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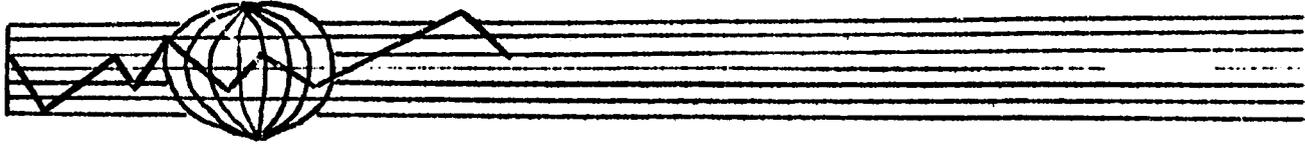
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ECONOMIC DEVELOPMENT CENTER



ANNUAL REPORT: 1973

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ECONOMIC DEVELOPMENT CENTER
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UNIVERSITY OF MINNESOTA

The University of Minnesota Economic Development Center was established in 1967 as a joint activity of the Department of Economics and the Department of Agricultural and Applied Economics. It is one of several centers and programs organized under the Office of International Programs.

The Economic Development Center was organized to facilitate the research interests of graduate students and staff in the two departments who are interested in development economics and policy. The program of the Center is closely linked to several other units of the University of Minnesota which have a strong development orientation, such as the Center for Comparative Studies in Social and Technical Change and the Office of International Agricultural Programs.

The program of the Center reflects the conviction that application of knowledge with respect to economic behavior can represent an efficient source of economic growth.

ANNUAL REPORT: 1972

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INTRODUCTION

The initial section of the Annual Report: 1973 is devoted to two papers based on research supported by the University of Minnesota Economic Development Center. The first paper by T. Paul Schultz, "Population Policy and the Demand Model of Fertility," discusses the economic demand theory of fertility and the policy implications of this new approach. The second paper by Surjit S. Sidhu, "Technical Change in Wheat Production in the Indian Punjab," analyzes the impact of the high-yielding wheat varieties in the Indian Punjab on costs of production and degree of mechanization, and investigates factors which explain rates of adoption of the new technology.

The research program of the Center is focused in four areas:

- Population and Labor Markets in Development
- Trade and Development: Interregional and International
- Commodity and Factor Markets in Developing Countries
- Technical Change and Resource Use

The second section of the Annual Report: 1973 contains short reports on research recently completed or currently underway.

The Annual Report: 1973 also describes several "Related Projects and Programs" in which members of the Departments of Economics and Agricultural and Applied Economics are involved. Particular attention is given to the work of the University of Minnesota in Argentina, India, and Thailand. There is also a section which outlines "The Graduate Program in Economic Development at the University of Minnesota," including graduate course offerings, staff, and staff developments.

The final sections list "Center Publications," "Workshops and Seminars," and "Sources of Support."

POPULATION POLICY AND THE DEMAND MODEL OF FERTILITY
T. PAUL SCHULTZ

(to be completed)

The period since the Second World War has been overshadowed in most low-income countries by historically unprecedented rapid rates of population growth. Although evidence is growing that population growth rates are stabilizing in most of these countries, and have begun to decline in some, the design and implementation of sound long-run population policy awaits an improved understanding of the causal relationships between individual reproductive behavior and the development process. Some tentative progress has been made in identifying and measuring several economic and demographic factors that appear to be responsible for a statistically significant share of cross-sectional variation in fertility. But little work has yet been done to extend this framework to account for time-series variation in fertility, or to adapt it to grapple with policy issues. Moreover, the "economic" arguments advanced in support of policies to slow rapid population growth continue to be based on disconcerting welfare assumptions that ignore the distributional issues at the core of the population problem. I shall discuss first, very briefly, the implications of and evidence for the evolving economic demand theory of fertility. Second, I shall suggest what I regard to be the policy implications of this new analytical approach.

There are many explanations of why human fertility varies from one society to another and among different groups or individuals within the

same society. An economic framework for the study of differential fertility has evolved from models of household nonmarket choice articulated by Jacob Mincer and Gary Becker. This general approach emphasizes both the time and money income constraints on a family's choice of final consumption activities. Though there is as yet no consensus on how constraints should be imposed on this general formulation to obtain a realistic but refutable demand theory of fertility, certain general implications can be noted.

The effect of changes in income on the demand for children depends, within this framework, on the source of income, and hence on the price effect embodied in that source. If children are not an inferior good, as seems intuitively appealing, an exogenous increase in the household's stock of nonhuman wealth increases unambiguously the demand for children. Exogenous increases in the household's stock of human wealth, as reflected by an increase in a parent's permanent (discounted lifetime average) wage rate, implies both a positive wealth effect and an offsetting price effect due to the increased shadow price of parents' time employed in the care and enjoyment of their children.

Given reasonable magnitudes for the parents' relative valuation of time and its allocation among market work, child rearing, and other nonmarket activities, this theory of household demand implies that the effect on desired fertility of an increase in the woman's value of time will be algebraically smaller (and probably negative) than that of the man's value of time. Cross-sectional studies of individual countries at all levels of economic development have confirmed this qualitative prediction. In part, because of the difficulties of measuring a permanent wage rate, particularly for women not currently in the paid labor force, education has often been used as a satisfactory proxy for lifetime wage rates. When fertility is regressed on the educational level of men and women, the women's coefficient

tends to be negative and several times its standard error, while the men's education coefficient is smaller in absolute magnitude and generally less significant statistically. When earnings or wage rates of men and women are studied for regional population aggregates or for couples where husband and wife are currently working, t-statistics increase for women, and men's earnings or family income is often positively correlated with fertility. The predicted positive relation between exogenous differences in nonhuman wealth and fertility is less often tested, because of the scarcity of information on personal nonhuman wealth and the endogenous nature of related life cycle savings behavior.

In low income countries, infant and child mortality is strongly positively related to the level of fertility in virtually all cross-sectional analyses of fertility to date. Although the economic framework suggests that child mortality would increase the price parents may expect to pay per surviving child, demand for births appear not to fall as the incidence of child mortality rises, quite the contrary. One way to account for this empirical regularity is to conclude that parent demand for children is not defined in terms of births but in terms of children that reach maturity, and their demand schedule for surviving children is highly price inelastic. Considerations of risk aversion, or substitution of demand from numbers of surviving children to the resource intensity of child rearing, may provide further explanations for this pronounced positive relationship between child mortality and subsequent levels of fertility.

The consistent effects on fertility of the shadow price of husband's and wife's time and child mortality encourage further exploration of this economic demand theory of fertility. Refinements of the model must now incorporate qualitative variation in the resource intensity of child rearing, without relying excessively on artificial "corner solutions" to the family's

allocation of time. The single-period static formulation has proven a powerful generalizing device for understanding cross-sectional variation in fertility, but little attention has yet been given to what economic theory and statistical techniques can say about dynamic models for time-series variation. Families are informed sequentially, and the constraints on childbearing jointly and simultaneously affect many other areas of economic and demographic decision-making in the household. Mate selection, the life cycle timing of marriage and migration, and the allocation of both spouses' time between market and nonmarket activities are decisions that are intimately related to similar price and income variables, as well as underlying tastes. Extending models of fertility to encompass these additional areas of jointly and simultaneously determined household choices may provide an important start toward modeling the economic development process from the point of view of the household sector.

Implications for Public Policy

It is premature to suggest that the demand approach to understanding the determinants of fertility has shed much light on the design and evaluation of population policy. The framework, however, challenges the adequacy of current procedures for evaluating the success of family planning, brings into sharper focus a variety of unconventional policy instruments to indirectly affect fertility while advancing other social goals, and raises fundamental questions about the validity of commonly encountered rationales for direct incentive payments to parents to slow rapid population growth.

The most common approach to evaluating family planning programs is to measure the program's output of services per unit of input. Information on the age of individuals accepting a method of birth control in the program and the clinically estimated effectiveness of the method they adopt yields a sophisticated measure of the potential number of births averted by the

program's services. But no method has been devised to estimate the extent to which program subsidized services replace or substitute for other higher cost and perhaps less reliable sources of birth control available in the private marketplace. The more price inelastic is parent demand for children, the smaller would be the real effect of a family planning program on the birth rate, as a fraction of this potential effect of its services.

If the evaluation of population policies is to be substantially improved, the tenuous link between the distribution of family planning services and the resultant decline in births must be statistically verified. Indirect inferences cannot be avoided, for there are unobserved links in the complex chain of events that in this case relate policy instruments to ultimate policy objectives. The demand approach to fertility determination stresses the need to identify and to allow for the influence of changing economic and demographic constraints on the household sector that are likely to be changing desired reproductive behavior. One might anticipate that family planning activity in many countries would be correlated with these structural changes in the society, giving rise by class and by region to differential rates of birth control acceptance within the program. Consequently, to appraise without bias the independent impact of family planning programs on fertility, all relevant demand constraints must be considered together with family planning inputs.

An economist might regard a family planning program as an investment augmenting and diffusing a useful stock of knowledge about new techniques of birth control not unlike technical assistance through farm extension agents. By lowering the fixed informational costs and perhaps also subsidizing the marginal user costs of modern methods of birth control, this investment should contribute to more efficient patterns of birth control

adoption. Possibly more important than its average effect on the birth rate might be the personal distribution of program benefits. Although all classes might benefit from the reduced marginal user costs, the fixed informational costs are probably a more severe barrier to adoption among segments of the population that reside in remote rural areas and have less sophisticated skills for searching out and evaluating the returns from new products and services. I would hazard a guess that in a dynamic society these informational benefits are likely to be greatest among the lowest classes, and, therefore, over generations a major payoff to family planning will be in slowing or reversing the disconcerting growth of economic disparities among classes in a society.

But few observers anticipate that further improvements in birth control technology can continue to reduce substantially the cost and increase dramatically the acceptability of newer methods. Given the apparent price inelasticity of demand for children, one may doubt whether further improvements in birth control technology will be responsible for a continuing fall in desired or actual fertility. The distinct possibility, therefore, exists, that as family planning programs succeed throughout the world in transmitting their more-or-less fixed stock of information and services to all strata in a society, further activity along these lines will have a sharply diminishing payoff.

The past search for policy options to cope with rapid population growth mirrors a natural but nonetheless one-sided technocratic view of the problem. It seems far simpler to disseminate a better birth control technology, which is already operational in developed countries, than to modify parent reproductive goals by indigenous processes of social change about which little is known. For example, expenditures on family planning that seek to lower the supply price of modern birth control technology and

hence reduce the cost (pecuniary and subjective) of restricting fertility are a widely approved policy response. Alternatively, expenditures on, say, public health that seek to reduce child death rates, contributing to a downward shift in parent demand for numbers of births, is thought to be a counterproductive or at best a controversial policy strategy. Both sets of policy options--the "supply" and "demand" sides--need further quantitative study if decision-makers are to be able to select an equitable and efficient mix of family planning and development policies for each social setting.

If, as is often asserted, familial behavior, involving marriage, reproduction, and women's role in the labor force, is particularly resistant to environmental changes associated with alternative development strategies, then to align development policies to foster the adoption of smaller family size goals may be ineffectual. Public policy would, then, wisely emphasize, for the moment, improvements in birth control technology and the dissemination of these improved techniques to all strata of society. Alternatively, if demand for children is price inelastic and family size goals are insensitive to the available mode of birth control, widespread acceptance of better birth control methods may not independently accomplish substantial reductions in the birth rate.

A related reaction to the apparently declining efficacy of improved birth control technology in the aftermath of a successful family planning program is to rely on direct economic incentives to change parent reproductive behavior. The common "economic welfare" arguments used in this regard to buttress the case for slowing rapid population growth are seriously flawed.¹

1. The micro economic approach calculates the present value of preventing a birth, as advanced by Stephen Enke, but ignores the nonpecuniary returns from children, and presumes that parent resources expended on their own children are somehow social costs. The second approach constructs a macro economic growth model and simulates the effect of population growth, as pioneered by Coale and Hoover. Social benefits are essentially measured in terms of per capita income which excludes, conveniently, the nonpecuniary returns parents obtain from their offspring.

In applying economic logic to the evaluation of the consequences of population growth, the unacceptable assumption is implicitly made that children are nothing more than a pecuniary investment. Although these average productivity or efficiency arguments for slowing population growth by direct incentive payments to parents are conceptually and even empirically inadequate, the consequences of rapid population growth on the personal distribution of income are less ambiguous and these equity effects are possibly more important in the long run.

The attraction of the demand model of fertility is that it identifies environmental conditions that should motivate parents to want fewer children and invest more in each child, and, moreover, these conditions are generally linked to eminently desirable social investment programs that should contribute to a less unequal personal distribution of future income. Support is growing for such programs as, for example, promoting the health and nutrition of mothers and young children, accelerating the growth of educational opportunities at the elementary and secondary level for women as well as for men, facilitating the entry of women into the labor force, and strengthening the economic and legal status of women and children. These are fundamental changes in any social order that will be resisted by many and could absorb more resources per prevented birth than direct incentive payments to avoid births.

Suppose the level and personal distribution of economic resources in a society affect fertility, and the relationship between economic and demographic variables and fertility can be specified and estimated with increasing precision along the lines discussed earlier. It would be surprising indeed if a mix of development policies were not then found that could accomplish nearly all that is currently sought in most parts of the world, but held the added promise of affecting fertility and the quality

and rate of population growth. The potential of the economic demand theory of fertility outlined in this paper is that it could provide a society, in principle, with a decentralized means to bring into better balance social and private interests in having children. This might be accomplished without sacrificing the important function individuals perform best--evaluating, ordering, and satisfying their own wants.

TECHNICAL CHANGE IN WHEAT PRODUCTION IN THE INDIAN PUNJAB
SURJIT S. SIDHU

Surjit S. Sidhu has been engaged in a comprehensive study of the impact of the high-yielding wheat varieties in the Indian Punjab on costs of production and degree of mechanization, and an analysis of factors explaining the rates of adoption of the new technology. The results of this study are summarized in the present paper. The research has been supported by the Rockefeller Foundation and the University of Minnesota Economic Development Center.

The issues involved in agricultural development policies of the developing countries evolve from: (1) the need to obtain maximum potential agricultural output, (2) the need for more productive employment of the rapidly growing labor force, (3) increasing social and political pressures for reducing the inequalities of income distribution, and (4) the problem of attaining a desirable balance among these goals. The recent agricultural transformations that are resulting from the spread of high-yielding varieties of (Mexican) wheat and rice in many less developed countries seem to have a direct bearing on each of these problems. It seems important to develop an understanding of this process of change as it is taking place. This provides us a unique opportunity to enhance our understanding of the process of agricultural development which is of crucial importance for designing national strategies for development.

The current research is an attempt to provide a quantitative assessment of this transformation during the years 1967/68 to 1970/71, in case of wheat in the Indian Punjab, in the center of the Indo-Pakistan wheat growing region. During the decades of the 1950's and 1960's Punjab has shown remarkable economic performance in which the introduction of the new high-yielding varieties of wheat played an important role.

Specific objectives of this research were: (1) to study the nature and magnitude of change in wheat production technology resulting from the introduction of high-yielding varieties of wheat, (2) to compare the long-run

cost functions of old and new varieties of wheat, (3) to compare the economic performance of small versus large and tractor-operated versus non-tractor-operated farms in producing wheat, (4) to investigate the response of wheat-producers to disturbances in factor markets generated by the shifts in factor productivities resulting from the adoption of new wheat technology, (5) to obtain estimates of several useful elasticity measures, (6) to investigate the role of education in wheat production, and (7) to study the question of economies of scale.

For empirical implementation of these objectives, three interrelated models were used: (1) a simple production model based on the standard neoclassical (Cobb-Douglas) production function, (2) the cost function of the Cobb-Douglas type, and (3) the profit function.

The data, on which the empirical findings are based, came from private farms. Studies in farm management conducted by the Government of India during the years 1967/68 and 1968/69 in the Ferozepur district of Punjab, and a similar study by the Government of Punjab during the year 1969/70 (conducted in 19 villages spread over practically the whole of Punjab) are the major sources of data. These data are supplemented by farm data for the year 1970/71 collected under the author's personal supervision.

Empirical Results

For the purpose of evaluating the nature and magnitude of change in the technology of wheat production from old to new wheat, Cobb-Douglas production functions of the two wheats were compared using data for 1967/68. The results indicate that the production function shift associated with the introduction of the new varieties has been of the neutral type and that the efficiency parameter for the new varieties is larger by 22.85 percent than the efficiency parameter for the old varieties. The gain in efficiency estimated from the profit function model is in the order of 44.70 percent.

This is an important result with the consequent increased potential for growth of wheat output. The magnitude of gain in efficiency is perhaps the largest reported in the history of improvement of cereal crop technology. In the case of hybrid corn, an outstanding U.S. example of technological success based on seed improvement, a 15 to 20 percent increase in yield of corn, was reported over the open-pollinated varieties.

One of the major earlier controversies of the "green revolution" was whether the unit costs of production were lower in the case of new varieties of wheat compared to the old varieties, or whether the new varieties simply produced a larger output per unit of land with a concomitant increase in the level of input applications. The upward shift in the production function for wheat resulting from the introduction of new varieties implies a reduction in the unit costs of producing wheat at given input prices.

The question whether the "green revolution," that is, the introduction of high-yielding varieties of wheat, resulted in a significant shift in the demand for labor (and other factors of production) has become controversial in the literature. The results of this investigation indicate an upward shift of the order of 25 percent in the derived per acre demand functions of labor, capital inputs, and fertilizer resulting from the introduction of new wheats. This shift in the factor demand functions has important implications for factor markets. In particular, it underscores a substantial labor-absorptive capacity of the "green revolution," in view of a rapidly growing labor force in India (both rural and urban) and slow rate of growth in demand for urban-industrial employment.

The shifts in demand for chemical fertilizer and various forms of capital have implications quite contrary to the shift in the labor demand function. It is suggestive of the impending necessity of developing larger supplies of these inputs.

The increased productivity of land from the introduction of new wheats was reflected in subsequent years in rising land values. This became a windfall gain to the owners of farm land--a gain at almost no cost to the owners. These gains were in addition to gains in net incomes that resulted from the new wheats, which increased linearly with the amount of land operated. Thus, even though the shift in the wheat production function resulting from the introduction of new varieties has been neutral in character, the "effects" of the "green revolution" seem to have increased existing inequalities of income distribution in favor of larger land owners. There seems to be an obvious need for fiscal measures to correct these increasing inequalities. These gains should also constitute an important source of funds for investments designed to create new income streams if one is interested in establishing the conditions necessary to maintain the momentum of the "green revolution."

In order to develop a perspective on the behavior of production and cost relationships of the new varieties after their introduction in 1966/67, the data pertaining to the four years 1967/68 to 1970/71 were analyzed. The input elasticities, for the Cobb-Douglas production function obtained from the four years' combined data, with respect to labor, land, capital, and fertilizer are 0.194, 0.500, 0.244, and 0.068, respectively. The results indicate that the production function for the new wheat was unstable over the four-year period studied. Subsequent to the year 1967/68 a decline is observed in the efficiency parameter of the production function. As a result, and also because of a rise in the average level of input prices relative to 1967/68, the long-run cost function for new wheat shifted upwards to the order of about 40 percent for 1968/69, 41 percent for 1969/70, and 32 percent for 1970/71. The rupees per quintal costs of producing new wheats calculated at the geometric means from each years'

sample were 50.91 for 1967/68, 72.97 for 1968/69, 70.81 for 1969/70, and 69.41 for 1970/71.

In addition to comparing the economic performance of old and new varieties of wheat, relative economic efficiency and its components of technical efficiency and price (or allocative) efficiency are compared for small versus large (larger than 10 acres of wheat) farms and tractor-operated versus non-tractor-operated farms, in the production of new wheat. These comparisons have considerable relevance in the context of the "green revolution" and the absorption of a rapidly growing labor force in India and other LDCs. The analysis is carried out in the framework of the profit function formulation used by McFadden, Lau, and Yotopoulos at Stanford University.

In comparing small and large farms, the results indicate that both types of farms have equal over-all economic efficiency and that they also have equal technical efficiency as well as price efficiency with respect to labor use. The tests supported this conclusion for each of the four years individually as well as when the data were pooled. The same conclusion holds for tractor-operated and non-tractor-operated farms in the case of year 1969/70.¹ In either case no strong evidence is found against the hypothesis of constant returns to scale.

Wheat producers in Punjab (both small and large) were, however, not able to maximize profits during the years 1967/68, 1968/69, and 1969/70, in the sense of equating the value of marginal product of labor to its wage rate. This was also the case of both the tractor-operated and non-tractor-operated farms for the year 1969/70. But during the last year,

1. Preliminary results from the analysis of data for all farm enterprises for this year, indicate that non-tractor-operated farms are more efficient economically than tractor-operated farms. Analysis for determining whether this difference is due to superior technical efficiency or the price efficiency (or both) of the non-tractor-farms is in progress.

1970/71, the hypothesis of absolute price-efficiency cannot be rejected for both the small and large farms. These results, thus, seem to suggest that in a changing agriculture, as was the case during the period under this investigation, one should expect the existence of a fair amount of inefficiency in the labor market but that producers do seem to react to overcome the existence of a disequilibrium.

From the profit function estimates certain elasticity estimates are obtained which have important policy applications. The best possible estimates of the input elasticities of the Cobb-Douglas production function, which are indirectly derived from the profit function estimates, with respect to labor, land, and capital services (including fertilizer) are 0.213, 0.522, and 0.265, respectively. These elasticities for labor, land, capital (excluding fertilizer), and fertilizer obtained from the direct estimation of the Cobb-Douglas production function are 0.194, 0.500, 0.244, and 0.068, respectively.

The labor demand elasticities with respect to the wage rate, quantities of land, capital, and price of wheat, respectively, are -1.271, 0.663, 0.337, and 1.271. All these estimates have the expected signs. The price elasticity of demand for labor indicates the demand is quite responsive to changes in wage levels. Positive responses for labor demand to increases in quantities of land and capital have important implications for labor absorption in wheat farming.

The elasticities of output supply with respect to the wage rate and output price are -0.271 and 0.271, respectively. The relatively inelastic output response with respect to wage rate, along with an elastic response of demand for labor with respect to wage rate, implies that exogenously enforced wage rates for agricultural labor above the market determined wage rates could result in a substantial increase in unemployment of the

agricultural labor force. The magnitude of output response to wheat price is important for any effort to use the output price as a policy instrument for inducing an increased supply of wheat.

Reduced form output elasticities obtained with respect to land and capital are 0.663 and 0.337, respectively. These elasticities indicate the output response of the average farm with respect to exogenous increases in quantities of land and capital, respectively, holding the normalized wage rate and not the quantities of labor as a constant.

Summary and Conclusions

In this investigation an attempt was made to give empirical content to the change in production technology of wheat resulting from the introduction of Mexican exotic varieties of wheat, based on farm-level primary data from the Indian Punjab for the years 1967/68 to 1970/71. The results indicate that the shift in the production function for wheat has been of the neutral type--it has not been strongly biased in either a labor-saving or a capital-saving direction. It has been cost-saving. Technical efficiency has increased by almost one-fourth and unit costs of production have declined by about 16 percent. The demand per acre for labor, fertilizer, and capital inputs increased by about 25 percent.

The results also indicate that tractor-operated farms are no better in terms of their economic performance in wheat production than non-tractor-operated ones and that large farms are no better than small farms--there are no differences in the technical and price efficiency parameters of these classes of farms. From the data analyzed in this study there seems to be no strong evidence against the phenomenon of constant returns to scale in the production of new wheat varieties. We cannot argue against small farms on the grounds of economies of scale. In order to maintain the momentum of the "green revolution," measures seem to be called for to

siphon off a part of the gains from capitalized land values for reinvestments designed to generate new income streams. Measures are also required for a more equitable distribution of income and wealth gains.

There seem to be only limited possibilities for growth by improving allocative efficiency in moving toward the given production frontiers. This is the inference from tests indicating rational producer response to disturbances in the labor market generated by shifts in the labor demand function. On the other hand, technical changes, such as the shift in the production function, constitute the more important sources for potential increases of output.

Finally, the analysis of our data have provided a number of elasticity measures which are important for applications of economic theory for developmental policy.

CENTER RESEARCH REPORTS

TECHNICAL CHANGE AND POPULATION GROWTH IN THE ECONOMIC DEVELOPMENT OF JAPAN
MITOSHI YAMAGUCHI

The relationships among technical change, population growth, and economic development are poorly understood. In this study an attempt was made to measure the effects of differential rates of technical change in the agricultural and nonagricultural sectors and of population growth on Japanese economic development in every decade for the period 1880-1970. This was an attempt to apply general equilibrium growth models to empirical data and, therefore, bridge the gap between abstract growth theory and history.

A compound two sector model which is a synthesis of an agriculture-nonagriculture two sector model and a consumption-capital goods two sector model was constructed theoretically. Empirically, this model was reduced by aggregation into a two sector model with an agricultural and a non-agricultural sector. The model was constructed to permit an evaluation of the effects of technical change, population, and labor force growth on per capita income and the flow of physical and human resources among sectors through product and factor markets for every decade. In contrast to Kelley and Williamson's work [1972], agricultural and nonagricultural technical change were treated independently, the labor participation rate was not assumed to be fixed, and the period covered extends from 1880 to 1970. Also much of the empirical analysis focused on the change in economic structure over time rather than simulation on a fixed structure.

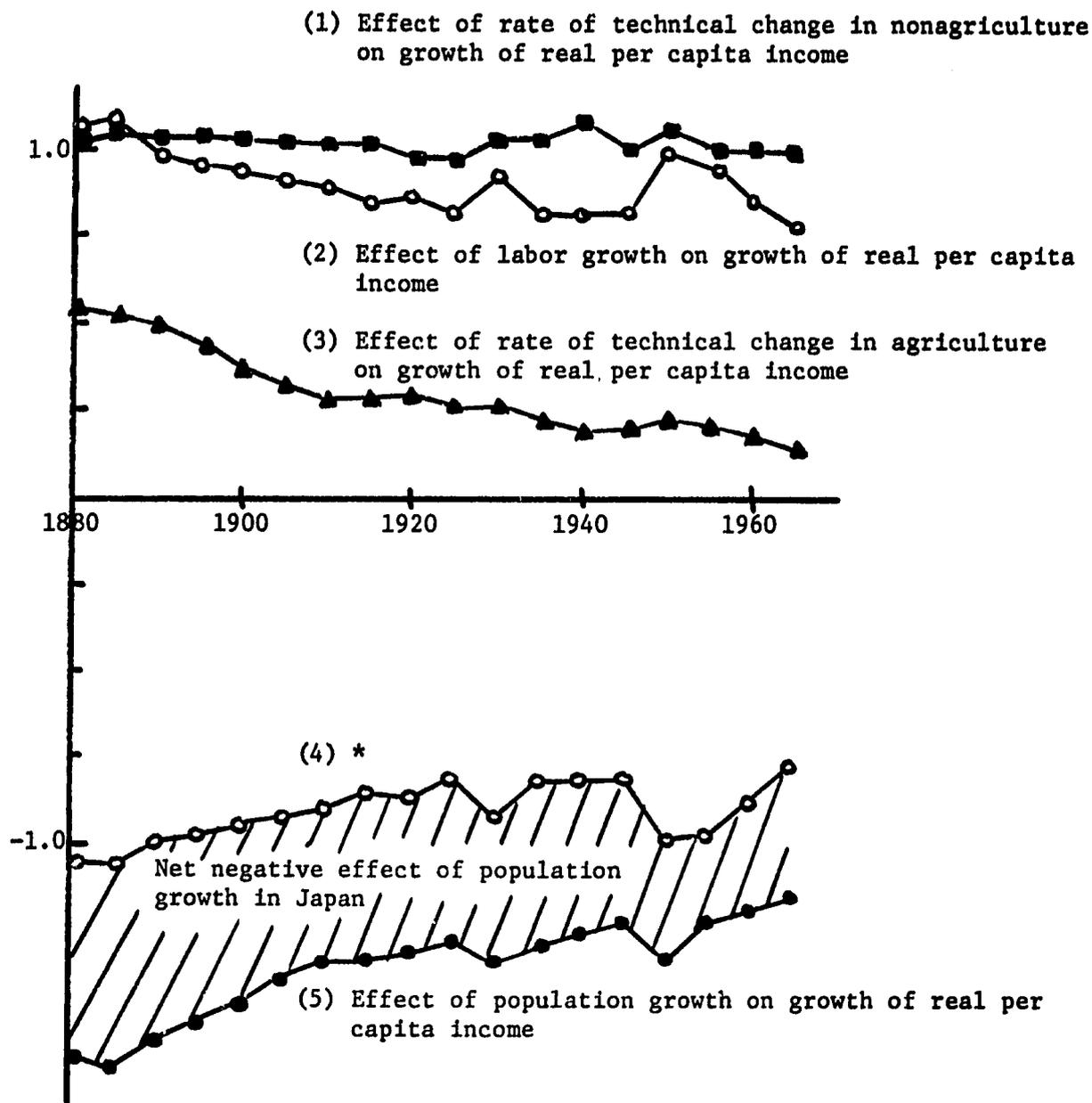
The following empirical analyses were carried out in our model:

1. Growth rates of exogenous variables such as technical change in agriculture and nonagriculture were measured during the period 1880-1970 using the equations and the production parameters of the model.

2. Matrices of "growth rate multipliers," which give us the effects of the exogenous variables on the endogenous variables, were obtained in our model for each decade. This allows an analysis of the structural change of the economy.
3. Comparisons were made of the Japanese and U.S. growth rate multipliers.
4. The historical contributions of exogenous variables to the endogenous variables were estimated for each decade.
5. To determine alternative growth paths, the complete model was simulated by assuming different values for the exogenous variables from the actual values of each decade.

Major implications drawn from the results of this study are:

1. Generally speaking, high rates of technical change and relatively low population growth are characteristics of Japanese economic development. The average rates of technical change in both sectors were about four times as large as population growth rates during the period 1880-1970.
2. The growth rate multipliers show, among other conclusions, that the negative demand effect of population growth on per capita income always outweighs its positive effect through the resulting increase in labor supply. However, the net negative effect decreased over time in Japan (see Figure 1). Furthermore, rapid economic development would not have been possible with high population growth rates or in the absence of high rates of technical change.
3. A comparison of Japanese and U.S. growth rate multipliers shows that the structure of the U.S. and the Japanese economies have become more similar over time.



* (2) and (4) have same values with opposite signs

Figure 1. Effect of technical change and population growth on real per capita income.

4. Overall, nonagricultural technical change has contributed more to economic development than agricultural technical change. However, the contribution of the latter was more stable from decade to decade and particularly important during the early economic development and depression periods.

5. The main simulation results are as follows.

If the population growth had been 3 percent throughout the period the growth rate of per capita income would have fallen by between 1.5 to 3 percent, depending on the decade. The per capita income growth rate would also have fallen by 0.5 to 2.0 percent in the absence of agricultural technical change and by 0 to 10 percent in the absence of nonagricultural technical change. In each of these cases labor and capital allocation and output mix would have differed substantially.

FAMILY SIZE AND INTERGENERATIONAL TRANSFER
URI BEN-ZION

This study focuses on the family decision process with regard to the number and quality of children. Each generation chooses subject to a budget constraint between current consumption, number of children and next period capital per child.

In the theoretical part, developed jointly with Assaf Razin, we analyze a multi-period model of intergenerational transfer and economic growth. Using the model, we also discuss the effects of some policy variables and of a change in the parameters on the optimal short run and long run solutions. The empirical analysis is yet to be completed.

RURAL-URBAN MIGRATION IN TUNISIA
MICHAEL J. HAY

The objectives of this research are to analyze the selectivity and determinants of the labor migration process in Tunisia. For this purpose information was obtained by interview for a sample of recent migrant and non-migrant men in a representative rural area of Northern Tunisia.

Preliminary analysis of these data shows the migrants in the sample to be substantially younger and better educated than the non-migrants. Migrants were more likely to have come from the landless group of the rural population who worked either as farm laborers or in the nonfarm sector. Of those whose households did have farms, the farm sizes were substantially less among the migrants. These findings support the hypothesis that migration is selective of those workers with the least favorable rural employment and income opportunities, and of the young and educated who are apparently best equipped to make the transition to the urban economy.

Currently, a multivariate analysis is being applied to the data to identify the effects of a number of personal and family characteristics on the probability of migration. The patterns and destinations of the sample migrants and the kinds of urban jobs they found are also being studied. The final segment of the research will be to use the knowledge gained about migration in Tunisia in an assessment of the probable effects of policy alternatives on rural-urban migration flows.

The research on this project is being supported by a grant from the Midwest Universities Consortium for International Activities, Inc. (MUCIA). The research in Tunisia was carried out in cooperation with the Center for Economic and Social Research (CERES) in Tunis. Mr. Hay is a Research Assistant in the University of Minnesota Department of Agricultural and Applied Economics.

INTERNATIONAL DIFFERENCES IN GROWTH RATES AND EDUCATION
ASSAF RAZIN

Recent empirical studies show that the accumulation of knowledge through education is a major determinant of the growth of per capita income. In two recent papers a theoretical model of economic growth in which technical progress is a result of investment in human capital was analyzed (Assaf Razin, "Optimum Investment in Human Capital," REStud (1972), and "Investment in Human Capital and Economic Growth," Metroeconomica (1972)). Later, uncertainty was also incorporated into the theoretical analysis (Assaf Razin, "Investment in Human Capital Under Uncertainty," Department of Economics, University of Minnesota, Discussion Paper 18, 1972).

This theoretical model is based on the assumption that there exists a stable relationship between the rate of increase in the productivity of the labor force and the fraction of the total population which is engaged in schooling. The purpose of the present study is to test this assumption empirically.

The data base for this study consists of observations on 10 developed countries over the period 1953-1965 (Sources: United Nations, Statistical Yearbooks, Demographic Yearbooks, and Compendium of Social Statistics). The index numbers of per capita real products are to be explained mainly by the percent of GNP of the gross domestic capital formation and by the percent of population at the school age enrolled in primary, secondary, and third levels of education. Although the study is not yet completed, some preliminary results might be stated. There seems to be a statistically significant and positive association between the rate of growth of GNP and the percent of the population at the school age enrolled in the secondary level of education, while the associations with other levels of education

do not seem to be significant. This finding is consistent with other empirical evidence (such as the one given in Becker, Human Capital), in which the estimates of rates of return to high school graduates are significantly higher than those of the college graduates. Estimates of the coefficients of the education and investment variables in the regression equation of the rate of growth of GNP are expected in the near future.

The research on this project is supported by a grant to the Economic Development Center. Mr. Razin is Visiting Professor, University of Minnesota, Department of Economics.

TRADE AND DEVELOPMENT: INTERREGIONAL AND INTERNATIONAL

REGIONAL AGRICULTURAL DEVELOPMENT PLANNING IN INDIA
MARTIN E. ABEL AND K. WILLIAM EASTER

This study is an outgrowth of an effort started in 1970 to improve and broaden India's agricultural development planning efforts. Past efforts by both Central and State governments have tended to be too gross, particularly concerning the objective of improving the geographic distribution of growth in agricultural output and incomes. Central agricultural programs offer the same solutions throughout India even though resource endowments vary greatly. This approach means that many key regional agricultural development problems go untouched.

Efforts have been made to improve state and district planning capabilities so that programs will be better designed to meet particular problem situations. The state tends to be too large for effective agricultural planning and there are too many districts for the district to serve as the unit for agricultural planning. Thus, a regional planning approach was suggested with each region to include 3 to 10 districts, with fairly uniform cropping and resource conditions. The region is generally small enough to deal with specific agricultural development problems and the number of regions is not so large as to make a national system unworkable.

The regional agricultural development planning model includes 4 basic elements: first, the delineation of regions based on climate, soils, cropping patterns, location, irrigation, etc.; second, the identification of restraints or barriers which are retarding a region's agricultural development. The third element, developing and evaluating alternative solutions to the restraints, requires the combining of formal analysis and judgment based on experience. An important part of this third element is an estimation of the time required to eliminate a restraint under

various alternatives. The fourth element is the feedback system which must accompany the action to remove restraints.

The purpose of this study is to help complete the first element of the model and to begin analysis which will help in meeting the requirements of the second two elements. More specifically, the study is concerned with delineating cropping regions and agro-climatic regions. In addition, analysis of regional agricultural growth and its sources will provide insights into the constraints on development and what has promoted development in different regions of India. This will provide a good basis for further studies in various agro-climatic regions to identify restraints and evaluate alternative solutions. In fact, several such efforts have already been completed (see pp. ⁸⁵⁻⁸⁶ for publications to date).

The research on this project is being supported by grants from the Ford Foundation and USAID. Mr. Abel is a Professor and Mr. Easter is an Associate Professor in the University of Minnesota Department of Agricultural and Applied Economics.

THE GREEN REVOLUTION IN PUNJAB
INDIA
SURJIT S. SIDHU

In many countries of Asia the recent agricultural transformations that are resulting from the spread of high-yielding varieties of wheat and rice have generated new hopes for the economies of these countries. The areas with favorable institutional and environmental conditions for the adoption of new seed varieties experienced phenomenal output growth during the late 1960's. Yet the disparate speed of success of the "green revolution" across countries and regions raises serious concern as to whether the momentum of attainment can be maintained. If one is interested in devising measures for the spread and furtherance of this process of transformation, it is important to understand the causes, nature, and significance of these changes in areas where they have occurred.

Indian Punjab, which is located in the center of the Indo-Pakistan wheat growing region, is one such area which has achieved significant increases in yields and output of wheat. It is planned that the analyses contained in Dr. Sidhu's PhD. dissertation will be further developed into a monograph which will provide a quantitative assessment of the nature, magnitude, and underlying causes of this successful transfer of new wheat technology to the Punjab region. Put differently, we seek to explain the process of absorption of new wheat technology. In so doing we hope to throw some light on the question as to why there has been a relatively more rapid success in Punjab than in other areas and to enhance our understanding of the "green revolution." Such an understanding is crucial for promoting "green revolutions" in other areas.

Other important policy issues in thickly populated areas of the world where land is a scarce factor relative to labor are: (1) Whether in terms of economic efficiency small scale agricultural systems can be

compatible with the new agricultural technology? (2) Whether the new agricultural technology has an implementable potential for absorbing the rapidly growing labor force in many of the less developed countries? (3) Whether the new technology is the source and cause of tensions in rural areas? What are the implications for reform of social, political, and economic institutions? (4) Whether education of the farm people is an important variable for promoting agricultural development and its implications for rural education strategies? These questions would be examined with the help of empirical findings.

Plan of the Monograph

The monograph would be comprised of five parts. In Part One a background perspective on Punjab and its agriculture leading into the "green revolution" will be developed. In Part Two an examination of the technical change will be carried out by comparing old and new wheat technologies and exploring the resultant shifts in factor productivities. In this part we would also explore the consequences of the "green revolution" over the four-year period 1967/68 to 1970/71. In Part Three we study the relative economic efficiency of small versus large farms and tractor operated versus non-tractor operated farms. In Part Four we explore the productive value of education in Punjab farming and compare labor productivities of family and hired farm labor. And in Part Five we summarize the conclusions and derive implications for policy for agricultural and economic development of LDC's and relate them to the role of "green revolution(s)."

The research on this project was supported by grants from the Ford Foundation and USAID. Mr. Sidhu is Assistant Professor in the University of Minnesota Department of Agricultural and Applied Economics.

REGIONAL AGRICULTURAL DEVELOPMENT IN INDIA: A COMPARATIVE STUDY
SUDHIN MUKHOPADHYAY

Introduction and Objectives. One of the peculiarities of the growth of agriculture in India during the last two decades is that a substantial increase in agricultural output at the national level has been accompanied by (i) a wide variation in the rates of growth in the different geographic regions, and (ii) a lack of stability in the growth rate over time. Besides creating problems for planning the supply of food and inputs for industries, this phenomenon has a tendency to accentuate regional disparity in the gains from economic growth. The problem of regional disparity assumes special significance in agriculture because, while most industrial inputs are spatially mobile, land and climate--two critical factors in agricultural production--are not transferable. While signs of modernization are increasingly noticeable in Indian agriculture, questions must arise regarding the nature of agricultural development in India and the reasons, extent, and implications of the persisting inter-regional and inter-temporal variations in growth rates of agricultural output.

So far, most regional studies of agriculture in India have focused attention on states as the geographical unit of study. But most Indian states cover widely varying agricultural features and rates of growth. Moreover, the economic, physical-technological, and behavioral relationships that lie behind the regional imbalance have not been fully explored. The present research will attempt to do this at the level of districts and groups of districts which represent similar characteristics of climate, soils, cropping patterns, etc. much more disaggregated than states.

Data. The data being used in the Abel-Easter study (pp. 33-34) will be utilized in this study.

Model Construction. The basic objective of the project will be to construct a model to explain the regional agricultural development in India over the periods 1954-1969 and 1959-1969, and to identify the sources of growth. Using the two-criteria definition of a region developed by Drs. Abel and Easter, a set of crops will be selected that reflects the changing nature of agricultural production in India. The model should have two features: (1) it should be able to explain changes in structural parameters over time, and (2) it should use both cross-section and time-series data to take full advantage of the information available.

The general methodology will be to construct production functions at national, regional, and some sub-regional levels, pooling cross-section and time-series data on variables, viz., acreage, yield, irrigation, fertilizer use, shares of traditional and high-yielding varieties, and prices. Testing will be carried out on the possible relationships between districts/regions cross-sectionally over time to determine the appropriate type of model to use. It is also intended to derive demand functions for the fertilizer input. It is likely that the primary focus of the study will be on a comparison of two predominantly wheat producing areas which have had marked differences in rates of growth in production.

Attempts will be made to estimate separately the effects of changes in price and technology on agricultural growth. Individual crops (e.g., wheat, rice) will be selected and explanations will be sought for regional divergences in the spread of technical change in terms of the nature of such change, constraints of complementary inputs, prices, and possible institutional and behavioral factors.

The research on this project is supported by grants from the Ford Foundation and USAID. Mr. Mukhopadhyay is Research Assistant in the University of Minnesota Department of Agricultural and Applied Economics.

REGIONAL DEVELOPMENT IN ARGENTINA
JOSE ANTONIO CERRO

Argentina is characterized by substantial regional differences in growth and development. The country is dominated economically by a single urban region. In spite of attempts to achieve diversification of economic activity the share of total national income and employment accounted for by the greater Buenos Aires region has continued to rise.

The objective of this study is to measure the regional and inter-regional impact of regional development programs in Argentina. The initial step will be to construct a regional model of the Argentina economy. The second step will involve the evaluation of the impact of four specific programs: (a) the construction of the Chocon Dam in southern Argentina; (b) the closing of approximately half of the sugar refineries in Tucuman; (c) the growth of the automobile industry in Cordoba; and (d) the Inter-American Development Bank (IDB) sponsored agricultural development program in Santiago.

MULTI-COUNTRY TRADE AND DEVELOPMENT: A PROGRAMMING ANALYSIS
JAMES M. HENDERSON
TERCAN BAYSAN
JOHN E. SCARBROUGH

This project has two parts: (1) the construction of an empirically oriented prototype model of multi-country trade within a nonlinear programming framework, and (2) applications of the model to specific problems of trade and development. Progress has been made in both areas during the past year. In particular, three distinct applications are currently underway.

Input-output information for individual countries serves as the principal data for the trade model. These data have been used in a number of previous trade and development studies, some within a linear programming framework. However, their potential for analysis is none too well understood in a single-country context, and is hardly understood at all in a multi-country context. James Henderson is nearing the completion of a paper in which the properties and potentials of the prototype model are formally established. This paper is designed to aid future multi-country trade and development studies for both developed countries and LDCs.

Henderson is also engaged in an application of the model to investigate the trading patterns of the original members of the European Economic Community (i.e., Benelux, France, West Germany, Italy, and The Netherlands). Input-output data for 1965 are being utilized. Data collection and rectification are in progress. Particular emphasis is being placed upon the effects of quantitative restrictions on trade. The price structure and agricultural demands generated by the EEC study will provide an important input for analysis of the LDCs which trade with the EEC countries.

Tercan Baysan's Ph.D. dissertation, "Economic Implications of Turkey's Entry into the Common Market," provides a second application of the model.

His study focuses upon the gains and adjustment costs from expanded trade between an LDC and more developed countries. It will incorporate some of the results of the EEC study. The major question is: Where does Turkey's comparative advantage lie in trade with the EEC countries? Some of the specific questions are: (1) Should Turkey's agricultural and food processing sectors be expanded? (2) What is the future of Turkey's import-substitution sectors? (3) Will expanded trade reduce the flow of Turkish labor to the EEC countries? Data collection and rectification have been completed. The relations of the 1967 Turkish input-output study have been disaggregated to a 50-sector basis to allow a more detailed treatment of the agricultural sectors. A suitable variant of the multi-country model has been formulated, and is being applied. This study will be completed within the next year.

John Scarbrough's Ph.D. dissertation, "The Economic Effects of Proposed Customs Unions among South American Countries," provides a third application. His study is focused upon the potential gains from expanded trade among LDCs. Opinions about the magnitude of such gains range from "virtually none" to "very large." The measurement of gains is an important part of this study. The requisite input-output data have been collected for Argentina, Bolivia, Brazil, Chile, Colombia, and Peru and are being adjusted to a uniform basis. A version of the multi-country model to allow comparison for alternative custom union configurations is in the process of being formulated. A major portion of the results of this study are anticipated within the next year.

The research on this project is being supported by a grant from the USAID. Mr. Henderson is a Professor in the University of Minnesota Department of Economics. Mr. Baysan and Mr. Scarbrough are Research Assistants in the University of Minnesota Department of Economics.

ECONOMIC GROWTH IN SWEDEN, JAPAN, AND TURKEY
 BESIM ÜSTÜNEL

This research project is designed to study the long-term growth performances of Sweden, Japan, and Turkey. These 3 countries were chosen for comparative study not because of their assumed similarities, but rather because of the striking actual dissimilarities. The basic assumption behind this choice is that these dissimilarities may serve as a magnifying glass for those who are seeking to explain the real growth-generating factors in national economies.

Modern economic growth is defined in this study as "achieving greater socio-economic efficiency," which enables a growing country to achieve not only a higher level of output but also greater "flexibility" in a rapidly changing world. This definition of growth calls for a reappraisal of important social, political, and institutional factors which contribute to the socio-economic efficiency of each country.

The cases of Sweden and Japan will be used to explain that "achieving societies" are usually those which successfully transform their social and institutional structures parallel to their economic structures. Those countries which have important structural "rigidities," and therefore delay structural changes, are bound to fail in their growth performances, as seen in the case of Turkey.

A systematic study of the critical growth-generating factors in Sweden and in Japan shows that "non-physical inputs," such as improvements in the educational level (knowledge), organization^{al} capacity, and changes in production technologies, can be much more important than the growth of "physical inputs" in achieving both higher standards of living and socio-economic flexibility.

These neo-factors, which are to be called "KOT (knowledge, organization, technology) factors" as opposed to "LCR-factors" (labor, capital, and

natural resources), seem to have been much neglected in Turkey--as in most LDCs--which, in turn, explains her relatively poor growth performance in the past.

When applied to the theory of international trade, this new approach gives some interesting results, especially in explaining the inter-relation between trade and growth. Changes in the "KOT-factors," which are the most important determinants of "growth," would also determine most of the world trade in manufactured goods.

This research has been supported by a grant from USAID. Mr. Üstünel is a Professor in the Department of Economics at the Institute for International Economics Studies, Stockholm, Sweden.

COMMODITY AND FACTOR MARKETS IN DEVELOPING COUNTRIES

THE OLIVE OIL ECONOMY OF THE MEDITERRANEAN REGION
OSAMA A. AL-ZAND

For thousands of years the olive oil industry has been one of the most important sources of food, employment, and income for millions of people living in the Mediterranean region. Its importance in the agricultural economy of this region is only surpassed by that of cereals. In recent years the status of this traditional industry has been challenged by its lack of response to the rapidly changing economic conditions affecting the supply of and demand for edible oils, including olive oil. The region has moved from almost complete self-sufficiency in edible oils via its olive oil production to one of the principal market outlets for oilseeds and seed oils mainly produced and exported by the developed countries. This development has greatly diminished the viability and competitive strength of olive oil as a primary agricultural commodity which continues to affect the livelihood of a large number of people who have only limited production and employment alternatives.

This study identified and analyzed the key economic problems facing the olive oil economy and its role in the emerging market situation for edible oils in the Mediterranean region. These problems were viewed in terms of: (a) the limited growth in olive oil production, (b) the rapidly increasing demand for edible oils resulting from rising incomes and population, (c) the instability of olive oil supplies and prices in comparison with the relatively stable and abundantly supplied seed oils, and (d) the institutional developments and constraints which have apparently facilitated the production of and trade in oilseeds without comparable accommodations for olive oil.

National olive oil marketing practices along with corresponding pricing and marketing policies in Tunisia, a major olive oil producer

and the second largest exporter of the product, were evaluated in terms of their efficiency in linking primary producers with the ultimate markets for their product. This evaluation has revealed marketing imperfections and pricing inequities in the existing channels. These imperfections and inequities have a decisive effect on the development of this sector as a self-sustaining commercial enterprise which can respond appropriately to actual market conditions and potentials.

A hypothetical buffer-stock scheme was tested for the purpose of measuring its impact in achieving market stability in the face of the persistent cyclical production pattern of olives and its adverse effect on regional and international markets for the product. The findings indicate that such a scheme can substantially reduce the irregularities in market supplies and prices, particularly during a severe production cycle.

THE SUPPLY OF MONEY AND BANK CREDIT IN ARGENTINA
EDGARDO BARANDIARAN

This study analyzed the process determining the supply of money and bank credits in Argentina since the banking reform of November 1957. Two definitions of money were used: the traditional one including banks' demand deposits and currency held by the nonbanking private sector, and a broader definition which includes, in addition, banks' savings and time deposits. The quantity outstanding of ordinary loans granted by banks to the public was used as the empirical counterpart of bank credit.

With the reform of 1957, the Argentinian monetary system took on the characteristics of Anglo-American systems. In these systems, the Central Bank cannot control the stock of money directly but rather controls it indirectly through the manipulation of policy instruments. Thus, the emphasis of the analysis was on the portfolio allocation decisions of banks and the public.

Empirical evidence indicated that in the short-run the supply of money and bank credit does not respond significantly to variables related to the returns of assets traded between banks and the public. The short-run behavior of the money stock and bank credit is determined largely by the behavior of high-powered money and its composition, by the public's portfolio disequilibriums, and by banks' expectations about the behavior of loanable capacity and demand deposits. A model based on this explanation of the supply of money and bank credit appears to do well at tracking the quarterly behavior of these variables.

This project was supported by a grant from the Ford Foundation. Mr. Barandiaran is an Assistant Professor in the Catholic University, Santiago, Chile, Department of Economics.

ECONOMIC DEVELOPMENT AND FOOD DEMAND: AN EXPLORATION INTO THE ECONOMICS OF TASTE
SACHIKO YAMASHITA

In consumer theory, tastes are traditionally treated as given, even though there is a history of economists who think tastes can be both the cause and result of economic activities. It is well known that consumer tastes change as the process of economic development proceeds. In this research an attempt was made to identify economic determinants of changes and formation of tastes in the case of food commodities.

The broad hypothesis under investigation was that relative prices are an inducing mechanism for taste formation. Specifically, two hypotheses were investigated: (1) the commodities which have a comparative advantage in production induce formation of relative taste preferences favorable to them; and (2) when the relative availability of commodities changes, as a result of technical developments in production and marketing or by the opening up of international trade, people change their tastes in response to change in relative prices (through the process of learning by consumption).

In order to investigate the first hypothesis, the standard demand model was modified by adding a "taste" variable as a demand shifter. This model was applied to the averaged data for the period 1957-62 of forty-three countries. The taste variable for each commodity was constructed as a ratio of the production of the commodity to the total food production in each country during 1934-38, and these ratios were used in the analyses for the 1957-62 period. This was the earliest possible period for which data were available that would represent the historical situation in which the influence of natural endowments and climatic conditions could reflect historical relative price differences of commodities among countries. The results indicated that taste preferences across

countries are largely similar for broad commodity groups but that there exist considerable differences in taste preferences among countries in the case of individual commodities. Table 1 shows that both the size and the t-values of the coefficients of the taste variable are larger in the case of regressions for individual commodities than when commodities are grouped. Also the table shows that the differences in the values of the coefficients of determination of the estimated equation with and without the taste variable are smaller for commodities when they are grouped together than for separate commodities.

The second hypothesis was investigated through a time-series analysis. In this case the standard demand model was modified by adding taste variables comprised of cumulated sums of the past consumptions of own and substitutable commodities. The results indicated considerable taste shifts for those commodities for which the relative prices declined sharply over time.

In the context of the development process two implications seem to follow from this analysis:

First, the finding that for broad commodity groups taste preferences across countries are similar has considerable importance for purposes of estimating demand projections in developing countries. In case a country lacks reliable data for estimating demand parameters, such parameters estimated from intercountry cross-section data or time-series data from other countries should provide a reasonable basis for food supply planning.

Second, the finding that relative price shifts influence commodity and country specific tastes and that the strength of the price shifts is quite important for this seems to suggest that some information on taste should be incorporated in policies pertaining to food demand planning. In the process of economic development, changes in income, technology,

Table 1. Regression estimates per capita demand function on intercountry cross-section data, 1957-62 averages.

Commodity	Coefficients of						R ²
	Income	1/Income	Prices		Taste	Trade	
			(1)	(2)			
Rice	-0.804	-132.43	-0.145		0.572	0.092	0.886
	(0.247)	(55.85)	(0.254)		(0.058)	(0.037)	
	-0.459	69.23	-0.556				0.382
	(0.539)	(121.00)	(0.564)				
Beef	0.553		-0.163	-0.005	0.835	0.029	0.866
	(0.081)		(0.171)	(0.210)	(0.076)	(0.021)	
	0.730		-0.881	0.051			0.400
	(0.170)		(0.378)	(0.445)			
Pork	0.235	-106.21	0.322	-0.176	1.063	0.040	0.910
	(0.214)	(88.45)	(0.196)	(0.196)	(0.081)	(0.018)	
	0.908	-45.44	-0.414	0.466			0.379
	(0.547)	(23.21)	(0.513)	(0.516)			
Meats, Poultry, and Fish	0.653		-0.461		0.587	-0.007	0.800
	(0.103)		(0.230)		(0.133)	(0.024)	
	0.949		-0.982				0.705
	(0.096)		(0.227)				
Animal Foods	0.602		-0.530		0.392	0.032	0.819
	(0.099)		(0.209)		(0.174)	(0.018)	
	0.787		-0.862				0.783
	(0.064)		(0.195)				

Note: Standard errors are in parentheses. R² is coefficient of determination adjusted by degrees of freedom.

trade, and social institutions, as well as direct pricing policies, all disturb existing price structures. Policies regarding food supply, therefore, should not only take into account short-run effects on demand of a price change, but also the effect on demand for specific food commodities resulting from the taste change due to a persistent shift in relative prices.

This project was supported by grants from the Rockefeller Foundation and the USAID. Miss Yamashita was a Research Assistant in the University of Minnesota Department of Agricultural and Applied Economics.

FERTILIZER USE, DISTRIBUTION, AND MANUFACTURING IN SOUTH KOREA: AN ECONOMIC ANALYSIS

DALE C. DAHL
YOUNG KUN SHIM
BAI YUNG SUNG
SANG WOO PARK

This project has four major objectives: (1) demand analysis, (2) distribution system study, (3) manufacturing and international trade, and (4) educational extensions of research findings.

Three separate analyses have been undertaken to estimate the demand for fertilizer in Korea. A time series analysis was completed for total fertilizer and separately for each nutrient. A derived demand for fertilizer was estimated from agronomic experimental data. Finally, a survey of 300 farms selected across Korea was made to develop a per farm fertilizer demand estimate as well.

Preliminary work has been done on the analysis of the distribution system for fertilizer. Some survey work conducted by a research team in Korea under the direct of Dr. Young Kun Shim was completed this spring. Additional work will be carried on including a mathematical characterization of the transportation, storage, and distributive functions now almost completely conducted by Korean government agencies.

Some preliminary work has been done on demand estimates for countries in the East Asian world, along with a review of international trade efforts in recent years. Projections of fertilizer manufacturing capacities made by TVA have been obtained and reviewed for this phase of the analysis.

Some effort has been made to involve the East-West Center (Department of State) at the University of Hawaii and the Agricultural Development Council in extending the methodological considerations and findings of this analysis to other Southeast Asian countries.

The research on this project is supported by a grant from the USAID. Mr. Dahl is a Professor in the University of Minnesota Department of Agricultural and Applied Economics; Mr. Shim is a Professor in the Seoul National University Department of Agricultural Economics (Suwon, Korea); Mr. Sung and Mr. Park are Research Assistants in the University of Minnesota Department of Agricultural and Applied Economics.

THE PRICE AND DISTRIBUTION SYSTEM FOR FERTILIZER IN TUNISIA
JEROME W. HAMMOND
DALE GOOD

The use of fertilizer in Tunisia has increased dramatically in recent years, much more rapidly than the world average. From the 1965-66 crop year to the 1970-71 crop year, utilization for Tunisia increased by 122 percent compared with the world increase of 48 percent. Much of Tunisia's expanded fertilizer use is the result of implementation of a specialized wheat program, a program jointly sponsored by the government of Tunisia, CYMMYT (the International Cereals Center in Mexico), the Ford Foundation, and USAID. However, the government of Tunisia and development specialists express the view strongly that major increases in agricultural production and productivity can be achieved by still greater fertilizer use. But major obstacles to this expansion exist--high fertilizer prices, marketing and distribution problems, and lack of information reaching farmers on the advantages of expanding use of fertilizer.

It is the objective of this study to determine if the efficiency of the pricing and marketing system could be improved and reflected in lower real fertilizer prices to producers. The study will be undertaken in three phases. First, available secondary data on fertilizer supplies, distribution, and prices will be assembled and reviewed. Second, data on actual industry operation and practices will be collected in Tunisia. This will include procedures and techniques used by the government and industry to estimate fertilizer demands, price and import policies, sources of fertilizer, extension activities regarding fertilizer use, credit policies and programs for fertilizer, costs of fertilizer distribution, and procedures to coordinate timing of fertilizer distribution with demands. The third phase of the study will be an analysis of some

alternative policies and industry organization that could affect fertilizer prices, availability, efficiency of distribution, and use. The latter phase of the analysis should be especially useful for agricultural development planning and plan implementation.

This project is supported by a grant from the USAID. Mr. Hammond is a Professor in the University of Minnesota Department of Agricultural and Applied Economics. Mr. Good is a Research Assistant in the Department of Agricultural and Applied Economics.

ECONOMICS OF FORESTRY INFORMATION: CASE STUDIES IN CENTRAL AMERICA
ROBERT LATHAM
HANS GREGERSEN

The purpose of this study is to develop a rationale for designing and evaluating information programs for forest-based sector planning and development projects. Conceptual models were developed for determining a) the total budget size appropriate for a given forestry information program, and b) the optimum internal allocation of a given budget to activities. The models postulate 3 basic design parameters: 1) relative impacts of information variables on the social production function, i.e., sensitivity of outcome to changes in values of the variables, 2) current state of knowledge about each variable, and 3) cost of information generation for each variable.

Field studies during 1972 in Central America were aimed at determining the usefulness of these models for policy and planning under actual field conditions. Results of the field investigation of 6 case studies indicate that, while the models are internally consistent and provide an efficient solution to information budget determinations and allocations, they are not operational in their original form because of institutional constraints.

Specifically, the major problems are caused by a separation of functional decision-makers from information decisions and activities and a lack of systematic interaction between functional decisions and information decisions. The pluralistic nature of decision-making contrasts with the monolithic structure assumed in the models. A further complication is the lack of clearly definable functional goals in most of the case studies. Information programs associated with the case studies appeared to respond to a) the strong incentive to generate information to support decisions which were already made; b) the practical reality of utilizing available organizational capabilities rather than developing capabilities to meet information

requirements; and c) the use of whatever technology was known, rather than searching for new technology more appropriate to the needs. All these empirical realities violate the assumptions of the abstract conceptual models.

Based on the results of the field investigation, the models are being adapted to provide guidelines for design and evaluation of forestry information systems under existing institutional conditions in Central America. Such guidelines will hopefully have more widespread application in other regions as well.

General adaptations of the models were presented and discussed at a seminar on forestry development planning, sponsored by the Swedish International Development Authority (SIDA) and FAO in Bradford, England, August-September, 1972.¹ The feedback from this seminar is being incorporated into the results and evaluation of the project which is currently under way.

This research has been supported by a grant from the USAID. The field phase of the research has received close cooperation from GAFICA, FAO advisory group attached to the Secretariat for the Central American Economic Integration program (SIECA). GAFICA/SIECA is also providing logistical support. Mr. Gregersen is an Associate Professor in the College of Forestry and in the Department of Agricultural and Applied Economics, University of Minnesota. Mr. Latham is a Research Fellow in the School of Forestry, University of Minnesota.

1. This presentation was published by FAO in April, 1973: FAO/SIDA Seminar on Forestry Development Planning for English-Speaking Countries in the Near East, Asia and Far East. (FAO/SWE/TF 91) Rome, 1973. Funds for preparation and presentation of this material came from FAO/SIDA.

THE PRODUCTION AND EXPORT POTENTIAL OF THAILAND'S OILSEED SECTOR
PETER K. POLLAK

Thailand's agriculture has been traditionally oriented towards the production and export of rice. A persistent imbalance in Thailand's foreign trade, however, has made it necessary to shift resources into the production of crops with a substantial export potential. Generally, these diversification efforts are modelled after the highly successful expansion of Thailand's corn production. Soybeans and peanuts are among the crops singled out for promotion by the Third Five-Year-Plan (1972-1976). Although both crops have been of minor importance in the past, a steadily rising demand for oilseeds--particularly in Japan--was apparently a decisive factor in the selection of these crops.

The objective of this study is to evaluate and to project the production and export potential of Thailand's oilseed sector under alternative developmental strategies. Since Thailand's economy is basically oriented towards free trade and a minimum amount of government interference, price policies will play a major role in attaining the goals laid down in the Third Five-Year-Plan. Particular attention is, therefore, being given to the significance of price incentives in the specific socio-economic environment in which farmers and merchants make their decisions.

During 1971-72 research was aimed primarily at establishing the data base for the study. Several field surveys of production and marketing of selected upland crops in Thailand were undertaken. Preliminary analysis indicates that Thailand's marketing sector provides a highly efficient link between producers on the one hand and domestic and foreign markets on the other. Secondly, average yields of most oilseeds are low compared to the yield levels achieved in temperate climates. Hence, the expansion

of the production of oilseeds will largely depend on the development of new, higher-yielding varieties.

Research on this project has been supported by the Rockefeller Foundation. Mr. Pollak is a Research Assistant in the University of Minnesota Department of Agricultural and Applied Economics.

TECHNICAL CHANGE AND RESOURCE USE

THE EFFECT OF AGGREGATE DEMAND ON TECHNOLOGICAL CHANGE

URI BEN-ZION

VERNON W. RUTTAN

In this study we have first analyzed the effects of money in the aggregate production function to distinguish between the hypothesis that (a) money is production factor; and (b) money is a proxy for the aggregate demand. The empirical result was strongly in the favor of the second hypothesis.

In the second stage we have developed an extended induced innovation model which specifies the relationship between technological changes and changes in aggregate demand. We have done some preliminary tests of the model using aggregate data for the whole economy and we are now extending the model and testing it using sectoral data.

INDUCED TECHNICAL CHANGE AND AGRICULTURAL DEVELOPMENT: UNITED STATES
AND JAPAN
HANS P. BINSWANGER

The basic purpose of this study was to test the induced innovation hypothesis at a very basic level. The hypothesis states that biases in efficiency gains arising from technical change and other sources are endogenously determined by economic forces rather than exogenously by the physical, chemical, and biological laws of nature.

The key idea of the test is: if biases are determined exogenously, two countries with different factor endowments and differences in other economic variables would experience the same patterns of biases over a prolonged period of time. If the biases differ, there is a strong presumption that these differences have been determined by endogenous economic forces. The test does not focus on the inducement mechanism per se but on the more basic question of what extent there is flexibility in the direction of technological change.

The test is based on a measurement of biases rather than on the regression techniques previously used by Hayami and Ruttan¹ and by Yeung and Roe². The advantage of this method is that it does not suffer from simultaneous equation bias due to the endogeneity of factor prices under the induced innovation hypothesis.

Biases were measured for the agricultural sectors of the United States from 1912 to 1968 and of Japan from 1890 to 1926. Estimation equations for the biases in the case of a many-factor production process were developed using a translog cost function in factor-augmenting form. Using these equations it is possible to divide observed share changes into a component due to efficiency gains and a component due to price changes. The components due to efficiency gains were then used to construct indices of biases.

A necessary first step in measuring these biases with the time series data was the empirical measurement of the parameters of the translog cost function which were to be used in the estimation equations for the biases. These parameters were estimated with cross section data of U.S. states. As a side result they provided estimates of a set of elasticities and cross elasticities of factor demand and of elasticities of substitution.

The main results can be summarized as follows: Technical change was machinery-saving in Japan but strongly machinery-using in the U.S. Both countries experienced a strong fertilizer-using bias, but in the case of Japan this occurred during an earlier period (1896-1920) than in the U.S., where the bias continued until 1968. In Japan technical change was essentially labor neutral, apart from temporary fluctuations, but the U.S. experienced a very strong labor-saving bias from 1944 to 1968. In both countries technical change was very slightly land saving. The difference between these biases is strong enough to reject the hypothesis that the biases are determined exogenously to the economic system. Hence, the basic premise of induced innovation hypotheses is correct.

However, it was not possible to infer from the measured series which economic variables determine the biases. Both a simple price inducement mechanism and a simple share inducement mechanism are inconsistent with the observed behavior of the biases, the factor prices and the factor shares.

This project was supported by the USAID first through a grant to the Department of Economics of the North Carolina State University and then by a grant to the University of Minnesota Economic Development Center. Mr. Binswanger is a Postdoctoral Research Associate in the University of Minnesota Department of Agricultural and Applied Economics.

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1. Yujiro Hayami and Vernon W. Ruttan, Agricultural Development: An International Perspective, Baltimore: Johns Hopkins Press (1971).
 2. Patrick Yeung and Terry Roe, Induced Innovation: A CES-Type Meta Production Function, Staff Paper F71-27, Department of Agricultural and Applied Economics, University of Minnesota (1971).

MECHANIZATION AND EMPLOYMENT IN BRAZILIAN AGRICULTURE, 1950-1971
JOHN H. SANDERS

The agricultural mechanization decision in many developing countries is complicated by the existence of a large agricultural population, high rural-urban migration rates since the Second World War, and a capital intensive, industrialization process. All of these factors reduce the ability of the nonagricultural sector to absorb labor. Moreover, many developing countries may have affected the mechanization decision in agriculture by their intervention in agricultural factor and product markets.

Brazil is an ideal country to examine the determinants and effects of agricultural mechanization. Brazilian mechanization has occurred at an extremely rapid rate in the post-War period and Brazil has actively intervened in its factor markets.

The major results of the study are:

1. Time series analysis indicates that the level of subsidized financing was the statistically most significant variable determining investment in tractors and its effect swamped the relative price variables. ^{see Figure 2 and Table 2)} This financing of the Bank of Brazil was provided at negative real interest rates.
2. The elasticity of substitution between labor and tractors was generally statistically significant and greater than one; hence shifts in relative factor prices had a large effect upon factor proportions. The factor proportions choice between tractors and labor was statistically associated with agricultural wages, the level of biological-chemical expenditures per hectare, the crop mix, and the distribution of crop farm size. Concentrations of crop area on large farms increased the tractor-labor ratio; hence

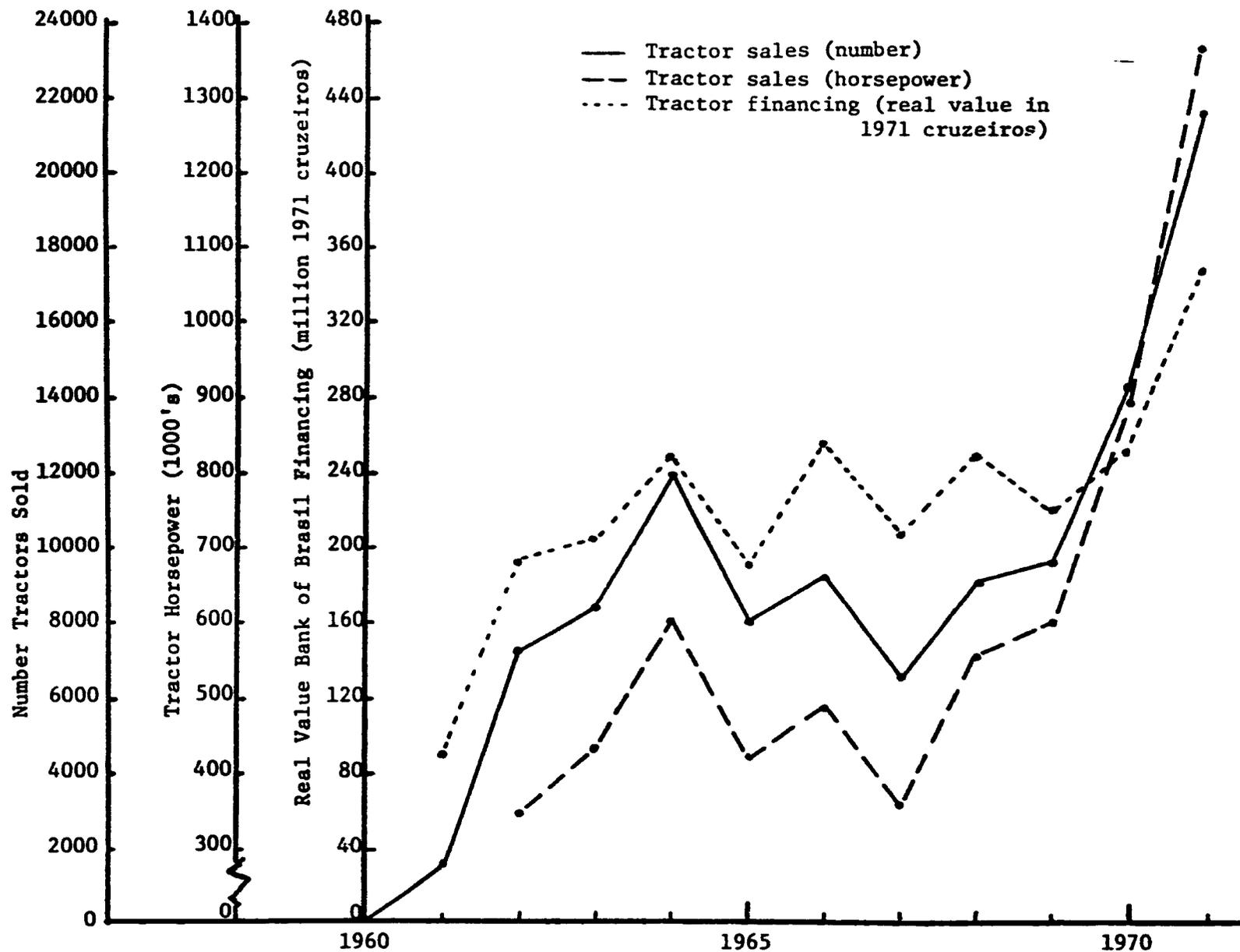


Figure 2. Tractor Financing and Domestic Tractor Sales, 1960-1971.

Notes: Tractor sales include domestic production only. Tractor imports are only financed on the subsidized terms if there is no "national similar." A small number of the tractor imports are financed.

The Bank of Brasil is the predominant lender at subsidized rates, though a limited amount of credits are provided by several other banks in which the state or federal governments are shareholders. The nominal value of credits are deflated with the Getulio Vargas Index of Domestic Prices (index No. 2) with 1971 as the base year.

Table 2. Tractor financing and terms, 1960-1971.

Year	Real Value of Tractor Financing of the Bank of Brazil (million 1971 Cr.)	Interest Rate of this Financing	Commercial Bank Interest Rate	Rate of Inflation ^{a/}
1960	90.5	--	19.6	26.3
1961	90.2	8	22.3	33.3
1962	186	9	25.1	54.8
1963	205	11	30.5	78.0
1964	248	11	33.3	87.8
1965	192	17.25	34.7	55.4
1966	256	17	34.9	38.8
1967	206	18	34.1	27.0
1968	249	15	33.7	28.1
1969	219	15	30.9	21.7
1970	255	15	N.A.	19.8
1971	349	15	N.A.	19.5

a/ GDP Implicit Price Deflator

Source: John^{H.} Sanders, "Mechanization and Employment in Brazilian Agriculture, 1950-1971," unpublished Ph.D. dissertation, University of Minnesota, August, 1973.

there was some evidence that the use of machinery is non-neutral with regard to farm size.

3. Capital inputs can be dichotomized into labor absorbing and labor releasing with biological-chemical inputs in the former category and mechanical inputs in the latter. Mechanization enabled a substantial expansion in crop area per worker. A reduction in the subsidy on the machinery price would have resulted in more labor absorption in Sao Paulo agriculture.
4. The private rate of return per hectare to mechanized land preparation was high. This was a surprising result since the primary effect of mechanization was expected to result from increasing the crop area per worker. This high rate of return to mechanized land preparation was due to a reduction in the number of cultivations required and increased yields from improved soil preparation.

In summary, machinery either replaced labor or prevented an increase in labor absorption. However, there was a yield effect from improved land preparation. More labor could have been absorbed in Brazilian agriculture if the capital price had not been subsidized. However, less than 20 percent of Sao Paulo mechanization was associated with the distorted factor price evaluated. Moreover, the private rate of return for mechanized land preparation was high even for small farmers. The public rate of return to mechanization will depend upon the weighting of the labor replacing, yield increasing, and other effects of mechanization by Brazilian policy makers. The social costs of labor released from agriculture still remain to be measured.

The research on this project was supported by a grant from the USAID and by a Foreign Area Fellowship. Mr. Sanders is currently a project specialist with the Ford Foundation teaching in the "Departamento de Economia Rural, Universidade de Ceara, Fortaleza, Brazil."

INSTITUTIONAL DETERMINANTS OF TECHNICAL CHANGE AND AGRICULTURAL PRODUCTIVITY
GROWTH: DENMARK, FRANCE, AND GREAT BRITAIN, 1870-1965
WILLIAM W. WADE

Empirical research of recent years has confirmed that a country's ability to achieve substantial growth in output and productivity hinges on the ability of the country to develop technology specific to agro-climatic conditions that will facilitate the substitution of relatively abundant factors for relatively scarce factors in the economy. The development of this technology has been hypothesized to depend on the proper functioning of an inducement mechanism of relative factor prices.

Data from the agricultural sectors of Denmark, France, and Great Britain for the period 1870 to 1965 were examined to determine if each one's ability to achieve rapid productivity growth is related to the successful or unsuccessful operation of a factor price inducement mechanism.

The general hypothesis of this study was that there are institutional forces, as well as economic forces, that affect the process of achieving rapid productivity growth. In the less successful cases where countries have achieved less than specular output and productivity growth, the institutional forces are important determinants of slow productivity growth.

Estimated equations were determined from a CES production function in order to allow hypothesis testing for the existence of factor price induced technical change biased to off-set the relatively scarce factor. The function was formulated specifically to separate neutral factor augmentation from non-neutral factor augmentation induced by factor prices.

$$Q_t = \left[a(A_t e^{\gamma_t + \delta I_t})^{-p} + b(L_t e^{\gamma_t + \lambda I_t})^{-p} \right]^{-1/p}$$

where Q , A , and L are output, land, and labor; a and b are the distribution parameters; and p is the substitution parameter. $e^{\gamma_t + \delta I_t}$ is the coefficient of land augmentation induced by I_t where I_t is an index of the relative labor-land price ratio. Similarly, λ is the parameter of non-neutral labor augmentation.

The econometric results indicated a clear presence of induced non-neutral biases in the Danish case which, on balance, favored labor augmentation. Danish agricultural productivity growth was nearly continuous after 1870 and indicated the adoption of new technology in accordance with the indicated biases. The inducement mechanism appears to have worked well. Biased technological innovation, clearly signalled by the inducement mechanism, resulted in rapid productivity growth.

In the French and British cases, where substantial productivity growth did not occur (from 1870 to 1925 in the British case and from 1870 to 1940 in the French case), the analysis indicated a clear absence of induced non-neutral biases. The usual version of the induced innovation hypothesis suggests the conclusion that the absence of technological innovation and the resultant static conditions of productivity are the logical expectation under conditions where no bias for technological innovations exists.

Historical materials (see Table 3) suggest that to consider the success or failure of a country to achieve productivity growth exclusively in terms of economic forces is a myopic view of the total bundle of forces that act together. Such a view excludes from consideration those extra-market forces which govern both behavior patterns and the organization of economic units as they meet to create those economic forces that might be filtered through some inducement mechanism. Thus, the failure to achieve productivity growth is consistent with either the nonexistence of economic forces or with the nonexistence of extra-market forces to communicate the economic

Table 3. Factor endowments and productivity measures comparisons.

		Japan	Denmark	France	United Kingdom	United States
Land Per Male Worker (Hectares)	1870/80 ¹	0.7	8.4	7.1	13.6	25.4
	1965	1.1	11.2	15.5	25.5	109.0
Output Per Male Worker (Wheat Units)	1870/80	2.4	10.7	7.5	15.6	14.6
	1965	10.7	58.1	49.0	59.3	145.0
Output Per Hectare (Wheat Units)	1870/80	2.7	1.3	1.1	1.1	0.5
	1965	7.5	5.2	3.2	2.3	0.9

1. Japan and United States data are for 1880; European country data are for 1870.

forces. The failure to induce needed technical innovation can be seen to be the fault not so much of a non-operative inducement mechanism as due to the nonoccurrence of enabling institutional changes.

The historical evidence of British and French sluggish growth suggests that the failure was more directly related to institutional deficiencies than to a non-operative inducement mechanism.

POLITICAL AND SOCIAL FACTORS ASSOCIATED WITH THE PUBLIC ALLOCATION OF
AGRICULTURAL INPUTS IN A GREEN REVOLUTION AREA: THE CASE OF RAJASTHAN
RICHARD BLUE
YASHWANT JUNGHARE

Agricultural economists typically have studied the supply of agricultural inputs to cultivators as a function of the market place. In countries where the problem is agricultural development, characterized by scarce resources and government intervention in the market place, political and social structural variables associated with resource allocation processes have been ignored, or treated as residual factors. Political scientists have generally viewed politics as a response to social and economic modernization. Less effort has been invested in the study of how political processes and social structure effect changes in agricultural performance. Partial answers to this broad question were developed in this paper.

This paper is guided by the following specific questions: First, does the government policy of equal distribution of fertilizer work or are institutional arrangements operating so as to allow some cultivators to improve their command over fertilizer? Second, if some cultivators do get more fertilizer, how do they get it? Are there different strategies associated with resource acquisition as well as different levels of success? Third, how do different classes of cultivators use the resource in question? Finally, do social characteristics and patterns of political involvement help differentiate between different groups of cultivators with respect to resource acquisition and use? Answers to these questions should give us a more precise and complete delineation of the interaction between politics and the economic development process at the level of the "consumer" of governmental policy.

This paper is based on cross-sectional survey data from Ladpura Tehsil in Kota District in the Chambal River Commanded Area of Rajasthan

for the year 1970-71. Rather than permit a free market economy to allocate fertilizer, the Government of Rajasthan controls the supply to any particular consumer through a regulatory system directed both to the price and amount of the good. The combination of government regulatory policy, poor infrastructure development, and a weak cooperative system serve to impose real difficulties on cultivators seeking to maximize their fertilizer inputs. Given these conditions, the following options are used by the rational Green Revolution cultivators: a) to drop out of high yielding varieties production and return to local wheats; b) to maximize the possibility of acquiring fertilizer on time and in sufficient quantity by entering the "black market," thus trading money for time; c) to minimize the quantitative constraint imposed by government by securing fertilizer at a fixed price through the cooperative system by trading off time, and social and political influences; and d) to acquire fertilizer at a fixed price in whatever quantity possible through the cooperative system by trading off time. For this analysis we identify groups b), c), and d) above as the High-Price, High-Consumption, and Low-Consumption groups, respectively. Each group was analyzed and compared in terms of their economic performance and political behavior.

The Cobb-Douglas production functions indicated that, given the amount of fertilizer, the High-Price group had allocated land to high yielding varieties of wheat in such a way that nearly resulted in the maximization of output whereas the High-Consumption group had less land and the Low-Consumption group had more land under high yielding varieties. Furthermore, it was observed that the High-Price group belongs to a relatively high social status group and can afford to be economic maximizers in so far as they protect their access to resources through lines of personal

influence and contact. Smaller, cooperative-oriented cultivators of lower status pay certain decision costs associated with electoral politics if they are to be successful in acquiring fertilizer. Cultivators who are unwilling or unable to acquire political influence in either arena do not secure adequate amounts of fertilizer. In other words, social and political factors do affect the resource allocation pattern under conditions of a government-regulated system. The paper concludes by drawing implications for government-regulatory policy in India.

This research was financed by a grant from the Midwest Universities Consortium for International Activities awarded to the senior author. Analysis and writing was supported by the Center for Comparative Studies in Technological Development and Social Change and the Economic Development Center of the University of Minnesota. Mr. Blue is an Assistant Professor in the Department of Political Science. Mr. Junghare is a Research Associate in the University of Minnesota Department of Economics.

TECHNOLOGY; INSTITUTIONS AND DEVELOPMENT: MINNESOTA AGRICULTURE, 1880-1970
JOSEPH C. FITZHARRIS
WILLIS L. PETERSON

The University of Minnesota Institute of Agriculture long has been noted for its strong research capacity and its contributions to the agricultural development of the state. Agricultural development was aided by the work of the Minnesota Experiment Station. This work, regardless of its potential, had value only in use. For farmers, knowledge of available techniques was a prior condition for use. A variety of institutional innovations occurred to link the farmer and the station researcher. Communication linkages informed researchers of the problems faced by farmers and farmers were informed of station work which could solve their problems.

Solutions to problems should be susceptible to measurement. The first objective of this study is to measure the impact of the Minnesota Experiment Station upon the agricultural development of Minnesota from 1880 to 1970. It should be possible to analyze the transmission of problems to researchers and solutions to farmers. The second objective is a detailed examination of the institutional innovations linking the farmer and the station researchers. Communication affects behavior, both for the farmer and for the researcher. This study will analyze the impact of these institutional innovations upon the research decision and resource allocation processes of the station. From this case study of Minnesota agricultural development, implications for contemporary agricultural development will be drawn.

The origins and development of the Minnesota Experiment Station have been traced and the evolution of related institutions detailed. Identification of the types of research and the methods has been accomplished. The staffing and decision-making processes have been charted. The collection and analysis of the published financial data also has been completed.

Some of these findings were reported in a recent paper.¹ The role of farmers' organizations in creating and guiding the development of the station and its related institutions was emphasized. Farmers brought problems to the station in a variety of direct and indirect ways, and these problems affected the types of research conducted. The problems, the available technology, the research type chosen, and the staff capabilities determined the methods employed in research. Through their control of the state legislatures, farmers influenced the station and its related institutions in the amounts and uses of granted funding. The allocation of unrestricted financial, physical, and staff resources began as the responsibility of the director of the station and the division heads jointly. Over time, this authority was usurped by division heads, then restored to the director. The closeness of the Regents to the Station was an important factor in its continuation and growth. The development of close relations with the various farmers' organizations and legislators ensured continued support from the groups who benefited most from the station's activities.

In the 1973-74 fiscal year, the station budget books will be analyzed. Case studies of technical and institutional innovations have been selected for analysis. Production data must be analyzed to account for the output and productivity growth of Minnesota agriculture. There also will be interviews with present and former experiment station and extension service staff members and officers of farmers' organizations.

The research on this project has been supported by a grant to the University of Minnesota Economic Development Center from the Rockefeller Foundation. Mr. Fitzharris is an Instructor in the College of St. Thomas Department of History. Mr. Peterson is a Professor in the University of Minnesota Department of Agricultural and Applied Economics.

1. Joseph Fitzharris, "Science for the Farmer: The Development of the Minnesota Agricultural Experiment Station, 1868-1910," presented to the Symposium on Midwest Agriculture, 1840-1900, held 10-12 May, 1973, at Iowa State University in Ames; forthcoming in Agricultural History, January 1974.

SCIENCE AND AGRICULTURAL PROGRESS: THE JAPANESE EXPERIENCE
YUJIRO HAYAMI

During the last year research was directed to an intensive review of the origins and evolution of the Japanese agricultural research system and to the measurement of the social rates of return to investment in rice breeding research.

The approach to improving productivity following the Meiji Restoration (1868) was the development and diffusion of indigenous technology. An initial attempt to import large scale mechanical technology from Great Britain and the United States was regarded as a failure. The Meiji government quickly redirected its agricultural development strategy toward the search for a modern technology more consistent with Japanese resource endowments and scale of farm operations. Japan also turned to Germany as a source of scientific knowledge and technical assistance in agricultural chemistry and soil science. An itinerant instructor system was established in 1885 to diffuse the best crop varieties and cultural practices used by Japanese farmers.

The establishment of a specialized experiment station began in the 1880's. The National Agricultural Experiment Station was established in 1893. The development of Japanese agricultural research after 1893 can be illustrated by the four stages in the evolution of rice breeding research since the establishment of the National Agricultural Experiment Station. During the first stage, from 1893 to 1903, emphasis was primarily

on pure line selection. Cross breeding was initiated but progress was limited by the shortage of expert breeds.

The third period, 1926-1949, was initiated by the development of a nationwide coordinated breeding program -- the "Assigned Experiment System." Under the Assigned Experiment System the National Experiment Station assumed responsibility for conducting the initial crossings up to the selection of the first several filial generations. The regional breeding center, in each of eight regions, conducted further crossing and selection work in order to develop varieties adapted to varying ecological conditions. The varieties selected at the regional station were then sent to the prefectural station to be tested for acceptability in specific locations. The varieties developed by the system were called Norin varieties (after the abbreviation of the Japanese words for the Ministry of Agriculture and Forestry). This system was highly successful. The Norin varieties diffused rapidly in Japan (Figure 3) and the Norin varieties of both wheat and rice have become important sources of germ plasm for efforts to develop fertilizer-responsive varieties of rice and wheat in the tropics in recent decades.

During the fourth period, since 1950, local experiment stations have also initiated breeding efforts rather than relying primarily on breeding work initiated at the National Experiment Station. By the late 1950's the area planted to varieties developed at the local stations exceeded the area planted to the Norin varieties.

The Japanese agricultural research system has been particularly innovative in achieving an effective balance between centralization and decentralization in its agricultural research system. The problem of

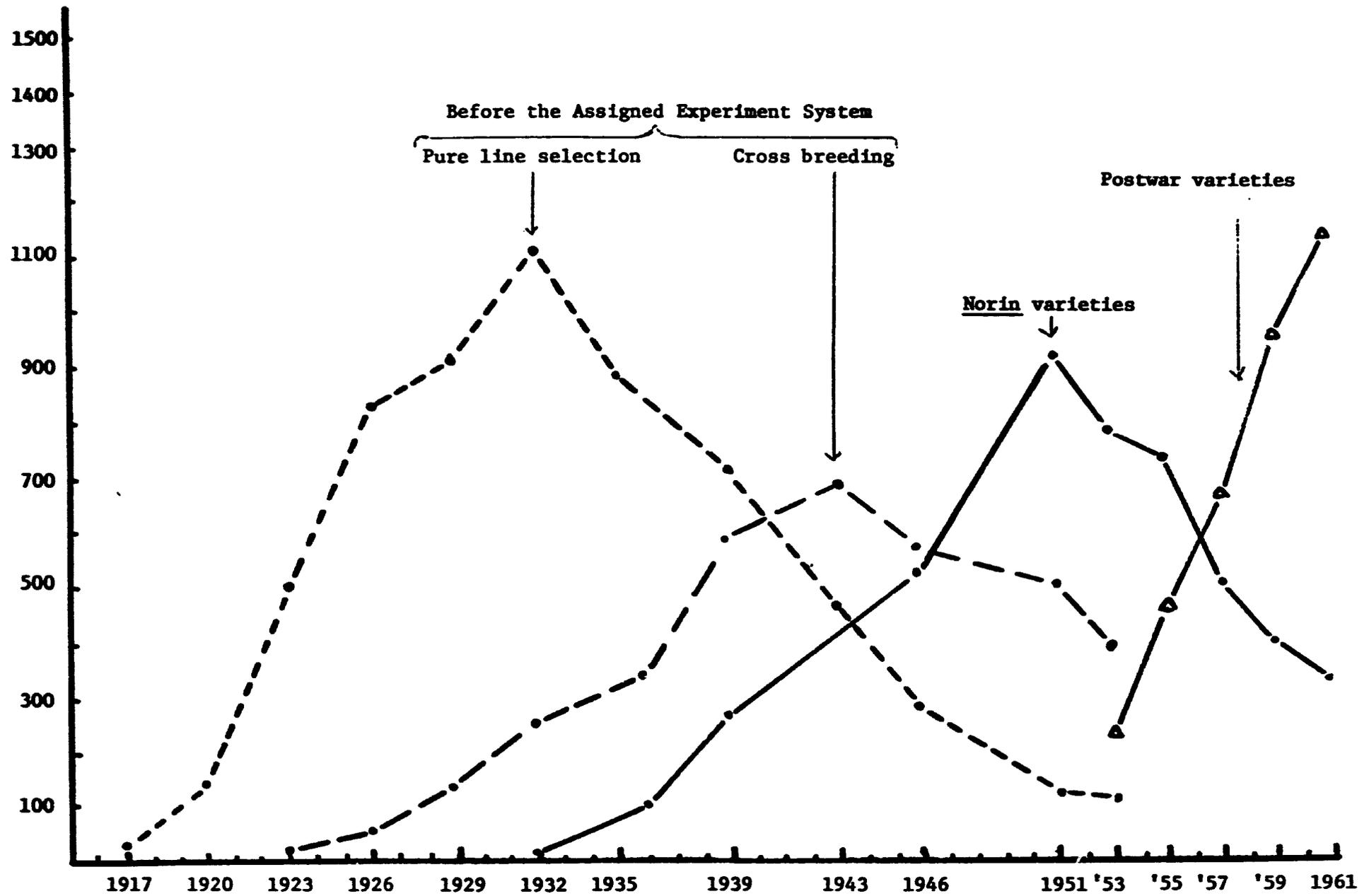


Figure 3. Changes in area planted in the improved varieties of rice.

achieving an effective balance between the formulation and implementation of national research priorities and effective response to local environmental and economic conditions remains an important unsolved problem for many national research systems. In Japan provincial funding of a substantial share of local research was an important factor in orienting the research system to regional resource endowments and economic opportunities. The provincial government contribution to the total agricultural research budget rose from 40 percent in 1897 to 73 percent in 1912 and has continued to account for more than two-thirds of the total since that time.

Estimates of the social rate of return to rice breeding research indicate that the rate rose from an annual return of 18 to 27 percent on research conducted prior to the development of the Assigned Experiment Station system to approximately 75 percent under the new system. This is a high rate of return by any standard. Furthermore, a substantial share of the gains were passed on to the consumer or were realized as savings of foreign exchange.

The research on this project has been supported by a grant from the Rockefeller Foundation to the University of Minnesota Economic Development Center. Yujiro Hayami is Professor of Economics at Tokyo Metropolitan University. The research reported above has been conducted in association with Saburo Yamada and Masakatsu Akino.

SOURCES OF PRODUCTIVITY DIFFERENCES AMONG REGIONS IN NORTH AMERICA
CLAYTON OGG

A production function framework will be employed to make productivity comparisons and account for their differences among regions in North America--Canada, United States, and Mexico. Use of state level data from separate countries in the same production function is a unique feature of this study. Binary variables will separate regions in all three countries on the basis of crop mix and factor scarcities. Comparisons can then be made between regions that while having many similarities have very different relative prices and levels of economic development. Some attention will be given to technology variables and variables which shift the production functions.

The research on this project was supported by a grant from USAID. Mr. Ogg is a Research Assistant in the University of Minnesota Department of Agricultural and Applied Economics.

ECONOMIC, SOCIAL, AND DEMOGRAPHIC MAPS FOR A HISTORICAL ATLAS OF SOUTH ASIA
JOSEPH E. SCHWARTZBERG

The University of Minnesota's South Asia Historical Atlas Project is nearing completion of the first comprehensive atlas of the political, cultural, social, demographic, and economic history of the area presently comprising India, Pakistan, Bangladesh, the Himalayan Kingdoms, Afghanistan, and Sri Lanka (Ceylon) from palaeolithic times to the present day. In preparation since September 1964, the work has engaged an inter-disciplinary, multi-national team of researchers and cartographers for a total of over thirty-five academic man-years. The undertaking of such a work at Minnesota was made possible by the gift to the University in 1962 of the Ames Library of South Asia, a specialized collection on that area surpassed only in the Western Hemisphere by that of the Library of Congress. The donor, the late Charles Lesley Ames, additionally provided a three-year fellowship, which, along with seed money from the Office of International Programs and the Hill Foundation, helped launch the work. Since 1966 the Project has been supported mainly by the U.S. Office of Education and the National Endowment from the Humanities. Generous additional assistance has been provided from various agencies within the University of Minnesota. The funds provided by the Economic Development Center are specifically slated for support of research and mapping related to the modern economic, social, and demographic history of South Asia, which, taken together, comprise a substantial portion of the entire work.

As India has had an unbroken series of decennial Censuses beginning in 1872, the Atlas Project has selected a number of Census years, specifically 1872, 1901, 1931, and 1961, as benchmark dates; for each benchmark we have attempted to create a cross-sectional view based on the mapping of a large number of important variables. These include population density,

rate of population growth, degree of urbanization, location, and growth rates for all major cities and towns, manufacturing employment (total and by industry, 1931 and 1961), percentage of population engaged in agriculture (1931 and 1961 only), land tenure pattern (1931 and 1961 only), intensity of agriculture (1901, 1931, and 1961), railroad network, road network, irrigation network, power grid (1961 only), airline network (1931, 1947, and 1961), literacy, internal and external migration (1931 and 1961 only), religion (1931 and 1961 only for most groups, also 1901 and 1872 for Christians and Sikhs), language (1961 only), scheduled castes and tribes (1931 and 1961), and major individual castes (1931 only). Separate maps are commonly prepared for data at the provincial/state level and for data at the much finer district level of analysis. Maps are drafted on only a few standardized scales to facilitate comparison from one map to another. Many of the topics considered have never before been cartographically portrayed (e.g., the distributions of specific mercantile castes, or of dominant cultivating castes; the equitability of landholding on the basis of regional variations in the relevant Lorenz curves, etc.).

Because of the slowness with which 1971 data are being published for India it is not yet possible to present data for that year in the same detail as for 1961, though the basic demographic data of the latest Census have already been mapped. Data for Ceylon for 1971 have recently become available and will be added to those presented for India. Pakistan's Census was delayed, because of internal turmoil, until the autumn of 1972 and it is doubtful if any but the most basic data will be ready in time for inclusion in the Atlas; and Bangladesh has yet to take its first post-Independence Census.

A number of synoptic maps, relating to the cropping pattern (staple and commercial crops as of 1961), landforms, climate, natural vegetation,

the economy in general (1857 and 1972), foreign aid (1950 and 1971) and foreign trade 1931 and 1961), distributions and growth of institutions of higher education (since 1857), distribution and growth of newspapers and other mass media (1931, 1961, and 1967), culture regions (as of the present) round out the coverage of data most relevant to the study of economic development.

The finished Atlas will comprise close to 700 individual maps on around 155 two-color map plates. Additionally, the work will include a large number of graphs, charts, photographs, and line drawings, as well as approximately one hundred pages of introductory and explanatory text, and a detailed bibliography and index. The total length should be around 300 pages.

It is expected that map compilation will be completed during the fall of 1973 and that the final drafting of all maps at the American Geographical Society of New York and the preparation of the Atlas text will be completed during the spring of 1974. The work will then be turned over to a commercial publisher with whom the University has entered into a publishing contract. Hopefully it will appear in late 1974.

This project has been supported by a Charles Lesley Ames Fellowship, the Office of International Programs, the Hill Foundation, U.S. Office of Education, National Endowment from the Humanities, and the University of Minnesota Economic Development Center. Mr. Schwartzberg is a Professor in the University of Minnesota Geography Department.

RELATED PROJECTS AND PROGRAMS

In addition to the activities funded directly by the Economic Development Center, both the Department of Economics and the Department of Agricultural and Applied Economics and individual staff members of the two departments are involved in a wide spectrum of international programs and activities.

THE UNIVERSITY OF MINNESOTA IN ARGENTINA

(to be completed)

THE UNIVERSITY OF MINNESOTA IN INDIA

The University of Minnesota has been engaged in work with the Ford Foundation in India in economics and agricultural economics since 1969. This involvement will be formally concluded on June 30, 1973. The work has been administered through the Office of International Programs.

Martin E. Abel spent the 1969/70 and 1970/71 academic years in India as Program Advisor in Economics with the Ford Foundation. In this capacity, he had responsibility for directing the Foundation's programs in economics which included programs for (a) the improvement of development planning capabilities at the State level; (b) the development of economic research capabilities in Central Ministries, notably Agriculture and Foreign Trade; (c) the improvement of the informational and analytical bases for agricultural development planning; and (d) the advanced training of Indian students of economics and agricultural economics. He continued his affiliation with the Ford Foundation as a U.S. based consultant during the academic years 1971/72 and 1972/73 and with his research on policy problems of Indian agricultural development.

K. William Easter was in India from January 1970 to July 1972 as an agricultural economist with the Ford Foundation and has spent the 1972/73 academic year at the University of Minnesota under Joint Department of Agricultural and Applied Economics and Ford Foundation auspices. He has been conducting research on the economics of improving village irrigation systems, on regional agricultural development planning and management, and on the modernization of Indian agriculture. In addition, he advised several Indian graduate students at the Indian Agricultural Research Institute on their research work in resource economics and in agricultural development planning.

Leonid Hurwicz spent the fall quarter of 1971 in India serving as visiting professor at the Delhi School of Economics and the Institute of Economic Growth under Ford Foundation auspices. While there, he continued his research on information requirements of decentralized planning.

The ongoing research on regional agricultural development planning in India, discussed elsewhere in this report, is a direct outgrowth of the involvement in India described above.

Publications and Reports

V. G. Pande and Martin E. Abel, Data on the Indian Economy: 1951 to 1969, The Ford Foundation, New Delhi, India, January 1970.

Martin E. Abel, "Agriculture in India in the 1970's," Economic and Political Weekly, Vol. V, No. 13, March 1970.

Martin E. Abel, Some Key Economic Policy Issues in India in the 1970's, The Ford Foundation, New Delhi, India, May 1970.

Rokuro Sase, V. G. Pande, and Martin E. Abel, Projections of India's Exports in the 1970's, The Ford Foundation, New Delhi, India, September 1970.

K. William Easter, Analysis of the Modernization of Indian Agriculture, The Ford Foundation, New Delhi, India, September 1970 (Mimeographed).

Martin E. Abel, "Differential Rates of Growth in Rural Incomes Resulting from Specific Government Policies Like the New Agricultural Strategy," paper presented at the Seminar on Income Distribution in India, sponsored by the Planning Unit of the Indian Statistical Institute, New Delhi, India, February 25-26, 1971 (Mimeographed).

Martin E. Abel and K. William Easter, "Agricultural Development Planning and Program Evaluation with a Focus on Regional Restraints," paper presented at the Rice Policy Conference, International Rice Research Institute, Los Banos, Philippines, May 9-14, 1971, and in Economic and Political Weekly, Vol. VI, Nos. 30-32, Special Issue, July 1971.

Martin E. Abel, "The Distribution of Agricultural Development Gains in India: A Case Study for South and Southeast Asia," Staff Paper P71-25, Department of Agricultural and Applied Economics, University of Minnesota, November 1971; and in Heady and Hall, eds., Externalities in the Transformation of Agriculture: The Distribution of Benefits and Costs from Development, Iowa State University Press (forthcoming).

K. William Easter and Shrinath Singh, "The Importance of Regional Differences in Agricultural Development," paper presented at the Annual Conference of Agricultural Statistics, New Delhi, March 1972. Also Staff Paper P72-1, Department of Agricultural and Applied Economics, University of Minnesota, January 1972.

Surjit S. Sidhu, Jitendar S. Mann, and Martin E. Abel, "The Demand for Cotton in India, 1951-1968," Staff Paper P72-16, Department of Agricultural and Applied Economics, University of Minnesota, June 1972.

K. William Easter, Regions for Indian Agricultural Planning and Management, The Ford Foundation, New Delhi, India, June 1972.

B. B. Batra and K. W. Easter, The Impact of Field Channels on Irrigated Villages in Sambalpur, The Ford Foundation, New Delhi, India, June 1972. Also Staff Paper P72-24, Department of Agricultural and Applied Economics, University of Minnesota, September 1972.

K. N. S. Nair, Constraints that are Limiting Agricultural Production and Causing Uneven Distribution of Gains--A Case, Palghat District, Kerala State, Ph.D. Thesis, Indian Agricultural Research Institute, New Delhi, India, 1972.

K. William Easter and Martin E. Abel, Cropping Regions in India (to be published July 1973).

P. Kumar, Economic Analysis of Village Irrigation Systems in Sambalpur District, Ph.D. Thesis, Indian Agricultural Research Institute, New Delhi, India, 1973.

THE UNIVERSITY OF MINNESOTA IN THAILAND

The Department of Agricultural and Applied Economics of the University of Minnesota has been associated, since 1967, with the activities in Thailand of the Rockefeller Foundation. In that year, Delane E. Welsch was appointed as a regular field staff member of the Foundation, posted to Bangkok, and also accepted an academic appointment at the University of Minnesota.

Foundation activities in Thailand chiefly involve university development. Dr. Welsch serves as visiting professor in the Department of Agricultural Economics of Kasetsart University, which is the major agricultural university in Thailand, and also in the Faculty of Economics of Thammasat University, which is a large law-government-liberal arts university.

Dr. Welsch's activities have evolved as the strength of the Department of Agricultural Economics has increased. Initially he taught undergraduate courses and tutored young staff members selected to go overseas for graduate degree studies. As the Thai staff returned from overseas, he assisted in revising and upgrading the Masters program and shifted his teaching to Masters coursework. At the present time he has nearly phased out of Masters teaching, being responsible for only one course per year, "The Making of Agricultural Policy in Thailand," and has concentrated more on thesis research supervision, advising six to eight Masters candidates per year. Throughout, he has also assisted in staff

development activities, development of teaching materials, and staff research. The latter have focused on multi-disciplinary approaches to research on corn, sorghum, rice, livestock, and human nutrition. Current priorities are on developing an agribusiness minor for the Bachelors degree in Agricultural Economics, and in planning the Department's expansion onto a second campus, which is part of the overall Kasetsart University development program. Activities on the second campus will include increased practical training in agriculture for undergraduates and developing an approach to integrated rural development in the surrounding area.

After four years in Thailand, Dr. Welsch spent the 1971-72 academic year at the University of Minnesota, with Dr. James P. Houck of the Department of Agricultural and Applied Economics replacing Dr. Welsch in Bangkok.

The program with the Rockefeller Foundation also provides a means whereby Ph.D. candidates from the University of Minnesota with an interest in agricultural development may undertake thesis research in Thailand under the supervision of Dr. Welsch. Two have done so thus far, A. John De Boer in 1969-71 and Peter K. Pollak in 1971-73. Staff members of Thai universities also enroll at the University of Minnesota for graduate studies, with the possibilities of thesis research back in their home country. In addition, a collection of reference and research materials on Thailand is maintained by the Department of Agricultural and Applied Economics.

(List of Publications to be added later.)

OTHER PROJECTS AND ACTIVITIES

(to be completed)

**THE GRADUATE PROGRAM IN ECONOMIC DEVELOPMENT AT
THE UNIVERSITY OF MINNESOTA**

GRADUATE COURSE OFFERINGS

Economic Development and Area Studies (Economics)

- 5-301* ECONOMIC DEVELOPMENT. (4 cr)
Problems of economic growth in low income countries. Theory of aggregate and per capita income growth. Role of population growth, productivity increases and capital formation. Allocation of resources between consumption and investment and among sectors.
- 5-331 ECONOMIC DEVELOPMENT. (4 cr)
Problems of economic growth in low income countries. Theory of aggregate and per capita income growth. Role of population growth, productivity increases and capital formation. Allocation of resources between consumption and investment and among sectors.
- 5-347, 5-348 DEVELOPMENT OF THE AMERICAN ECONOMY. (4 cr per qtr) Green
Application of economic theory and empirical methods to topics in American economic development, particularly during the 19th century period of accelerated growth and industrialization.
- 5-313 ECONOMY OF THE U.S.S.R. (4 cr) Boddy
Development of economic organization of the state, planning and control of use of resources, and distribution of product. Performance of the economy in agriculture and industry under 5-year plans. Internal and external economic policy. Public finance, income distribution, and economic incentives under Soviet system.
- 5-311* ECONOMY OF LATIN AMERICA. (4 cr)
Analysis of current economic problems: exchange controls, land reform, inflation and fluctuation in prices of basic commodities. Evaluation of foreign aid proposals.
- 5-341 ECONOMY OF LATIN AMERICA. (4 cr)
Analysis of current economic problems: exchange controls, land reform, inflation, and fluctuation in prices of basic commodities. Evaluation of foreign aid proposals.
- 5-315 ECONOMICS OF ASIA. (4 cr)
Economic development of the Far East following contact with Western civilization. Current problems: population growth, capital formation, international economic relations, choice between types of economic organization.
- 8-311, 8-312 ECONOMIC GROWTH AND NATIONAL PLANNING. (3 cr per qtr)
Models of the process of economic growth; exogenous factors to which growth is attributed. Techniques useful in planning, e.g., input-output, national income accounting programming. Questions of policy.
- 8-831, 8-832 ADVANCED TOPICS IN ECONOMIC DEVELOPMENT. (3 cr per qtr)

*Not available to economics majors.

International Economics (Economics)

- 5-401* INTERNATIONAL ECONOMICS. (4 cr)
The case for free trade. Effects of tariffs; protection of infant industries; common markets. Balancing international receipts and payments, the role of exchange rate changes, international monetary reform.
- 5-431 INTERNATIONAL ECONOMICS. (4 cr)
The case for free trade. Effects of tariffs; protection of infant industries; common markets. Balancing international receipts and payments, the role of exchange rate changes, international monetary reform.
- 5-461, 5-462, 5-463 INTERNATIONAL TRADE AND PAYMENTS THEORY. (3 cr per qtr)
Gains from trade; effect of trade on factor prices; tariffs; customs unions. Relation of trade theory to growth and development. Balance of payments disequilibrium, exchange rates, capital movements, international liquidity.
- 5-411 U.S. FOREIGN ECONOMIC POLICY. (4 cr; offered 1972-73 and alt yrs)
Development of U.S. foreign economic policy in 20th century and current issues of U.S. foreign economic policy.
- 8-481, 8-482 ADVANCED TOPICS IN INTERNATIONAL TRADE THEORY. (3 cr per qtr)
Chipman, Krueger

General Economics (Economics)

- 5-307* COMPARATIVE ECONOMIC SYSTEMS. (4cr) Maynes, Smith
Functions of all economic systems; the market economy, liberal socialism, the centrally planned economy. Analysis of American and Soviet economies.
- 5-337 COMPARATIVE ECONOMIC SYSTEMS. (4 cr) Maynes, Smith
Functions of all economic systems; the market economy, liberal socialism, the centrally planned economy. Analysis of American and Soviet economies.

Agricultural Economics (Agricultural and Applied Economics)

- 5-720 ECONOMICS OF WORLD AGRICULTURE. (3 cr) Raup
Distribution, quality, and utilization of agricultural resources, agricultural organization and structures; location of agricultural activity; national and international agricultural policies.
- 5-750 AGRICULTURAL TRADE AND COMMERCIAL POLICY. (3 cr) Houck and Abel
Patterns of trade in agricultural products; trade policies and practices of export and import nations; commodity agreements; agricultural trade policies of common market areas; negotiations and potential trade developments.
- 5-790 SEMINAR: WORLD FOOD SUPPLY PROBLEMS. (3 cr) Martin and others

*Not available to economics majors.

8-278 AGRICULTURAL AND ECONOMIC DEVELOPMENT. (3 cr) Cochrane and Abel
Theories of socio-economic growth; models of economic growth; consumption, production, and supply relations in agricultural development; agricultural development policy.

8-378 SEMINAR: AGRICULTURAL DEVELOPMENT. (3 cr) Abel

Development Workshops

Three workshops with a strong development orientation are available to graduate students and staff:

Agricultural Development Workshop (Abel, Peterson)

Human Capital Workshop (Hause, Krueger, Schultz)

Trade and Development Workshop (Krueger, Schultz)

Resource and Regional Economics Workshop (Easter, Maki, Martin, Shane, Waelti)

The workshops meet on a weekly or semi-weekly basis throughout the academic year. Participants consist of staff members and graduate students conducting active research on topics related to the workshop subject matter area.

STAFF

Economics

Professor

Francis M. Boddy
 O.H. Brownlee
 John S. Chipman
 Edward Coen,
 Director of Graduate Studies
 Mrinal Datta-Chaudhuri*
 Walter W. Heller
 James M. Henderson
 Clifford Hildreth
 Leonid Hurwicz
 John H. Kareken
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 E. Scott Maynes

Herbert Mohring
 Marcel K. Richter
 T. Paul Schultz
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Edward M. Foster
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 Christopher A. Sims
 Harlan M. Smith

Neil Wallace

Assistant Professor

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 John Danforth
 Charles Freedman
 Jean-Claude Koeune
 Robert Shiller
 Craig E. Swan

*Visiting Professor 1973/74

Agricultural and Applied Economics

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Martin E. Abel
 Sherwood O. Berg
 John Blackmore
 O. Uel Blank
 W. Keith Bryant
 Willard W. Cochrane
 Dale C. Dahl
 Reynold P. Dahl
 Selmer A. Engene
 Earl I. Fuller
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 Kenneth H. Thomas
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Assistant Professor

Thomas Daves
 Carole J.B. Yoho

Postdoctoral Research Associate

Hans Binswanger
 John W. Schamper

Economic Development Center

Executive Committee

Martin E. Abel	Lee R. Martin
Robert T. Holt	T. Paul Schultz
Anne O. Krueger	William E. Wright

Director

Vernon W. Ruttan^c
Lee R. Martin^d
Martin E. Abel^e

^aTerm expired July 1, 1973

^bTerm began July 1, 1973

^cJuly 1, 1972-December 31, 1972

^dActing Director, January 1, 1973-September 1, 1973

^eSeptember 1, 1973

(new members of Executive Committee to be
included in the final report)

STAFF DEVELOPMENTS

(to be completed)

CENTER PUBLICATIONS

CENTER BOOKS AND MONOGRAPHS

- Yujiro Hayami (with Barbara B. Miller, William W. Wade and Sachiko Yamashita). An International Comparison of Agricultural Production and Productivities. St. Paul: University of Minnesota Agricultural Experiment Station Technical Bulletin 277, 1971 (paper).
- Yujiro Hayami and Vernon W. Ruttan, Agricultural Development: An International Perspective. Baltimore: The Johns Hopkins Press, 1971.
- Peter Gregory, Industrialization and Wages in Japan. Geneva: International Labour Office, Second Impression, 1973.

CENTER REPRINT SERIES

- 70-1 Lawrence B. Morse, "The 1967 Peruvian Exchange Crisis: A Note," The American Economic Review, Vol. 60, No. 1, March 1970, pp. 189-194.
- 70-2 Yujiro Hayami and V.W. Ruttan, "Factor Prices and Technical Change in Agricultural Development: The United States and Japan, 1880-1960," The Journal of Political Economy, Vol. 78, No. 5, September/October 1970, pp. 1115-1141.
- 70-3 Yujiro Hayami and V.W. Ruttan, "Korean Rice, Taiwan Rice, and Japanese Agricultural Stagnation: An Economic Consequence of Colonialism," The Quarterly Journal of Economics, Vol. 84, November 1970, pp. 563-589.
- 70-4 Yujiro Hayami and V.W. Ruttan, "Agricultural Productivity Differences Among Countries," The American Economic Review, Vol. 60, No. 5, December 1970, pp. 895-911.
- 71-1 Yujiro Hayami, "Elements of Induced Innovation: A Historical Perspective for the Green Revolution," Explorations in Economic History, Vol. 8, No. 4, Summer/1971, pp. 445-472.
- 71-2 V. Somasundara Rao, "Tariffs and Welfare of Factor Owners: A Normative Extension of the Stolper-Samuelson Theorem," Journal of International Economics, Vol. 1, No. 4, November 1971, pp. 401-415.
- 71-3 Vernon W. Ruttan, "Technology and the Environment," American Journal of Agricultural Economics, Vol. 53, No. 5, December 1971, pp. 707-717.
- 71-4 Aida Recto Librero, "The International Demand for Philippine Coconut Products: An Aggregate Analysis," The Philippine Economic Journal, Vol. 10, No. 1, First Semester 1971, pp. 1-22.
- 72-1 Yujiro Hayami, "Rice Policy in Japan's Economic Development," American Journal of Agricultural Economics, Vol. 54, No. 1, February 1972, pp. 19-31.

- 72-2 Yujiro Hayami and Willis Peterson, "Social Returns to Public Information Services: Statistical Reporting of U.S. Farm Commodities," The American Economic Review, Vol. 62, No. 1, March 1972, pp. 119-130.
- 72-3 Vernon W. Ruttan and Yujiro Hayami, "Strategies for Agricultural Development," Food Research Institute Studies, Vol. XI, No. 2, 1972, pp. 129-148. (With "Comment" by George L. Beckford, pp. 149-154.)
- 73-1 T. Paul Schultz, "Explanation of Birth Rate Changes over Space and Time," Journal of Political Economy, Vol. 81, No. 2, Part II, March/April 1973, pp. S238-S274.

CENTER BULLETIN SERIES

- 73-1 K. William Easter and Martin E. Abel, Cropping Regions in India, June 1973.

CENTER STAFF PAPERS

1968

Morris Teubal, "Optimum Patterns of Agricultural and Industrial Development for a Small Economy." Instituto Torcuato Di Tella, Centro de Investigaciones Economicas, Buenos Aires (26), Argentina (AO).

1969

Morris Teubal, "Developing Strategy for a Medium-Sized Economy." Instituto Torcuato Di Tella, Centro de Investigaciones Economicas, Buenos Aires (26), Argentina (AO).

1970

Ralph H. Hofmeister, "Growth With Unemployment in Latin America: Some Implications for Asia." Prepared for the AID, NESAP Employment Conference, Kathmandu, July 6-9, 1970 (AO).

Yujiro Hayami and Vernon W. Ruttan, "Induced Innovation and Agricultural Development." Presented at a conference on the Micro Aspects of Development, University of Illinois (Chicago Campus), November 20, 1970 (AAE SP71-1; Econ DP3).

Peter Gregory, "Wage Structure in Latin America." Presented at a seminar on Labor Issues and Planning Process at the Organization of American States, Washington, July 1970 (Econ DP4).

1971

Clayton Ogg, "Johnson and Johnson on Sugar Policy." Draft, University of Minnesota, Department of Agricultural and Applied Economics, January 1971.

Vernon W. Ruttan and Yujiro Hayami, "Technology Transfer and Agricultural Development." Paper presented at the Conference on Agriculture and Economic Development, Tokyo, September 6-10, 1971 (AAE SP71-10).

Peter Gregory, "Wages Under Conditions of Surplus Labor in Japan." Draft, University of Minnesota, Department of Economics, 1971.

Adolf Weber, "Agricultural Modernization in Market and Planned Economies: The German Experience," August 1971 (AAE SP71-16).

Patrick Yeung and Terry Roe, "Induced Innovation: A CES-Type Meta-Production Function," December 1971 (AAE SP71-27).

Vernon W. Ruttan, "Perspective on the 'Green Revolution' in Asia." Summary of papers presented at the Rice Policy Conference, International Rice Research Institute, Los Banos, Philippines, May 9-14, 1971, and Conference on Agricultural and Economic Development, Japan Economic Research Center, Tokyo and Hakone, September 6-10, 1971 (AAE SP71-30).

Marcelo Selowsky and Lance Taylor, "The Economics of Malnourished Children: A Study of Disinvestment in Human Capital," December 1971 (Econ DP13).

1972

Abdelmagid Slama, Willis Anthony, and John DeBoer, "Livestock Projections by the Technique of Flow Charts," January 1972 (AAE SP72-3).

Lee R. Martin, "Some Market Effects of Agricultural Development on Functional Income Distribution in Developed Countries," March 1972 (AAE SP72-9).

Francisco E. Thoumi, "Industrial Capacity Utilization in Colombia: Some Empirical Findings," April 1972 (Econ DP14).

Assaf Razin, "Investment in Human Capital Under Uncertainty," July 1972 (Econ DP19).

Surjit S. Sidhu, Jitendar S. Mann and Martin E. Abel, "The Demand for Cotton in India, 1952-1968," June 1972 (AAE SP72-16).

Peter K. Clark, "A Competitive Market Model for 'Futures' Price Determination," August 1972 (Econ DP21).

B.B. Batra and K. William Easter, "High Returns from Field Channels in Irrigated Indian Villages," September 1972 (AAE SP72-24).

M.A. Zaidi and S.K. Mukhopadhyay, "Economic Development, Structural Change and Employment Potential," September 1972 (IRC4).

Martin E. Abel, "The Developing Countries and United States Agriculture," October 1972 (AAE SP72-25).

Hans P. Binswanger, "The Measurement of Biased Technical Change in the Many Factor Case: U.S. and Japanese Agriculture," December 1972 (AAE SP72-28).

Hans P. Binswanger, "Induced Innovation: A Critical Review of the Theory and Conclusions from New Evidence," December 1972 (AAE SP72-29).

1973

Edgardo Barandiaran, "The Supply of Money and Bank Credit in Argentina," January 1973 (AAE SP73-4).

Osama A. Al-Zand, "The Economics of Olive Oil and Oilseeds in the Mediterranean Region," January 1973 (AAE SP73-5).

S. Bisalish and M. Shane, "An Appraisal of the State Bank of India," January 1973 (AAE SP73-7).

Surjit S. Sidhu, "Economics of Technical Change in Wheat Production in Punjab (India)," January 1973 (AAE SP73-9).

Martin E. Abel, Delane E. Welsch, and Robert W. Jolly, "Technology and Agricultural Diversification," January 1973 (AAE SP73-10).

Surjit S. Sidhu, "Relative Efficiency in Wheat Production in the Indian Punjab," January 1973 (AAE SP73-11).

Hans P. Binswanger, "A Cost Function Approach to the Measurement of Factor Demand Elasticities and Elasticities of Substitution," January 1973 (AAE SP73-12).

Masakatsu Akino and Yujiro Hayami, "Sources of Agricultural Growth in Japan, 1880-1965," April 1973 (AAE SP73-13).

Vernon W. Ruttan, "Technology Transfer, Institutional Transfer, and Induced Technical Change in Agricultural Development," June 1973 (AAE SP73-16).

T. Paul Schultz, "Economic Factors Affecting Population Growth: A Preliminary Survey of Economic Analyses of Fertility," April 1973 (Econ DP29).

Center Staff Papers (SP) and Discussion Papers (DP) are available as indicated by the following:

(AO) - available from author only

(AAE) - available from Department of Agricultural and Applied Economics

(Econ) - available from Department of Economics

(IRC) - available from Industrial Relations Center

CENTER PH.D. THESES

1968

Lawrence B. Morse, The Peruvian Experience with Fixed and Flexible Exchange Rates: An Empirical Examination, Department of Economics, University of Minnesota, 1968.

V.S. Rao, Disaggregated Demand and Some Aspects of the Pure Theory of International Trade, Department of Economics, University of Minnesota, 1968.

1971

Eduardo Sarmiento, Efficient Allocation of Resources in the Supply of Water for Domestic Consumption: Colombia, Department of Economics, University of Minnesota, 1971.

Sung Hwan Ban, Long-Run Productivity Growth in Korean Agricultural Development, 1910-1968, Department of Agricultural and Applied Economics, University of Minnesota, 1971.

Aida Eguia Recto, An Analysis of the International Demand for Philippine Coconut Products, Department of Agricultural and Applied Economics, University of Minnesota, 1971.

1972

Edgardo E. Barandiaran, The Control of Money and Bank Credit in Argentina, Department of Agricultural and Applied Economics, University of Minnesota, 1972.

Alvin John DeBoer, Jr., Technical and Economic Constraints on Bovine Production in Three Villages in Thailand, Department of Agricultural and Applied Economics, University of Minnesota, 1972.

Peter Greenston, The Food for Peace Program and Brazil: Valuation and Effects of the Commodity Inflow, Department of Economics, University of Minnesota, 1972.

Terry Monson, Migration, Experience-generated Learning and Infant Industries: A Case Study of Turkey, Department of Economics, University of Minnesota, 1972.

*Enrique O. Scala, The Efficiency of Import Substitution in the Argentine Automotive Industry, Department of Economics, University of Minnesota, 1972.

*Francisco E. Thoumi, A Theory of International Trade of Used Durable Goods with an Application to Underdeveloped Countries, Department of Economics, University of Minnesota, 1972.

Remigio D. Torres, Potential Benefits and Pricing of Irrigation Water: A Case Study of the Santa Cruz System, Department of Agricultural and Applied Economics, University of Minnesota, 1972.

Surjit S. Sidhu, Economics of Technical Change in Wheat Production in Punjab (India), Department of Agricultural and Applied Economics, University of Minnesota, 1972.

1973

- * John H. Sanders, Mechanization and Employment in Brazilian Agriculture, 1950-1971, Department of Agricultural and Applied Economics, University of Minnesota, 1973.
- * Mitoshi Yamaguchi, Technical Change and Population Growth in the Economic Development of Japan, Department of Agricultural and Applied Economics, University of Minnesota, 1973.
- * Sachiko Yamashita, An Exploration of the Economics of Taste and Demand for Food, Department of Agricultural and Applied Economics, University of Minnesota, 1973.
- * William W. Wade, Institutional Determinants of Technical Change and Agricultural Productivity Growth: Denmark, France, and Great Britain, 1870-1965, Department of Agricultural and Applied Economics, University of Minnesota, 1973.

Copies of Ph.D. theses completed under Center sponsorship may be obtained from University Microfilms, Ann Arbor, Michigan. Copies of the theses identified by (*) will not be available from University Microfilms until early 1974.

WORKSHOPS AND SEMINARS
July 1972-July 1973

WORKSHOPS

AGRICULTURAL DEVELOPMENT WORKSHOP

July 21

Nathan Rosenberg, University of Wisconsin
 Natural Resources, Technical Change, and Economic Growth

August 4

Reinhold Sachs, Institute for Foreign Agriculture, Technical University
 of Berlin
 Using University Graduates in Development Assistance: Some Aspects of
 Motivation Analysis

August 17

Surjit Sidhu (Thesis Oral)
 Economics of Technical Change in the Production of Wheat: An Empirical
 Investigation in the Case of the Indian Punjab

September 29

Sudhin Mukhopadhyay
 Demand Functions for Fertilizer: A Survey

October 6

Robert Latham
 The Economics of Natural Resource Information

October 13

William Easter
 Investment in New and Old Irrigation Systems: Implications of the
 Sambalpur Study

October 20

John Mellor, Cornell University
 Domestic Markets and Agricultural Development

November 3

Hans Binswanger
 The Translog Production Transformation and Cost Function

November 10

Richard Nelson, Yale University
 An Evolutionary Theory of Economic Development

November 16

William Newell, St. Olaf College
 The Economic Development of French Agriculture

December 1

Edgardo Barandiaran (Thesis Seminar)
 The Control of Money and Bank Credit in Argentina

December 8

T. Paul Schultz
 Economic Factors Affecting Population Growth: A Preliminary Survey of
 Economic Analysis of Fertility

- December 15
Reynold Dahl and Malcolm Purvis
The Development Consultant: In Haiti, Zaire, and Tunisia
- January 5
Bai Yung Sung
Fertilizer Demand Estimation in Korea: A Progress Report
- January 12
G. Edward Schuh, Purdue University
Modernization of Brazilian Agriculture
- January 19
Mathew Shane
A flow of Funds Model of Regional Growth: The Upper Midwest
- January 26
Ronald Duncan
Criterion for Evaluating Research on Product Development
- February 2
Sudhin Mukhopadhyay
Regional Agricultural Development in India: A Proposal
- February 9
Mitoshi Yamaguchi
Technical Change and Population Growth in the Economic Development of
Japan and the United States
- February 16
John Sanders
The Demand for Tractors in Brazil
- February 23
Michael Hay
Rural-Urban Migration in Tunisia
- March 2
Willard W. Cochrane
Agricultural Planning in the Philippines
- March 9
John Sanders
The Demand for Tractors in Brazil (continued)
- March 16
Mathew Shane and Siddanaik Bisaliah
Appraisal of the Performance of the State Bank of India
- March 23
Vernon W. Ruttan
The Environment for Rural Development in Southeast Asia in the 1970's:
Implications for the ADC Program
- March 30
Joseph Fitzharris, College of St. Thomas
Science for the Farmer: The Minnesota Agricultural Experiment Station,
1868-1910

April 6

William Wade (Thesis Oral)

Agricultural Productivity Growth in Denmark, Great Britain, and France:
1870-1965

April 13

Clayton Ogg (Thesis proposal)

Agricultural Productivity Differences Among Regions of North America

April 27

John Sanders (Thesis Oral)

The Demand for Tractors in Brazil

May 4

Richard Blue

Political Determinants of Resource Allocation: Green Revolution in India

May 11

Martin Abel and William Easter

Regional Agricultural Development Planning: A Conference Report

May 18

Sachiko Yamashita (Thesis Oral)

An Exploration in the Economics of Taste and Food Demand

May 25

Mrinal Datta-Chaudhuri,

Regional Planning in India

June 6

Mitoshi Yamaguchi (Thesis Oral)

Technical Change and Population Growth in the Economic Development of Japan

June 8

Egbert Gerken,

An Alternative Approach to the Theory of Labor Supply in LDC's

June 15

Bai Yung Sung

Farm Demand for Fertilizer in Korea

HUMAN CAPITAL WORKSHOP

September 28

John Hause

The Covariance Structure of the Earnings Profile

October 5

Thomas Stinson

The Demand for Education

October 19

Uri Ben-Zion

Theory of Productive Saving

October 24

John Danforth

Attitudes Toward Risk

November 9

Charles Rambeck

Public School Expenditure Decisions

November 14

Hans Binswanger

The Measurement of Technical Change Biases in the Many-Factor Case

November 21

Besim Üstünel, Institute for International Economics Studies, Stockholm
Growth, Trade and Technology from "Trade-Generated Growth to Growth-
Generated Trade"

December 12

Reuben Gronau, Hebrew University

The Wage Rates of Women--A Selectivity Bias

January 11

Uri Ben-Zion

The Demand for Children

January 16

Elizabeth Newell, St. Olaf College

Italian Fertility Decline

January 25

T. Paul Schultz

Fertility and Education

February 1

John Atwell, University of Toronto

Canadian-American Earnings--Education Differentials

February 8

Samuel Bowles, Harvard University

The Invisible Hand: A Marxist Critique

February 8
Charles Orvis
Demand for Higher Education

February 15
John Hause
Earnings, Profile, Ability and Schooling

February 22
Doug Welland
Relationship of Ability and Earnings--Psychological Literature--Wage Relations

March 1
Henro Ito
Secondary Labor Force Participation

March 8
James McDonald
Market Signalling and Education as Certification

March 29
John Larson
Turnover and Specific Training

April 5
Gary Becker, University of Chicago
Theory of Marriage

April 10
Jack Rodgers
Discrimination

April 12
Alfonso Serrano
Income Distribution and Human Capital

May 2
Marc Nerlove, University of Chicago
Qualitative Dependent Variables

May 11
Victor Fuchs, National Bureau of Economic Research
Mortality Effects in Developed Countries

May 17
Hollis Chenery, IBRD
Alternative Strategies of Development

May 18
Michael Balch, University of Iowa
Uncertainty

May 24
James Heckman
Child Care and Work Effort

May 31

Lee Lillard, NBER

Life Cycle and Cross Sectional Earnings Models

June 10

Paula Stephan, Georgia State University

Labor, Leisure, and Training

TRADE AND DEVELOPMENT WORKSHOP

October 3

Anne O. Krueger
 Turkish Economic Development

October 10

Lee R. Martin
 Some Market Effects of Agricultural Development on Functional Income
 Distribution in Developed Countries

October 17

Sudhin Mukhopadhyay
 Economic Development, Structural Change, and Employment Potential

October 26

Peter Kenen, Princeton University
 Tariff Changes and World Welfare

October 31

Tercan Baysan
 Economic Implications of Turkey's Entry into the Common Market

November 10

Richard Nelson, Yale University
 An Evolutionary Theory of Economic Development

November 14

Hans Binswanger
 The Measurement of Technical Change Biases in the Many-Factor Case

November 21

Besim Üstünel
 Growth, Trade, and Technology from "Trade-Generated Growth to Growth-
 Generated Trade"

December 8

J. N. Sinha, Office of Population Research, Princeton University
 Macroeconomic Implications of Rapid Population Growth

January 16

Elizabeth Newell, St. Olaf College
 The Sources of Mortality Change in Italy

January 24

W.J. Adams, Harvard University
 (to be supplied)

February 6

Anne Krueger
 Rents

February 16

T. N. Srinivasan
 Reanalyzing the Harris-Todaro Model: Policy Rankings in the Case of
 Sector-Specific Wages

February 20

Armeane Choksi

Economic Efficiency of Indian Iron and Steel Industry

February 27

Eugenia Rubenstein

Hoof and Mouth Disease

March 5

W. Max Corden, Princeton

The Wage Differential and Urban Unemployment in LDC's: Implications for
Optimum Subsidy or Protection Policies

March 6

Chong Nam

Economic Costs of Interest Rate Distribution in Korea

April 17

Uri Ben-Zion and Vernon Ruttan

Aggregate Demand and Induced Technical Change over the Business Cycle

April 23

Aba Schwartz, Ohio State

Migration and Distance

May 1

Vernon W. Ruttan

Technology Transfer, Institutional Transfer, and Induced Technical and
Institutional Change in Agricultural Development

May 8

Sudhin Mukhopadhyay

Indian Agricultural Change: A Cross Section and Time Series Study

May 17

Hollis Chenery, IBRD

Alternative Strategies of Development

May 22

Yun Wing Sung

Induced Technical Change in Japanese Economic Development

May 29

Michael Hay

Rural-urban Migration in Tunisia

June 5

Tercan Baysan

Effective Tariff Protection for Turkey

RESOURCE AND REGIONAL ECONOMICS WORKSHOP

April 2

Dale E. Hathaway, Michigan State and Ford Foundation
The Future of International Programs and the Role of American Universities

April 16

James Angus
Spatial Distribution of Employment: Alternatives for a Metropolitan Region

April 30

Alan Hopeman
An Economic Analysis of Flood Damage Reduction Alternatives in the
Minnesota River Basin

May 14

Mathew Shane
The Role of Financial Institutions in Rural-Urban Migration

June 4

Hans-Erik Uhlin
Development of a Regional Policy in Sweden's History, Current Status,
an Evaluation and the Emerging National Land-Use Plan for Sweden

June 11

Ernesto Venegas
Inter-regional Demand for Migration

DEPARTMENTAL SEMINARS

July 21

Nathan Rosenberg, University of Wisconsin
Natural Resources, Technical Change, and Economic Growth

August 9

Reinhold Sachs, Technical University of Berlin
Training for Economic Development: The German Experience

September 1

In Keun Wang, Seoul National University
The New Community Movement in Korea

September 20

S. Swamy, Indian Institute of Technology
Comparative Economic Growth in India and China

December 4

Clyde Swenson, Michigan State University
Employment and Income Distribution Effects of the Green Revolution,
Tharjavur District: India

January 22

John B. Shoven, Yale University
General Equilibrium Analyses of the Taxation of Capital Income in the
United States

January 24

William J. Adams, Harvard University
Corporate Power and Allocative Efficiency in the North Atlantic Community

January 24

Philip Raup
Urban and Rural Dimensions of Regional Conflicts in Western Europe

January 26

Bernt Stigum
Dynamic Stochastic Parameter Estimates

January 29

Hal R. Varian, University of California
Equity, Envy, and Efficiency

February 2

Robert Hudec, University of Minnesota
Where Do We Go from Here in Negotiating Trade in Agricultural Products?

February 5

V.S. Vijas, Agricultural Prices Commission, Government of India
Approaches to the Poverty Problem in India

February 8

Samuel Bowles

The Iron Fist and the Invisible Hand: A Marxist Critique of Economic Theory

February 19

Dale C. Dahl, University of Minnesota

Regional Research Proposal on Organization and Control of the U.S. Food System

February 21

Yoram Barzel, University of Washington

A Theory of Rationing by Waiting

March 5

Max Corden, Oxford University, England

The Wage Differential and Urban Unemployment in LDCs; Implications for Optimum Subsidy or Protection Policies

March 28

Robert Reeser, Chief of Party, Tunisia Project

Some Reflections on the Department's Program in Tunisia

April 4

Bruce Davidson, University of Sydney

The Economic Development of the Northern Regions of Australia

April 10

Clifford Hildreth, University of Minnesota

Ventures and Bets

April 17

Clifford Hildreth, University of Minnesota

Uncertain Prospects

April 24

Peter Clark, University of Minnesota

Demand for Futures

May 1

Peter Clark, University of Minnesota

Distributional Equilibria

May 2

Marc Nerlove

Notes on the Log-Linear or Logistic Model for the Analysis of Qualitative Socioeconomic Data

May 7

Walter Wilcox

What Can We Expect for Commercial Farm Legislation in 1973?

May 11

Victor Fuchs, National Bureau of Economic Research

Mortality Effects in Developed Countries

May 18

Michael Balch, University of Iowa

Subjective Expected Utility for Conditional Primitives

June 5

Bill Miller (Thesis Oral)

Equilibrium in Dynamic Exchange Models

SOURCES OF SUPPORT

Since its establishment in 1967 the University of Minnesota Economic Development Center has received support from the following sources:

Ford Foundation, July 1, 1967	
Allocation to the EDC by the Office of International Programs from a 1964 Ford Foundation institutional development grant to the University of Minnesota	\$ 50,000

U.S. Agency for International Development, July 1, 1970	800,000
A211(d) grant for Research on the Policy Problems of Agricultural Development. Funds are made available to support two programs for five years.	

(I) Agricultural Economics Research and Training Program (\$230,000)

(II) Development Policy Program (\$570,000)

Rockefeller Foundation

For Support of research on "Science and Agricultural Progress: The Japanese Experience"

July 1, 1971	12,200
July 1, 1972	12,900
July 1, 1973	

Expenditures by the University of Minnesota Economic Development Center for its program of research, publication, graduate education and related activities during the fiscal year ending June 30, 1973 were as follows:

Ford Foundation grant

U.S. Agency for International Development
Program I () and Program II ()

Rockefeller Foundation grant

Total

Additional support for the Center program has been through funds made available directly to the two cooperating Departments or to individual staff members and graduate students. Where such funding was available, it is identified in the individual research reports.

Table I(b)

Budget Detail for AID Program II

Development Policy Program

July 1, 1972 - June 30, 1973

C 58 2 2-1

Research Projects	Personnel	Salary and Fringe Benefits	AID 211 (d) Grant Support			Other Support		
			Computer and Data Processing	Travel and Expenses	Supplies and Equipment	Total	Amount	Source
Regional Agricultural Development in India: A Comparative Study								
Research Associate	Surjit Sidhu	6,323.37			19.87	6,343.24		
Research Assistant	Sudhim Mukhopadhyay	2,077.06			7.93	2,084.99		
Institutional Determinants of Technical Change and Agricultural Productivity Growth: Denmark, France, and Great Britain 1870-1965								
Research Assistant	William Wade	5,893.96				5,893.96		
Research Assistant	Sachiko Yamashita	7,496.00	15.00	207.96	15.15	7,734.11		
Rural-Urban Migration in Tunisia								
Research Assistant	Michael Hay	3,210.33 ¹				3,210.33		
Mechanization and Employment in Brazilian Agriculture 1950-1971								
Research Assistant	John Sanders	7,715.66 ²	13.00	6.00	41.99	7,776.65		
Family Size and Intergenerational Transfer								
Research Specialist	Uri Ben-Zion	3,678.34	132.48		1.68	3,812.50		
Research Assistant	Elion Amit	517.20				517.20		

Research Projects	Personnel	AID 211 (d) Grant Support					Other Support	
		Salary and Fringe Benefits	Computer and Data Processing	Travel and Expenses	Supplies and Equipment	Total	Amount	Source
Economic, Social and Demographic Maps For A Historical Atlas of South Asia								
Staff	Joseph Schwartzberg	6,698.12		82.04		6,780.16		
Multi-Country Trade And Development: A Programming Analysis								
Staff	James Henderson	4,840.24		175.35		5,015.59		
Research Assistant	John Scarbrough	5,224.49		506.61		5,731.10		
Research Assistant	Tercan Baysan	4,633.44				4,633.44		
Political and Social Factors Associated with the Public Allocation of Agricultural Inputs in a Green Revolution Area: The Case of Rajasthan								
Research Associate	Yashwant Junghare	1,215.00				1,215.00		
International Differences in Growth Rates and Education								
Visiting Professor	Assaf Razin	1,840.00				1,840.00		
Economic Growth in Sweden, Japan and Turkey								
Staff	Besim Ustunel	4,888.96				4,888.96		
Economics of Forestry Information: Case Studies in Central America								
Research Fellow	Robert Latham	2,599.08		154.66		2,753.74		

Research Projects	Personnel	AID 211 (d) Grant Support					Other Support	
		Salary and Fringe Benefits	Computer and Data Processing	Travel and Expenses	Supplies and Equipment	Total	Amount	Source
Sources of Productivity Differences Among Regions in North America								
Staff Research Assistant	T. Paul Schultz Clayton Ogg	25,808.39 6,093.75		244.64		26,053.03 6,093.75		
Program Support and Administration								
Staff	Vernon Ruttan	16,085.25		339.03		16,424.28		
Secretarial Services	Linda Hendrickson Sharon Linkert	6,201.73 3,330.04				6,201.73 3,330.04		
General Program Support			1,826.02	232.77 ³	3,570.70	5,629.49		
Work Study		232.20				232.20		
Honorarium	Peter Kennen	100.00				100.00		
TOTAL		126,692.61	1,986.50	1,949.06	3,657.32	134,285.49		
¹ Includes \$1,500 from stipends, \$1,667.50 salary and \$22.83 fringes ² Includes \$4,203 from stipends, \$2,906.25 salary, \$36.41 fringes, \$480 quarters allowance, and \$90 insurance ³ Travel for Lee Martin								
Unofficial Budget Statement Office of International Programs September 12, 1973								

Table II (b)

AID Program II - Development Policy Program Budget Summary, 1970/71 to 1972/73

Items	Actual July 1, 1970-June 30, 1971			Actual July 1, 1971- June 30, 1972				Actual July 1, 1972-June 30, 1973			
	Budgeted (1)	Spent (2)	Uncommitted balance (3)=(1)-(2)	Budgeted (4)	Budgeted plus carry-over (5)=(3)+(4)	Spent (6)	Uncommitted balance (7)=(5)-(6)	Budgeted (8)	Budgeted plus carry-over (9)=(7)+(8)	Spent (10)	Uncommitted balance (11)=(9)-(10)
1. Salaries	41,904	36,641	5,263	90,557	95,820	85,555	10,265	96,970	107,235	118,101	(10,866)
2. Fringe Benefits	3,353	2,669	684	7,075	7,759	6,052	1,707	7,596	9,303	8,592	711
3. Computer and Data Processing	2,600	87	2,513	3,500	6,013	1,410	4,603	3,054	7,657	1,987	5,670
4. Travel and Expenses	6,400	4,364	2,036	11,000	13,036	1,928	11,108	12,500	23,608	1,949	21,659
5. Supplies and Equipment	4,500	2,023	2,477	2,000	4,477	4,552	(75)	2,000	1,925	3,657	(1,732)
Total	58,757	45,784	12,973	114,132	127,105	99,497	27,608	122,120	149,728	134,286	15,442

Table II (b) continued

AID Program II - Development Policy Program Budget Summary, 1973/74 and 1974/75

Items	Projected July 1, 1973-June 30, 1974				Projected July 1, 1974-June 30, 1975			
	Budgeted (12)	Budgeted plus carry-over (13)=(11)+(12)	Committed (14)	Uncommitted balance (15)=(13)-(14)	Budgeted (16)	Budgeted plus carry-over (17)=(15)+(16)	Committed (18)	Uncommitted Balance (19)=(17)-(18)
1. Salaries	103,866	93,000	93,919	(919)	111,282	110,363	55,176	55,187
2. Fringe Benefits	8,163	8,874	9,374	(500)	8,775	8,275	8,179	96
3. Computer and Data Processing	6,500	12,170	12,300 ¹⁾	(130)	6,954	6,824	7,000 ⁴⁾	(176)
4. Travel and Expenses	12,500	34,159	2,124 ²⁾	32,035	12,500	44,505	-0- ⁵⁾	44,535
5. Supplies and Equipment	2,000	268	10,000 ³⁾	(9,732)	2,000	(7,732)	7,500 ⁶⁾	(15,232)
Total	133,029	148,471	127,717	20,754	141,511	162,265	77,855	84,410

1) Abel/Easter \$8,500, Ben-Zion \$1,300, Hay \$500 and program support \$2,000.

2) Basu \$186, Schwartzberg \$1,422 and possibly Krueger \$516.

3) Abel/Easter \$6,000 and estimated program support \$4,000.

4) Abel/Easter \$5,000 and program support \$2,000.

5) No amount estimated yet.

6) Abel/Easter \$3,500 and estimated program support \$4,000.

Unofficial Budget Statement
Office of International Programs
September 12, 1973

DEVELOPMENT POLICY PROGRAM

PROGRAM II: 211 (d)

	Salary ¹ 1973/1974	Salary (Projected 1974/1975)
Hendrickson, Linda -- Secy. 7/1/73 - 6/30/74	6,300.00	6,665
Fringes	963.90	1,019
Mehra, Yash Pal -- RA Programmer 6/15/73 - 7/31/73	1,072.80	
Fringes	15.79	
Zion, Ben -- Secy. (Patsy Broas) Fringes - 7/16/73 - 8/15/73	211.00	
	32.29	
Bayson, Tercan -- RA 7/1/73 - 7/31/73	788.00	
9/16/73 - 12/15/73	1,773.00	
Fringes	9.62	
Henderson, James -- Prof. 7/1/73 - 8/31/73	5,800.00	
Fringes	933.80	
Krueger, Ann O. -- Prof. 8/16/73 - 9/15/73	2,322.24	
Fringes	373.90	
Abel, Martin 7/1/73 - 6/30/75	14,875.00	15,619
Fringes	2,394.87	2,515
Nam, Chong -- RA 6/19/73 - 9/15/73	2,345.00	
9/16/73 - 6/15/74	5,319.00	
Fringes	41.13	
Scarborough, John -- RA 9/16/73 - 9/15/73	2,345.00	
9/16/73 - 6/15/74	5,319.00	
Fringes	41.13	
Schultz, T. Paul -- Prof. 7/1/73 - 9/15/73	6,250.00	25,069
9/16/73 - 6/15/74	17,625.00	
Fringes	3,843.88	4,036
Rudish, Gershom -- TA 7/16/73 - 9/15/73	1,576.00	
9/16/73 - 1/15/74	2,364.00	
Fringes	27.64	

Skoog, Gary -- RA 9/16/73 - 1/15/74	2,364.00	
Yamashita, Sachiko -- RA 7/1/73 - 7/31/73 Fringes	788.00 9.62	
Jolly, Robert -- RA 7/1/73 - 6/30/74 Fringes	6,107.00 107.12	
Sanders, John -- RA 7/1/73 - 7/31/73 Fringes	788.00 9.62	
Mukhopadhyay, Sudin -- RA 7/1/73 - 9/30/73 10/1/73 - 12/30/73 Fringes	2,364.00 1,773.00 41.47	4,200 55
Strait, Mary -- Secy. 7/1/73 - 6/30/74 Fringes	3,450.00 527.85	3,623 554
TOTAL SALARY	\$93,919.04	\$55,176
TOTAL FRINGES	\$ 9,373.63	\$ 8,179

¹Fringe benefits for civil service are 15.3% and for fulltime faculty they are 16.1%. These same rates were applied to the 1974/1975 salary rates.

²Salaries are projected at a 5% increase.

Unofficial Budget Statement
Office of International Programs
September 12, 1973

Table I(a)

Budget Detail for AID Program I

Agricultural Economics Research and Training Program I

July 1, 1972 - June 30, 1973

	Personnel	AID 211(d) Grant Support					Other Support	
		Salary and Fringe Benefits	Computer and Data Processing	Travel and Expenses	Supplies and Equipment	Total	Amount	Source
Research Projects:								
Induced Innovation in Agricultural Development								
Staff	Vernon Ruttan				487.03	487.03		
Research Associate	Hans Binswanger	4626.88	150.75	203.12	235.55	5216.30		
Research Assistant	S. Mukhopadhyay	3468.75		445.95	15.97	3930.67		
Research Assistant	Mitoshi Yamaguchi	7453.80	196.67		6.48	7656.95		
Research Assistant	William Meyers	1293.75			1.14	1294.89		
Research Assistant	E. Barandiaran	1125.00			27.68	1152.68		
Fertilizer Use, Distribution and Manufacture in South Korea								
Staff (UofM)	Dale C. Dahl			205.25	76.45	281.70	20800	UMAAE
Research Assistant	Bai Yung Sung	5812.50	406.64	205.25		6424.39		
Research Assistant	Jiann-Shing Lin	491.34				491.34		
Research Assistant (Undergrad)	Udo Udokang	475.42				475.42		
Staff (Korea)	Young K. Shim	*1199.00		*327.57		1526.57		
Research Assistant	H. Oh	* 564.07				564.07		
Interviewers		*1017.88		*1552.28		2570.16		
Secretarial Services		* 332.47				332.47		
Supplies					*1283.59	1283.59		

*Under Memorandum of Agreement, Dr. Young K. Shim
7/1/72-6/30/73

	Personnel	AID 211(d) Grant Support					Other Support	
		Salary and Fringe Benefits	Computer and Data Processing	Travel and Expenses	Supplies and Equipment	Total	Amount	Source
Technical Change in Wheat Production in the Punjab								
Research Assistant	Surjit Sidhu	4602.48	502.83		354.21	5459.52		
International Olive Oil Economy								
Staff	Osama Al-Zand	4270.77	30.49		27.74	4329.00		
Graduate Trainings:								
Staff	Terry Roe		55.00			55.00	18200	AID(Tunisia)
	Lee Martin			113.78		113.78		
	W. B. Sundquist			120.79		120.79		
	Reese Dahl			177.25		177.25		
Seminar Speakers	R. Sachs	150.00				150.00		
	W. Newell	50.00				50.00		
	N. Rosenberg	100.00		59.00		159.00		
	J. Mellor	150.00		188.15		338.15		
	E. Schuh	150.00		139.00		289.00		
	V. Vyas	150.00		108.00		258.00		
	J. Williamson			524.74		524.74		
	J. Kendrick			649.72		649.72		
	R. Meyers			612.59		612.59		

	Personnel	AID 211(d) Grant Support					Other Support	
		Salary and Fringe Benefits	Computer and Data Processing	Travel and Expenses	Supplies and Equipment	Total	Amount	Source
Program Support and Administrations:								
Secretarial Services	Sharon Linkert <u>a/</u>	3546.92				3546.92		
Editorial and Clerical Services	Barbara Miller ($\frac{1}{2}$)	4749.06				4749.06		
Supplies and Equipment					469.58	469.58		
Printing Charges					524.51	524.51		
Totals		45780.09	1342.38	5632.44	3509.93	56264.84	39000	

Unofficial Budget Summary
 Department of Agricultural and Applied Economics
 September 4, 1973

Abbreviations:
 UMAAE - University of Minnesota Department
 of Agricultural and Applied Economics

a/ Prog. I 12 months ($\frac{1}{2}$)
 Prog. II 12 months ($\frac{1}{2}$)

Table II(a)

AID Program I - Agricultural Economics Research and Training Budget Summary, 1970/71 to 1972/73

	Actual July 1, 1970-June 30, 1971			Actual July 1, 1971-June 30, 1972				Actual July 1, 1972-June 30, 1973			
	Budgeted (1)	Spent (2)	Balance (3)=(1)-(2)	Budgeted (4)	Budgeted plus carry-over (5)=(3)+(4)	Spent (6)	Balance (7)=(5)-(6)	Budgeted (8)	Budgeted plus carry-over (9)=(7)+(8)	Spent (10)	Balance (11)=(9)-(10)
<u>Items</u>											
1. Salaries	31,032	4,485	26,547	33,265	59,812	38,771	21,041	37,354	58,395	43,990	14,405
2. Fringe Benefits	2,909	232	2,677	3,104	5,781	1,820	3,961	3,334	7,295	1,790	5,505
3. Computer and Data Processing	2,000	38	1,963	2,500	4,463	1,047	3,416	2,500	5,916	1,342	4,574
4. Travel and Expense	2,000	307	1,693	3,000	4,693	3,927	766	3,000	3,766	5,633	-1,867
5. Supplies and Equipment	2,800	119	2,681	600	3,281	2,702	579	600	1,179	3,510	-2,331
TOTAL	40,741	5,181	35,561	42,469	78,030	48,266	29,763	46,788	76,551	56,265	20,286

AID Program I - Agricultural Economics Research and Training Budget Summary, 1973/74 and 1974/75

	Projected July 1, 1973-June 30, 1974				Projected July 1, 1974-June 30, 1975			
	<u>Budgeted</u> (12)	Budgeted plus <u>carry-over</u> (13)=(11)+(12)	Com- <u>mitted</u> (14)	<u>Balance</u> (15)=(13)-(14)	<u>Budgeted</u> (16)	Budgeted plus <u>carry-over</u> (17)=(15)+(16)	Com- <u>mitted</u> (18)	<u>Balance</u> (19)=(17)-(18)
<u>Items</u>								
1. Salaries	37,047	51,452	40,446.81	11,005.19	42,945	53,950.19	27,430.30	26,519.89
2. Fringe Benefits	3,525	9,030	1,850.90	7,179.10	3,762	10,941.10	4,476.67	6,464.43
3. Computer and Data Processing	-0-	4,574		4,574.00	-0-	4,574.00		4,574.00
4. Travel and Expense	3,000	1,133		1,133	1,174	2,307.00		2,307.00
5. Supplies and Equipment	6,000	3,669	3,500.00	169	3,000	3,169.00	1,500.00	1,669.00
TOTAL	49,572	69,858	45,797.71	24,060.29	50,881	74,941.29	33,406.97	41,534.32

AGRICULTURAL AND APPLIED ECONOMICS

PROGRAM I: 211(d) - SALARIES

	<u>73/74</u> ¹⁾	<u>74/75</u> ²⁾
Bai Yung Sung - Grad 7/1/73-6/30/74	7714.52	
Salem Gafsi - Grad 7/1/73-9/30/73	2364.00	
Dale L. Good - Grad 7/1/73-6/30/74	5450.31	
Michael Hay - Grad 7/1/73-10/31/73	2955.00	
Peter Pollak - Grad 10/1/73-12/31/73	886.50	
Clayton Ogg - Grad 7/1/73-6/30/74	7781.50	
Mary Strait - C.S. 7/1/73-6/30/74	3450.00	3622.50
Fringes	520.95	579.60
Barbara Miller - C.S. 7/1/73-12/31/73	4596.00	4825.80
Fringes	694.00	772.13
Hans Binswanger - Acad. 7/1/73-9/30/73	3949.98	
Fringes	635.95	
Terry Roe - Acad. 7/1/72-6/30/74with AID in Tunisia		18382.00
Fringes		3124.94
Young K. Shim - Acad. 7/1/73-6/30/74 (Memorandum of Agreement)	1299.00	600.00
	<hr/>	<hr/>
TOTAL SALARY:	40446.81	27430.30
TOTAL FRINGES	1850.90	4476.67

1) Fringes are 16.1 on Academic and 15.1 on Civil Service Salaries.

2) Salaries were increased by 5%, fringes to 17.0 and 16.0.

Department of Agricultural and Applied Economics
September 4, 1973