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AN ANALYSIS OF OUTPUT, EMPLOYMENT AND
INCOME DISTRIBUTIONAL EFFECTS OF SELECTED AGRICULTURAL POLICIES:
A MICRO-ECONOMIC APPROACH*

A Proposal for Collaborative Research with Asian Scholars

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1 RESEARCH OBJECTIVES

1.1 Introduction

This research project is a collaborative effort among American and Asian scholars to develop a new approach for the analysis of agricultural development policies of developing economies. The research focuses on problems of agricultural output, employment and income distribution. The analytical design is the study of micro-development at the village level.

The end result of the research will be a number of alternative models which can be used by development agencies to examine and evaluate the effect of various government instruments on the partial equilibrium level of output, employment and income distribution. Aggregation will also yield a first approximation of the general equilibrium level of these variables.

Two features distinguish this research project from other attempts to study agricultural employment and income distribution: the collaborative format and the micro-development design.

A large and materially significant component of local input is contributed by the Asian scholars in the countries involved. Both data collection and hypotheses formulation will be implemented on the local level by scholars who are well trained in the latest techniques of analysis and who are also intimately familiar with the local environment--socio-cultural, political and economic. The American researchers, on their part, will provide theoretical input as well as expertise in empirical analysis. The collaboration develops on fully equal grounds. The research team, consisting of the local collaborators and the U.S. based personnel, will assume joint responsibility for any research output.

Agricultural policies, such as the introduction of new varieties of seeds and fertilizers, irrigation, land reform, are implemented at the village level.

Nevertheless, there do not exist economic hypotheses that specify the variables associated with change at the village level in the process of agricultural development. This failure of the study of micro-development is especially critical when problems of employment and income distribution are being investigated. In such cases aggregation conceals both the magnitude and the causes of employment shifts and of income inequalities.

1.2 Income Distribution

An important policy goal in the developing economies is the reduction of poverty and the equalization of income between different groups. Many policy instruments, such as the introduction of new seed varieties, provision of agricultural credit, the building of roads and water conservancy projects, designed to promote production and marketed output, have definite redistributive effects. In this study we shall examine the effect that various actual and potential government policies have on changes in the relative income positions of various groups in the agricultural sector. These agricultural groups will be defined in terms of various cross-classifications such as education level, the type of tenancy arrangements, adopters versus non-adopters, the type of crops, geographical location and other factors. The analysis will be carried out within the cultural and institutional setting of the country taking into account all the constraints and externalities specific to the local environment.

1.3 Employment

A closely related issue to income distribution is that of employment. Agricultural practices which increase output may have displacement effects in terms of labor employment. They may also increase labor requirements. It is therefore important to ascertain the effects of various government policy instruments on aggregate agricultural employment. Such effects may even extend to the availability of labor to the industrial sector.

1.4 Output

Discussion will be incomplete if output is left out of the picture. Here we are concerned with both the aggregate output effect as well as the substitution effects between various varieties of the same crop and between various crops. These will undoubtedly have an influence on income and on employment. The demand for new varieties and new crops is also a subject that deserves serious attention for a complete evaluation of the income distribution effects.

1.5 Intersectoral Migration

Eventually the three effects analyzed above will combine to set into motion forces which will either encourage or inhibit migration to the agricultural sector. No analysis is complete without at least some examination, however superficial, of the potential effects of intersectoral migration.

1.6 An Example

Some of the interrelationships that arise between income distribution, employment and output can be illustrated by using as an example two policy instruments, farm size and the dissemination of new varieties of seeds. Farm size, to a certain extent, is a control variable for government policy. It can be affected by land redistribution. It can also be influenced by tenurial or other land use arrangements that incorporate an absolute land ceiling for the cultivator. Similarly new varieties can be disseminated either exclusively to large farmers, or to farmers in general who are able to purchase (and willing to use) the input packages that come with the new varieties.

Besides the direct redistributive effects of government policies on land size and on dissemination of new technology there also exist indirect effects. These can operate through the production function and may further affect output, employment and income distribution among different groups of producers.

The large farms are usually land and capital intensive operations. Small farms are labor intensive. These differences arise from the (actual or imputed) differences in the prices of the factors of production that small and large farms face. The usually low price of capital for large farms is often further biased downwards through conscious government policies. As a result one may observe that large farms choke off the potential for increased labor demand through mechanization of agricultural operations. Under what conditions might the new technologies have labor displacing effects and in which cases might they create additional jobs?

Small farmers usually have ample endowments of cheap family labor. Is the proper maximand, for small and large farms alike, yield per acre--irrespective of the relative price of labor and irrespective of other ratios such as output per unit of labor? There is evidence that the quality of labor varies between small and large farms. The former rely mainly on highly motivated family labor; the latter often employ indifferent wage labor. Should such differences in labor quality really exist, to what extent could they affect the optimum pattern of dissemination of new technology between small and large farms?

2 RESEARCH FRAMEWORK

2.1 Introduction

The basic strategy of this research framework is to proceed from observations on the microeconomic level to deduce the macroeconomic behavior of the agricultural sector. The advantages of this approach are that it enables us to identify and distinguish between different groups in the agricultural sector; it allows us to apply the tools of microeconomic analysis under the appropriate ideal conditions; and statistically it implies that one can bypass the vexing problems of identification so often present in the simultaneous equations context.

After having identified the microeconomic behavior of the various groups, an integration technique will be used to obtain the aggregate behavioral functions. The model of the agricultural sector will then be closed by adding equations which link that sector to the rest of the economy. The changes in relative income positions, in employment and in output for various groups of agricultural producers can be studied within this model in a general equilibrium context consistent with the specific local circumstances.

2.2 The Socio-Cultural and Political Structure

Detailed studies of local institutions and structure are crucial because they delineate the possibilities and constraints to change, not only from an economic point of view, but also from the social, cultural, political and organizational points of view. Failure to take into account these local conditions frequently accounts for the failure of many government agricultural development programs. It is clear that under different institutional settings, the same policy instrument may produce vastly different results.

This part of the study will depend very much on the efforts of the local collaborators.

2.3 Microeconomic Models of Household Behavior

The first thing that needs to be established for each of the groups of households that we wish to examine is their empirical behavior in response to various changes in their environment. The effect of various government policy instruments can be regarded as producing changes in the environment. Through these we shall be able to trace the impact of government policies on the various groups. A number of different complete models of behavior will be postulated on a theoretical level and will later be tested in the empirical section. The hypotheses will include that of household utility maximization, utility satisficing, and models of limited aspiration. Essentially, we want to know the income, employment and output response of the households to changes in the prices of the outputs and inputs, in wage rates, in the infrastructure (such as irrigation and communication), in taxes, in organization, in agricultural practices and seeds and in the composition of the household. This is the indispensable first step for the determination of the effects of alternative government policy instruments and for measuring their differential impact on income distribution, employment and output.

Microeconomic models of household behavior are quite numerous [Bardhan and Srinivasan 1971], [Jorgenson and Lau 1969], [Nakajima 1969], [Sen 1966a]. It suffices to say that for each agricultural group we want to distinguish a supply function for agricultural labor, a supply function for nonagricultural labor, demand functions for agricultural inputs, supply functions for agricultural outputs, a demand function for nonagricultural consumer goods, and, if possible, a savings function.

2.4 Government Policy Goals and Instruments

In order to evaluate a given government policy it is important to identify the goal(s) of this particular policy. Very often there can be goals which are

implicit rather than explicit, e.g., the reduction of poverty level or the equalization of income. Sometimes these objectives may even conflict.

Having identified the goals, it is then necessary to examine the range of alternatives that are open to the government to achieve these objectives. Some objectives may be infeasible because of the physical laws of production. Other objectives may be infeasible because of the presence of certain institutional and political constraints. Insofar as possible, the set of feasible alternatives and the set of constraints will be as clearly identified as possible for each of the countries included in our study. In addition to institutional and political constraints there can also be other constraints which are financial or budgetary in nature.

It should be pointed out here that whether a given variable is a policy instrument or an endogenous variable in the system depends on both the institutional context (for example, free or controlled markets) and the accompanying circumstances. For instance, the government may want to use the output price as an instrument; however, if transportation is backward, output price may be a very ineffective instrument. Another example is the private rural credit market, which often renders inoperative the official agricultural credit policy. Here we attempt to examine all these questions in depth so that one may have a clear picture of the real alternatives that are available.

2.5 Macroeconomic Models of the Agricultural Sector

In order to trace the general equilibrium impact of given government policies, it is necessary to construct a complete macroeconomic model of the agricultural sector with explicit links to the nonagricultural sector. These links consist of the demand functions of the various agricultural outputs, the supply functions of the various manufactured or imported agricultural inputs, the demand function for labor in nonagriculture and the supply functions of manufactured consumer goods. In addition, there are tax and transfer functions

as well as the supply and demand functions of public investment (that is, water conservancy, irrigation transportation and communication projects). The macro-functions that pertain to the agricultural sector itself are of course obtained from aggregation of the microeconomic behavioral equations.

The aggregation procedure that will be used in this study follows Houthakker [1955] and Johansen [1972]. Given the microeconomic behavior of the households, conditional on their prior holdings of physical, financial and human assets, as well as other attributes such as the type of tenancy arrangement, the aggregate functions are derived by an integration of the demand and supply functions over the distribution of the assets and other characteristics.

Many alternative models will be constructed, each reflecting a different set of institutional and sociological circumstances.

The behavior of the agricultural sector is completely determined given a specification of all these functions and the prices and other government policy variables that are determined exogenously, that is, outside of the agricultural sector. Examples of these may be the interest rate, the price of consumer goods, the supply price of certain manufactured agricultural inputs, etc.

In terms of methodology, the construction of these macroeconomic models will be similar to that used in Lau and Yotopoulos [1972]. From the equilibrium determined by these macroeconomic functions, the endogenous variables to the macroeconomic system can be obtained. These equilibrium values may then be inserted into the aggregate functions of each type of household and their relative income positions can be determined. A by-product of this study is a comparison of the intra-group distribution of income across the various groups. For instance, it is possible to determine whether income distribution tends to be less skewed amongst owner-operators than amongst tenants. The effects of various government policy instruments will be investigated within such a framework.

2.6 Bibliography

- I. Adelman and C. T. Morris, "An Anatomy of Income Distribution: Patterns in Developing Nations," Development Digest, 9, No. 4 (October 1971), pp. 24-37.
- A. B. Atkinson, "On the Measure of Inequality," Journal of Economic Theory, 2 (1970), pp. 244-263.
- P. K. Bardhan and T. N. Srinivasan, "Cropsharing Tenancy in Agriculture: A Theoretical and Empirical Analysis," Amer. Econ. Rev., 61, No. 1 (March 1971), pp. 48-64.
- W. P. Falcon and C. H. Gotsch, "Relative Price Response, Economic Efficiency, and Technological Change: A Study of Punjab Agriculture," in W. P. Falcon and G. F. Papanek, eds., Development Policy II: The Pakistan Experience, (Cambridge: Harvard University Press, 1971), pp. 160-185.
- C. H. Gotsch, "A Programming Approach to Some Agricultural Policy Problems in West Pakistan," in H. B. Chenery, ed., Studies in Development Planning, (Cambridge, 1971), pp. 223-246.
- H. S. Houthakker, "The Pareto Distribution and the Cobb-Douglas Production Function in Activity Analysis," The Review of Economic Studies, 23, No. 1 (1955), pp. 27-31.
- L. Johansen, Production Functions: An Integration of Micro and Macro, Short Run and Long Run Aspects, (Amsterdam, 1972).
- D. W. Jorgenson and L. J. Lau, "An Economic Theory of the Agricultural Household," paper presented at the Far Eastern Meeting of the Econometric Society, Tokyo, June 1969.
- L. J. Lau and P. A. Yotopoulos, "A Test for Relative Efficiency and Application to Indian Agriculture," The American Economic Review, 61, No. 1 (March 1971), pp. 94-109.
- _____ and _____, "Profit, Supply and Factor Demand Functions," The American Journal of Agricultural Economics, 54, No. 1 (February 1972), pp. 11-18.
- _____ and _____, "Micro-Functions in a Macro-Model: An Application to the Agricultural Sector in Developing Economies," Stanford University, Research Center in Economic Growth, Memorandum No. 108 (revised, May 1972).
- C. Nakajima, "Subsistence and Commercial Family Farms: Some Theoretical Models of Subjective Equilibrium," in C. R. Wharton, ed., Subsistence Agriculture and Economic Development, (Chicago, 1969), pp. 165-184.
- A. K. Sen, "Peasants and Dualism With or Without Surplus Labor," Journal of Political Economy, 74 (October 1966), pp. 425-450.
- _____, "Labor Allocation in a Cooperative Enterprise," Review of Economic Studies, 33 (October 1966), pp. 361-371.
- J. E. Stiglitz, "Rural-Urban Migration, Surplus Labor and the Relationship between Urban and Rural Earnings," Eastern Africa Economic Review, 1 (December 1969), pp. 1-27.
- P. A. Yotopoulos and L. J. Lau, "A Test for Relative Efficiency: Some Further Results," American Economic Review, forthcoming.

3 RESEARCH IMPLEMENTATION

3.1 Introduction

Three countries are included in this phase of the research project, the Republic of China (Taiwan), Malaysia and Thailand. The particular choices have in large measure been determined by the availability of suitable local collaborators and data, and by our desire to have as wide a range of development experience as possible. These three countries have very different historical development patterns, different factor endowments and social organizations, are now at different points on the development scale, and, in general, are faced with different problems. The challenge is therefore to develop a framework sufficiently flexible to accommodate all three countries.

3.2 Data Collection and Sources

The data collection has already been initiated by the local collaborators in anticipation of an affirmative response to our request for funding. The data collection, to this point, has been supported fully by local funds. It is expected that some additional funds might become necessary for the collection of other antecedent data through small, one-shot surveys in the areas under investigation.

A list of typical data that are being collected is appended to the end of this section. In the cases of Malaysia and Thailand where the local collaborators are currently conducting surveys for the collection of data, the questionnaires utilized will be appended to the local requests for funding. The following will describe briefly the main sources of data and the surveys carried out by the local collaborators.

3.2.a Taiwan

The study of Taiwan draws on published data as well as on primary data collected by Lawrence J. Lau and also by the local collaborator, Mr. Wuu-Long Lin.

There are at least two alternative data sources for Taiwan that will be used conjointly: Report of Farm Record-Keeping Families in Taiwan, and A Report on Cost Survey of Agriculture Products (in Chinese).

The data in Report of Farm Record-Keeping Families in Taiwan were compiled from the daily records kept by farm families with the help of specially trained supervisors. The data cover the period from 1953 to 1970, with the sample increased to about five hundred families in 1964. The published data distinguished five farm sizes (average size of less than 0.5 hectare, 0.5 to 1.0 hectare, 1.0 to 1.5 hectares, 1.5 to 2.0 hectares, and above 2.0 hectares) and eight crop regions (Northern Rice, Middle Rice, Southern Rice, Tea, South-Western Mixed Farming, South-Western Sugarcane and Rotation, Bananas and Pineapple, and Eastern Mixed Farming Region).

The Report on Cost Survey of Agricultural Products gives detailed information on the revenue and cost structure and it covers annually the period since late 1950's. It distinguishes in great detail among several crops and prefectures. For example the 1970 report refers to fifty crops and six livestock with the samples ranging from 6 to 132 for each crop or livestock. Unit prices of various inputs are reported in detail including chemical and organic fertilizer, labor wage rate, animal wage rate, and mechanical wage rate.

The detailed information on Taiwan is conducive for both cross section and time series analysis of the nature proposed in this study.

3.2.b Malaysia

The primary data for Malaysia are currently being collected by the local collaborator, Professor Mokhtar bin Tamin, in association with Messrs. Ani bin Arope and Lai Kok Chew. The survey covers padi production and marketed crops in the Tanjong Karang Double Cropping Areas, District of Kuala Selangor, West Malaysia. The collection of a total of about 200 questionnaires will be completed in April 1972.

3.2.c Thailand

The primary data for Thailand are being collected by Professor Kamphol Adulavidhya in cooperation with local institutions through three different surveys. First, the Rice Technology Study sponsored by the International Rice Research Institute has covered 150 sample farms in Amphur Donchedi, Sapan Buri province, in the Central Plain. Second, the Food Legume Study in the Upper Central Plain has collected interviews from a sample of 100 farmers. Similar information may be forthcoming from the Food Legume Study at Chiengmai University. Third, a Study of Corn and Sorghum Production in the Upper Central Plain is being conducted during the month of April and will cover about 100 farms.

3.3 Studies of Local Institutions and Structure

On the whole these studies will be done by the local collaborators. However, it is expected that the U.S. based personnel will attempt to make a substantial input to these studies through critical questioning. Very often, local institutions of considerable import can be neglected even by local scholars because these have been taken for granted. It is hoped that by drawing together scholars from countries with diverse development experience many of the implicit assumptions may be brought into the open. This will enrich our understanding of the process of development.

The following sections highlight some local institutions and briefly describe some features of the structure of the agricultural sector of the three countries which become relevant for this research project.

3.3.a Taiwan

The story of agricultural development of Taiwan is well documented [Lee 1971] and it is unnecessary to repeat it here. The following discussion is suggestive of the relevance of the Taiwan case for the other countries of South East Asia, especially for Malaysia and Thailand.

A number of the characteristics of Taiwan are none too dissimilar with features that are prevalent in other Southeast Asian countries. The country has a tropical and subtropical climate, limited land resources, high population growth rates with abundant labor reserve for agriculture (at least in the early years of its development), small scale farm system and a historical background of long years of colonial domination. Yet in a period of just over twenty years, while the country was moving from the group of less developed to that of developed countries, the Taiwanese agriculture went through three distinct phases.

Labor surplus existed in agriculture from 1945 to 1965. Agricultural development during that period was grounded in the use of labor intensive techniques. Crop breeding was combined with the improvement of culture methods and the introduction of new seeds and complementary inputs of pesticides and fertilizers. Irrigation infrastructure was developed. Land reform was further responsible for emphasizing labor intensive techniques. Between 1950 and 1966 farm size decreased from an average of over two hectares to about one hectare. Yet throughout the period both output and sales per farm steadily increased. Farmers' incomes during that period were about 90% of those in the non-farm sector.

The rapid growth of the non-agricultural sector led to a gradual decrease in the labor surplus and to agricultural labor "shortages" starting in 1965. Between 1967 and 1969 wages in agriculture increased by 15% and in manufacturing by a slightly high percentage. Mechanization expanded during that period with emphasis on machinery that replaces labor at peak seasons (such as power tillers, small Japanese binders and combines). Coupled with the labor squeeze was also a cost squeeze through higher prices of purchased inputs. The gap between farm and non-farm incomes has increased to 57%.

The second phase of Taiwanese agriculture set in motion forces that are fully developing in the early 1970's into a third phase of agricultural growth. The number of part-time farmers has increased. Joint farming operations have developed whereby 20 to 30 farmers work the land jointly but the yield of each plot is family rather than common property. Farm machine service teams propose to circumvent the diseconomies of scale that exist in mechanized agriculture. And mechanization as well as higher agricultural income objectives are being jointly served by the current attempts to develop integrated farms of an optimum size, say, of ten hectares, that besides crops would also combine production of hogs, apiary, silkworms, chickens, ducks, and fish.

Taiwan presents a model case of agriculture servicing the goals of overall economic development by: (i) supplying food and fiber for the needs of a growing population and growing incomes; (ii) supplying exports and foreign exchange; (iii) supplying labor for a rapidly growing non-agricultural sector; and (iv) supplying capital for financing the costs of development. As such, the case of Taiwan, studied in detail in its different phases, could be most illustrative for the other nations of Southeast Asia that also depend on a large agricultural sector.

Within the general framework of interrelationships between agriculture and the other sectors in the process of development a number of specific questions can be investigated that have relevance for Taiwan as well as for other developing countries of Southeast Asia. How have supply curves of output and how have demand curves for inputs (labor, fertilizer, mechanical equipment) shifted through the successive stages of Taiwan's agricultural development? What were the employment and the income distributive implications of such shifts for different sectors of the economy, regions of the country and groups of producers? How does the efficiency of the farm size observed in the 1950's compare with the efficiency of the smaller farms observed in the 1960's and the larger operations expected for the 1970's? In Taiwan agricultural statistics one can distinguish between farmers who derive at least one-half of their incomes from agriculture ("regular" members of the farmers' associations) and others ("associate" members of farmers' associations). What has been the impact of this government policy instrument of cooperation upon output, employment and income distribution? The land consolidation program that started in Taiwan in 1961 seems to be highly successful. Besides the expected economies of scale inherent in pest control, mechanization, access roads and paths, etc., it is estimated that the program resulted in savings of irrigation water of up to 20% and increase in crop production of about 30%. The comparative analysis of consolidated and non-consolidated farms would shed further light on the gains from land consolidation.

3.3.b Malaysia

Basic Data

Antecedent data for Malaysia are relatively scarce, although more complete for West Malaysia (Malaya) than for East Malaysia (Sarawak and Sabah).

The 1969 population of Malaysia was roughly 10.66 million, with about 85 percent in West Malaysia and the balance in East Malaysia. Population has been growing at a relatively fast rate of 3 percent per year. Urban population has been increasing at a higher rate than the overall population. From 26.5 percent of the total in 1947, urban population has increased to over 35 percent recently (UN-ECAFE [1965] estimates this proportion at 42.7 percent for 1957, while Siew's [1968] estimate is 33.3 percent for 1967). Another significant population statistic for Malaysia is the ethnic composition. On the basis of the 1962 census, after adjustment for the separation of Singapore, the Malay population is somewhat under 50 percent of the total, with the Chinese over 30 percent, Indian about 15 percent and the balance of other indigenous ethnic groups. There is a greater proportion of Chinese and Indians in the cities than in rural areas. The traditional urban-rural income inequalities might well overlap in the case of Malaysia with the Malay-nonMalay income inequalities. The ethnic composition of the population is important also for other reasons. Historically, much land was reserved for Malays and this has caused problems with respect to new land development policies. A recent study by Mehmet [1972] indicates that labor markets are isolated ethnically.

Malaysia is one of the better developed countries of Asia with income per capita amounting to US \$310 in 1967, about the fourth largest in Asia--excluding the Middle East. Recent growth rates in GNP have been high averaging 5.9 percent per year for the period 1969-68. With small change in domestic prices, this contributed to a change in real per capita income of about 2.7 percent per year for the period 1960-66. The rate of growth of manufacturing has been higher than that of agriculture, ranging for the former from 4.9 percent per year to 11.0 percent per year for the period 1950-60 and 1960-68, respectively, while for the latter ranging from 2.9 percent to 4.7 percent for the respective

period. The highest agricultural growth rate has been observed in West Malaysia. Exports account for about one-third of the GNP.

Land and Land Tenure

Only a small proportion of the land is cultivated (about 10 percent for West Malaysia) and much of the remaining land is potentially useable with existing agricultural techniques. It was estimated that arable land in West Malaysia in 1962 represented only 37 percent of potentially arable land. Government plans provide for extending the land under cultivation. In the period 1953-63 land under cultivation increased by 15 percent and plans are for another increase of about 13 percent by 1975.

In 1963, about 66 percent of the land was devoted to rubber, 16 percent to rice, 8 percent to coconut and the remaining land was divided between fruits, oil palm and other foods.

Land use was regulated by the state and permission to use the land for non-traditional purposes is often difficult to obtain. This makes it hard both to initiate manufacturing and also for farmers to respond to changes in relative prices [Crosson 1966]. There has also been much fragmentation of land holdings.

Non-export crops, including rice, are grown on small holdings. Though estimates vary, the average farm size reported by FAO is 4.32 acres, but as this includes plantation land the more realistic estimate is 2 acres, or less than in India [UN-FAO, 1968, p. 382]. It is estimated that 15.2 percent of the area and 45.3 percent of the farms fall in the land size below 2.75 acres per holding.

The incidence of tenancy and hired labor is unequally distributed over provinces in West Malaysia. Tenancy rates are relatively highest where rice predominates, also in the same areas there is more use made of hired labor. Where rice represents a small part of the cropland, there are relatively more owner-operators.

Labor Utilization

Malaysia is a country which until relatively recently suffered no serious unemployment problems. With the labor force increasing by about 3 percent per year since the late 1950's, the unemployment rate rose to 6 percent of the labor force in 1965, 6.8 percent in 1968 and 8 percent in 1970 [UN-ECAFE, 1971, p. 249]. Unemployment is mostly concentrated among the young and the urban population. (For example, in 1965 the unemployment rate in the 15-19 year old group was 16 percent, with urban unemployment for this age group being at 27 percent and rural being at 14 percent. The unemployment rate among women was 7.9 percent while for men it was 5.2 percent in the same period. See Crosson [1966]).

Since more than half of the work force is employed in agriculture, this sector has been relied upon for the absorption of unemployment. The First Malaysia Plan anticipated that agriculture, mostly through the opening up of new lands, could absorb 70 percent of the additions to the labor force. With land development proceeding slower than planned, unemployment increased.

Rice

In 1961-62 production of rice was about 606,000 tons, representing about two thirds of the consumption requirements. About 315,000 tons were imported, mostly from Thailand. Self-sufficiency in rice has been a major development aim and West Malaysia is approaching that goal. In the 8 years to 1969/70 rice output increased by one half to reach 915,000 tons while imports were reduced to 262,932 tons. This increase in production was due both to increased acreage planted in the wet season and to greatly expanded double cropping due to irrigation. The following table illustrates.

	<u>Acres Planted (1000)</u>		
	<u>wet padi</u>		<u>dry padi</u>
	<u>main season</u>	<u>off-season</u>	
1961/62	873	46	58
1969/70	938	326	54

Source: Malaysia, Monthly Statistical Bulletin, May 1971

The increase in double cropping has been unequally distributed. Largest acreages have been added in Kedah and Perak, though other states as Selangor and Pulau Penang have attained higher rates of double cropping. Kedah and Penang have relatively higher tenancy and hired labor rates as compared to Perak and Selangor. It would be of interest to examine if the large increases in double cropping have had any effect on the tenancy and employment patterns. It has been estimated that double cropping should yield incomes from 2 to 2.2 higher than single-cropping. One would have had expected the introduction of double cropping also to cause shifts in the patterns of income inequality.

Besides double cropping, the introduction of high yielding varieties (HYV's) of rice will also tend to increase income and production. It has been estimated [Barker 1971] that the HYV's were used in almost 25 percent of rice acreage in 1969/70 and they yielded about 2 to 3 times the output per acre of traditional varieties. The cost of irrigation and the expansion of cultivation to submarginal lands may be the main limiting factors to the economic expansion of rice lands. In recent years and despite increases in arable land yields per acre have maintained their levels or even increased and they seem to be greater in Malaysia than in Thailand. It is claimed, however, that costs per ton of rice have also increased, being higher than Thailand.

Self-sufficiency in rice seems attainable for West Malaysia. Chew [1971] by estimating production and consumption trends determined that with a population growth of 2.8 percent per year and growth of income per capita of 2 to 3 percent self-sufficiency could be attained by 1975. "Near-Sufficiency" (about 97 to 98 percent) should be reached by 1972. Key factors for attainment of these goals include the provision of irrigation, insecticides and pesticides and also adequate drying and storage facilities.

3.3.c Thailand

Basic Data

The population of Thailand in 1969 was about 34.3 million. The population growth rate has been relatively high at 3.1 percent per year since 1947. It has recently decreased to 3.0 percent per year for the period of the 1960's. In 1970 the rural areas accounted for 87.5 percent of the total population, with agriculture employing 75.6 percent of the active population. Urbanization seems to have been slightly increasing. Labor force participation has been declining for the population of eleven years and over, a phenomenon which is partly attributed to increases in education [Spoelstra and Isarangkan 1971].

In the period 1958-60 to 1968-70 GNP has increased at a rate of 7 percent per year with real income per capita increasing at 4 percent per year [Inukai 1970]. In the same period agricultural production has grown by 5.7 percent per year, while per capita food product has increased by 2.5 percent per year [UN-ECAFE 1970]. There is some evidence that these growth rates have contributed to increasing urban-rural inequalities in income distribution, to widening existing regional differences, and to accentuating the income differences that have existed among farmers.

Land and Land Tenure

The pressure of population upon land resources is relatively slight in Thailand. The ratio of population to arable land is low. The average farm size is 6.2 acres. Double cropping is relatively insignificant. Irrigation extends to one quarter of the crop land, with the balance being rainfed [UN-FAO 1968]. Irrigation facilities are unequally distributed among regions, with the Central Plain accounting for about 45 percent of the total irrigated farmland.

The prevalent thought among Thai planners is that land expansion is easy: it was estimated that only 41 percent of the arable land was cultivated in 1961 and that this could be increased to 47 percent by 1975 [UN-FAO 1968].

Traditionally land held idle reverted to the state, although now holding of idle land is discouraged by high taxes. Even so there is still speculation in land, especially near Bangkok--though no indication is given as to how this affects cultivation.

The general impression has been that Thailand is a land tilled by small land owners. This has been changing. A 1962 report [Behrman 1968] stated that 90 percent of the land was owner operated. The 1963 Census of Agriculture showed that 80 percent of the farms were owner operated. The proportion has dropped to only 40 percent in the 1968 survey. The situation appears even worse in the Central Plain where as early as 1964, 29 percent of the farmers were "pure" tenants, while 56 percent of all farmers rented some land. Data problems may be related to the differences between temporary and permanent title to the land. Under temporary title the farmer cultivates the land without rent obligation but his title is nonnegotiable. After three years of cultivation and the payment of a fee the farmer can acquire permanent and negotiable title. In Khon-Kaen in 1962, 81 percent of the land was held in temporary title, 9 percent in permanent and 10 percent owned by the government.

Alternative estimates of the growth of tenancy compose a slightly different picture. The National Statistical Office of Thailand, as reported in FAO [1968] calculated a growth in tenancy of 3 percent per year in the period 1953-68, reaching an overall average of 16 percent tenancy while the ratio is 41 percent in the Central Plains and 18 percent in the Northern Region. Limits to the size of land holdings were abolished in 1953 and this may have had some effect on the rise of tenancy. Also the increase of tenancy in the Central Region seems to be related to much greater than average water and road development enabling increased output and access to markets.

This preliminary survey suggests that the relationship between the land ownership system in Thailand, changes in land tenure, changes in tenancy, land

improvements and land speculation merit further investigation. One would expect to find some definite interrelationships between these institutional arrangements and the changes in the patterns of employment and income distribution.

Labor Utilization

The basic characteristic of the Thai economy is generally low rates of unemployment. A 1969 survey, for example, recorded a very low level of unemployed workers of 0.2 percent. In urban areas as exemplified by Bangkok unemployment was higher at 1.6 percent. This was concentrated mainly on males 11 to 24 years old with unemployment rates ranging from 4.7 percent to 5.5 percent, while unemployment for men and women over 25 was 1.07 percent, of whom 83 percent had never worked. Higher unemployment rates are also recorded for the age brackets 18 to 25 years with secondary and higher education, again most of whom had never worked. This, of course, could be interpreted as frictional unemployment or as overinvestment in education.

There have also been higher estimates of unemployment, with UN-ECAFE [1970] placing it for 1966 at 6.63 percent. However, the overall low unemployment picture for Thailand appears quite accurate. The explanation of this phenomenon might lie in the preponderance of agriculture which relies mainly on small holder owner-operators. In 1969, for example, 80 percent of the labor force was employed in agriculture with manufacturing and services employing, respectively, 7 percent and 14 percent [Spoelstra and Isarangkan 1971]. This distribution of the labor force contributes to heavy seasonality which is illustrated in the following table.

Quarterly Employment Index by Sector
(average overall 4 quarters = 100)

	<u>Sept.</u>	<u>Dec.</u>	<u>Mar.</u>	<u>June</u>
Agriculture	104.5	103.0	89.7	102.3
Manufacturing	85.8	99.3	140.5	74.3
Services	89.5	92.1	115.5	102.9

Source: Spoelstra and Isarangkan [1971, p. 82]

The tight labor market situation is evidenced by the fact that during the peak seasons of agricultural activities agriculture is drawing from the manufacturing and the service sectors, which, in turn, rely for workers on agriculture during the slack agriculture season.

Rice

Rice production predominates in the agricultural sector. In 1951-63, rice accounted for 82 percent of the cultivated area, with the production of rice amounting to 54 percent of the value of total agricultural product and 17 percent of National Income. Rice processing accounted for 23 percent of value-added in manufacturing and represented 43 percent of all exports. The export taxes on rice contributed 15 percent to the total government revenue. In terms of diet, rice represented 40 percent of the monetary value of total food consumed and 60 percent of total caloric intake. In the mid 1950's, according to a UN estimate, 88 percent of all farmers cultivated rice and in 1953, according to a Farm Survey, 58 percent of all rice produced was consumed on the producing farms [Behrman 1968, p. 92]. In 1968, the proportion of rice sold in the market was 57 percent for the Central Plains and only 20 percent for the Northeast. Rice is indeed of paramount importance for the economy of Thailand and the introduction of new technologies in rice could have profound effects both domestically and also in trading countries.

The type of rice grown varies in different parts of the country. The glutinous rice is concentrated in the Northeast, equalling about 88 percent of the crop, while in the rest of the country it represents less than 10 percent. The non-glutinous long grain rice is most preferred as an export, thus commanding a higher price and perhaps contributing to regional income inequality. Such regional distribution in the patterns of cultivation, far from reflecting uneconomic choice, results from the fact that the type of rice grown is a function of the irregular grain and the short growing season in the Northeast [Behrman 1968, p. 105]. The biggest constraint on rice production in the Northeast and

Central regions is water control. Yields per hectare are relatively low in Thailand (1.60 mt-ha) mostly due to use of marginal lands, low proportion of irrigated land, and low use of fertilizer. Irrigation projects have been undertaken in the Central Plain to improve yields.

Diversification and Price Responsiveness

The next two most important crops are kenaf and corn. The latter was only recently introduced in Thailand and mainly for export purposes. Both are alternatives to upland rice and both can be considered to a certain extent as competing crops as farmers respond to world market price changes. For example, decreased production of jute in Pakistan led to increased price of kenaf and thus increased kenaf production and decreased corn production in 1961. Both crops are cultivated by small holders and represent only a small part of the area planted. According to a survey in 1961-62 in the Northeast region, 64 percent of the kenaf producers also had holdings of wet rice [Behrman, 1968, p. 141].

Impact of New Technologies

To date there has been low use of fertilizer in Thailand. Most chemical fertilizers are being used for vegetables, tobacco and mulberry bushes and not for the major crops. Flood conditions and poor drainage render a large proportion of the Thai rice land (as large as 40 percent according to UN-FAO [1968]) unsuitable for high yielding varieties. Within this context the use of fertilizer would be uneconomic. In the Central Region, on the other hand, with the largest share of irrigation, there has also been increasing use of modern agricultural inputs, increasing mechanization, and increasing tenancy rates.

The specific characteristics of Thai rice cultivation raise a number of questions relating to employment patterns and income distribution characteristics. Regional differences in the suitability of HYV rice tend to accentuate the existing regional income differentials. Increase in tenancy associated with the expansion of HYV in certain regions further contributes to increases in

income inequality. The dependence of the rice produces on the export market may create further problems. Thai rice has been heavily taxed on export, so sheltering somewhat the domestic market from the world market. Important domestic redistribution effects could arise if the world market in rice collapses.

3.4 Empirical Estimation of Microeconomic Behavior

This consists of estimating the labor supply functions, output supply functions (multiple outputs if necessary), and factor demand functions, including labor demand functions, for each of the various possible and mutually exclusive groupings of households. With these functions, it is possible to calculate the partial equilibrium income distribution, employment and output effects of given changes in government policies. Variables such as climatic factors, water availability, location and accessibility will also be included explicitly as exogenous variables to allow the treatment of a wide variety of government policies.

The exact specification of these functional forms will be determined to a large extent by the data. One can consider, in addition to the traditional Cobb-Douglas and C.E.S. functional forms, the "transcendental logarithmic" functional form introduced by Christensen, Jorgenson, and Lau (1972). Both the output supply functions and the factor demand functions will be derived from a profit function so that the resulting system of supply and demand functions is consistent with profit maximization subject to a technology constraint.

Estimation of these functions will take place locally as far as possible. Where there are limitations either because of computer capacity constraints or because of unavailability of supporting computer programs, estimation will be done at Stanford. A complete data file will be maintained at each country as well as at Stanford to safeguard against accidental loss. In general, regression results that are useful will be duplicated abroad and at Stanford as a consistency check.

3.5 Empirical Estimation of Macroeconomic Behavior

In this stage comprehensive survey data of the nonagricultural sectors are missing. Therefore, the equations linking agriculture to nonagriculture will have to be estimated using time-series data. Essentially what one is interested in is the supply function to agriculture of various inputs used in agriculture such as chemical fertilizers, agricultural implements and tractors, as well as the demand function for agricultural outputs. Especially important is the non-agricultural sector's demand for labor. The data for these functions will be collected at the local level. There are some statistical problems remaining to be solved for the combined use of time-series and cross-section data. As a first approximation in this phase of the study these problems will be ignored.

3.6 Simulation Experiments

The microeconomic behavioral equations that are estimated--the output supply and labor supply functions and the factor demand functions--will be aggregated to give the macroeconomic behavioral equations of all agricultural households taken as a whole. Central in this aggregation is the observation that the same price must prevail in all markets, after appropriate adjustments, for instance, transportation costs, are made. It is not necessary to assume that all households are identical in this aggregation. In fact, since we want to measure the differential impact on the various groups of households, the assumption of non-identical households is more plausible. These equations will be pooled with the macroeconomic behavioral functions which link the agricultural and nonagricultural sectors. Together they will determine equilibrium values of various quantities and prices. Now with this model, one can simulate the effects of changes in various government policy instruments. What we shall be able to obtain are the changes in the comparative static equilibrium values as a result of changes in government policy. We shall simulate output and input price policy, water

conservancy policy, land policy, imports policy, transportation policy and other relevant policy instruments available to each specific country.

With the equilibrium values of quantities and prices determined, one can then return to the microeconomic behavioral functions to work out the precise impacts on the various groups. This is, if one likes, a kind of incidence study-- who benefits and who loses as a result of government policy changes.

3.7 Bibliography

General

Christensen, L. R., Jorgenson, D. W. and Lau, L. J., "Conjugate Duality and Transcendental Production Frontiers," Discussion Paper No. 238, Harvard Institute of Economic Research (April 1972).

Taiwan

Chang, T. T. and Associates, Long-Term Projections of Supply, Demand and Trade for Selected Agricultural Products in Taiwan, The Research Institute of Agricultural Economics, National Taiwan University, Republic of China (October 1970).

Chen, Y. E., "Structure and Productivity of Capital in the Agriculture of Taiwan and Their Policy Implications to Agricultural Finance," Economic Digest JCRR, Taipei (1968).

China Council on Sino-American Cooperation in Humanities and Social Science, Conferences on Economic Development of Taiwan, Taipei (1967).

Christensen, R. P., Taiwan's Agricultural Development, USDA, Economic Research Service, Washington, D.C. (1968).

Department of Agriculture and Forestry, Provincial Government of Taiwan, Report of Farm Record-Keeping Families in Taiwan, Taipei (1966).

Hsieh, S. C. and Lee, T. H., "Agricultural Development and Its Contributions to Economic Growth in Taiwan," Economic Digest JCRR, No. 17, Taipei (April 1966).

_____ and _____, "An Analytical Review of Agricultural Development in Taiwan," Economic Digest JCRR, No. 12, Taipei (July 1958).

Huang, C. L., "Structure of Agricultural Labor Force and Changes in Composition of Agricultural Employment of Taiwan in the Last Decade" (Chinese edition), Department of Agricultural Economics, National Taiwan University, Taipei (1971).

Lee, T. H., Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960, Cornell University Press (1971).

_____, Intersectoral Capital Transfer in the Economic Development, Taiwan--A Case Study, Ph.D. dissertation, Cornell University (1967).

Lin, W. L., Agricultural Growth in Taiwan Economic Development, 1952-1970, Ph.D. dissertation, Stanford University (1972).

Mao, Y. K., "A Study on Structural Change of Farm Income and Agricultural Production Cost in Taiwan" (Chinese edition), Department of Agricultural Economics, National Taiwan University, Taipei (December 1969).

Provincial Department of Agriculture and Forestry and JCRR, Report on a Cost Survey of Agricultural Products, (in Chinese).

Rural Economic Division, "Taiwan Farm Income Survey of 1967--With a Brief Comparison with 1952, 1957, and 1962," Economic Digest JCRR, No. 20, Taipei (January 1970).

Shen, T. H., Agricultural Development on Taiwan Since World War II, Cornell University Press (1964).

Tsui, Y. C. and Lin, T. L., "A Study of Rural Labor Mobility in Relation to Industrialization and Urbanization in Taiwan," Economic Digest JCRR, No. 16, Taipei (May 1964).

United Nations, "Relationship between Agriculture and Industrial Development: A Case Study in Taiwan," Economic Bulletin for Asia and Far East, 14, No. 1 (June 1963).

Wang, Y. T., "Technological Changes and Agricultural Development of Taiwan, 1948-1965," Economic Digest JCRR, No. 19, Taipei (April 1968).

Malaysia

Abdul Rahman bin Haji Yusof and Ani bin Arope, "Price Policy in Malaysia," MARDI Agricultural Economic Bulletin, 1, No. 5 (September 1971).

Barker, R., "The Asian Experience with High Yielding Rice Varieties--Problems and Benefits," (October 1971), mimeo.

Brandt, K., Efferson, J. N. and Paarlberg, D., "Policies and Measures Leading Toward Greater Diversification of the Agricultural Economy of the Federation of Malaya," Ford Foundation Report to the Government of the Federation of Malaya, (1963), mimeo.

Chew, L. K., "On Prospects of Self-Sufficiency in Rice for West Malaysia," MARDI Agricultural Economic Bulletin, 1, No. 1 (January 1971).

_____ and Ani bin Arope, "Towards Optimal Size of Rice Farms," MARDI Agricultural Economic Bulletin, 1, No. 2 (April 1972).

Crosson, P. R., Economic Growth in Malaysia, National Planning Association, Jerusalem: S. Monson (1966).

Malaysia, Monthly Statistical Bulletin, Rice Supplement (1960).

_____, Monthly Statistical Bulletin (May 1971).

Mehmet, O., "Manpower Planning and Labour Markets in Developing Countries: A Case Study of West Malaysia," Journal of Development Studies, 8 (January 1972).

Narkswadi, U. and Selvadurai, S., Economic Survey of Padi Production in West Malaysia, Malaysia: Ministry of Agriculture and Cooperatives (December 1968).

Siew, N. C., "Development Challenge in Malaysia," (1968), mimeo.

UN-ECAFE Growth Series No. 2, Economic Development and the Role of the Agricultural Sector, Bangkok (1965).

_____, Economic Survey of Asia and the Far East, 1970, Bangkok (1971).

UN-FAO, Indicative World Plan for Agricultural Development to 1975 and 1985, Provisional Regional Study No. 4, Asia and the Far East, Rome (1968).

Thailand

Barker, R., "Trends in Rice Production in South and Southeast Asia," IRRI Seminar, September 30, 1967.

Behrman, J. R., Supply Response in Underdeveloped Agriculture, Amsterdam: North Holland (1968).

UN-ECAFE, Economic Survey of Asia and the Far East (1970).

UN-FAO, Indicative World Plan for Agricultural Development to 1975 and 1985, Provisional Regional Study No. 4, Asia and the Far East (1968).

Inukai, I., "Regional Income Differentials in Thailand," ARTEP/II (June, 1970).

Spoelstra, N. and Isarangkan, C., "Some Aspects of Labour Use in Thailand," Conference on Manpower Problems in East and Southeast Asia (May 1971).

3.8 Appendix: Technical Memo on Data Requirements (November 1971, revised)

I. Data for production functions, profit functions, relative efficiency, input demand curves and output supply curves.

1. Total quantity of output produced; price of marketed share; total value of output.

One should distinguish different varieties of output produced and variations in market prices obtained due to differences in variety, differences in location and differences in time of marketing.

If possible information should be collected about the self-consumption share of output; also its variety so that a value can be inputed to self consumption.

2. Quantity of variable inputs of production; market or imputed price of these inputs; total cost for each of these inputs.

A crucial variable input is labor. Where hired labor is used one should obtain quantities and wage rates by type of work where applicable. Is food provided by the employer? For permanently attached labor is an estimate of amount of agricultural work possible? The salary drawn; are meals included? For family labor one should obtain an estimate of the amount of time devoted to agricultural activities. Imputation of the wage of family labor can be done by utilizing information on the composition of the household and the quantity of land cultivated. Seasonal distribution of labor inputs.

Quantity and type of fertilizer used; price; also quantity and type of herbicides/insecticides; price.

Area of land cultivated, distinguishing different categories, e.g. irrigated, unirrigated, double or single cropped. Land rent by category, land price if available, land taxes. Depending on circumstances land can be a variable or a fixed factor of production.

Quantity and price of credit.

Costs of irrigation.

Quantity and price of fuel, etc.

Information on availability, accessibility and quantity of water inputs.

3. Quantity of fixed factors of production by category.

Type, make and year of important equipment; quantity; how old; any idea about life expectancy?

Inventory of fixed assets, e.g. farm structures, private irrigation works, etc; age; if possible value at construction or at present.

4. The rate of agricultural taxation, if any.

The information in Section 3 will be useful in converting capital assets into capital flows.

II. Data for imputing the price of family labor and also for estimating an agricultural labor supply curve.

1. Composition of each household, i.e. number of members, age primary activity.

2. For each member imputation of the time available for work into employed and unemployed portions; of the time employed what portion goes to agricultural activities? Days of subsidiary employment and wage rate for members of the household.

3. Human wealth, i.e., education of each household member.

4. Asset income and non-human wealth, if possible.

III. Data for estimating the demand for agricultural output (not necessary).

1. Consumption expenditures of each household, broken down by broad categories with quantities, prices and values.

IV. Data for comparing different socio-economic groups.

1. Categorical variable such as adopters, non-adopters; landlords, owner operators, tenants, sharecroppers, other tenancy arrangements; proximity to markets, etc.

4 RESEARCH OUTPUT

4.1 Academic Output

It is envisaged that the proposed research will result in a series of journal articles to be jointly authored by the local collaborators and U.S. based personnel. It is hoped that a conference can be organized at which many of the research findings may be presented and discussed. If the research findings are sufficiently significant and coherent, a book-length monograph to be jointly authored by all of the investigators may be appropriate. The research reports will also be made available to the relevant government agencies of the respective countries as possible aids in policy formulation and analysis.

4.2 Nonacademic Output

The project will provide some educational and training functions for the research assistants and students as well as the principals involved. In addition, this will be an opportunity to test out the viability of this new framework of international scientific collaboration.

5 POSSIBLE RESEARCH EXTENSIONS

5.1 Geographical Extensions

Should this particular form of international research collaboration prove successful and this particular research project yield significant and useful results, a natural extension will be in the geographical coverage to include other developing economies in Southeast Asia and possibly Africa and Latin America. Already data of a comparable nature either have been or are in the process of being collected in Indonesia, Republic of Korea and the Philippines. Scholars in these countries have also expressed active interest in participating in this project and a willingness to provide local financial support. However, it is felt that at this initial stage because of limitations of resources and time, attention should be focused on the three economies chosen--Republic of China, Malaysia and Thailand. It is also felt that experience gained in the implementation and execution of this project may be very helpful to the formulation of other comparable studies elsewhere.

5.2 Methodological Extensions

Because of limitations of both data availability and the state of the art, many problems can only be treated in a rather superficial manner in this proposed phase of the research project. Roughly, these problems fall into the following four areas:

(i) Personal Income Distribution. To get at the important but vexing problem of personal income distribution, it is necessary to have a reasonably large and random sample of households with detailed income, assets and liabilities, and education data. A time series of such data may be especially helpful.

(ii) Dynamics. What we have developed is basically a comparative statics framework for the analysis of the effects of various policies. In many applications, not only the equilibrium values, but the actual time paths of approaches

to these equilibrium values may be of crucial importance. An explicit dynamic framework with various speeds of adjustments has to be developed for this purpose. There will also be additional data requirements.

(iii) Micro-Macro Linkage. The linking of microeconomic functions in a macroeconomic equilibrium model is not completely satisfactory because of the partial reliance on time series macroeconomic data. Conceptually one should be able to derive all the macroeconomic functions from aggregation of microeconomic functions. To implement such a scheme will require microeconomic data not only from agriculture but also from the sectors that link with agriculture, for instance, the industrial sector. This appears to be a rather ambitious undertaking at this point.

(iv) Statistical Problems. There are statistical problems to the combined use of cross-section and time-series data as well as disagreements on the proper interpretation of these estimates. To bring our empirical findings into the proper perspective it is important that some of these problems be closely examined.

6 SCHEDULE

6.1 Introduction

It is proposed that the research project starts on September 1, 1972 and runs for a period of eighteen months through February 28, 1974. Since the basic data have either been collected or are in the process of being collected, it is believed that an eighteen month period is not only feasible but desirable as it allows an intense concentration of research efforts with a minimum of interruptions which may dampen the momentum. This latter consideration is especially important in a project which involves as many principals as this one. It is expected that both of the U.S. based principal investigators will be able to devote a significant proportion of their time on the research project.

6.2 Schedule

<u>Date</u>	<u>Activity</u>
September 1972	<ol style="list-style-type: none">1. Data collection to be continued or completed2. Preparation of background papers on local history and institutions3. Planning Seminar, September 10-16 in Hong Kong4. September 1-9 and September 17-23, selected local visits by the U.S. based principal investigators for on-the-spot consulting on the data, the framework, and empirical implementation
September to May 1972	<ol style="list-style-type: none">1. Full-time research on the project by the Taiwan collaborator, research economist at Stanford (Lin)
October to December 1972	<ol style="list-style-type: none">1. Full-time research on the project by one of the U.S. based investigators (Yotopoulos)
December 1972	<ol style="list-style-type: none">1. Data collection completed2. Data processing and analysis to begin both abroad and at Stanford

<u>Date</u>	<u>Activity</u>
March 1973 (3 weeks)	1. Visit by one of the U.S. based principal investigators to each of the three countries to discuss the empirical results and further directions of research
July 1973 (1 week)	1. A Conference of all the principals on this research project in Asia where the research results will be reported and critically discussed. A suitable forum may be the Far Eastern Meeting of the Econometric Society. 2. The research results will be written up jointly, with possible future extensions of this research indicated.
October 1973	1. Preliminary drafts of the final reports of each country as well as the general final report will be circulated for comments both in the countries involved and in the United States. Such reports will be made available to the Ford Foundation for review.
February 1974	1. Final report to be submitted to the Ford Foundation.

7 RESEARCH PERSONNEL

7.1 Introduction

The research personnel may be divided into two groups. One group consists of the local collaborator who heads the project in each country and directs the activities of students and research assistants involved. The other group consists of the U.S. based research personnel that also includes the Taiwan local collaborator who is currently residing at Stanford. This group is headed by Professors Yotopoulos and Lau at Stanford University. Close contact will be maintained both between the two groups and among the group of local collaborators. The specific distribution of the research personnel follows:

Malaysia

Local Collaborator: Professor Mokhtar bin Tamin, Department of Agricultural Economics, University of Malaya

Local Associates: Mr. Ani bin Arope, Deputy Director, MARDI
Mr. Lai Kok Chew, MARDI

Research Assistants

Thailand

Local Collaborator: Professor Kamphol Adulavidhaya, Department of Agricultural Economics, Kasetsart University

Research Assistants

Taiwan

Local Collaborator: Dr. Wuu-Long Lin, Research Economist, Stanford University

Research Assistants

U.S. Based Personnel--Stanford

Collaborators: Professor Pan A. Yotopoulos, Food Research Institute, Stanford University
Professor Lawrence J. Lau, Department of Economics, Stanford University

Taiwan Collaborator: Dr. Wuu-Long Lin, Research Economist, Stanford University
Research Assistant: Sandra Schwartz, Economist, University of British Columbia

7.2 Appendix: Curriculum Vitae of Local Collaborators

1. Mokhtar bin Tamin--to be supplied
2. Kamphol Adulavidhaya--to be supplied

7.3 Appendix: Curriculum Vitae of U.S. Based Personnel

1. Pan A. Yotopoulos---appended
2. Lawrence J. Lau--appended
3. Wuu-Long Lin--appended
4. Sandra Schwartz---appended

August 1970

CURRICULUM VITAE

I. PERSONAL

Name: Pan A. Yotopoulos
Address: Stanford University
Food Research Institute
Stanford, California 94305
Date of Birth: [REDACTED]
Place of Birth: [REDACTED]
Citizenship: U.S.A.
Marital Status: Married to the former Mary Kroos; two children

II. EDUCATION AND DEGREES HELD

1962 Ph.D. in Economics, University of California,
Los Angeles. Dissertation title: "Disguised
Unemployment and Elastic Supplies of Labor:
The Theory and an Empirical Test for Greece."
1958-60 University of California, Los Angeles
1957 M.A. in Economics, University of Kansas. Thesis
title: "Demonstration Effect and Economic Development."
1956-58 University of Kansas, Lawrence, Kansas
1956 Diploma in Political Science and Economics,
University of Athens, Greece
1954-55 University of Athens, Greece, Law School
Department of Political Science and Economics
1951-54 University of Athens, Greece, Law School

III. EMPLOYMENT RECORD

1972- Professor of Economics, Food Research Institute,
Stanford University

1968-72 Associate Professor of Economics, Food Research
Institute, Stanford University

1967-68 Associate Professor of Economics, and Director,
Economic Research Center, University of Hawaii

1960-67 Instructor, Assistant Professor, Associate Professor,
Professor, Department of Economics, University of
Wisconsin, Milwaukee

1963-65 (On leave from University of Wisconsin) Director of
Basic Research and Acting Director General, Center
of Planning and Economic Research, Athens, Greece

1961 (On leave from University of Wisconsin) Senior
Associate, Center of Economic Research, Athens,
Greece

IV. HONORS AND PROFESSIONAL SOCIETIES

American Agricultural Economics Association Award for Professional
Excellence-Published Research, 1969

Member of the American Economic Association

Member of the Econometric Society

Member of the American Agricultural Economics Association

Who's Who

American Men of Science

National Register of Scientific and Technical Personnel

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V. PUBLICATIONS

Books

1. (With Adam A. Pepelasis), Surplus Labor in Greek Agriculture, 1953-1960, Athens, Center of Economic Research, 1962. (Translated also into Greek.)
2. The Elasticity of the Labor Supply Curve: A Theory and an Evaluation for Greek Agriculture, Athens, Center of Planning and Economic Research, 1964.
3. (editor), Economic Analysis and Economic Policy, Athens, Center of Planning and Economic Research, 1966.
4. Allocative Efficiency in Economic Development: A Cross Section Analysis of Epirus Farming, Athens, Center of Planning and Economic Research, 1968. Received the 1969 Award for Outstanding Research of the American Agricultural Economics Association.

Articles

1. "The Elusive Test of Disguised Unemployment: John Lossing Buck's Data," The Indian Journal of Economics, Vol. 42, No. 164 (July 1961), pp. 27-35.
2. "Institutional Affiliation of the Contributors to Three Professional Journals," The American Economic Review, Vol. 51, No. 4 (Sept. 1961), pp. 665-670.
3. "The Wage-Productivity Theory of Underemployment: A Refinement," The Review of Economic Studies, Vol. 32, No. 1 (Jan. 1965), pp. 59-66.
4. "The Functional Relationship between the Wage Rate, Labor, and Leisure," Spoudai (Studies), Vol. 15, No. 3 (Jan. 1965), pp. 305-318.
5. "From Stock to Flow Capital Inputs for Agricultural Production Functions: A Microanalytic Approach," Journal of Farm Economics, Vol. 49, No. 2 (May 1967), pp. 476-91.
6. "The Greek Farmer and the Use of his Resources," Balkan Studies, Vol. 8, No. 2 (1967), pp. 365-386.
7. (With John Wise), "A Test of the Hypothesis of Economic Rationality in a Less Developed Economy: An Abstract," American Journal of Agricultural Economics, Vol. 50, No. 2 (May 1968), pp. 395-397; Also Econometrica, Vol. 36, No. 5 (1968).

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8. "On the Efficiency of Resource Utilization in Traditional Agriculture," Food Research Institute Studies in Agricultural Economics, Trade and Development, Vol. 8, No. 2 (1968), pp. 125-135.
9. (With Benton F. Massell), "A Note on Labor Migration," Kyklos, No. 2 (1969), pp. 331-333.
10. (With John Wise), "On Testing Competing Hypotheses: Economic Rationality Versus Traditional Behavior--A Further Development," American Journal of Agricultural Economics, Vol. 51, No. 1 (February 1969), pp. 203-208; also "Rejoinder," pp. 209-210.
11. (With John Wise), "The Empirical Content of Economic Rationality: A Test for a Less Developed Economy," Journal of Political Economy, Vol. 77, No. 6 (November-December 1969), pp. 976-1004.
12. (With John Wise), "Epilegomena on Traditional Behavior Models," American Journal of Agricultural Economics, Vol. 51, No. 4 (November 1969), pp. 938-939.
13. (With Lawrence Lau and Kutlu Somel), "Labor Intensity and Relative Efficiency in Indian Agriculture," Food Research Institute Studies in Agricultural Economics, Trade and Development, Vol. 9, No. 3 (1970), pp. 43-55.
14. (With Lawrence Lau), "A Test for Balanced and Unbalanced Growth," Review of Economics and Statistics, Vol. 52, No. 4 (November 1970), pp. 376-384.
15. (With Lawrence Lau), "A Test for Relative Efficiency and an Application to Indian Agriculture," American Economic Review, Vol. 61, No. 1 (March 1971), pp. 94-109.
16. (With Lawrence Lau), "Profit, Supply and Factor Demand Functions," American Journal of Agricultural Economics, 54 (February 1972), pp. 11-18.
17. (With Lawrence Lau), "A Test for Relative Economic Efficiency: Some Further Results," American Economic Review (December 1972), forthcoming.
18. (With Jeffrey B. Nugent), "The Balanced-Growth Version of the Linkage Hypothesis: A Test," Quarterly Journal of Economics (1972), forthcoming.

Book Reviews

1. "Oscar Lange: Political Economy, Vol. I," The American Economic Review, Vol. 54, No. 6 (December 1964), pp. 1091-1093.
2. "William G. Demas: The Economics of Development in Small Countries," The American Economic Review, Vol. 57, No. 1 (March 1967), pp. 245-247.
3. "P. Pavlopoulos: A Statistical Model for the Greek Economy," The American Economic Review, Vol. 57, No. 4 (September 1967), pp. 948-950.

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4. "Simon Kuznets: Modern Economic Growth: Rate, Structure and Spread," The Journal of Developing Areas, Vol. 1, No. 4 (July 1967), pp. 535-536.
5. "Jere Behrman: Supply Response in Underdeveloped Agriculture: A Case Study of Four Major Annual Crops in Thailand, 1937-1963," Journal of Economic Literature, Vol. 8, No. 2 (June 1970), pp. 459-462.
6. "R. T. Shand, ed.: Agricultural Development in Asia," Journal of Asian Studies, Vol. 29 (August 1970), pp. 909-911.
7. "Ugo Papi and Charles Nunn (ed.): Economic Problems of Agriculture in Industrial Societies," American Journal of Agricultural Economics, Vol. 53, No. 1 (February 1971), pp. 147-149.

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VITA

LAWRENCE J. LAU

Date of Birth:

Place of Birth:

Education:

B.S. with Great Distinction (Physics and Economics),
1964 Stanford University

M.A. (Economics), 1966 University of California

Ph.D. (Economics), 1969 University of California
Dissertation: "Duality and Utility Structure"

Specialized Fields:

Applied Economic Theory; Economic Development;
Econometrics; East Asian Studies; and Management
Science

Affiliations:

Phi Beta Kappa; Tau Beta Pi; American Economic
Association; Econometric Society; International
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Experience:

1969- : Assistant Professor of Economics,
Stanford University

1968-1969: Visiting Assistant Research Economist,
University of California, Berkeley

1967-1968: Assistant Professor of Economics,
Stanford University

1966-1967: Acting Assistant Professor of Eco-
nomics, Stanford University

Honors, Awards and Grants:

National Science Foundation Grant for research on
"Behavioral Equations and the Neoclassical Theory
of Production and Consumption", 1970-71.

Social Science Research Council, Joint Committee
on Contemporary China Grant, 1971-1972.

Renewal of National Science Foundation Grant for
research on "Behavioral Equations and Market Equili-
brium in the Neoclassical Theory of Production and
Consumption: A Project in Applied Economics," 1971-
1973 (with Mordecai Kurz).

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Publications of Lawrence J. Lau:

1. "Towards a Mathematical Model of Government Behaviour," Zeitschrift für Nationalökonomie, Vol. 28, No. 4, November 1968, pp. 355-380 (with B. S. Frey).
2. "Duality and the Structure of Utility Functions," Journal of Economic Theory, Vol. 1, No. 4, December 1969, pp. 374-396.
3. "Labor Intensity and Relative Efficiency in Indian Agriculture," Food Research Institute Studies, Vol. 9, No. 3, 1970, pp. 43-55 (with P. A. Yotopoulos and K. Somel).
4. "A Test for Balanced and Unbalanced Growth," The Review of Economics and Statistics, Vol. 52, No. 4, November 1970, pp. 376-384 (with P. A. Yotopoulos).
5. "A Test for Relative Efficiency and an Application to Indian Agriculture," American Economic Review, Vol. 61, No. 1, March 1971, pp. 94-109 (with P. A. Yotopoulos).
6. "Ideology, Public Approval, and Government Behavior," Public Choice Vol. 10, Spring 1971, pp. 20-40 (with B. S. Frey).
7. "Peasant Consumption, Saving, and Investment in Mainland China," in W. A. D. Jackson, ed., Agrarian Policies and Problems in Communist and Non-Communist Countries, University of Washington Press, Seattle, 1971, pp. 305-337.
8. "Profit, Supply and Factor Demand Functions," American Journal of Agricultural Economics, Vol. 54, No. 1, February 1972, pp. 11-18 (with P. A. Yotopoulos).
9. "Economic Development and Industrialization," in Y. Wu, ed., A Handbook on Communist China, Frederick A. Praeger, New York, 1972, forthcoming.
10. "Agricultural Surplus and Capital Formation: The Experience of Mainland China," Food Research Institute Studies, 1972, forthcoming.
11. "Applications of Profit Functions," in D. L. McFadden, ed., An Econometric Approach to Production Theory, North Holland Publishing Company, Amsterdam, 1972, forthcoming.
12. "A Bibliography of Materials on Provincial Level Economics and Politics in China," The China Quarterly, forthcoming (with R. M. Field, M. Oksenberg and F. Teives).

Publications, cont'd.

13. "Micro-Functions in a Macro-Model: An Application to Agricultural Employment and Development Strategies," in E. B. Ayal, ed., Proceedings of the Conference on Micro-Aspects of Development, University of Illinois Press, Urbana, Illinois, forthcoming (with P. A. Yotopoulos).
14. "Economies of Scale, Technical Progress, and the Nonhomothetic Leontief Production Function: An Application to the Japanese Petrochemical Processing Industry," The Journal of Political Economy, 1972, forthcoming (with S. Tamura).
15. "Profit Functions of Technologies with Multiple Inputs and Outputs," The Review of Economics and Statistics, 1972, forthcoming.
16. "Conjugate Duality and the Transcendental Logarithmic Production Function," The Review of Economics and Statistics, 1972, forthcoming (with D. W. Jorgenson and L. R. Christensen).
17. "A Test for Relative Efficiency: Some Further Results," The American Economic Review, 1972, forthcoming (with P. A. Yotopoulos).

Book Reviews: Lawrence J. Lau

1. G. Myrdal, The Asian Drama: An Inquiry into the Poverty of Nations 3 volumes, The Twentieth Century Fund, Inc., New York, 1968, in Stanford Law Review, Vol. 21, No. 4, April 1969, pp. 967-976.
 2. A. Eckstein, W. Galenson and T. Liu, eds., Economic Trends in Communist China, Aldine Publishing Company, Chicago, 1967, in Journal of the American Oriental Society, Vol. 89, No. 3, 1969, pp. 654-656.
 3. R. K. Diao, Taxation System of Communist China (Chinese edition), Union Research Institute, Hong Kong, 1969, in The China Quarterly, No. 44, October-December 1970, pp. 226-228.
 4. T. Hsiao, The Land Revolution in China, 1930-1934: A Study of Documents, University of Washington Press, Seattle, 1969, in Agricultural History, 1971, forthcoming.
- ~~_____~~

Working Papers:

1. "Planning and Economic Growth in Communist China," paper presented at the Association of Asian Studies, Honolulu, June 1968.
2. "International Differences in Social Security Development," paper presented at the Conference of the Western Economic Association, Corvallis, August 1968, issued as Research Memorandum No. 65, Research Center in Economic Growth, Stanford University (with K. Taira).
3. "Direct and Indirect Utility Functions, Theory and Applications," Working Paper No. 149, Institute of Business and Economic Research, University of California, Berkeley, March 1969.
4. "Self-Duality: A Comment," Working Paper No. 150, Institute of Business and Economic Research, University of California, Berkeley, March 1969.
5. "Budgeting and Decentralization of Allocation Decisions," Research Memorandum No. 89, Research Center in Economic Growth, Stanford University, March 1969.
6. "An Economic Theory of the Agricultural Household," paper presented at the Fourth Far Eastern Meeting of the Econometric Society, Tokyo, June 1969 (with D. W. Jorgenson).
7. "A Simple Demonstration of the Equivalence of the Chow Test and the Classical Test for a Set of Linear Hypotheses," Research Memorandum No. 100, Research Center in Economic Growth, Stanford University, June 1970.
8. "Semiorders and the Theory of Choice," Technical Report No. 31, Institute for Mathematical Studies in the Social Sciences, Stanford University, Stanford, July 1970 (with D. T. Jamison).
9. "A Linear-Logarithmic Expenditures System: An Application to U.S. Data," paper presented at the Second World Congress of the Econometric Society, Cambridge, England, September 1970 (with B. M. Mitchell).
10. "The Use of Provincial Data in the Study of the Chinese Economy: Promises, Problems and an Illustrative Application," paper presented at the Social Science Research Council Conference on the Economy of China, Cambridge, Massachusetts, December 11-12, 1970.

VITA

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Education:

B.S. with Honor (Agricultural Economics),
1965 National Taiwan University

M.S. (Economics), 1968 Kansas State University
Thesis: "The Effects of Weather on Crop
Production in the Great Plains"

Ph.D. (Food Research Institute with major
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University
Dissertation: "Agricultural Growth and
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Specialized Fields:

Economic Development; Quantitative Economics;
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puter Programming

Affiliations:

Honor Society of Phi Kappa Phi; American
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Experience:

1968- : Graduate Research Assistant,
Stanford University

7/71-9/71: Dissertation Research, Chinese-
American Joint Commission on Rural
Reconstruction, Taipei.

6/70-9/70 Research Assistant, Harvard University

2/68-9/68 Research Associate, Kansas State
University

Honors, Awards and Grants:

Dissertation Research Grants, National Science Foundation, 7/71-7/72.

Fellowship, Center for Research in International Studies, Stanford University, 7/71-9/71.

Fellowship, Stanford University, 9/68 to present.

Scholarship of Chinese Statistical Association, 1962.

Honor Student, National Taiwan University, 1961-1965.

Research and Publications of Wu-Long Lin:

1. "An Analysis of Consumer Demand with Projection to 1975 and 1980, Taiwan," Review of Bank of China, October & December 1971.
2. "A Modification of A Two-Stage and Three-Stage Least Squares Computer Program," Dept. of Economics, Stanford University, May, 1971, (with R. Code and L. Lau).
3. "Measuring the Effect of Weather on Crop Production", Canadian Journal of Agricultural Economics, Vol. 17, No. 1, pp. 91-98 February 1969, (with Orian Buller).
4. "Influence of Weather on Number of Cattle and Implication for a Regional Economy," submitted for publication, (with O. Buller).
5. "The Interpretation of Multicollinearity by Venn Diagram," submitted for publication, (with G.V.L. Narasimham, O. Buller).
6. "An Analysis of Private Consumption Expenditure with Long-Run Projection 1975-1980 and Its Implication for Resource Allocation: Taiwan," current research.
7. "Consideration of Income Generation and Employment Linkage in Economic Planning", current research.

CURRICULUM VITA

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FAMILY STATUS: Married to William T. Ziemba

UNIVERSITY ATTENDANCE:

University of California, Berkeley October 1966 - August 1969
Ph.D. Program
Theory Screening Exam: June 1967
Qualifying Exams: May 1968
Fields: Economic Planning and Economic
Development - currently working
on dissertation

University of Wisconsin, Madison September 1965 - August 1966
MA in Economics
NDEA Fellowship

University of California, Berkeley September 1962 - June 1964
BA with Honours in Economics
Phi Beta Kappa

The George Washington University, September 1960 - June 1962
Washington, D.C.
AA

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TEACHING EXPERIENCE:

Lecturer, Department of Economics, University of B.C., July 1971 -

RESEARCH EXPERIENCE:

1. Research Assistant for Professor Roy Radner October 1966 - August 1969
 - a. Center for Research in Management Science - dissertation research, educational planning: activity analysis model of education, comparison of three schools in California Higher Education System with investigation of criteria for comparisons of university, state college and junior college activities and development of planning model.
 - b. Growth project - international comparisons of interindustry input-output tables
Technical Report #5: Note on the Availability of Interindustry Tables, includes a review of the literature on international comparisons and a summary of the countries which publish input-output tables

2. Center of Planning and Economic Research September 1964 - June 1965
Athens, Greece
Research Assistant for Professor Tillo Kuhn (York University, Toronto) on his study of Greek transportation
Also independent work on the use of imported second-hand machinery.

3. Research Assistant for Professor Roy Radner June 1963 - June 1964
Disaggregated Cobb-Douglas production functions for U.S. industries

4. Research Assistant for Professor Jack Lessinger Fall Semester 1962
(Now of the University of Washington, Seattle)
Urban land uses in the San Francisco Bay Area

MAJOR COURSE WORK:

Economic Development: Chenery, Mrs. Clemhout, Morgan, Hawkins, Strasma
Economic Planning: Radner, Malinvaud
Econometrics & Stat.: Radner, Jorgenson, Goldberger
International Trade: Letiche, Higgins, Baldwin
Public Finance: Diamond, Straxma, Break
Economic Theory: Jorgenson, Farrell, Harsanyi, Harris

REFERENCES:

Professor Roy Radner, Economics Department, University of California, Berkeley
Dr. Simone Clemhout, Economics Department, University of California, Berkeley
Professor Pan A. Yotopoulos, Food Research Institute, Stanford University,
Palo Alto, California
Professor W. Erwin Diewert, Economics Department, University of British Columbia,
Vancouver

13

TEACHING AND RESEARCH INTERESTS:

Economic planning and public policy including development planning, foreign trade, public finance, urban planning, educational planning, and comparative systems.

PAPERS:

"On Approaches to Development Planning", Co-existence, July 1970

"Second-Hand Machinery in Development or How to Recognize a Bargain", Journal of Development Studies (Forthcoming).

"Note on the Availability of Interindustry Tables", Project for the Information and Optimization of Economic Growth Technical Report #5 University of California, Berkeley, 1968

"Factor Analysis and the Stability of Input-Output Coefficients for Educational Planning" UBC Economics Discussion Paper No. 72

"Choice of Technique in Educational Planning", dissertation in process

8 RESEARCH FACILITIES

8.1 Introduction

Research will be carried out in the countries involved and in the United States. A brief description of the facilities available follows.

8.2 Taiwan

Office space available at the Joint Commission for Rural Reconstruction (JCRR).

Computer facilities are not available at JCRR, but access may be obtained through other government agencies.

Commercial computer time is expensive.

Most of the collected Taiwan data are already stored on tape in the U.S.

8.3 Malaysia

Office space available at the University of Malaya and at MARDI.

Commercial computer facilities are available in Kuala Lumpur and also in Singapore.

8.4 Thailand

Office space available at Kasetsart University.

Description of computer facilities will be forthcoming from the local collaborator.

8.5 Stanford University

Office space available at the Food Research Institute and at the Center for Research in Economic Growth.

Computer is IBM 360-67 available at \$500/hr. There is also some free time available.

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Computer programs already developed for the specific purposes of this project and on storage at the Stanford Computation Center are TTLS, Nonlinear Estimation Program and Simulation Programs.

Keypunch facilities and facilities for handling tapes exist.

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9 RESEARCH BUDGET

9.1 Introduction

The total research budget may be divided into three parts:

First, a local budget covers the expenses to be incurred by the local collaborators for the marginal data collection operations, primary data processing, research assistance, clerical assistance, honoraria, etc. These expenses will be defrayed either from local institutions or from direct grant applications by the local collaborators to the local Ford Foundation Office.

Second, an international travel budget for the local collaborators for a two-to-three month stay at Stanford. The project will be greatly expedited and the collaborators, both U.S. and local, will greatly benefit if a physically close working relationship that can also take advantage of the Stanford facilities becomes possible. It is hoped that other funds can be obtained to finance such a visit by the local collaborators for the spring of 1973.

Third, the appended budget refers to Ford Foundation support to defray research costs incurred in the United States and also international travel costs of the collaborators and their associates.

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