ecija	61	7	122	190
Camarines Sur	41	3	113	57
	2 dry seasons			
Laguna	0	0	109	109
Nueva Ecija	0	0	131	131
Camarines Sur	0	0	103	103

Impact of Government Policies on Farms of Various Sizes

It is difficult to separate the Masagana 99 effects from the rice price and fertilizer price effects. Instead, three size groups of farms, the end results of the policies — participation rates, amounts borrowed, expenditures on inputs and repayment and income effects are compared.

Participation in Masagana 99

Studies examining credit in developing countries usually found out that large farmers obtain a disproportionate amount of institutional credit, and even prevent small farmers from getting loans. Table 11 shows the number of small farmers reporting credit from Masagana 99, other sources of credit and no credit. The chi-square test was used to examine the hypothesis that the use of credit was independent of the farm size. The hypothesis was rejected at the 1 per cent level for four out of the five samples. There were fewer small farmers receiving loans from Masagana 99 than expected. This seems to support the finding noted above. However, fewer large farmers were without loans than expected.

The average amount borrowed per hectare by farmers in three size groups is shown in Table 12. In four of the five samples, the small farmers with Masagana 99 loans significantly borrowed more per hectare than the medium size group while the medium size group generally borrowed more per hectare than the large size group. Although the legal loan limit was ₱1,200 per hectare, small farmers reported substantially higher borrowing rates. They may have overstated their farm area to the Masagana technicians in an attempt to obtain credit for consumption purposes. The tendency for small farmers to obtain higher loans per hectare also occurs with other credit sources although the differences were not generally significant. The data also showed that farmers borrowing from Masagana 99 had significantly larger loans than those borrowing from other sources, in 12 of the 15 comparisons made.

Table 13 shows the expenditures on fertilizer, insect control, herbicide, and hired weeding labor by the farmers of different size groups having loans from two sources and those farmers having no loans. In several cases, the small farmers with Masagana 99 loans spent significantly more on their inputs than the small farmers with loans from other sources or with no loans at all.

Tables 11, 12 and 13 taken together indicate that small farmers seem not to be adequately represented in obtaining loans, and those who do get Masagana 99 loans tend to borrow larger amounts per hectare than the bigger farmers. But the small farmers spend less on inputs than the bigger farmers.

Non-borrowers and Non-repayment

Farmers were asked why they did not borrow from Masagana 99. The distribution of farmers giving various reasons by farm size is shown in Table 14. The most important reason, given by 50 per cent of the respondents, was their outstanding (unrepaid) loans.

Some of the farmers indicated they preferred to borrow from sources other than Masagana 99. Their reasons for doing so, grouped by size of farms, are shown in Table 15. The most prevalent reason given was the existence of outstanding Masagana 99 loans.

The evidence suggests that unpaid Masagana 99 loans were more a problem for farmers with larger areas than those with less than one hectare. This does not support the claim that loans granted under Masagana 99 were too large for small farmers.

Production Impact

Table 16 shows the farmers' gross revenue per hectare in the three credit categories and farm size groupings. The price of paddy

TABLE 11

Number of Sample Farmers Reporting Credit From Various Sources By Size of Farm. Laguna, Nueva Ecija and Camarines Sur, Philippines, 1975-77

	Masagana 99			Other sources[a]			No loans			
Season	<1.0	1.0-2.5	>2.5	<1.0	1.0-25.	>2.5	<1.0	1.0-2.5	>2.5	Chi-square
Wet 1975	3	36	17	15	26	7	9	31	6	15.28***
Wet 1976	10	43	12	8	29	13	10	22	4	4.94
Wet 1977	5	59	30	6	29	20	11	20	16	11.74**
Dry 1976	6	35	16	9	38	10	18	28	4	15.79***
Dry 1977	10	39	17	21	19	8	23	27	10	13.02**
All seasons	34	212	92	59	141	58	71	128	40	

[a] Includes 3 per cent of the sample having loans from both Masagana 99 and other sources.

TABLE 12

Amount Borrowed (₱/ha) By Farmers of Different Sizes Having Loans From Various Sources, Laguna, Nueva Ecija and Camarines Sur, Philippines

Season	Masaganà 99			Other Sources			Both		
	<1.0	1.0-2.5	>2.5	<1.0	1.0-25.	>2.5	<1.0	1.0-2.5	>2.5
Wet 1975	3219	1555[b]	864[b]	649	503	246[a]	6112	558	–
Wet 1976	2355	1161[c]	997	612	489	368	–	795	–
Wet 1977	948	1004	846	1145	596	618	2430	1061	2864
Dry 1976	1935	1003[c]	716[a]	605	672	548	–	–	1237
Dry 1977	2118	1078[c]	923	1192	830[a]	934	–	1860	2750
All seasons	2080	1142	860	880	608	548	–	–	–

Note: The letters a, b, and c indicate that the means of one size group were significantly different from those of the next bigger size group at the 10, 5 and 1 per cent level of significance using a t-test.

TABLE 15

Expenditures on Inputs (₱/ha)[a] By Farmers of Different Sizes With Loans From Various Sources, Laguna, Nueva Ecija and Camarines Sur, Philippines

Season	Masagana 99			Other Sources			No Loans		
	<1.0	1.0-2.5	>2.5	<1.0	1.0-25.	>2.5	<1.0	1.0-25.	>2.5
Wet 1975	692	395[b]	378	205	252	162	217	270	292
Wet 1976	895	284[a]	598	402	328	279	690	396[b]	735[a]
Wet 1977	459	493	591	247	398	378	540	470	563
Dry 1976	593	481	504	301	357	408	400	353	460
Dry 1977	546	556	644	702	550	645	679	550	511
All seasons	657	444	547	427	366	371	529	400	516

[1] Fertilizer, insect control, herbicides and hired weeding labor.

Note: The letters a, b and c indicate that the means of one size group were significantly different from the means of the next bigger size group at the 10, 5 and 1 per cent level of significance using a t-test. See Appendix Table 2 for the computed t-statistics.

TABLE 14

Reasons Given Why Respondents Had not Borrowed From Masagana 99 Laguna, Nueva Ecija and Camarines Sur, Philippines, 1976-77

Reasons	Total No	Percentage of Respondents Giving Indicated Reasons			
		<1.0 ha	1.0-2.5 ha	>2.5 ha	All
Enough cash or capital	88	28	19	24	[illegible]
Have outstanding loans	191	37	57	46	[illegible]
Shouldered by landlords	7	2	2	2	[illegible]
Afraid of risk	15	5	3	4	[illegible]
Others	65	24	14	15	[illegible]
No response	22	4	5	9	[illegible]
All	388	100	100	100	[illegible]

was roughly ₱1 per kilogram. This also indicates the approximate yield in kilogram per hectare. The small farmers in Masagana 99 did not have higher levels of output than those with other loans although both groups had higher output than farmers without loans. Medium farmers with Masagana 99 loans had higher output than those with loans from other sources, although in the 1977 wet season, the opposite was true. On the average, medium farmers without loans had higher output levels than those with non-Masagana loans. The same is true for farmers with more than 2.5 hectares. Farmers without credit or farmers with Masagana credit averaged nearly ₱900 per hectare higher output level than those with credit from non-Masagana sources.

No consistent difference in the net returns per hectare of farmers from different size groups having Masagana 99 loans is noticeable. Medium and large farmers with loans from other sources had somewhat lower returns than those with Masagana 99 loans or no loans. Within the group having loans from other sources, net returns declined with farm size. The opposite was true for farmers with no loans — net returns increased with farm size.

Modeling the Impact of Price and Income Policies

The examination of empirical evidence on the effects of credit sources and input use on farms of various sizes yields a few patterns

This is partly because of the relatively small sample of farmers studied and the effects of prices, technology, irrigation, weather and non-farm events like personal decisions. All these have an impact on the eventual observed outcome. The only way to properly evaluate policy effects is through a model designed for that purpose. This section discusses such model and presents the analysis.

TABLE 15

Reasons Given By Respondents Who Preferred Loan Sources Other Than Masagana 99. Laguna, Nueva Ecija, and Camarines Sur, Philippines, 1976-77

Reasons	Total No.	Per Cent of Respondents Giving Indicated Reasons			
		<1.0 ha	1.0-2.5 ha	>2.5 ha	All
Have outstanding M99 loan	81	35	34	44	37
Other sources have zero or lower interest	20	13	9	6	9
Easier to borrow from other source	14	11	5	6	6
Other reasons	40	17	18	19	18
No response	66	24	34	25	30
All	221	100	100	100	100

TABLE 16

Gross and Net Revenue (₱/ha) of Farmers in 3 Size Groups With 3 Sources of Financing, Constraints Survey, Laguna, Nueva Ecija and Camarines Sur, Philippines, 1976-77

Source of Financing	Gross Revenue (₱/ha)			Net Revenue (₱/ha)a/		
	<1 ha	1-2.5 ha	>2.5 ha	<1 ha	1-2.5 ha	>2.5 ha
Masagana 99	2918	2671	3004	2261	2227	2457
Other loans	2860	2279	2166	2432	1913	1795
Self-financed	2476	2442	2909	1947	2042	2393

a/Gross revenue minus costs of fertilizer, hired labor and insecticide.

The farmer decision making model simulates farmer choice among production technologies. The model distinguishes farms with different qualities of irrigation, various tenures, sizes, and different savings consumption behavior. The analyst can assume that farmers make their choice among inputs according to various decision rules. A range of interest rates, loan limits, fertilizer and rice prices are evaluated (Rosegrant 1978).

TABLE 17

Responses of Palay Yield (kg/ha) Estimated From Experiments Conducted in Farmers' Fields in Nueva Ecija, Philippines in 1972, 1973 and 1974, Used in the Farmer Decision Making Model. (Rosegrant 1978)

Variable	Definition	Coefficient
Intercept		1079.83**
N x SR	Nitrogen (kilogram/hectare) times solar radiation 45 days before harvest (kilocalories/ square centimeters)	0.91**
N^2	Nitrogen (kilogram/hectare) squared	– 0.06**
SD	Stress days – days in excess of 3 for which paddy is without standing water	110.68**
P	Phosphorus (kilogram/hectare)	3.81**
WCI	Weed control using one application of herbicide	160.11**
WC2	Weed control using one handweeding plus herbicide	297.94**
ID	Insect damage measured as per cent of plants infested	–7.87**
IC	Expenditure on insecticide (₱/hectare)	1.47*
%C	Per cent clay content of soil	28.40**
N x SD	Nitrogen times stress days	– 0.39**
SR x SD	Solar radiation times stress days	– 8.95**
R^2		0.72

*Coefficient significant at 0.05 level.

**Coefficient significant at 0.01 level.

An estimate of the production function for modern rice varieties incorporating weather and insect variables and management inputs was used to relate inputs to production in the model (Table 17). Frequency distributions of insect damage, solar radiation and typhoon damage were derived from field observations in Central Luzon. A water balance model computes stress days as a function of irrigation flows, rainfall, and water losses. It was used to generate frequency distributions of stress days for good, average, and poorly irrigated sites and various soils.

Frequency distributions of yield were then computed for each water regime for levels of nitrogen inputs from zero to 196 kilogram per hectare, phosphorus from zero to 98 kilogram per hectare, and for three levels each of insecticide and weed control. These yield distributions were estimated by substituting the frequency distributions of weather and insect variables by the production function through repetitive random sampling. The typhoon damage distribution enters the computation exogenously to the production function as a yield reducing factor.

The level of nitrogen giving maximum expected yield, the yield at that level, and its standard deviation are shown in Table 18 for seven water regimes, as computed in the production model. Maximum yield nitrogen levels range from 112 kilogram per hectare for rainfed areas to 152 kilogram per hectare for high quality irrigation during the dry season. The expected yields ranged from 2.6 ton per hectare to 3.7 ton per hectare. Yield variability is greatest during the wet season, reflecting the possibility of yield loss from typhoons. It is lowest for high quality irrigated dry season conditions.

Given alternative technologies each with a distribution of yields, costs, and returns, the model evaluates the outcome for various technology choices under both risk neutral and risk averse behavior of farmers. Risk averse behavior is modeled as a "safety-fixed" rule. This maximizes the minimum net returns obtained with a fixed confidence level. Formally, the decision rule is to maximize net returns, d:

$$d = \mu - \kappa\delta$$

where μ is expected net returns, δ the standard deviation of the net returns distribution, and k, the rate of substitution between expected

TABLE 18

Yield Maximizing Nitrogen Level, Maximum Expected Yield, and Standard Deviation of Yield, Three Qualities of Irrigation, From Estimated Yield Distribution.

Season	Irrigation Quality	Yield Maximizing Nitrogen (kg/ga)	Maximum Expected Yield (kg/ha)	Standard Deviation of Yield (kg/ha)
Dry	High	152	3747	555
Dry	Medium	140	3092	704
Dry	Low	124	2455	781
Wet	High	128	2977	833
Wet	Medium	124	2972	828
Wet	Low	124	2958	828
Wet	Rainfed	112	2592	794

Complementary inputs set at high levels: 60 kilogram/hectare phosphorus; 2 applications insecticide; 1 application of herbicide plus 1 handweeding average soil quality.

net returns and risk. The parameter k specifies the desired confidence level: the greater the value of k, the greater the degree of risk aversion. If k is set at zero, the decision rule is identical to the risk neutral rule used in the model, which is to maximize expected net returns.

The maximum level of productive inputs used is implicitly set by the choice of technologies available. In addition, these levels may be reduced by the capital constraint: total spending on fixed and variable costs in season t + 1 cannot exceed total savings from production in season t plus new borrowings in season t + 1. The maximum amount and cost of credit to any farm are set within the model to reflect credit policy. Total savings in season t are the difference between net returns and consumption, which is a positive linear function of income.

The financial side of the model permits farmers to borrow from both the institutional and informal sectors. All farms are assumed to begin in the institutional market at the specific interest rate with credit available up to a maximum loan limit per hectare. The farm borrows from the institutional market. If simulated production in some season is so low that a farm is no longer able to meet both subsistence and repayment requirements, the farm defaults on the loan, using the funds to supplement consumption and increase savings. In subsequent seasons, the farm obtains production loans from the informal market, having higher interest rate and lower loan limit than the institutional market.

It would be impossible to simulate enough sets of outcomes to generate stable distributions of inputs and yields for all possible combinations of farm types, environments and policies at reasonable cost. Therefore, a Markov chain process was used to represent the decision process over several seasons. The key variables in the Markov chain process are the level of savings and financial market where the farm operates. A choice of technology is determined when savings level and financial market are specified, a decision rule is chosen, and all necessary parameters (such as input costs and price of rice) are set. The technology choice in turn determines a yield distribution, determining distributions of net returns, income, savings and financial market access for the subsequent period. The distribution of savings is then the basis for computing the probabilities of moving to any savings state in the next period.

The Impact of Various Policies

The evidence from the surveys discussed in section II suggests that few differences exist among rice farms of different sizes in the Philippines. The major consistent and significant difference by size of farm was in the amount of loan. Smaller farms borrow considerably more on a per hectare basis than larger farms.

This relationship implies a definition of farm size in terms of income and consumption behavior. According to the decision making model, the increase in loan size per hectare with a decrease in farm size suggests that loans are used for consumption and production purposes. This means that some culturally defined consumption level cannot be met by small farmers even with their non-farm income. The gap between consumption and income levels is apparently filled by credit.

Small farms require larger loans per hectare than large farms to finance any given consumption level over a season. For example, to finance a ₱400 consumption gap, a one hectare farm would have to borrow ₱400 per hectare, a 2.5 hectare farm, ₱160 per hectare, and a 5 hectare farm only ₱80 per hectare.

With a larger loan, the smaller farm must produce more per hectare to repay the loan. The higher production requirement implies a higher probability of default for small farms. Thus, over several seasons small farms will spend greater time in the informal financial market, where input use, yield, and income is reduced by the high interest rate and low credit ceiling.

To test the magnitude of this farm size-consumption-income effect, model runs were made for three farm sizes, 1.0 hectare, 2.5 hectares (the average rice farm size in Central Luzon) and 5.0 hectares, with a ₱400 consumption requirement in excess of non-farm income. For each farm size the model was run through 20 simulated seasons with the profit maximizing nitrogen and other input levels chosen internally. Choice of input levels, yield, and income as calculated by the model for the different farm sizes are shown in Table 19. (For this and all other analyses, except when indicated, the price of rice is ₱1.00 per kilogram and that of nitrogen and phosphorus, ₱3.70 per kilogram. These are the approximate rates prevailing in the Philippines in recent seasons).

The results show that with a ₱400 consumption requirement financed by loans, the 1.0 hectare farmer would use considerably less nitrogen and other inputs and achieve lower yields and incomes than the larger farms, even with the same environment, production function and decision rules. The irrigated 1.0 hectare farm for example, uses 16 kilogram per hectare less nitrogen and ₱65 per hectare less complementary inputs, obtaining yields 12 per cent lower and incomes 11 per cent lower than the 2.5 hectare farm. Differences are comparable for rainfed farms.

Farms larger than 2.5 hectares use relatively small additional amounts of inputs. The irrigated 5.0 hectare farm uses only 6 kilogram per hectare more nitrogen and ₱35 per hectare more complementary inputs, getting 4 per cent higher yields and 3 per cent higher incomes than the 2.5 hectare farms.

The differences observed in Table 19 are largely due to the difference in the probability of default causing smaller farms to default sooner and spend more time in the informal credit market. For irrigated conditions, 1.0 hectare farms have access to the institu-

TABLE 19

Mean Levels of Inputs, Yield, and Income (per crop) for Different Farm Sizes, Irrigated and Rainfed as Determined By the Simulation Model of Farmer Decision Making.

Farm Size (hectare)	Nitrogen (kilogram/ hectare)	Other Inputs (₱/hectare)a/	Yield (kilogram/ hectare)	Imcome (₱/hectare)
		Irrigated		
5.0	53	244	2215	650
2.5	47	219	2134	629
1.0	31	154	1907	568
		Rainfed		
5.0	33	170	1756	507
2.5	27	151	1696	491
1.0	15	110	1559	454

a/ Phosphorus, Insecticide, herbicide, weeding labor.

tional market only 20 per cent of the time. On the other hand, 2.5 hectare farms are in the institutional market 44 per cent of total seasons, and 5.0 hectare farms 54 per cent of the time. Under rainfed conditions, the proportions are 6, 32 and 44 per cent respectively.

For the consumption requirement defined here, small farms are at a decided financial disadvantage compared with larger farms. However, this disadvantage is a function of the size of the consumption per income gap: as non-farm income increases to cover subsistence consumption needs, the performance of small farms approaches that of the larger farms. If no gap exists, the performance of small farms equals that of larger farms. This exercise shows that part of the apparently "conservative" behavior of small farmers without appeals to risk aversion, environmental differences, or lack of knowledge can be explained. Occasional bad weather reduces production value below the required level to permit the small farmers to repay their loan.

Interest Rate Policy

The Masagana 99 program provides credit to farmers at subsidized interest rates. The nominal rate on Masagana loans has been 12 per cent per year, with an effective rate including service charges and discounting of about 16 per cent per year, or 8 per cent every six months.

Interest rates can alter farmers' choices of inputs, yield and income through both price and income effects. When credit is needed to finance the purchase of productive inputs, a decrease in the interest rate lowers the real cost of inputs. This increases the marginal net returns and the optimal levels of use of those inputs. An interest rate reduction also increases net income and savings, decreasing the probability of default and easing the capital constraint on input levels.

To examine the impact of alternative interest rates on input choice, yield, and income, model runs were made with interest rates set at 8, 16, and 24 per cent for 6 months. The range covers the current Masagana level to approximately the rate prevailing in the informal financial market.

Results for these interest rates are shown in Table 20 (for irrigated farms) and Table 21 (for rainfed farms). As shown by the results, all farm sizes, input usage and yields are quite insensitive to interest rates. Very large increases in the interest rate produce only small reductions in input use and yields.

The decrease in nitrogen use is 2 to 5 kilogram per hectare with each 8 percentage point interest. The reduction in other inputs is ₱4—14 per hectare, leading to yield losses of 1 to 2 per cent.

Interest rates have a larger impact on incomes. Each shift in the interest level results in an income reduction of 3 to 5 per cent. The results therefore indicate that the interest rate subsidy relative to informal market interest rates are effective, primarily as income subsidy rather than as incentive for boosting production.

Fertilizer Subsidy and Rice Price Support

The two primary alternatives to credit policy employed to induce increased input use, production, and income are fertilizer price subsidies and rice price support.

TABLE 20

Mean Input Use, Yield and Income for Irrigated Farms at Alternative Institutional Market Interest Rates.

Farm Size (hectare)	Interest Rate 6 months)	Nitrogen (kilogram/ hectare)	Other Inputs (₱/hectare)[a]	Yield (kilogram/ hectare)	Income (₱/hectare)
5.0	0.08	53	244	2215	650
	0.16	49	231	2173	619
	0.24	44	217	2124	592
2.5	0.08	47	219	2134	629
	0.16	43	207	2093	602
	0.24	40	195	2052	579
1.0	0.08	31	154	1907	568
	0.16	28	143	1870	542
	0.24	25	133	1831	518

[a]Phosphorus, insecticide, herbicide, and weeding labor.

A decrease in fertilizer price relative to the price of rice through fertilizer subsidies or rice price support have a number of effects on input use, yield, and income. First, the decrease in input price relative to the price of rice increases the optimal input level. Higher inputs produce higher yields and with the reduced input price (or increased rice price), increase income and savings. Higher income reduces the probability of default, extending the farmer's time in the institutional financial market. The larger savings (and lower input prices in the case of fertilizer subsidy) allow the farm to finance higher input levels when the loan ceiling is binding.

TABLE 21

Mean Input Use, Yield, and Income for Rainfed Farms at Alternative Institutional Market Interest Rates

Farm Size (hectare)	Interest Rate (6 months)	Nitrogen (kilogram/ hectare)	Other Inputs (₱/hectare)	Yield (kilogram/ hectare)	Income (₱/hectare)
5.0	0.08	33	170	1756	507
	0.16	31	162	1730	488
	0.24	28	155	1709	474
2.5	0.08	27	151	1696	491
	0.16	25	145	1675	476
	0.24	23	140	1658	464
1.0	0.08	15	110	1559	454
	0.16	13	106	1537	437
	0.24	10	100	1516	422

[a]Phosphorus, insecticide, herbicide, weeding labor.

To test the responsiveness of farms of different sizes to changes in fertilizer price, the model was run with prices of fertilizer between ₱5.70 and ₱1.70 per kilogram in increments of ₱0.50 per kilogram, with the rice price held constant at ₱1.00 per kilogram. The responsiveness of farmers in terms of nitrogen use, yield, and income to shifts in fertilizer price are summarized in Tables 22 and 23. According to those data, a reduction in the price of fertilizer from ₱3.70 to ₱2.70 per kilogram increases application rates from 12 to 18 kilogram per hectare, yields by 100 to 150 kilogram per hectare and incomes by ₱60 to ₱100 per hectare.

The tables show the average in nitrogen use, yield, and income with each ₱0.10 per kilogram decrease in fertilizer price in successive price ranges. Responsiveness to fertilizer price declines slightly as farm size decreases. The low responsiveness of small farms is due to the higher proportion of these farms operating in the informal credit market, where the credit ceiling prevents full response to price signals.

TABLE 22

Response to Fertilizer Price on Irrigated Farms By Farm Size

Farm Size (hectare)	Change in Nitrogen Yield and Income With Each ₱0.10 Kilogram Decrease in Fertilizer Price Over the Range			
	5.70 – 4.70	4.70 – 3.70	3.70 – 2.70	2.70 – 1.70
	Nitrogen applied (kilogram/hectare)			
5.0	1.3	1.5	1.8	2.2
2.5	1.1	1.4	1.8	2.1
1.0	0.7	1.3	1.6	2.0
	Yield (kilogram/hectare)			
5.0	13.2	14.9	14.8	15.3
2.5	12.9	13.4	14.3	16.1
1.0	8.2	13.2	14.5	15.3
	Income (₱/hectare)			
5.0	5.1	7.1	10.1	15.1
2.5	5.2	6.9	10.0	15.1
1.0	4.8	6.6	10.0	14.7

TABLE 23

Response to Fertilizer Price on Rainfed Farms by Farm Size

Farm Size (hectare)	Change in Nitrogen, Yield and Income With Each ₱0.10/ Kilogram Decrease in Fertilizer Price Over the Range			
	5.70 – 4.70	4.70 – 3.70	3.70 – 2.70	– 1.70
	Nitrogen applied (kilogram/hectare)			
5.0	1.1	1.4	1.5	1.9
2.5	1.0	1.4	1.4	1.8
1.0	0.5	1.1	1.2	1.7
	Yield (kilogram/hectare)			
5.0	8.5	9.6	10.2	11.3
2.5	8.4	9.7	10.0	11.1
1.0	6.3	8.9	9.6	11.2
	Income (₱/hectare)			
5.0	1.9	3.5	6.3	9.0
2.5	1.8	3.5	6.2	8.8
1.0	1.5	3.2	6.0	8.8

For all farm sizes, the increase in nitrogen use in response to price changes is larger for lower fertilizer prices. This is due to the greater improvement in financing capability combined with the increases in the proportion of farmers operating in the institutional market who can take full advantage of the price reduction.

Yield response to price changes modestly increases as fertilizer prices decrease as a result of the increase in nitrogen use response. The income response in turn increases with the price reductions of fertilizer. The increasing yield response and the distribution of successive price reductions over larger inputs account for this.

Tables 24 and 25 show the increase in nitrogen use, yield and income with increases in the price of rice.

The response of fertilizer use, yield and income is substantially greater for each ₱0.10 per kilogram increase in rice price compared with each ₱0.10 per kilogram decrease in the fertilizer price. This is be-

TABLE 24

Response to Rice Price on Irrigated Farms By Farm Size

Farm Size (hectare)	Increase in Nitrogen Use, Yield and Incomes For Each ₱0.10 Kilogram Increase in Rice Price Over the Range			
	0.75 – 1.00	1.00 – 1.25	1.25 – 1.50	1.50 – 2.00
	Nitrogen applied (kilogram/hectare)			
5.0	7.2	5.6	4.8	3.2
2.5	6.8	5.2	4.0	3.2
1.0	6.4	4.4	3.2	2.8
	Yield (kilogram/hectare)			
5.0	126.8	101.6	47.6	22.4
2.5	125.2	101.2	44.8	22.7
1.0	114.8	96.0	42.4	21.8
	Income (₱/hectare)			
5.0	128.0	172.4	187.6	194.8
2.5	125.6	176.4	184.4	192.8
1.0	119.6	162.0	178.4	186.6

TABLE 25

Response to Rice Price on Rainfed Farms by Farm Size

Farm Size (hectare)	Increase in Nitrogen Use, Yield and Incomes For Each ₱0.10/ Kilogram Increase in Rice Price Over the Range			
	0.75 – 1.00	1.00 – 1.25	1.25 – 1.50	1.50 – 2.00
	Nitrogen applied (kilogram/hectare)			
5.0	6.8	4.0	3.2	2.6
2.5	6.0	3.6	3.2	2.4
1.0	3.2	3.2	2.8	2.2
	Yield (kilogram/hectare)			
5.0	92.0	100.0	30.0	17.2
2.5	89.6	98.8	27.2	17.2
1.0	66.8	94.4	24.8	16.4
	Income (₱/hectare)			
5.0	102.8	128.0	143.6	147.4
2.5	101.8	128.0	141.6	147.2
1.0	91.6	123.2	138.0	145.8

cause ₱0.10 per kilogram is a much larger percentage change in rice prices than fertilizer prices. A rise in rice prices from ₱1.00 to ₱1.25 per kilogram would result in 8 to 14 kilogram per hectare higher application rates of nitrogen, from 235 to 250 kilogram per hectare yield increase and from ₱300 to ₱430 per hectare increased incomes.

For both irrigated and rainfed farms, the increase in nitrogen use with a given increase in the price of rice declines as the price increases. This response is due to the decreasing relative improvement in the nitrogen per rice price ratio with each equal shift in the price of rice combined with the declining marginal productivity of nitrogen at higher application rates resulting from the higher rice prices.

The response of complementary input use to increases in the price of rice (not shown in the tables) does not follow a smooth pattern. Insecticide, herbicide, and labor are available in discrete packages. Thus, a given increase in the price of rice can have a threshold effect, turning a previously unprofitable package to a profitable one. The average increase in complementary input uses per ₱0.10 per kilogram increase in the price of rice over the full price range shown is: for irrigated farms, ₱29 per hectare for 5 hectare farms, ₱28 per hectare for 2.5 hectare farms, and ₱23 per hectare for 1.0 hectare farms. For rainfed farms, the respective increases are ₱25, ₱24, and ₱20 per hectare.

The declining increase in nitrogen use and the declining marginal productivity of that nitrogen as prices and the level of nitrogen use increase show a downward trend to successive yield increases. (The single exception for rainfed farms is a lumpy increase in the use of complementary inputs as described).

Despite the declining yield increases, the increase in income with equal increases in rice price grows because the increased price is distributed over the entire output of rice.

Crop Insurance

Both the surveys and model results on the impact of farm size point to a major problem of the Masagana program: a fairly high rate of default has forced many farmers out of the institutional credit market into the informal market. The higher interest rates and lower credit ceilings in that market reduce input use, yield, and income.

To insure against default, a crop insurance program linked to the institutional loan market can be set up. Such program would pay back the outstanding loan of a farmer unable to do so, due to a poor harvest. The farmer will then be able to remain in the institutional financial market, with a larger debt, in subsequent seasons.

Table 26 shows crop insurance results for three farm sizes assuming the same ₱400 difference between consumption requirements and income reflected in Table 19. This large consumption per income gap causes a high default rate for all farm sizes, so it is a high estimate of insurance benefit crop. This and subsequent tables show the results as increases or decreases compared with the situation depicted in Table 19.

The results in Table 26 show that the crop insurance program analyzed here has greater benefit to small farmers than to large farmers. This is because it insures the difference between production and a minimum consumption level, not the difference between actual and normal production.

TABLE 26

Increases in Average Level of Inputs, Yield, and Income Due to a Fully-subsidized Crop Insurance Plan with a ₱400 Consumption/Income Gap.

Farm Size (hectare)	Nitrogen (kilogram/ hectare)	Other Inputs (₱/hectare)	Yield (kilogram/ hectare)	Income (₱/hectare)
		Irrigated		
5.0	24	114	343	90
2.5	30	139	424	111
1.0	36	209	651	172
		Rainfed		
5.0	14	61	171	45
2.5	20	80	231	61
1.0	32	121	368	98

Table 27 shows the results when farmers pay part of the cost of the crop insurance program. Large farmers partially subsidize small farmers because the probability of default of the larger farmers is less than that of the small farmers. This is because of the assumed identical subsistence consumption levels.

TABLE 27

Increases in Average Level of Inputs, Yield and Income Due to Crop Insurance Plan Financed By 8 Per Cent Per Season Interest Charge on Loans With a ₱400 Consumption/Income Gap.

Farm Size (hectare)	Nitrogen (Kilogram/ hectare)	Other Inputs (₱/hectare)	Yield (Kilogram/ hectare)	Income (₱/hectare)
		Irrigated		
5.0	20	107	317	45
2.5	26	132	398	66
1.0	32	197	625	127
		Rainfed		
5.0	8	51	132	10
2.5	14	70	192	26
1.0	26	111	329	63

An alternative estimate is shown in Table 28, for cases where non-farm income is sufficient to cover subsistence consumption requirements. Here, the benefits of crop insurance are considerably less than the case shown in Table 26. This is because the ability to meet consumption requirements eliminates the consumption loan needs. Without the income consumption gap, repayment performance does not vary by farm size, so results are not shown by size.

Conclusions and Implications

The data from a series of surveys of rice farmers in 3 provinces between the wet season of 1975 and the dry season of 1977 showed that farmers with less than 1 hectare borrowed from Masagana 99 less frequently than moderate size farmers (1.0-2.5 hectares). The small farmers borrowed more per hectare than the medium sized farmers, who in turn borrowed more than the large farmers (>2.5

TABLE 28.

Increases in Average Level of Inputs, Yield and Income Due to Crop Insurance Plan, No Consumption Gap.

Farm Type	Nitrogen (Kilogram/ hectare)	Other Inputs (₱/hectare)	Yield (Kilogram/ hectare)	Income (₱/ha)
		Fully-subsidized crop insurance		
Irrigated	18	89	264	73
Rainfed	9	41	112	33
		Eight per cent Interest charge		
Irrigated	14	81	238	23
Rainfed	3	31	73	–7

hectares). However, there was generally no difference in the expenditures on inputs, yield, levels, and net revenue of farmers in the three size groups. Hence, the empirical evidence indicates that small farmers used the Masagana 99 loan program for consumption and production credit.

A computerized simulation model was built to examine the effects of policy initiatives on the fertilizer application rate, yields and net income of farmers with various farm sizes. Results were separately generated for irrigated and rainfed farms. It was assumed that all three sizes of farms use ₱400 per farm for consumption. This assumption resulted in a difference of 20 kilogram per hectare of fertilizer use between the 1.0 hectare farms and the 5.0 hectare farms, even with the same response function, irrigation conditions and decision rules.

The simulation model examined the effect of variations in interest rate, fertilizer price, rice price, and the impact of a crop insurance program on farms of various sizes.

Use of fertilizer, other inputs and consequently income was very non-responsive to variations in the interest rate from 16 to 48 per cent per year on both rainfed and irrigated farms. The analysis showed much greater differences between the three farm size groups and the low and high interest rate for any group. The largest response between low and high interest rates was 5 kilogram per hectare of nitrogen reflected in about 50 kilogram per hectare of output. This suggests a relatively little gain from policies fixing interest rates.

Analysis of the response to fertilizer price variation showed small farmers to be substantially less responsive to price changes at high prices than the large farmers. For example, at a fertilizer price of ₱5.00 per kilogram, a ₱0.10 per kilogram reduction induced the 5 hectare farmers to increase fertilizer application by 1.3 kilogram per hectare. The 1 hectare farmers on the other hand, would only increase their use by 0.7 kilogram per hectare. This was reflected in a 13.2 kilogram per hectare yield increase in the 5 hectare farms and an 8.2 kilogram increase in the 1 hectare farm. Despite these differences in fertilizer use and yield brought about by the price change, both farms gained about ₱5 per hectare, because of their differences in production function. At lower fertilizer prices the response was quite uniform across size. This indicates that fertilizer price changes have a very similar impact on rice farms of all sizes.

A similar impact was noted when rice price variation was evaluated. All three farm size groups reacted similarly. A 25 per cent increase in palay price from ₱1.00 to ₱1.25 per kilogram led to a 10 kilogram increase in nitrogen applied on 5 hectare rainfed farms and an 8 kilogram increase on 1 hectare farms. The resulting income rise was ₱320 on the 5 hectare farms and ₱308 on the 1 hectare farms.

Crop insurance policy was found to be significantly benefiting the small farmers. The 1 hectare farmers had yield increases roughly twice as large. Income increases were more than twice as large as the 5 hectare farmers because of the crop insurance policy examined. This manifests the ability of small farmers to remain in the lower cost, higher loan limit institutional credit market despite losses brought about by bad weather. The benefits gained by large farmers were less because through their higher income generating capacity they tended to remain in the institutional credit market even without crop insurance. When a charge for crop insurance was built the relative benefit to small farmers was reduced. Their gains per hectare though, still exceeded those of the large farmers.

This study suggests that small farmers can be differentially assisted by imaginatively designed policies. But the usual price and income policies will likely assist small farmers less than big farmers, even on a per hectare basis. This conclusion means that any serious attack on the problems of income distribution must tackle the issue on the distribution of assets. On the other hand, the empirical analysis and model do not support the contention that present policies and technological changes have been differentially attractive to larger farmers.

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