EARNINGS AND EFFORTS OF FAMILIES
ON SMALL FARMS IN HAWAII

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Analysis of a statewide random sample of small farm operators in Hawaii shows no statistical relation between net farm income and contacts with Cooperative Extension, nor with levels of education of the operators. Experience in farming and total sales were more powerful influences in this cross-sectional analysis. Non-farm income for such families is also analyzed as a part of overall family strategies.

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Small farms contribute little to total agricultural production in the U. S., the families who operate them typically receive more income from non-farm sources than they do from their farms, and many of the operators are disabled or aged. Some people feel small farms should thus not be included in agricultural programs. However, some of these farms could contribute to agricultural production to a substantially greater degree if improved techniques were used, and for many new farm operators the small farm is the only viable entry point to become a successful commercial farmer. Furthermore, the continued healthy existence of small farms may be an important means of maintaining viable rural communities. Without entering further into the debate about the value of maintaining small farms in a society that is increasingly complex and specialized, it seems useful to pursue questions about the behavior and motivations of families who operate small farms. Such information may help clarify some of the issues in the debates about small farm policy.

The Study Population

A study of small farms was conducted in Hawaii, using a statewide random sample of 638 farm operators who had less than $20,000 in gross sales during the preceding year. A response rate of 98 percent was secured. These farms were a mixture of producers of coffee, vegetables, nursery products, cattle, sugar, fruit, and miscellaneous other commodities. The mean non-farm income was $13,474 in 1977, the mean age
of the operator was 56, and the mean education level was 11 years. The annual gross farm sales averaged $6,400.

These farm families can be viewed as having developed a balanced portfolio of activities that produce income and lifestyles that the families generally judged to be superior to concentrating on large-scale farming or leading a totally urban existence. This does not mean that everything was exactly balanced the way the families preferred at all times, but there was no evidence of a widespread, pent-up frustration from being unable to devote more attention to farming. An indication of this feeling is the result of presenting the families with the hypothetical possibility of improving their incomes by working more than at present. In such a case, their preferences for the types of changes they might prefer were as follows:

<table>
<thead>
<tr>
<th>Type of Change</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Work Increase Desired</td>
<td>43%</td>
</tr>
<tr>
<td>More Work on Family's Farm</td>
<td>29%</td>
</tr>
<tr>
<td>More Non-Farm Work</td>
<td>25%</td>
</tr>
<tr>
<td>More Other Agriculture Work</td>
<td>3%</td>
</tr>
</tbody>
</table>

A Simple Model

Following conventional theory, welfare (U) is assumed to be a function of consumption (X) and leisure (L),

\[ U = U(X, L). \]  

(1)

Goods and services can either be purchased in the market \(X_M\) or they can be taken out of the production of the family enterprise \(X_F\), which includes both farm and household production activities. The family also uses family-produced capital \(K_F\), as well as capital it purchases in the market \(K_M\).
Consumption is derived from work sold in the market (\(W_M\)) or used in the family enterprise (\(W_F\)). The production process is also affected by the goods and services employed,

\[ X = f(W_M, W_F, K_M, K_F), \]

which is subject to the standard conditions that marginal product be positive and declining. Time also is a constraint,

\[ T = W_M + W_F + L. \]

For purposes of simplification, a two-person household is assumed, one person being identified as the farm operator and the other as the spouse of the operator. Each earns a wage, explicitly in the market, denoted by \(w_M\), or implicitly in the family enterprise, denoted by \(w_F\). Standard maximizing conditions indicate that

\[ w_{MO} = w_{FO} = r_0 \]

and

\[ w_{MS} = w_{FS} = r_S \]

where \(w_{MO}\) and \(w_{FO}\) are the wage rates or marginal productivities of the farm operator, and \(w_{MS}\) and \(w_{FS}\) are the equivalent for the operator's spouse. The marginal rate of substitution between leisure and goods \(\left(\frac{\partial U}{\partial L}/\frac{\partial U}{\partial X}\right)\) is denoted by \(r_0\) and \(r_S\) for the operator and spouse, respectively.

The empirical estimation of the production function in equation (2) is fraught with obvious difficulty. Not only is the \(X_F\) component of \(X\) not known, but the measurement of \(K\) as a flow concept is a near impossibility. Other empirical difficulties emerge if the product of the family enterprise is partly consumed by the family and partly exchanged on the market, which of course is the empirical situation.
Nevertheless, some empirical data of relevance can be developed reliably and tested statistically.

The component of X gained outside the family enterprise is directly dependent on decisions to work in the market and the amount of capital held by the workers, which is usually in the form of education. Age is related to the time horizon of working lives and the work capacity of the individuals, both of which influence employers and employees in their decisions to have the individual employed. For historically valid investment reasons, age is also expected to negatively affect education levels. This sort of simple model was tested, and is shown in Figure 1. The only surprise in the preliminary analysis was the failure, and consequent elimination from the model, of the education of the spouse to be significantly related to the non-farm income of the family. This lack of significance would not seem to emerge from considerations that the marginal product of the more educated spouses would be so greatly valued in the family enterprise that it would not be rational for the spouse to seek employment in the market. Rather, it presumably derives from patterns of discrimination in job promotions, although such an explanation is somewhat speculative.

The interaction of the likelihood of the farmer holding a non-farm job and the likelihood of the farmer's spouse also holding a non-farm job is posited as being mutually reinforcing rather than being competitive. The opportunity costs in the labor market for farmers with higher education levels—including those who choose not to hold non-farm jobs—should be higher than those who have lower levels of education; consequently, it would be expected that the education levels of the primary operators of the farm would be positively associated with non-farm income, as well as...
possibly being positively associated with net farm income, even though marginal differences in education may contribute negligibly to farm profits. In other words, farmers with formal educations command a premium in the non-farm labor market and will logically devote less effective time and energy to the farm and more to non-farm employment than would a person with less formal education, ceteris paribus. But, if unusually appealing profits can be made in farming by some farmers, they will be exploited in preference to additional efforts in non-farm endeavors.

Job skills on the farm are not generally derived from formal education, so variations in formal education should not directly lead to varying production efficiencies on the farm. However, the opportunity costs in terms of non-farm employment are higher for farm operators with high education levels, which not only leads them to pursue non-farm employment, but they also command higher non-farm income once the decision is made to take the non-farm job.

(The path diagrams used in these figures are constructed as they are traditionally presented in the literature, with the arrows representing the direction of causation, and the numbers being standardized coefficients. The regression equations under the figures are equivalent to the path diagrams. Standard errors are shown in parentheses.)

Variations in Farm Income

Fluctuations of commodity prices may be the overwhelming factor in variations of net farm income. Unfortunately, such price data were not available for the farms in this study. As a result, the coefficient of determination for such a regression analysis explaining net farm income for farms that produce a wide range of commodities is expected to be low.
Nevertheless, some interesting relationships emerge, as shown in Figure 1. The level of total farm sales emerges as a strong variable. (This is a legitimate variable for consideration, for quite conceivably the biggest operations could have shown the biggest losses, which was indeed the case for cattle and sugar growers.) The negative coefficients shown for formal education and farming experience were contrary to expectations, even though the levels of significance were low.

The role of education has been discussed as an important variable in terms of non-farm income, and perhaps therein lies the explanation of its role in relation to net farm income. Conceivably, farmers with higher education levels exert less effort in achieving on-farm efficiency than they would if their off-farm efforts were less remunerative. A more reasonable assertion is that levels of education beyond full literacy are essentially irrelevant.

The absence of significant relationships between net farm income and the incidence of past contacts with the Cooperative Extension Service is disturbing to some people. Conceivably, extension agents have negligible effect, or more realistically, the data reflect the results of the more inherently efficient farmers having less need of such assistance. In other words, the direction of causality is not readily determined from such cross-sectional data. (It may be of interest to note that no correlation was found between gross sales and the incidence of contact with Extension.)

A positive relationship was anticipated between net farm income and the incidence of farmers who were actively increasing their farm operations, since those with higher farm incomes were likely to want to increase such incomes. No such relationship was found, suggesting that
a counteracting data discrepancy may be operative in the sense that expenditures to upgrade farm operations may have been responsible for lowering reported net incomes.

As one means of lessening the error involved in excluding price variations as a variable, the same regressions were performed for separate commodity groups. Since farmers in each of these groups faced much the same set of prices during the year in question, some of the questionable findings encountered in the analysis of the entire sample can be re-examined with less "noise" occurring from differences in commodity prices. As shown in Figure 2, formal education is more appropriately shown not to be significantly associated with net farm income, and contrary to the unexpected signs of the coefficient in the analysis of the larger population, experience in farming is positively rather than negatively associated with net farm income. Contact with Extension still is not significantly related. As would be expected, the $R^2$ is substantially higher.

**Financial Decisions**

A more complex path analytic diagram is shown in Figure 3. Although the $R^2$ values are low, most of the variables specified in the model achieved satisfactory levels of significance. (Causality rather than prediction is the objective of the exercise.) Total sales are positively associated with the operational expenses incurred and negatively associated with whether or not the farm operator's spouse had a non-farm job, thus being less available for on-the-farm labor. Due to the restriction on the observations to less than $20,000 in annual commodity sales, it was not reasonable to include in that regression a variable for off-farm employment for the farm operator. In other words, farming at this level
would not be impeded by off-farm employment. The level of operational expenses had a strong inverse correlation with the level of farm loans (for purposes other than land acquisition), reflecting that past capital improvements had a tendency to lower short-run operating costs. Such long-term loan commitments were in turn negatively associated with the age of the operator, reflecting the shorter planning horizons of the older farmers. The older operators were also definitely less likely to be considering expansion, as were families in which the operator's spouse held an off-farm job.

Conclusion

The foregoing discussion of families with small farms illustrates the complexity of the decision processes and of the factors that influence these decisions. The usefulness of Extension efforts is one of the more serious policy questions to be raised in this context. Although studies of the impacts of Extension have been conducted, little has been done with micro data such as used in this study of small farms. Furthermore, little is known about the value of properly targeting Extension efforts in terms of clientele needs and capacities. One might even raise the question of whether improved net farm income is an appropriate criterion of success for useful programs in Extension such as estate planning, soil conservation, and land use planning.

Another major question not fully explored is the way in which very special circumstances are exploited by families with small farms. Our awkward data handling procedures rarely reflect the subtleties of such "qualitative" differences, which leads to low $R^2$ values and unexpected signs. A third major analytic difficulty is common in much of the
literature in household economies: the empirical complexity of a family's objective function makes analysis of their decisions extremely difficult.
\[ J_f = 0.646 - 0.009A_f + 0.017E_f + 0.395J_s \]
\[ J_s = 0.310 - 0.005A_s + 0.025E_s \]
\[ Y_n = 1.746 + 0.601J_s + 0.236E_f + 1.562J_f \]
\[ Y_f = 1296 + 4.29C - 212.5E_f + 0.488S_f - 0.043F - 6171 \]
Figure 2. Regression Analysis of Net Farm Income for Coffee and Vegetable Farmers.

Contact with CES (C) → .08
Education of Farmer (E_f) → -.02 → .65
Total Farm Sales (S_f) → .79 → Net Farm Income (Coffee) (Y_{fc}) → .19
Experience in Farming (F) → -.29
Trying to Increase Farm Activity (I)

Contact with CES (C) → .10
Education of Farmer (E_f) → -.03 → .67
Total Farm Sales (S_f) → .59 → Net Farm Income (Vegetables) (Y_{fv}) → .22
Experience in Farming (F) → -.03
Trying to Increase Farm Activity (I)

\[ Y_{fc} = -1518 + 8.94C - 22.1E_f + .576S_f + 46.2F - 36861 \quad R^2 = .57 \]
\[ (8.99) (71.4) (.061) (17.8) (1088) \]
\[ Y_{fv} = -916 + 14.5C - 35.6E_f + .406S_f + 52.7F - 241.61 \quad R^2 = .53 \]
\[ (16.3) (150.7) (.078) (29.6) (740) \]
Figure 3. Regression Analysis of Farm Financial Decisions.

\[ S_f = 7465 - 1856J_g + .052X \]
\[ J_g = .310 - .005A_s + .025E_s \]
\[ J_f = .770 - .009A_f + .017E_f + .395J_g \]
\[ Y_n = 1.746 + .601J_g + .236E_f + 1.562J_f \]
\[ I = .762 - .010A_f - .101J_g + .015Y_n \]

\[ R^2 = .05 \]
\[ R^2 = .07 \]
\[ R^2 = .31 \]
\[ R^2 = .31 \]
\[ R^2 = .13 \]