SUPPLY RESPONSIVENESS OF RICE FARMERS IN LAGUNA, PHILIPPINES

J. C. FLINN, K. P. KALIRAJAN* and LINDA L. CASTILLO†

International Rice Research Institute, P.O. Box 933, Manila, Philippines

The supply response and input demand by farmers using modern rice technology in Laguna, Philippines were estimated using profit function analysis. The results indicate that farmers do maximise short-term profits and respond to price changes efficiently. The supply elasticity of rice with respect to its own price was approximately unity. Changes in real wages were estimated to have a greater impact on rice profit and supplies than changes in the real prices of mechanised land preparation, fertiliser or pesticides. Production elasticities derived from the profit function were consistent with those estimated directly from the underlying production function.

Like many Asian countries, the Philippines seeks self sufficiency in domestic rice requirements. By most measures the Government has been successful in this task; in 1971 the Philippines imported nearly 0.37 mt of rice but by 1980 exports were in the order of 0.24 mt (Palacpac 1980). The increase in output was brought about by a combination of land reform, government investment in rice infrastructure (particularly irrigation), farmer adoption of high-yielding rice varieties and increased use of chemicals, notably fertiliser.

These sources of output growth, while effective in the 1970s, may be more difficult to repeat in the 1980s. The irrigation areas easiest and least costly to exploit have been developed and, in general, input costs are rising relative to rice prices. Under these circumstances, policy analysts are interested in rice supply response and the demand for inputs among farmers who already have adopted the currently available modern rice technology. Estimates of supply response for rice as input levels (notably fertiliser) change are reported in several studies (e.g. David and Barker 1978; Rosegrant and Herdt 1981). However, there are few which report supply response and input demand in response to changing prices.

The conventional method of studying supply response is to use time series data and regress quantity supplied on price allowing for various lags and shifters in the model. Lim (1975) reviewed the estimation difficulties inherent in this approach. One problem is that input demand and output supply are parts of a general system, hence estimating the latter alone may provide inefficient estimates of the underlying supply relationship. It is desirable, therefore, to estimate simultaneously the interlinked output supply and factor demand equations. Profit function analysis, the procedure used in this paper, is an approach to deriving simultaneously these systems of output supply and factor demand equations (Yotopoulos and Nugent 1976; Yotopoulos and Lau 1979).

* Now at the National University of Singapore, Singapore.
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The profit function model, popularised by Lau and Yotopoulos (1972), expresses the maximum profit of a firm in terms of prices of output and variable inputs and quantities of fixed factors of production. Thus, the framework accommodates the reality that prices, technology and resource endowments may vary among farmers.

The assumptions inherent in a profit function model are (Lau and Yotopoulos 1972, p. 11):

(a) firms seek to maximise short-term profits, given the resources and technology with which they operate;
(b) firms are price takers with respect to prices received for output and prices paid for inputs; and
(c) the production function which underlies the profit function exhibits decreasing returns to scale in the variable inputs.

The assumption of a profit, as opposed to a utility, maximising objective has been criticised widely (e.g. Lipton 1968; Dillon and Anderson 1972). Whether this assumption is valid as a working approximation for a given set of data can be verified statistically within the profit function context (Junankar 1980). There are other limitations of profit function methodology. For example, the model is static. Actual profits (which must be positive) are used as a proxy for expected profits. Estimating a profit function is also contingent on different farmers facing different input and product prices. It is critical, therefore, that the price variability recorded reflects true variability in prices received and paid by sample farmers for the same input or product; not differences related to farmer's storage or sale policies, quality differences, etc. nor differences arising from errors in measurement.

The Study Area and Model

A sample of 81 rice farmers was drawn from the province of Laguna which lies between Los Baños and Manila in the Philippines. Their environment is not typical of most Filipino rice farms in the sense that they used advanced methods of rice production and above average opportunities exist for employment in the non-agricultural sector. Nonetheless, their situation provides an example of what the rice sector may look like as technological change and industrialisation spread to other parts of the country.

Four farmers included in the sample were owner-operators and the remainder were lease-holders and share-tenants. The sampled farmers, on average, double-cropped 2.2 ha of well-irrigated rice land (Table 1). A third of the sample owned carabao (water buffalo) and 41 per cent owned hand tractors in 1978. However, all the farmers used carabao for land preparation and 93 per cent used tractors as well. Even on mechanised farms, carabao are still used for operations not easily handled with machines (e.g. preparing the edges of paddy fields) and frequently for final harrowing as well. The farmers grow modern varieties and by Philippine standards apply high levels of fertiliser per unit of land. In the

1 This assumption is necessary to link the primal production and dual profit models of the production process. However, input demand and output supply functions (elasticities) are directly derived from the restricted profit function without having to assume profit maximisation (Bapna, et al. 1981).

2 Cordova (1979) and Smith and Gascon (1979) review changes in rice production in Laguna between 1965 (before the introduction of modern varieties) and 1978.
### TABLE 1
Rice Production Systems, Laguna, Wet Season, 1978

<table>
<thead>
<tr>
<th>Item</th>
<th>Physical units</th>
<th>Unit</th>
<th>Level</th>
<th>Value (P/unit)</th>
<th>Mean (P)</th>
<th>CV(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice area</td>
<td></td>
<td>ha</td>
<td>2.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output/ha</td>
<td></td>
<td>t</td>
<td>3.90</td>
<td></td>
<td>1047</td>
<td>11</td>
</tr>
<tr>
<td>Paddy (rough rice)</td>
<td></td>
<td>kg</td>
<td>250</td>
<td></td>
<td>1.52</td>
<td>9</td>
</tr>
<tr>
<td>Fertiliser</td>
<td></td>
<td>kg</td>
<td>1</td>
<td></td>
<td>130.58</td>
<td>28</td>
</tr>
<tr>
<td>Pesticides</td>
<td></td>
<td>kg</td>
<td>28</td>
<td></td>
<td>1.48</td>
<td>26</td>
</tr>
<tr>
<td>Carabao</td>
<td></td>
<td>hours</td>
<td>32</td>
<td></td>
<td>14.97</td>
<td>18</td>
</tr>
<tr>
<td>Power tiller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour/ha*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establishment</td>
<td></td>
<td>days</td>
<td>26</td>
<td></td>
<td>13.63</td>
<td>15</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>days</td>
<td>32</td>
<td></td>
<td>14.64</td>
<td>13</td>
</tr>
<tr>
<td>Harvest</td>
<td></td>
<td>days</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>days</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample size</td>
<td></td>
<td>n</td>
<td>81</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey conducted by Department of Agricultural Economics, IRRI, during dry season 1979.

* In the dry season 1979, a US$1 = P7.35. CV is the coefficient of variation of the price of that input.

* The value of family labour imputed at the equivalent cost to hire that service.

* This payment is in kind, being one-sixth to one-seventh of the gross yield.

Survey season, yields were 3.9 t/ha, nearly twice the national average. The largest direct or imputed expenditures for rice production were for labour and for land preparation (plowing and harrowing).

Mean prices and the coefficient of variation of prices are listed in the last two columns of Table 1, respectively. Fertiliser had the lowest reported price variability and pesticides the highest. The price variability recorded for rice and fertiliser were unlikely to be due to quality differences. Modern varieties of rice, mainly IR36, are sold after harvest while fertilisers (mainly urea) are standard products. Pesticides, however, cover a more heterogeneous range of inputs. Observed price differences were related to location (varying labour and transport costs) and differences in dealer prices and interest rates within and between locations.

The output function for the rice production process was specified as:

\[
Y = a \prod_{i=1}^{6} x_i^{b_i} \prod_{i=1}^{2} z_i^{c_i} \exp dD + u,
\]

where \( Y \) = output of rice, per farm (kg);
\( X_1 \) = quantity of fertiliser applied (kg);
\( X_2 \) = number of days of mechanical (hand tractor) power used in land preparation;
\( X_3 \) = quantity of pesticide applied (kg of active ingredient);
\( X_4 \) = number of carabao days used for land preparation;
\( X_5 \) = number of days of transplanting labour;
\( X_6 \) = number of days of labour used for crop maintenance, mainly weeding;
\( Z_1 \) = rice area (ha);
$Z_1 = \text{capital service flow (Pesos)}^1$;
$D' = \text{an irrigation scale ranging from 1 to 5 based on the reliability of irrigation supplies;}$
$u = \text{an error term with usually-assumed properties; and}$
$a, b, c, \text{ and } d$ are parameters to be estimated under restrictions$^4$:

$$0 < b, c < 1 \text{ and } \Sigma b, c < 1.$$

Because of the Cobb-Douglas form of the production process limitations are imposed on the generality of the results which can be deduced from the analysis. For example, the elasticity coefficients are constant, implying constant shares regardless of input level, and the elasticity of substitution among inputs is unity. Yet for practical purposes this functional form continues to be applied with effect (e.g. Dillon and Anderson 1972; Yotopoulos and Lau 1979). A Cobb-Douglas production function was used for two reasons. First, estimating the parameters is straightforward, as is their interpretation in the dual profit-function because it is also Cobb-Douglas. Second, using this model allowed more ready comparison of our results with others.

The normalised restricted profit function, derived from the underlying production function (1), is given by Yotopoulos and Lau (1979):

$$\ln \Pi* = \ln \alpha + \Sigma \beta_i \ln P_i + \Sigma \gamma_j \ln Z_j + \delta D + u,$$

where $\Pi^* = \text{restricted profit (current revenue less current variable costs) per farm, normalised by the price of rice;}$
$P_i = \text{the real price of fertiliser/kg}^2;$
$P_r = \text{the real cost/day of renting a power tiller;}$
$P_p = \text{the real price of pesticides/kg;}$
$P_a = \text{the real price/day of animal power;}$
$P_o = \text{the real wage/day for crop establishment}^6;$
$P_m = \text{the real wage/day for crop maintenance};$
$Z_i, Z_j, \text{ and } D$ are as defined in equation (1); and
$\alpha, \beta_i, \gamma_j, \text{ and } \delta$ are parameters to be estimated.

The profit function is 'restricted' in the sense that equation (2) specifies the profit realised when the quantities of some inputs are fixed in the short run. It is also specified in terms of normalised prices of variable inputs and quantities of fixed factors. As such, the associated levels of variable inputs, $X'^*_i$, which maximise expected profits cannot be estimated directly from equation (2). The optimal levels of variable inputs are estimated from the input demand functions which, via the Shephard-Hotelling lemma, are derived by differentiating the profit function with respect to input prices (Yotopoulos and Lau 1979, p. 12). The

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$^1$ The capital service flow, $Z_1$, was calculated as the sum of depreciation, maintenance and opportunity cost on the farmers' capital assets used in rice production. Junankar (1980) discusses a number of the problems inherent in measuring capital inputs in profit function studies.

$^4$ For economy in printing and ease of reading, we hereafter do not specify the range over which $i$ and $j$ are summed.

$^6$ The real price of an input is the cost/unit normalised by output price. Thus, $P_i = P_r / P_o$ where $P_r$ is the unit cost of fertiliser and $P_o$ the price of rice.

$^6$ Family resources were valued at an opportunity cost equivalent to the hiring rate for that service at that time. Harvest labour is not included in the production or profit function as it is a function of output.
negative of the partial derivative of the profit function (2) with respect to the normalised price of an input yields directly the demand function for that factor. For the case of the Cobb-Douglas restricted profit function:

\[ X' = -\delta \Pi^*/\delta P = -\beta \Pi^*/P. \]

Equation (3) is rearranged and estimated empirically as:

\[ (X', P)/\Pi^* = \beta + v, \]

where \( X' \) is the quantities of variable production inputs defined in equation (1); and

\[ v = \text{error terms representing divergence between expected and realised price of each variable input.} \]

Because of the assumed Cobb-Douglas form of the underlying production function, the simultaneous solution of equation (4) and the profit function (equation 2), provides estimates of the factor demand elasticities as opposed to the factor demand equations. Zellner's seemingly unrelated regression method provides asymptotically efficient estimates of the parameters \( \alpha, \beta, \gamma, \) and \( \delta \) (Byron 1970).

**Results and Discussion**

**Profit maximising assumption**

A condition necessary to derive a profit function from its underlying production function is that farmers maximise short-term profits (i.e. equate the marginal value products of variable inputs to their respective opportunity costs). The validity of this assumption can be tested directly by examining whether the \( \beta \) parameters derived from the profit function and those derived from the factor demand equations coincide (Yotopoulos and Lau 1979, pp. 15-16; Junankar 1980). If the \( \beta \) parameters derived from these two sets of equations do not differ significantly, then the sample farmers, on average, maximise short-term profits, given their technology and resource base. Because it is desirable to estimate simultaneously the profit and factor demand equations to avoid problems of simultaneous equation bias, Yotopoulos and Lau (1979) and Junankar (1980) constructed \( F \) statistics to test the null hypothesis that the \( B_k \)s, when derived from the two sets of equations separately and jointly, do not differ significantly.

Byron (1970) shows that this null hypothesis can also be directly evaluated by examining whether the Lagrange multipliers, used in the Aitkens least squares technique to impose the restrictions, differ significantly from zero. If they do not, the hypothesis of profit maximisation cannot be rejected. This approach has been further elaborated by Kalirajan (1981). Byron (1970) similarly shows that the restrictions as a whole can be tested using Wald's (1943) test statistic which is asymptotically \( \chi^2 \) with \( k \) (number of restrictions) degrees of freedom.

The Lagrange multipliers were not significantly different from zero, nor was the \( \chi^2 \) test (Table 2).\(^7\) Thus, the hypothesis that Laguna rice farmers maximise current profits cannot be rejected. The acceptability of this assumption is supported by Roumasset's (1976) finding that a sample of farmers he studied in the same province maximised expected profits.

\(^7\) The algorithm LINRES developed by R. P. Byron and extended by K. P. Kalirajan at the Australian National University in Canberra was used to solve this problem.
TABLE 2

Tests of Restrictions on β-Parameters of Restricted Profit Function and Factor Demand Functions

<table>
<thead>
<tr>
<th>Restrictions</th>
<th>Lagrange multipliers</th>
<th>( \chi^2 )-test statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertiliser</td>
<td>1.513</td>
<td></td>
</tr>
<tr>
<td>Mechanical power</td>
<td>6.080</td>
<td></td>
</tr>
<tr>
<td>Pesticides</td>
<td>5.110</td>
<td></td>
</tr>
<tr>
<td>Animal power</td>
<td>1.832</td>
<td></td>
</tr>
<tr>
<td>Crop establishment</td>
<td>3.973</td>
<td></td>
</tr>
<tr>
<td>Crop maintenance</td>
<td>3.838</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.985)</td>
<td>(2.181)</td>
</tr>
<tr>
<td></td>
<td>(4.496)</td>
<td>(3.644)</td>
</tr>
<tr>
<td></td>
<td>(4.693)</td>
<td>(2.556)</td>
</tr>
<tr>
<td></td>
<td>0.762</td>
<td>1.355</td>
</tr>
<tr>
<td></td>
<td>1.089</td>
<td>0.503</td>
</tr>
<tr>
<td></td>
<td>1.822</td>
<td>1.284</td>
</tr>
</tbody>
</table>

* Figures in parentheses are standard errors of estimates (\( n = 81 \)).

* Student \( t \)-values to assess whether \( \lambda \) was significantly different from zero. None of the \( t \)-values are significant at the five per cent level.

and that uncertainty considerations were not dominant in explaining differences between these farmers' use of inputs in rice production.

Elasticities of output supply and input demand

The parameter estimates of the restricted profit function and the associated factor demand elasticities are listed in Table 3. The coefficients are logical in sign and, other than for the real prices of transplanting labour and animal power, they are significantly greater than zero.

TABLE 3

Jointly-Estimated Normalised Profit Function and Factor Demand Elasticities, Wet Season, Irrigated Rice, Laguna, 1978*

<table>
<thead>
<tr>
<th>Variable(^{a})</th>
<th>Restricted estimates</th>
<th>Factor demand elasticities</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>8.065</td>
<td>-0.157** (.055)</td>
</tr>
<tr>
<td>( \beta_1 )</td>
<td>-0.157** (.055)</td>
<td>-0.157** (.055)</td>
</tr>
<tr>
<td>( \beta_2 )</td>
<td>-0.257** (.053)</td>
<td>-0.257** (.053)</td>
</tr>
<tr>
<td>( \beta_3 )</td>
<td>-0.052** (.020)</td>
<td>-0.052** (.020)</td>
</tr>
<tr>
<td>( \beta_4 )</td>
<td>-0.087( ^{--} ) (.084)</td>
<td>-0.087( ^{--} ) (.084)</td>
</tr>
<tr>
<td>( \beta_5 )</td>
<td>-0.139( ^{--} ) (.258)</td>
<td>-0.139( ^{--} ) (.258)</td>
</tr>
<tr>
<td>( \beta_6 )</td>
<td>-0.258** (.076)</td>
<td>-0.258** (.076)</td>
</tr>
<tr>
<td>( \gamma_1 )</td>
<td>0.739** (.109)</td>
<td></td>
</tr>
<tr>
<td>( \gamma_2 )</td>
<td>0.084* (.039)</td>
<td></td>
</tr>
<tr>
<td>( \delta )</td>
<td>0.094* (.044)</td>
<td></td>
</tr>
</tbody>
</table>

* Numbers in parentheses are estimates of asymptotic standard errors (\( n = 81 \)). ** and * indicate significance at the one and five per cent levels, respectively; \( ns \) indicates not significant.

* Variable inputs (fertiliser, machines, pesticides, animal power and labour) are in terms of real prices; fixed inputs are in physical units.
The output (i.e. supply) elasticity for rice with respect to its own price (estimated as $\Sigma \beta_i$) is approximately one (0.95). By implication, Laguna farmers are responsive to changes in rice price. For planning purposes, therefore, a one per cent change in rice price, ceteris paribus, would probably bring about a similar change in rice supplies from this province.

Our estimates imply that a 10 per cent increase in real wages would induce a 4.0 per cent decrease in rice supplies, comprised of a 2.6 per cent decrease due to reduced labour use in crop management and a 1.4 per cent decrease due to reduced labour use for transplanting. Wage rates in this part of Laguna will most likely continue to rise. If real wages increase, adjustments in labour use for crop maintenance may be partly offset by increased use of herbicides. Similarly, rising costs of transplanting labour may make direct seeding or mechanical transplanting more attractive to farmers than it is at present.

The estimated price elasticity of demand for fertiliser (−1.16) is higher but consistent with the range −1.06 to −1.11 reported by Monge (1980) for Central Luzon, and assumed by Rodriguez (1981) when examining the impact of changing fertiliser prices on the rice sector in the Philippines. The recent 10 to 15 per cent increase in the real price of fertiliser in the Philippines may, therefore, induce a 12 to 18 per cent decrease in fertiliser use in the region in the short run. This in turn, given the functional form of our profit function, would reduce profits by a similar proportion.

The demand for mechanical land preparation (elasticity of −1.26) is more responsive to changes in rice prices than was the demand for animal power (−1.09) and pesticides (−1.05). By implication, agricultural machinery policies (e.g. tariffs or subsidies on power tillers or regulated fuel prices) are predicted to have a quantifiable effect on the demand for machinery services in rice production and, consequently, on rice output. However, the analysis does not provide the opportunity to examine the cost effectiveness or distributional impact of alternative mechanisation policies.

The elasticity of rice output with respect to land input exceeds 0.7 while that with respect to capital is less than 0.1. Thus, within the range of farm sizes studied, an increase in farm size would have a substantial impact on farm profits when compared to increases in capital intensity per farm. Improving the quality of irrigation also has a significant impact on output. The small magnitude of the irrigation quality variable is probably due to the fact that the wet-season crop is less dependent on irrigation supplies than is the dry-season rice crop, and that the level of irrigation management in Laguna is good by Philippine standards. Therefore, the results would not apply to the less adequately irrigated areas of Laguna or to the Philippines in general.

Production elasticities

By duality, there is a one-to-one correspondence between the production and profit function. As a result, implicit production elasticities can be derived from the profit function. The indirect production elasticities

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* The own and cross-price elasticities of demand can be derived from the profit function (Yotopoulos and Lau 1979). For example, given a Cobb-Douglas production function, the demand for variable inputs is price elastic ($\beta_i$) and the cross-price elasticity of input $i$ with respect to the real price of input $k$ is $\beta_{ik}$. 

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TABLE 4

Maximum Likelihood Estimates of Rice Production Function and Production Elasticities Derived from the Profit Function, Wet Season, Irrigated Rice, Laguna, 1978

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>MLE estimates</th>
<th>Indirect estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a$</td>
<td></td>
<td>504.240</td>
<td></td>
</tr>
<tr>
<td>$b_1$ Fertiliser</td>
<td>kg</td>
<td>0.080** (.01)</td>
<td>0.081</td>
</tr>
<tr>
<td>$b_2$ Mechanical power</td>
<td>days</td>
<td>0.124** (.006)</td>
<td>0.132</td>
</tr>
<tr>
<td>$b_3$ Pesticides</td>
<td>kg</td>
<td>0.027** (.007)</td>
<td>0.027</td>
</tr>
<tr>
<td>$b_4$ Carabao</td>
<td>days</td>
<td>0.124** (.002)</td>
<td>0.045</td>
</tr>
<tr>
<td>$b_5$ Labour establishment</td>
<td>days</td>
<td>0.020** (.022)</td>
<td>0.071</td>
</tr>
<tr>
<td>$b_6$ Labour maintenance</td>
<td>days</td>
<td>0.143* (.007)</td>
<td>0.132</td>
</tr>
<tr>
<td>$c_1$ Area</td>
<td>ha</td>
<td>0.364** (.021)</td>
<td>0.379</td>
</tr>
<tr>
<td>$c_2$ Capital flow</td>
<td>P</td>
<td>0.004** (.020)</td>
<td>0.048</td>
</tr>
<tr>
<td>$d$ Irrigation</td>
<td>scale</td>
<td>0.021** (.002)</td>
<td></td>
</tr>
</tbody>
</table>

Numbers in parentheses are standard errors. ** and * indicate significance at the one and five per cent levels, respectively; ns indicates not significant.

Indirect production elasticities estimated as in equation (5).

\[(b' \text{ and } c') \text{ are derived from the parameters of the profit function as follows (Yotopoulos and Lau 1979, p. 21):}\]

\[b' = -\beta(1 - \mu)^{-1} \text{ for variable inputs; and}\]

\[c' = \gamma(1 - \mu)^{-1} \text{ for fixed inputs,}\]

where \(\mu = \Sigma \beta;\) and \(\beta\) and \(\gamma\) are estimated from equation (2).

The indirect production elasticities (\(b'\), \(c'\)) and the production elasticities estimated directly from the production function (the \(b\) and \(c\)) of equation (1) are listed in Table 4.

It is not possible to test whether the two estimates of the production elasticities differ significantly because the indirect estimates do not have standard errors in the normal sense. However, both sets of production elasticities are logical and reasonably similar. The three most dissimilar estimates are either not significantly different from zero when estimated directly (capital service flow) or indirectly (animal power) or both (labour for crop establishment).

The similarity between the directly and indirectly derived production elasticities has two implications. First, it reinforces the acceptability of the profit maximising assumption which underlies the equivalence of the primal (production) and dual (profit) models of production. As a result, we have added confidence in the rice supply and input demand elasticities reported in Table 3. Second, simultaneous equation bias does not seem to be a problem when estimating the production elasticities from the production function specified as equation (1).

Both the directly (0.89) and indirectly (0.92) derived production elasticities imply that decreasing returns to scale prevail. The production elasticities estimated for land (0.36 to 0.38) are consistent with those reported for other parts of the province (Kikuchi and Hayami 1980) and
more generally for the Philippines (Ryan 1978). Also, the short-run production elasticity for fertiliser (0.08) is similar to those reported by David and Barker (1978) for modern rice in the Philippines. The production elasticity is somewhat lower for pesticides (0.03) than for fertilisers. This is not surprising as Laguna farmers now grow modern varieties which, while fertiliser responsive, are resistant to many of the more common rice pests.

Summary and Inferences

Rice supply and input demand elasticities were estimated using profit function analysis for a sample of farmers in Laguna, Philippines who use advanced methods of irrigated rice culture. An assumption inherent in this approach, which was tested, is that farmers maximise short-term profits, given the technology and fixed resources at their disposal. The analysis shows, inter alia, that the sample farmers, on average, maximise profits with respect to normalised prices of variable inputs, thus supporting empirically the assumption of profit maximisation.

The analysis implies that Laguna rice farmers respond to price changes in an efficient manner. Output supply was responsive to rice price (elasticity of 0.95) and, on the input side, most sensitive to wage rates, the cost of mechanical land preparation and, to a lesser extent, the real price of fertiliser. The price elasticities generated provide part of the data base that is needed to evaluate the implications of alternative price policies on rice supplies and input demand in an advanced rice producing region of the Philippines.

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