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Economic Analysis of  
Labor Supply of Farm  
Families to Non-Farm Enterprises:  
A Preliminary View

by

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## FOREWORD

This paper is one of a series produced by the Rural Off-Farm Employment Assessment Project at Kasetsart University. The project is funded by the U.S. Mission of the Agency for International Development in Thailand under Project No. 493-0306. The objective of the Project is to provide information to the Royal Thai Government, USAID, and other international donors, to be used to identify and develop appropriate policies and programs for the rural non-farm sector in Thailand.

The Working Paper Series is designed to share interim or Preliminary results on different aspects of the Project work. Some papers also discuss methodologies to be used in future studies.

A list of Working Papers produced to date, along with a list of Research Papers of the Project, is included at the end of this report. Copies of papers in either series can be obtained from Dr. Tongroj Onchan, Director, Center for Applied Economics Research, Kasetsart University, Bangkok 9, Thailand.

Tongroj Onchan  
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## I. INTRODUCTION

### 1.1 Problem Setting

In Thailand, the rural poverty problems of farm families are of great concern to the government and persons affected. It has been recognized that Thai farmers have low income and live in poverty. The number of people (under poverty) is estimated to be about 11 million in recent years. It reveals the seriousness of the problems which need to be urgently resolved (Tongroj, et.al.). One alternative to alleviate poverty is to increase the employment opportunities in the rural sector. That is, employment-oriented development strategies which try to provide a meaningful employment in rural areas have to be seriously brought into consideration. So far, these strategies seem to be ignored among developing countries as stated by Meyer and Larson (1978):

The economic development strategies pursued in many low income countries have placed primary emphasis on large-scale, capital-intensive activities in both the agricultural and nonagricultural sectors. Small-scale, labor-intensive farm and non-farm firms have frequently been overlooked, at best, and in many cases have suffered discrimination from policies and programs which favor large-scale activities.

In Thailand, policies regarding the development in rural employment opportunities have been integrated in the National Economic and Social Development Board since the Fourth Plan. High among rural development policy goals of Thailand is the creation of meaningful employment

opportunities for rural families. Alternative agricultural technologies are judged by their "appropriateness: in terms of factor availabilities. Market policy is directed at the needs of the farm families with relatively little land and large amounts of family labor to devote to production. Government institutions which provide services to the rural sector are increasingly directing efforts at the needs of labor extensive supply farm families. Finally, direct, employment creating projects and programs are being introduced into rural areas to improve employment and income through the meaningful employment of rural residents.

There is a growing theoretical and empirical literature that suggests some opportunities for additional employment and income that exist within rural areas. The labor force can be absorbed within agricultural sector, and also between agricultural sector and non-agricultural sector. The more chances people have to participate in non-farm activities, the more income they will receive. Research indicating the importance of certain types of employment, includes, for example, studies by Mellor (1976), and Johnston and Kilby (1975). Studies emphasizing the importance of non-farm income as a major contribution to the total family income include Fuhs and Vingerhoet (1971), Larson and Hu (1977), Meyer and Larson (1978), and Smith (1978).

The income of a farm family may be generated from different economic activities. Some members in the family may have a chance to earn income from both agricultural and non-agricultural activities. Some members may work only in non-agricultural activities. Some members may migrate to work in other areas and send remittances to the family. Family members will allocate their time according to their specialization (may be determined by educational level) and their ability to respond to non-farm activities. Smith (1978) argued that those family members with lesser skills will spend their time on farm activities, and those members who are more highly skilled will spend greater amounts of time off the farm.

This study will attempt to identify the major factors affecting the farm family labor supply to non-farm enterprises. These factors may include family income, asset income, off-farm wage rate, stock of farm machinery, irrigation availability, cropping patterns and others.

The specific objective of this paper are: to develop a neoclassical framework based on a multiple-persons theoretical farm household model to explain market labor supply behavior in the rural areas; to develop an empirical model of the labor supply of farm families to non-farm enterprises; to understand the role of the family members participating in non-farm enterprises; to investigate the importance of off-farm income contributed to the total family income. These households to be studied are included in the Rural Off-Farm Employment Assessment Project.

The labor data from each member of family has been collected since March 3, 1980 on a weekly basis.

The organization of this paper depends on the data and time availability of the author. Since the data are continuing to be collected and are not fully checked, this paper is constrained by the incompleteness of the data. The first section of the paper will present a brief discussion of the theoretical model derived from recent research which incorporates some modification based on the author's reformulation and the specific purposes investigated of this study. The second section presents descriptive data on characteristics of the labor force participation of family members based on the survey data from three selected periods. The last section will be devoted to the summary and recommendations for future study.

## 1.2 Theoretical Background of Farm Labor Supply

In recent years there has emerged a new field in social science called the "new household economics". The first development of the theory is associated with the work of Becker (1970), and Mincer (1962). The recent work by Becker (1965), and Lancaster (1970) incorporated production into household consumption by recognizing the interrelationship between production and consumption in the household utility maximization as derived from the traditional theory of choice. The model recognizes the complexities of the relationships among economic

variables such as husband's income, wife's income, husband's wage rate, etc. The applications of these models to the off-farm labor supply of the farm family may be found in the study done by Gronau (1973), Rosenzweig (1978), and Evenson (1978). These theories view household is considered to derive utility from the combination of members leisure time with market and home goods. Smith (1978) summarized how the theory of household economics as applied to off-farm labor supply of farm husbands and wives depends upon six assumptions;

- 1) the household utility function;
- 2) household members are rationale in terms of being utility maximizer;
- 3) family has an accurate perception of its non-market resource value;
- 4) and the time allocation for market activities are not limited by institutions;
- 5) the farm enterprises which are experiencing multiple job holding by farm members are subject to diminishing marginal physical and economic returns;
- 6) the farm production function is independent of off-farm time allocation.<sup>1/</sup>

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<sup>1/</sup> the details of discussion may be found in Sexton (1975), and Huffman (1976).

We postulate that the family members will choose between the amount of goods produced by the family and their leisure time based on their preferences for such commodities. Each family members will consume part of the production and sell the rest of the product to the market. Commodities included in the model are integrated into what we call a "composite" commodity,  $Z_i$ , in order to limit the choice of each individual between the commodity and leisure in finding the optimum solution. To simplify the model, only the husband and spouse will be considered in the study.

The utility function may be shown as

$$U = u (Z_i , L_i) \dots \dots \dots (1)$$

Where  $U$  is a household utility function

$Z_i$  is commodity produced by person  $i$

$L_i$  is leisure time of person  $i$

$i$  is  $h$  (husband) and  $s$  (spouse)

The members in the family are maximize their utility function subject to income constraints, household production constraints, and time constraints.

The family's income constraints is defined as income earned by husband, and spouse and other non-earned income of the family ( $R$ ). The equation is

$$\sum_i W_i T_i + R = \text{full family income} \dots \dots \dots (2)$$

The production constraint is stated as the allocation of inputs and time in the production of  $Z_i$ . That is

$$Z_i = Z_i (X_i, t_i) \dots \dots \dots (3)$$

Where  $X_i$  is the amount of market good used in the production of  $Z_i$ , and

$t_i$  is the amount of time spent by person  $i$  in the production of  $Z_i$ .

The amount of good  $Z_i$  may be purchased at the market price  $P_z$ . The value of time (leisure) can be given by the arbitrary value of opportunity rates.

The total costs in producing bundles of commodity,  $Z_i$  is

$$P_z Z + \sum_i W_i L_i \dots \dots \dots (4)$$

the time constraint is one of the major constraints in the production of  $Z_i$ . The time constraints are

$$T = L_{o_i} + L_i \dots \dots \dots (5)$$

Where  $L_{o_i}$  is husband and spouse's working labor.

$L_i$  is leisure time of husband and wife

As stated by Rosenzweig and Evenson (1972), expenditures on goods must be equal to total family income, including asset income, R. Therefore time allocated by husband and spouse to the production in the household and market work cannot exceed their full time. The full income equation may be demonstrated as

$$\sum W_i T_i + R = Pz Z + \sum W_i L_i \dots\dots\dots (6)$$

The equation above may be simplified to

$$Pz Z = \sum W_i L_{0i} + R$$

In order to maximize the household utility function, the Lagrangian technique may be employed, and then derive the first-order condition for utility maximization. The structural equations will be developed. The marginal value of each members in the household allocating their times will be equal to their market wage rates. From the results of the first-order conditions, we can totally differentiate the equations, then employ Cramer's rule to generate own and cross wage effects on the market labor supply of both husband and spouse.

The changes in labor supply are due to wage rates, and other exogenous variables. The reduced form labor supply function is<sup>2/</sup>

$$S^L = S^L (Pz, W_i, \text{ and other exogenous variables})$$

Given the theory developed above, the empirical model will be constructed. The expected effects of each independent variables will

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<sup>2/</sup> The full derivation of the supply function may be found in Gronau (1973), Rosenzweig (1978).

be careful examined in the next following months.

The next section will devote to the descriptive findings of the labor force participation in the three selected periods.

## II. Labor Force Participation

The previous section discussed the theoretical labor supply model. This section focuses on the descriptive findings of labor force participation from three selected weeks. The general data collection procedures are discussed in Project Paper #1 (Tongroj et. al, 1979). The project is currently obtaining weekly data from 424 rural farm families. Data from each family are gathered once per week for the entire year, March 3, 1980 - February 27, 1981. The data include both farm and non-farm (off-farm) labor contributions of each family member. Since the data are gathered weekly, seasonal variation, unique male, female and child labor utilization patterns, and amounts of short-term off-farm work will be obtained. In short, these data provide a comprehensive view of each family member participating in farm and non-farm activities.

The labor questionnaires were designed to use as a daily records of economic activities for each member in the family. The questionnaires were designed to record all major labor uses, including that of family and hired and exchange laborers. The household choices, such as

cooking, attending ceremonies, are not included. In most areas the labor questionnaires, along with the other questionnaires are distributed to the farm operators every weekends and the completed questionnaires collected for the previous week.

Due to the limitation in time for preparation of this paper, we selected only three week long periods for analysis. They were selected in the months of March, June and September, to present changes in pattern of labor utilization. The labor force participation in various economic activities within village and outside village will be discussed in Section 2.1. The average hour worked per person per day will be presented in Section 2.2.

Sample households chosen for the study are located in Chiangmai, Khon Kaen, Roi Et and Suphan Buri. As you expected, rice farming is their dominant enterprise. A large proportion of sample households participate (at least one member participate) in nonfarm activities. The characteristics of family members appeared in Sumala and Meyer (1980). The descriptions of the enterprises found in 1979 in these households can be found in Orasa and Meyer (1980). Therefore the next section will emphasize only the household labor force participation on non-farm enterprise.

## 2.1 Labor Force Participation Rate.

In this study, only members of the family aged 14 to 65 are assumed to be "economically active" in the sense that they can participate in productive labor. The families who have only older persons, or having no married couples were eliminated. There are 43 households in Suphan Buri, 138 in Chiang Mai, 132 in Khon Kaen, and 73 households in Roi-Et were included in the study.

Among the sample households the average number of family members per household for the entire sample was 5.9, of which 3.9 of the first period, 3.8 of the second period, and 3.9 of the third period belonged to the economically active member. The labor force participation (LFP) rate is the total number of working members during that week divided by the total number of economically active members. In the first period (March) the labor force participation rate was about 72 percent in Suphan Buri the lowest, whereas the highest labor force participation rate was found in Chiangmai. Similar patterns of LFP were found in the second period. For the third period people in Supahn Byri seem to spend more time on economic activities as compared to Khon Kaen and Roi Et. The patterns of LFP over time are similar for each area. Time spent on various activities increased steady from period 1 through period 3. The labor force participation rate was 85, 89, and 91, for period 1, 2, 3, for all males and all females combined (Table 1 thru 3).

Table 1. The Labor Force Participation for household family members by province, for seven . day period ending March 10, 1980.

Province	Economically <sup>1/</sup> Active	Working	LFP(%) <sup>2/</sup>
<u>Khon Kaen</u>			
All members	557	505	90.66
Male	282	260	92.19
Female	265	245	92.45
<u>Roi Et</u>			
All members	280	234	83.57
Male	153	129	84.31
Female	127	105	82.68
<u>Chiang Mai</u>			
All members	503	479	95.22
Male	249	237	95.18
Female	254	242	95.27
<u>Suphan Buri</u>			
All members	189	136	71.95
Male	105	82	78.09
Female	84	54	64.28
All areas	1,529	1,354	85.55

<sup>1/</sup> Members between 14 and 65 years of age.

<sup>2/</sup> LFP is labor force participation rate working members divided by economically active member.

Table 2. The labor Force Participation for household family members by province, for seven day period ending June 9, 1980.

Province	Economically Active	Working	LFP (%)
<u>Khon Kaen</u>			
All members	514	476	92.61
Male	262	240	91.60
Female	252	236	93.65
<u>Roi Et</u>			
All members	267	235	88.01
Male	143	122	85.31
Female	124	113	91.12
<u>Chiang Mai</u>			
All members	499	448	89.78
Male	247	210	85.02
Female	252	238	94.44
<u>Suphan Buri</u>			
All members	195	154	78.97
Male	109	86	78.97
Female	86	68	79.06
All areas	1,475	1,313	89.01

Table 3. The Labor Force Participation for household family members by province, for seven day period ending September 2, 1980.

Province	Economically active	Working	LFP (%)
<u>Khon Kaen</u>			
All members	567	534	94.17
Male	295	275	93.20
Female	272	259	95.22
<u>Roi Et</u>			
All members	280	267	95.35
Male	145	139	95.86
Female	135	128	94.81
<u>Niang Mai</u>			
All members	486	440	90.53
Male	240	210	87.50
Female	246	230	93.49
<u>Suphan Buri</u>			
All members	188	176	93.61
Male	98	93	94.89
Female	90	83	92.22
All areas	1,521	1,417	93.16

## 2.2 Hours worked per person per day

This section presents the hourly changes in labor input for various economic activities. (hours worked per person per day) for farm household families, in three selected periods. Table 4-7 show how total time available per day was divided among farm, non-farm, and farm-non-farm mixed. More than 5 hours per day for all provinces, except for Suphan Buri were spent for farm, non-farm and farm plus non-farms combined. Caution is required when interpreting these data. The average hours worked per person per day may look very low. Since it includes only time spent on income generating activities. As stated earlier, time spent on household chores was not counted. Therefore the average hours worked appeared to be very low.

The allocation of family member's time to different enterprises was analyzed. In Khon Kaen, the data show that males spend more time on farm employment relative to their time spent on non-farm, and farm plus non-farm employment. It is interesting to see that males spend about one hour each day on hired-labor employment while females spend slightly less than an hour. The trend of time spent on farm activities is slightly upward for both males and females. The evidence in Khon Kaen shows that males spend more time than women in hired labor. The reverse was found in self-employed categories. (Table 4)

In Roi Et, males spend considerably more hours in self-employed (3.5) than hired-laborer (1.5) for the dry season. The similar results are found for females during the same period, but females seem to spend less time as hired laborers. During the beginning of the wet season, it is not surprised that males and females participate more hours on farm work, indicating the labor peaks in this period. During the period of taking care of crops, people in the sample areas spent fewer hours on farm activities. It means that they will have more time to either participate in self-employed work or more time as hired laborers (Table 5).

Cropping patterns vary from region to region. It was found that males and females in Chiang Mai put substantially, more hours on farm work when periods change. Both males and females work as hired laborers are surprisingly large amount compared to Khon Kaen and Roi Et. One of the reasons may be because the sample areas are located very close to Chiang Mai City. Hours spent on self-employed activities in the household ranged from 1.14 to 1.97 for males, and 1.33 to 2.05 for females. Hours worked per males and females who participate in both farm and non-farm work are less than one hour per day (Table 6).

As expected in Suphan Buri where the majority of farmers grow only rice and a few other crops, the average hours worked per day increased over the three periods for both males and females. The more time members spend on farms, the less time members have left

over to work as hired workers. The average hours worked for both males and females as hired laborers decreases over time. In general, we found that farmers in Suphan Buri, on the average, spent less hours on various activities as compared to farmers in Khon-Kaen, Roi-Et and Suphan Buri.

### III. Summary and Future Research

It is premature to derive firm conclusions from this study. The theoretical model is not fully developed, and needs modification. The results from the survey data are very preliminary. It is unclear whether the periods selected represent a slack period of farm work during the dry season. A peak demand for farm work, or slightly less demand for work during the mid-crop season. Since the selected areas were scattered, the cropping pattern and also the seasonal sequence of cultural practices may be different. Recognizing these limitations, some interesting results remain from farm household:

1. Among different occupations, during the dry season period, farmers seem to spend more time on income-earned activities and self-employed activities. As compared to planting and taking care of crops.

2. Male seem to spend more hours working as hired laborers, than females.

3. Among the three selected periods, despite some variation in working hours, both males and females seem to work more hours on farm during the planting season, while they spent less hours on non-farm activities.

Table 4. Average number of Hours Worked per Day per Person by Type of Employment for farm Household Family members, in three selected periods of Khon Kaen, 1980.

Occupation	Male			Female		
	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>
	----- hours-----					
Farm	1.82	2.44	2.95	1.45	2.47	2.20
Non-Farm:						
Hired Labors	1.46	1.19	1.47	0.70	0.63	0.33
Self-Em- ployed	0.83	0.35	0.49	1.87	1.00	1.17
Farm plus Non-farm	1.03	1.30	1.04	0.94	1.09	1.07
TOTAL	5.14	5.28	5.95	4.95	5.19	4.77

<sup>1/</sup> Survey results for seven day period ending March 10, 1980.

<sup>2/</sup> Survey results for seven day period ending June 9, 1980.

<sup>3/</sup> Survey results for seven day period ending September 2, 1980.

Table 5. Average Number of Hours Work per day per person by type of Employment for Farm Household Family Members, Roi Et, Three selected periods, 1980.

Occupation	Males			Females		
	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>
	----- hours -----					
Farm	0.37	3.10	2.34	1.13	2.64	2.00
Non-Farm:						
Hired Laborers	1.56	0.82	0.86	0.20	0.44	0.57
Self-Employed	3.52	1.63	2.19	3.17	1.45	0.95
Farm plus Non-Farm	0.20	0.27	0.22	0.56	0.46	0.20
TOTAL	5.65	5.82	5.61	5.06	4.99	3.72

<sup>1/</sup> Survey results for seven day period ending March 10, 1980.

<sup>2/</sup> Survey results for seven day period ending June 9, 1980.

<sup>3/</sup> Survey results for seven day period ending September 2, 1980.

Table 6. Average number of hours work per day per person by type of employment for farm household family members, Chiang Mai, three selected periods, 1980.

Occupation	Males			Females		
	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>
	-----hours-----					
Farm	0.56	0.35	1.90	0.39	0.62	0.73
Non Farm:						
Hired Laborers	2.17	3.40	1.96	1.96	2.95	1.97
Self-Employed	1.97	1.61	1.14	1.77	1.33	2.05
Farm plus Non-Farm	0.79	0.08	0.44	0.84	0.12	0.53
TOTAL	5.49	5.44	5.44	4.96	5.02	5.28

<sup>1/</sup> Survey results for seven day period ending March 10, 1980.

<sup>2/</sup> Survey results for seven day period ending June 9, 1980.

<sup>3/</sup> Survey results for seven day period ending September 2, 1980.

Table 7. Average number of hours worked per day per person by type of employment for farm household family members, Suphan Buri, Three selected periods, 1980.

Occupation	Males			Females		
	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>	Period one <sup>1/</sup>	Period two <sup>2/</sup>	Period three <sup>3/</sup>
	----- hours -----					
Farm	1.49	1.63	3.62	1.44	1.87	3.67
Non-Farm:						
Hired Laborers	1.32	0.85	0.82	1.19	0.95	0.89
Self-Employed	0.46	0.86	0.19	0.75	0.71	0.17
Farm plus Non-Farm	0.60	0.76	0.62	0.69	0.82	0.26
TOTAL	3.87	4.10	5.25	4.07	4.35	4.99

<sup>1/</sup> Survey results for seven day period ending March 10, 1980.

<sup>2/</sup> Survey results for seven day period ending June 9, 1980.

<sup>3/</sup> Survey results for seven day period ending September 2, 1980.

There are some questions remaining to be answered and should be addressed here:

1. The question is to expand industry in the rural sector whether there is enough labor to supply the industry and at what wage rate? To answer part of the question, a labor supply model has to be carefully estimated.

2. What other factors besides wage rate affect labor supply of the farm family, such as family income, family wealth, cropping pattern, availability of irrigation water, number of children at younger age, etc.?

3. The question of which factors determine the seasonal pattern of labor utilization in sample areas is not yet clear.

Efforts will be put in the next following months trying to clarify some of these issues. Hopefully, we can receive a better prospective view of the rural labor market.

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