Labor Allocation and Productivity
of Men and Women on Thai Farms

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Abstract

This paper examines the efficiency of labor allocation and the productivity of labor by gender between and within farm and non-farm enterprises on Thai farms. A Cobb-Douglas production function is estimated for both types of enterprises using disaggregated data. The estimated parameters of these functions are utilized to analyze efficiency and productivity issues. The results showed that inter-enterprise efficiency can be enhanced by allocating more labor of men to non-farm enterprises and more labor of women to farm enterprises, but cultural constraints may impede such substitution. Policy makers need to improve incentives for non-farm enterprises.

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OF MEN AND WOMEN ON THAI FARMS

INTRODUCTION

Rural development analysts and decisionmakers have placed increased emphasis on expanding rural non-farm employment in recent years. One area of concern has focused on rural industrialization and small-scale enterprises (Anderson and Lieserson; World Bank). Another has focused on the allocation of labor in farm households, including work on non-farm enterprises (Evenson; Onchan and Chalamwong). Numerous programs have been designed to enhance rural incomes through both farm and non-farm employment, but the allocative efficiency impacts of such programs have been largely ignored (Chalamwong, et.al.).

This paper reports on an analysis of resource use for a sample of Thai farms. The sample is particularly well suited for this study because detailed data were carefully collected on both farm and non-farm enterprises in the household.The purpose of the analysis is to analyze: 1) the efficiency of labor allocation by gender between and within farm and non-farm enterprises; and 2) the productivity of labor by gender in these enterprises. These issues are analyzed by estimation of a Cobb-Douglas production function and derivation of marginal productivity and efficiency criteria. The efficiency criteria utilized assumes that farm-households allocate resources consistent with the opportunity cost of these resources, and allow for a test of the hypothesis that farm-households allocate resources in different activities so that the opportunity cost of each resource is equalized across activities.

The framework used in this study also allows for an analysis of how market incentives can influence labor productivity of farm-households. Recent contributions to the economic development literature have stressed that improving such market incentives can lead to increased productivity of input use in the agricultural sector (Schultz). The relationship between incentives and women's productivity has received little attention in the literature on women's role in development (Cloud and Overholt).

ANALYTICAL FRAMEWORK

Consider a farm-household producing two outputs: an agricultural good (i.e. rice) and a non-agricultural good (i.e. bamboo baskets). The production function for each good is assumed to be the Cobb-Douglas form:

$$(1) \quad \ln Y_i = \ln A_i + \sum_{j=1}^{N} b_{ij} \ln X_{ij}$$

where i=1 for the farm good; i=2 for the non-farm good; $\ln Y_i$ is the natural log of the value of output of the respective good; b_{ij} is the output elasticity of the jth input used in the ith enterprise; $\ln X_{ij}$ is the natural log of the jth input used in the ith enterprise.

Profit maximization and economic rationality requires that farm-households allocate resources among competing activities so that the opportunity cost of each resource is equalized across activities. The opportunity cost of each input used in production is given by the value

of its marginal product (MVP) (Ferguson):

$$(2) \quad MVP_{ij} = b_{ij} \frac{Y_i}{X_{ij}}$$

Efficient allocation of resources requires:

$$(3) \quad b_{2j} \frac{Y_2}{X_{2j}} - b_{1j} \frac{Y_1}{X_{1j}} = 0$$

If the difference in eq. (3) is positive, then farm households use too much of the jth input in farm production vis-a-vis non-farm production. If eq. (3) is negative, then too much of the jth input is used in non-farm production. Resource misallocations that occur can then be explained by either the lack of economic rationality or due to the incentives and/or constraints that farm-households face (i.e. distorted product and input prices). Disincentives are reflected directly through the MVP of the input and reduce the opportunity cost and value of using an input in a particular enterprise.

STATISTICAL METHODOLOGY AND RESULTS

The Cobb-Douglas production function presented in eq. (1) is estimated by ordinary least squares separately for non-farm and farm enterprises, respectively, due to the availability of input use data by enterprise type. This approach overcomes drawbacks and/or alternative methods utilized in recent studies of multiproduct firms and farms (for example: Just, et.al.; Shumway, et.al.), such as lack of disaggregation of inputs used in different products and not considering the allocation of inputs that are constrained to the farm-household to different enterprises. These problems can lead to biases in the results and/or imposition of restrictions that may not be substantiated empirically.

The specification of eq. (1) differs between farm and non-farm enterprises in terms of the inputs utilized. A six input production function is specified for farm production, while a four input production function is specified for non-farm production. The inputs used are: X_{i1} the total number of hours of family male labor used in the ith enterprise; X_{i2} the total number of hours of family female labor used in the ith enterprise; X_{i3}, the amount of hours of hired labor used in the ith enterprise; X_{i4}, the intermediate input expense (in baht)[1] incurred in the ith enterprise; X_{i5}, the value of capital services (in baht) used in farming; X_{i6}, the amount of land cropped (in rai)[2]; Y_i is the total value of production of the ith enterprise. This study departs from previous work that weighted female labor contributions by a factor of .75 to .8 with respect to a male's labor contribution. A weighting scheme assumes that a woman's labor productivity is lower than a man's, but such differences have been challenged by recent empirical work (Cloud and Overholt). The reasons why women's productivity is low is explained away by such a weighting scheme before it can be analyzed. Measures of capital services and land utilized in non-farm enterprises were not available although the magnitudes of each are small compared to farm enterprises.

The data were part of an exceptionally rich data set collected from 424 farm-households in 25 villages in the Thai provinces of Chiang Mai, Khonkaen, Roi Et, and Suphan Buri during the 1980/81 crop year.[3] A total of 250 farm-households met the data requirements for the farm

production function estimation, and 91 satisfied the data requirements
necessary for estimation of the non-farm enterprise production function.

The results of the estimated Cobb-Douglas production functions are
presented in Table 1 for both farm and non-farm enterprises.[4/] The
estimates of the parameters b_{ij} are the estimates of the output elas-
ticities of the disaggregated inputs. The estimated parameters for the
farm production function are all significant at the 5 percent level and
are of reasonable magnitude. For the non-farm production function, all
coefficients, except the estimated output elasticity for hired labor, are
significant at the 5 percent level.

The estimated marginal value products (calculated by eq. (2)) for
each input by enterprise type are presented in Table 2. An analysis of
intrafarm enterprise efficiency reveals that hired labor and intermediate
inputs are underutilized, and capital services and land are overutilized
when the value of the marginal product is compared to the opportunity
cost of using these inputs (which is the relevant market input price).
Both male and female labor are overutilized on farm enterprises given the
market wage rate for farm labor. However, the opportunity cost of using
another hour of woman's labor time is twice as much as using another hour
of a man's labor time in farming.

Examination of intra non-farm enterprise efficiency reveals that
intermediate inputs are overutilized (again comparing the marginal value
product and market cost of these inputs), while male labor time is
underallocated and female labor time is overallocated based on the market
wage rate. The insignificance of the variable for hired labor implies
that farm-households will not hire labor for non-farm production.

Applying eq. (3) reveals that allocation of both male and female
labor time is overutilized in farm production (the difference calculated
in eq. (3) is positive), vis-a-vis non-farm production. This misalloca-
tion is more serious in the allocation of male labor time than female
labor time. This finding appears to contradict the main assumption
incorporated in the framework of the new household economics models:
economic agents allocate resources (including time and labor) so that the
opportunity cost of each resource in any activity is equalized (Evenson,
Sumner).

These results can be interpreted in relation to what is generally
known about labor allocation patterns in Thai farm-households. The
overutilization of resources in farming has been explained in other
studies by the risk aversion behavior of farmers. The rice crop is the
most important farm enterprise on most farms, both in terms of proportion
of total crop area and source of food for family consumption. Therefore,
it is argued that households first devote resources to assure family rice
subsistence, then to other enterprises to generate cash income.

Second, women tend to allocate relatively more time to non-farm
enterprises than men. Banno confirmed this result for this entire
sample. Traditions as well as logic influence this pattern. Men
traditionally perform some farm tasks such as plowing and harvesting,
while women transplant rice. On the other hand, women tend to stay
closer to the house in order to care for children, garden plots, and
animals and to prepare food. They work on non-farm enterprises during
periods when there is less labor demand for these tasks. Men also work
on some non-farm enterprises, such as blacksmithing and wood carving,
which earn a good return but for which some specialized skills are
required and product demand is limited and seasonal. They will not.

Table 1. Estimates of the Cobb-Douglas Production
Function for Farm and Non-Farm Enterprises

Parameter (Variable)	Enterprise Type	
	Farm	Non-Farm
Constant	6.0304	-2.1696
	(.3713)[a]	(1.0386)
b_{i1} (male labor)	.1143	.5572
	(.0430)	(.1099)
b_{i2} (female labor)	.1839	.5668
	(.0534)	(.1471)
b_{i3} (hired labor)	.0720	.0599
	(.0235)	(.0952)
b_{i4} (intermediate inputs)	.1225	.3887
	(.0341)	(.1217)
b_{i5} (capital services)	.0502	
	(.0279)	
b_{i6} (land)	.1996	
	(.0456)	
R^2	.4694	.5769
F	35.8223	29.3202
Number of Observations	250	91

[a] Standard errors in parentheses.

Table 2. Estimated Marginal Value Products for Inputs in Farm
and Non-Farm Enterprises and Market Input Prices

Input	MVPFarm[a]	MVPNonfarm[a]	Market Input Price[b]
Male Labor	1.1013(baht/hr)	6.175(baht/hr)	4.65(baht/hr)
Female Labor	2.1213(baht/hr)	3.056(baht/hr)	4.65(baht/hr)
Hired Labor	142.824 (baht/hr)	n.s.[c]	4.65(baht/hr)
Intermediate Inputs	215.779	.3870	1 baht[e]
Capital Services	.5232	n.a.[d]	1 baht
Land	191.992 (baht/rai)	n.a.[d]	500-900(baht/rai)

[a] The MVP is calculated using eq. (2) at the point of geometric means.
[b] Taken from Chalamwong, et al., p. 11.
[c] Not significant.
[d] Not available.
[e] 1 baht of capital services or intermediate inputs should return
1 baht (assuming no interest rate charges).

however, generally work on silk and cotton weaving and embroidery which provide much non-farm employment for women.

Both men and women take off-farm jobs. Frequently this work is not available at the average wage rate used in this study, or it is available just at the time of peak labor demand on the farm. In many cases, men migrate seasonally to bigger cities where they obtain employment in relatively high paying construction jobs. Someone must stay at home to protect the property, tend to children and livestock, and care for gardens. This usually is the wife because of her lower income earning potential in the labor force (Blaug).

IMPLICATIONS

Thai farm households appear to allocate their labor resources rationally within the limits of cultural constraints, but not consistent with market opportunities. These findings suggest that labor allocative efficiency can be enhanced by substituting more labor time of men for women in non-farm enterprises, and more labor time of women for men in farm enterprises. Thai farmers also lag behind some other Asian farmers in the use of modern varieties, fertilizers and other modern inputs. This underutilization of intermediate inputs is confirmed for these farms. The challenge for Thai decisionmakers, therefore, is to find ways to increase productivity of farm and non-farm rural enterprises, rather than simply increase low productivity employment. The productivity and income earning potential of women would be enhanced through improvement of incentives in non-farm activities (particularly product prices) which will raise the productivity and value of women's labor. The specific ways to do this are still being explored. Mead discusses how subcontracting with urban firms could contribute to improving the quality of production, improving production technology and increasing demand. A challenge that must be faced is that many products of several non-farm enterprises, such as pottery and bamboo products, face sharp competition from substitutes produced in the expanding manufacuturing sector.

NOTES

1/ Approximately 20 baht = $U.S. 1.00
2/ 1 rai = 0.4 acres.
3/ See Mead and Meyer for a description of sampling procedures and characteristics of the farm-households interviewed.
4/ A translog production function was fitted and estimated, but a test of the null hypothesis—the C-D is the appropriate production function—could not be rejected for either enterprise type.

BIBLIOGRAPHY

Anderson, Dennis and Leiserson, Mark W., "Rural Non-farm Employment in Developing Countries," Economic Development and Cultural Change, Vol. 28,, No. 2, January 1980.

Banno, Yasuo, "Farm Household Labor Supply in Non- and Off-Farm Work in Rural Thailand," Unpublished M.S. Thesis, Thammasat University, Bangkok, Thailand, 1982.

Blaug, Mark, "An Economic Analysis of Personal Earnings in Thailand," Economic Development and Cultural Change, Vol. 23, No. 1, October 1974.

Chalamwong, Yongyuth; Meyer, Richard; and Hushak, Leroy, "Allocative Efficiency of Part-Time and Full-Time Farms: The Case of Thailand," ESO No. 979, Department of Agricultural Economics, The Ohio State University. June, 1983.

Cloud, Kathleen and Overholt, Catherine, "Women's Productivity in Agricultural Systems: An Overview," in Rural Development Growth and Inequity, Contributed Papers Read at The 18th International Conference of Agricultural Economists, Gower Publishing Co. Ltd., 1983.

Evenson, Robert E., "Time Allocation in Rural Philippine Households," American Journal of Agricultural Economics, Vol. 60, No. 2, 1978.

Ferguson, C.E., The Neoclassical Theory of Production and Distribution, Cambridge University Press, Cambridge, Mass., 1979.

Just, Richard; Zilberman, David; and Hochman, Eithan, "Estimation of Multicrop Production Functions," American Journal of Agricultural Economics, Vol. 65, No. 4, 1983.

Mead, Donald C., "Subcontracting in Rural Areas of Thailand," Michigan State University, East Lansing, International Development Working Paper No. 4, 1982.

Mead, Donald C. and Meyer, Richard L., "Rural Off-farm Employment Surveys: Approaches and Methodology," Kasetsart University, Bangkok, Research Paper No. 3, May 1981.

Onchan, T. and Chalamwong, Y., "Rural Off-Farm Employment and Income of Rural Households in Thailand: Some Research Findings," Center for Applied Economics Research, Kasetsart University, Bangkok, Research Paper No. 4, October 1981.

Schultz, T.W. (editor), Distortion of Agricultural Incentives, Indiana University Press, 1978.

Shumway, C.; Pope, Roulon; and Nash, Elizabeth, "Allocatable Fixed Inputs and Jointness in Agricultural Production: Implications for Economic Modeling," American Journal of Agricultural Economics, Vol. 66, No. 1, 1984.

Sumner, Daniel A., "The Off-Farm Labor Supply of Farmers, American Journal of Agricultural Economics, Vol. 64, No. 3, August 1982.

World Bank, Thailand: Toward a Development Strategy of Full Participation, World Bank Country Report, Washington, D.C., World Bank, 1980.