T. Paul Schultz

The Economic Growth Center
Yale University

Annual Report 1984-1985

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THE ECONOMIC GROWTH CENTER

YALE UNIVERSITY

ANNUAL REPORT

1984 – 1985

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THE ECONOMIC GROWTH CENTER

T. Paul Schultz, Director
Dorothy R. Nitshke, Business Manager

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Gustav Ranis
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Raaj K. Sah
John Strauss

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Colin I. Bradford, Jr.
Burton Singer

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Mo-Hung Che, General Electric Company
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THE ECONOMIC GROWTH CENTER

YALE UNIVERSITY

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Malcolm K. Brachman	President, Northwest Oil Company
Henry J. Heinz II	Chairman of the Board, H.J. Heinz Company

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Paul C. Warnke	Partner, Clifford & Warnke; Former Director, United States Arms Control and Disarmament Agency

DEDICATION

Simon Kuznets died on July 9, 1985. He left his considerable mark on many students and colleagues, but also on ideas in economics and institutions. In a real sense he was both the intellectual and organizational father of the Economic Growth Center and it has been the great good fortune of those associated with the Center over the past 25 years to have been able to count on him as guide, advisor and friend. In gratitude and affection this report is dedicated to him.

PREFACE

The Economic Growth Center is comprised of faculty in the Economics Department at Yale University with special research interests. This report outlines the purposes, structure and activities of the Center during its twenty-fourth year. The section on Programs of Research reviews the range of theoretical and empirical studies that were conducted by faculty, visitors, and postdoctoral fellows at the Center in 1984-1985. In addition to facilitating the graduate and undergraduate teaching by its faculty within the Economics Department, the Economic Growth Center administers jointly with the Department a Master's degree program in International and Development Economics and provides supervision and training for a small group of postdoctoral fellows in economic demography and development economics. This report is produced annually as a nontechnical survey of current research and training at the Center. Research reports are available as Center Discussion Papers and Center Reprints, and occasionally as book-length studies or collections of papers.

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THE ECONOMIC GROWTH CENTER

Introduction

The Economic Growth Center at Yale University was created to conduct research on economic development and related topics. Each year economists from other universities and research organizations are invited to visit the Center to conduct their research generally for periods up to a year. All resident members of the Center are regular faculty appointments in the Yale Economics Department and perform teaching, administrative and supervisory services within Yale College and Yale Graduate School. In conjunction with the Department of Economics, the Economic Growth Center assists in administering a program of study in International and Development Economics leading to a Master of Arts degree. Training of Ph.D. students and select postdoctoral fellows is directed by faculty members of the Center and is administered by its staff. From its own external research grants and endowment, the Center provides supporting services for faculty research, as well as for instructional and administrative functions within the University.

Research Objectives

The Economic Growth Center was founded by members of the Yale Economics faculty in 1961 to analyze the process of economic development and relationships among countries. The Center does not attempt to promote particular development policies; its strength lies in its faculty's diverse specialties, scholarship, and intellectual independence. Nonetheless, the Center is continually engaged in pursuing an agenda of research that holds promise of improving policy and enhancing the prospects for economic development. As private individuals, faculty members at the Center act as advisors and consultants to governments and foundations on various matters of development.

Twenty-five years ago the Center's research program, relying primarily on analytical models of development and

utilizing national income accounts, emphasized regularities in structural changes which accompany modern economic growth. While the nature of the aggregate development process remains an important topic of study, in the last decade a new focus of research has emerged that deals with the behavior of individual households and firms. This new line of work includes the application of microeconomic theory and the use of suitable statistical methods in the analysis of large sample surveys.

Publications

Results of the Center's research are disseminated to academic, business, and government communities through many channels. Discussion papers, which report on preliminary work, are distributed along with journal reprints to a large number of academic and research libraries in the United States and abroad with whom special exchange relations have been established. In return, these libraries provide their own books, monographs and periodicals which constitute the core of the Economic Growth Center Library Collection. Book-length studies, resulting from Center research and conferences, are published by Yale University Press as well as other publishers. The Annual Report of the Center describes current activities and summarizes research findings; it is available on request. A list of this year's books, Center papers and discussion papers is provided in Appendix B. Books may be ordered directly from the publishers, papers from the publications office of the Center.

International and Development Economics

With the cooperation of the Economic Growth Center, the Department of Economics offers a one-year program of study in International and Development Economics leading to the Master of Arts degree (formerly the IFEA degree). The Program is an intensive course of study in economic theory, trade and applications for those with a professional interest in international economics and development. Most students in the Program have experience in central banks, foreign ministries,

planning agencies, and other public and private agencies concerned with international economics and development.

Visitors

Visiting scholars are selected from a pool of applicants each year, generally in February or March, for the academic year starting in September. Since the Center has no funds for the support of visitors, applicants must indicate how they plan to finance their visit, as well as include their vita, proposed research agenda, and examples of their research. Visitors are encouraged to secure funding for local research assistance and for computational and secretarial services. Applicants are chosen primarily on the basis of their proposed research and the way it fits into the Center's current work.

Postdoctoral training provides an important opportunity for younger scholars to audit advanced courses and participate in workshops at Yale, while undertaking their own research under the direct supervision of Center faculty. Postdoctoral fellowships may be available from a variety of sources, although advanced planning is important since granting agencies require considerable lead time in their review of fellowship applications. In recent years, fellowships were obtained in economic demography from the Center for Population Research, the National Institute of Child Health and Human Development, the Hewlett Foundation, the Population Council, and the Rockefeller Foundation.

The Library

The holdings of the Economic Growth Center collection focus on materials relating to statistics, economics, and planning in over 100 developing countries. It is one of the most extensive collections of its kind in the United States. Specialized reference services provided by the Yale Social Science Research Library ensure that acquisitions are informed, consistent, and up-to-date.

Financial Support

During 1984-85 funding for Economic Growth Center research was provided by the University, government, foundations, international agencies and private sources. The University provides funding support for faculty teaching positions, partial maintenance of the specialized Economic Growth Center Library and other University library collections, and provision of offices and some utilities. The United States government traditionally provides support for basic research in the social sciences but because of a general decline in that support, the Economic Growth Center has sought a greater share of its support from the private sector -- from both corporations and individuals.

The program of research at the Center could not continue without funding from many sources outside of Yale. These additional funds allow faculty members to extend and deepen the scope of their research commitments by releasing them from full-time teaching obligations during the academic year and by sponsoring their research during the summer. The productivity of researchers is greatly enhanced by the Growth Center's employment on a long-term basis of an experienced support staff: research assistance and programming, administrative, and secretarial services.

The Center has also been involved in financing the collection of data abroad to facilitate research. Collecting primary data is costly, and documenting and disseminating these data in the form of computer files is complex; yet these activities are essential to much of the pioneering research performed at the Center by faculty, graduate students, and visitors. The installation of the Center's own data processing equipment, word processing, and high-speed communication links with the Yale mainframe computer have been timely investments in the last decade, for which grant support has been essential.

Project grants were made by the Andrew W. Mellon Foundation, the United States Department of Agriculture, EMBRAPA, the National Sciences Foundation, the General Service Foundation,

the National Institutes of Health, and the Japan Foundation. Broader, multipurpose grants less tied to specific projects were made by the William and Flora Hewlett Foundation, the Exxon Educational Foundation, the Rockefeller Foundation, the Taiwan Institute of Economic Research, and private individuals. These broader grants are especially important as seed money to enable the Center to start small projects that would otherwise not be possible before individual funding is secured. The funds are used to develop research in important frontier areas for which research funding may not yet be available; to respond flexibly and quickly to new challenges and research opportunities as they arise; to help hire exceptionally able junior faculty prior to the availability of project funding; and to cover staff costs incurred between projects.

Advisory Committee

The Economic Growth Center benefits from an Advisory Committee consisting of outstanding business leaders concerned with the developing countries. The Committee provides a forum for consideration of basic issues of Center structure, organization, research focus, and finance.

Members of the Advisory Committee in 1985-1986 are:

Henry J. Heinz II, Chairman of the Board, H.J. Heinz Company (Co-Chairman);

Malcolm K. Brachman, President, Northwest Oil Company (Co-Chairman);

David E. Bell, Professor of Population Sciences and International Health, Harvard University;

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Ichiro Hattori, President, Daini Seikosha Company, Ltd., Tokyo, Japan;

James L. McCabe, President, McCabe Capital Managers Limited;

Robert R. Nathan, Chairman, Robert R. Nathan Associates;

John R. Petty, President, Marine Midland Bank, Inc.;

Alexander M. Vagliano, Former Executive Vice President, Morgan Guaranty Trust Company;

Paul C. Warnke, Partner, Clifford & Warnke, Former Director, United States Arms Control and Disarmament Agency.

Staff

During 1984-85 the Economic Growth Center professional staff included 12 Yale faculty members, 3 visiting faculty members, 5 postdoctoral fellows, 8 visiting scholars and a permanent support and administrative staff of 11, listed above on page ii and iii.

At the end of the academic year Louka Katseli resigned from Yale to return to her position as Director General of the Greek Centre of Planning and Economic Research. Brian Wright resigned to accept an appointment at the University of California at Berkeley, while Zvi Eckstein resigned to accept an appointment at the University of Tel Aviv in Israel.

Willem Buiter accepted an appointment as Professor at Yale, resigning his ties with the London School of Economics. Vassilis Hajivassiliou moved to the Center upon completing his Ph.D. at M.I.T.

Andrea Ross left to take a position elsewhere in the University. Barbara McCann joined the secretarial staff, and Lois Van de Velde rejoined the Center.

Postdoctoral Fellows

In 1984-85, three fellows were affiliated with the Postdoctoral Program in Economic Demography, coordinated by the Growth Center. Joyce Cooper, from the University of Pennsylvania, studied the determinants of migration and the role of uncertainty and asymmetric imperfect information in United States migration decisions, and extended her studies to the process of rural-urban migration found in low-income countries. Charles Griffin, a second-year NIH postdoctoral trainee, originally from the University of North Carolina, worked on the demand for health care and its effects on child health in the Philippines. Shahidur Khandker from Bangladesh, a Rockefeller

Fellow with research support from the Hewlett Foundation, studied women's roles in rural households. Two additional fellows worked at the Center. Ijaz Nabi was a Fulbright scholar from Pakistan analyzing industrialization in light engineering firms. Edna Angeles, a research fellow from PIDS in the Philippines, studied rural linkages in the development process.

Visitors in 1984-85 included: Willem H. Buiter, Visiting Fisher Research Professor, on leave from the London School of Economics, who worked on macroeconomic policy design in open interdependent economies; Elmar DaCruz, research economist with EMBRAPA in Brazil, who worked on regional differences in technical change in agriculture; James J. Heckman, Visiting Fisher Research Professor from the University of Chicago who gave a series of lectures on microeconometrics and worked on models of fertility spacing, discrimination, and labor market outcomes; Jan Hoem, Professor of Demography at the University of Stockholm who worked on models for study of longitudinal life event histories; Daemo Kim from Chung An University in Korea whose interest was in labor; Daniel Landau from the University of Connecticut at Waterbury continued work on agricultural economics; Sudipto Mundle from the Centre for Development Studies in India; Terry Roe from the University of Minnesota at St. Paul, who worked on agricultural household models; James Roumasset from the University of Hawaii, who worked on models of household behavior and institutional change; Chikayoshi Saeki of Saga University in Japan continued his work on the personal income distribution in Japan; and Toshiko Tange from Kanto Gakuin University in Japan who worked on issues of international trade. Visitors for 1985-86 are listed with the other current staff at the front of this Report.

PROGRAMS OF RESEARCH

This section briefly outlines the research activities of faculty and visitors at the Economic Growth Center in 1984-85. The discussion is organized by subject headings:

(1) International Trade and Finance,
(2) Patterns of National Development,
(3) Technology,
(4) Public Finance,
(5) Agricultural Economics,
(6) Household Production and Consumption,
(7) Economic Demography and Labor.

Several new themes emerging from the research done at the Center can be distinguished among the varied research papers, reports, and proposals that are summarized below: the responsiveness of the international trade system to debt crises and capital flows; the factors that endogenously force the withdrawal of political regulations from the economic marketplace and achieve a persisting liberalization; the determinants of personal savings and investment behavior; the consequences of government food pricing, health, and educational policies on nutrition and health; and the consequences of unwanted fertility on the adaptive behavior of populations and on economic development.

1. International Trade and Finance

It has long been argued that considerations of national defense may justify government intervention in markets, particularly foreign trade markets. As long ago as 1791 Alexander Hamilton suggested that the independence and safety of a country were materially connected with the prosperity of its manufactures. Such an argument is equivalent to the belief that both the productive capacity and the output of some manufacturing industries that are the result of a laissez-faire market equilibrium may be inadequate for national security needs. These arguments are discussed by T.N. Srinivasan

(Discussion Paper No. 483). He finds that the levels of consumption, of employment, and of foreign trade in strategic industries that are market-determined may be different from those levels deemed desirable from the point of view of security. Although foreign trade intervention may contribute to the achievement of some objectives, it is not the optimal form of intervention for it does not achieve its goals at the least cost in terms of foregone welfare.

Arguments for national security may also be based on economic considerations of externalities. For example, potential aggressors may covet a nation's wealth; to deter them, defense expenditures are judged to be needed. In accumulating wealth, however, citizens ignore the extra defense burden that the additional wealth imposes on society. In other words, the impact of private wealth accumulation on national security is not perceived as part of the private decision-making calculus and may on the one hand lead to a greater accumulation of wealth by individuals than is socially desirable. If, on the other hand, private producers anticipate that during wartime price ceilings may be set on their products, they may build up less productive capacity than is socially desirable. In all such cases, unless this externality affects foreign trade adversely, intervention in such trade is not cost-effective.

Another argument for intervention is grounded on the probability of adversaries imposing trade embargoes or economic sanctions during hostilities, a possibility that is likely to be ignored by competitive (atomistic) producers and consumers. The threat of such sanctions and trade controls has been used strategically in the pursuit of defense as well as foreign policy goals. For instance, the export of strategic commodities and weapons, as well as transfer of sensitive technologies to the East, is subject to government control in the West. Historically, economic sanctions and embargoes have been used repeatedly. Yet neither theory nor experience suggests that such policies are likely to be successful in most situations in achieving the desired objectives. The literature on East-West

trade relations and/or the arms race amply bears out this conclusion.

In another paper, Srinivasan (with Jagdish Bhagwati) considers the theory of "Directly Unproductive Profit-Seeking" (DUP) activities, examining their implications for economic theory. Two classes of DUP activities are distinguished: one in which the DUP activity is triggered by policy that is itself exogenously specified (e.g., tariff-revenue seeking that results from pre-specified tariff); the other in which DUP activity emerges endogenously from policy (e.g., tariff seeking). Implications for both positive and normative modes of analysis in economic theory are considered in depth for both these classes of DUP activity.

The research of Michael Jones has focused on the macroeconomics of open economies. The performance of the world economy over the recent period of floating exchange rates has sharply modified our view of the costs and benefits of flexible exchange rates. Exchange rates have been volatile. They have, apparently, been slow to adjust to long-run levels, and their movements have not tended to reduce the impact on foreign employments and escalations of policy actions at home. These broad features of the world economy are incorporated in models containing three key situations: first, private market expectations of future government policies strongly influence the current levels of forward-looking variables, such as the exchange rate; second, sluggish movements of some nominal variables, such as nominal wages written into long-term contracts, make the dynamics of employment and inflation a concern of policymakers; and, third, control by national governments over national objectives is confounded by spillovers from the actions of foreign governments. The description and implementation of optimal macroeconomic policies in such an environment are the subjects of Jones's theoretical work.

One set of issues deals with the conduct of policy over time when the private sector is farsighted. The traditional techniques of dynamic optimization are not suitable for

analyzing these issues, for traditional techniques suppose that governments today can commit themselves to the policies that will be implemented in the future. When such commitments are impossible, policies for the future are not directed at today's problems. The course of policy when private markets are aware of this fact is determined by the subtle interplay of policy makers' views on what private markets expect in the future and private market views on what the course of policy is likely to be.

In his working paper "Open Economy Monetary Policy: An Application of Dynamic Games," Jones surveys and compares several ways of modelling this interplay. His example is the much discussed result that employment-conscious governments will generate excessive inflations in their attempts to surprise anticipating private markets with higher price levels. This result, he argues, is sensitive to the dynamic structure of the economy and to the model of the government-private market interplay. The contrary result sometimes voiced in the open economy literature—that governments tend to expand money too slowly and leave real exchange rates excessively appreciated during employment downturns--is also found to be possible. There appears to be no hard-and-fast answer to this perennial policy issue. But, it is hoped, the ambiguities suggested by Jones's theoretical model can guide empirical explorations of structural parameters and of government-private market interaction.

In a second working paper, "Exchange Rate Surveillance, Policy Coordination, and Time Consistency," Jones supplements the analysis of the interaction of governments and the private market with that of the dynamic game played between national governments. The key issues here are the benefits achievable from the explicit coordination of national policies and the extent to which I.M.F. surveillance of countries' exchange rate policies can substitute for explicit coordination. The paper demonstrates the somewhat unsettling conclusion that surveillance may substitute <u>too</u> well for coordination; that is,

in the presence of farsighted markets, cooperation among governments to account for spillovers from one country to another can lower national welfares. Again, Jones finds that the benefits of surveillance (if any) and the precise form of surveillance are sensitive to the magnitudes of key structural parameters. The model provides a useful check on the robustness of recent simulations of more complex models that focused on similar issues, and it suggests some qualitative results which add to the ongoing debate on the form and desirability of surveillance in a regional (e.g., E.M.S.) and global (e.g., I.M.F.) context.

In papers on exchange-rate policy, Louka Katseli analyzes both theoretically and empirically the process of real exchange-rate determination in the major OECD countries. In "Real Exchange Rates in the 1970s" (Discussion Paper No. 403), the determinants of real exchange rate behavior are investigated in the context of a simple two-country model with traded and non-traded goods. The empirical section of the paper studies the interconnection between nominal exchange rates and domestic and foreign prices in thirteen industrial countries. In almost all cases financial markets appear to clear more quickly than goods markets. Thus, domestic prices exhibit more sluggish adjustment relative to nominal exchange rates. Three rough groupings of countries emerge from the empirical analysis: the large industrialized countries (with the possible exception of Japan), the Scandinavian countries, and the smaller European countries.

In the major industrialized countries, exchange rates can be considered predetermined with respect to relative prices. Past movements of nominal exchange rates, however, influence foreign prices in a way that is consistent with these countries' possession of market power. In all small countries, with the exception of Belgium, the nominal exchange rate does not seem to be affected by lagged values of domestic or foreign prices. The foreign price level of traded goods can be considered similarly predetermined. The domestic value-added deflator, however, is strongly influenced by lagged values of foreign prices.

Differences across countries emerge in terms of their adjustment to innovations. "News" that affects nominal exchange rates and domestic prices is positively correlated in Austria, Belgium and Italy, and negatively correlated in the Netherlands and the Scandinavian countries. This effect could be the outcome of more independent nominal exchange rate policies in the northern countries as opposed to integrated policies of the countries in the European Monetary System. There are also substantial differences in the response to innovations.

The central hypothesis of the paper on "Discrete Devaluation as a Signal to Price Setters" (Discussion Paper No. 467) is that both the extent and speed of adjustment of the real exchange rate is affected by the way in which the central bank manages the nominal exchange rate. Within a monopolistic price adjustment framework, firms tend to strengthen their expectations about two determinants of pricing decisions—an overall increase in costs and an aggregate (as opposed to a local) shift in demand for the firm's output. Thus, it is shown that an unexpected devaluation of the exchange rate shortens implicit price contracts and increases the rate of price adjustment in the non-traded goods sector. In this way discrete change in the exchange rate acts as an "information signal" that leads to fast overall adjustment of non-traded goods prices. The hypothesis is tested and not rejected at the macro, sectoral and firm levels on the basis of macro and micro data on Greek prices before and after the January 1983 discrete devaluation.

Finally, in a paper entitled "Emigration, Repatriation, and Economic Policy: A Greek Perspective," Katseli analyzes the migration-repatriation cycle as a decision-making process on the part of the individual migrant. This process is broken down into the choice about emigration, the timing of the decision, the country of destination, the size of the accompanying family unit, the length of stay abroad, the allocation of savings between the country of origin and destination (emigrant remittances), and finally the choice to return to the home country. The paper then analyzes the effects of these decisions

on a country's output and its sectoral composition as well as on its trade pattern, the terms of trade, the real exchange rate and its balance-of-payments. The empirical evidence presented in this paper draws inferences not only from aggregate time-series analysis but also from a small sample survey of recent repatriates from West Germany to Greece.

Kenneth Kletzer has been studying a number of theoretical topics in international borrowing and lending. One significant issue is the effect of the degree of openness of a country's capital market on the benefits of trade liberalization and the response of a country's capital account to changes in trade policy. Policies selected by countries to reduce restrictions on international transactions have been diverse: Chile removed trade barriers while leaving capital restrictions intact; Argentina opened its capital account while retaining trade restrictions. Japan has recently agreed to U.S. demands to remove some of its capital account restrictions. On the other side of the issue, the U.S. Congress has considered proposals for import taxes aimed at stemming the recent influx of capital.

Both the normative and positive aspects of this issue are studied in a series of papers by Kletzer coauthored with Charles Engel of the University of Virginia. While a large number of different approaches with different underlying assumptions could be chosen, the authors use two-sector full-employment optimal savings models appropriate for addressing questions related to efficiency. Such models provide a benchmark for evaluating the dynamic effects of trade policies.

The dynamics of the current account and trade balance following the imposition of tariffs or taxes on foreign borrowing are studied in "Current Account Policies" (Discussion Paper No. 477). This paper examines a small open-economy model consisting of two sectors—one that produces a good that can be currently consumed or invested, and another that is a consumption good only. The first composite good is produced using labor and capital, while the second pure consumption good uses labor and land in production. This structure is the

simplest arrangement which allows a capital good to be produced and traded, as well as permitting international transactions in financial assets. Because international borrowing is inherently a dynamic phenomenon, the model is an intertemporal one. The dynamics of the current account are described over an infinite horizon to allow a distinction between short-run and long-run effects of policy changes, that would be impossible in a simpler two-period framework. Also, an infinite horizon allows for steady-state trade deficits or surpluses; per capita net holding of foreign assets can remain non-zero. Households are assumed to maximize an intertemporal utility function that gives rise to a general form of savings such that they save or dissave according to whether their current wealth is less than or greater than some target level.

The paper shows that if a tariff is placed on the consumption good, capital is immediately traded for bonds, leading to an initial current account surplus. If the tariff is placed on the composite good, the desired capital stock of the country increases, which leads to an initial current deficit. In either case the process of adjustment back to steady state entails current account surpluses as wealth is accumulated. In the first case, the steady-state trade deficit rises with an increase in the holding of foreign assets. In the second case, with a tariff placed on the composite good, the effect on the long-run trade balance is ambiguous. In any case, the imposition of the tariff reduces national welfare regardless of its effect on the trade balance or current account.

An alternative policy aimed at reducing current account deficits is the imposition of a tax on foreign borrowing. The immediate effect of the imposition of a borrowing tax is an export of capital for foreign bonds. Savings are shown to increase so that there is a current account surplus as the economy adjusts to steady state and an increase in the steady-state trade deficit.

"The Dynamics of Trade and Capital Account Liberalization" (also with Engel) addresses the dynamic effects of

liberalization policies when initial restraints on international transactions are significant. The approach and small-country results parallel those of the previous paper, although with some modifications. The undesirability of capital account restrictions during trade liberalization is demonstrated for a country that is relatively small in international capital markets. For a large country, a restraint on international borrowing analogous to the optimal tariff is welfare-improving. The robustness of the results to alternative savings formulations (still assuming optimizing households) is also considered.

Kletzer and Engel have studied an extension of this model in which capital is used in both sectors but is immobile between sectors. Such a model introduces an avenue for what appears to be a powerful motive for international borrowing--easing internal adjustments to trade liberalization or terms-of-trade shocks. A country that removes tariffs will desire to shift resources into the export sector. However, in the short-run, the economy cannot achieve its most desirable allocation of capital since the capital stock in the import-competing sector can only be reduced over time. If the country can borrow internationally, bonds can be exchanged for capital for the export sector, a process that mitigates the internal capital adjustment problem. This additional motive for borrowing internationally increases the tendency for trade liberalization to result in current account deficits. This model also allows a useful examination of the income-distribution effects of liberalization.

Typically, trade theorists have treated international capital mobility in a static framework, considering only international transfers of capital goods and ownership claims on capital. However, countries rarely maintain balanced trade and generally accumulate foreign assets (debt) through an excess (shortfall) of savings over investment. One motive for borrowing from abroad is to increase the investment rate of a rapidly growing country. In "Optimal Foreign Borrowing of

Capital in a Two-Sector Model" (Discussion Paper No. 469), Kletzer and Engel investigate the dynamic pattern of borrowing of a small country intending to purchase capital equipment on international markets. The country produces capital and a non-traded consumption good, but may wish to borrow or lend capital to achieve a higher level of welfare. Most examinations of optimal international indebtedness focus on borrowing directly for consumption. In this model, higher levels of consumption are the ultimate goal of borrowing, but consumption goods cannot be borrowed directly.

The paper is concerned in particular with changes in borrowing patterns as the time horizons of individuals in the small country change. In this model, a shift in time-preference favoring the future leads to higher steady-state consumption at the expense of current consumption. If consumables were borrowed directly, then such a cut would lead immediately to less borrowing or more international lending by the country. It follows in this model that the capital stock employed in the consumption goods industry must be reduced. If the consumer goods sector is capital-intensive, the country must reduce its capital stock immediately by lending abroad. However, if consumption goods are labor-intensive, the overall capital stock must rise, which requires foreign borrowing. This case offers a possible explanation for the question of why a country that becomes more future-oriented and wants to increase its long-run wealth may wish to increase its foreign debt. A second issue addressed in this paper is the stages of the balance of payments. In this model, optimizing households in an initially capital-poor country will borrow to increase their capital stock but then reduce their foreign debt over time as wealth is accumulated. The country could eventually become a net creditor to the rest of the world. This model has been extended to demonstrate an adjustment motive for foreign borrowing when capital is imperfectly mobile between the two industries in a two-country setting.

In a paper in progress, "The Impact of Technological Progress on External Indebtedness," Kletzer considers the effects of improving productivity (1) under regimes of both free trade and protection, (2) with traded goods, and (3) within an optimal borrowing model. The immediate response of foreign borrowing to technological progress depends upon the factor bias of the improvements and the relative factor intensity of the affected sector. The dynamic path of the current account depends upon how households allocate their optimal savings. Productivity improvements under a regime of free trade lead to an increase in the current account deficit and to an increase in the steady-state trade surplus. Immiserizing technological progress (in a tariff-distorted economy) will often lead to an increase in current account surpluses because of a reduction in permanent income.

Kletzer continues to study the relationship between sovereign immunity and international capital mobility. An earlier paper has been extended to incorporate the rescheduling of debt in an intertemporal optimizing model of borrowing under sovereign risk, in which national income is subject to random fluctuations. While lenders have an incentive to reschedule loans rather than allow debt repudiation and impose consequent penalties, the presence of a rescheduling option relaxes the incentive for voluntary full repayment of debt. These incentive issues imply loan contracts of short maturities with frequent debt rescheduling in equilibrium. This line of reasoning is being extended to incorporate capital accumulation in order to understand better the relationship between indebtedness and access to international credit.

2. Patterns of National Development

Gustav Ranis has been studying environmental conditions affecting the quantity and quality of change in technology in the industrial sectors of developing countries. His work focuses particularly on an analysis of the contrasting

historical experience of the Indian and Japanese cotton textile industries in both weaving and spinning. Several related papers, coauthored with other members of this NSF-supported research activity, including Keijiro Otsuka of Tokyo Metropolitan University and Gary Saxonhouse of the University of Michigan, were completed during the year and are now being prepared for publication.

Currently Ranis is investigating rural linkages in developing countries, with special emphasis on the impact of rural non-agricultural activities on agricultural productivity. The experiences of the Philippines and Taiwan are being examined to test empirically various theoretical propositions. The project's objective is to gain a better understanding of the concept of rural balanced growth, a concept that has been somewhat neglected in recent years.

From our current vantage point it is readily apparent that since World War II some low-income countries have adopted development policies that have accelerated their development, whereas others pursued policies that resulted in slower rates of growth. John Fei and Gustav Ranis are beginning a project that tries to identify factors fostering the evolution of policy in contemporary low-income countries over the last 35 years (1950-1985) that encouraged long-run growth. After the Second World War most LDCs adopted mixed economic systems that combined a large governmental presence in the economy with elements of a market system. The researchers' goal is to investigate the characteristics of institutional change in developing economies to determine whether liberalization takes place during the course of development, that is, whether political forces gradually withdraw from the economic system and permit the changing balance of economic rewards (prices) and productivity to dictate increasingly how economic resources are allocated.

The research will measure institutional change by comparing rates of change in development-related policies within countries. For Taiwan, Fei and Ranis have identified more than sixty such activities over time, roughly categorized in ten

policy areas: domestic fiscal and taxation policies; externally focussed fiscal and taxation policies; interest rates; exchange rates; capital movement; agriculture; labor, manpower, and education; science and technology; public enterprises; and development planning. From such a policy matrix a gradual liberalization trend in Taiwan can be clearly detected from 1950 to 1985. The relationships between policy evolution and two other phenomena, change in the structure of production and the political process of policy formation will be analyzed. Lessons from this study of the evolution of policy, production structure, and liberalization in the highly successful NICA's (newly industrialized countries in Asia) may be transferable to other low-income countries (e.g., those in Latin America).

John Fei continued his research on the economy of mainland China, both historical and contemporary. Historically, the period 1840-1940 was a long transitional growth phase when traditional China was penetrated by Western influences through trade (in the 19th century) and capital movement (in the 20th century). While the major economic events in this period have been documented quantitatively and qualitatively, it is Fei's purpose to investigate the possibility of forming a theory of growth. By applying contemporary growth theoretic notions, in particular the theory of growth of open dualistic labor surplus economy, he plans to give the transitional growth story and the observable facts a more logically coherent form.

Fei's interest in mainland China is focused on three facets: (1) the foundation of post-World War II growth under Communism in terms of prewar economic structural characteristics; (2) the phases of economic and political evolution in the period 1950-1985; (3) an assessment of the cause and the prospect of the liberalization movement of recent years.

In a paper with Clive Bell, "On the Uses and Abuses of Economy-Wide Models in Development Policy Analysis," T. N. Srinivasan discusses the evolution of economy-wide models in development policy analysis. The study traces development-modeling efforts from early exercises that described technology

in terms of fixed input coefficients--thus assigning a limited role to prices in determining the choice of production, consumption and investment activities--to contemporary models that treat prices as endogenous. These new models use a computable general equilibrium (CGE) framework in which technology is described in terms of production functions that allow continuous and smooth substitution among inputs.

This evolution in thinking about constraints on the development process reflects a growing dissatisfaction with development planning for mixed economies that have large private sectors. In these countries, the implicit assumption of early models--namely, that a sufficient number of policy instruments are available to ensure that the private sector conforms to any desired plan--is simply not valid. The questions that can be profitably addressed by CGE models are nonetheless restricted in important ways by the nature of the models' theoretical foundations, though models could be improved through the introduction of noncompetitive behavior and various forms of rationing. Moreover, what CGE models can say about income distribution is limited, and their treatment of factor employment is not wholly convincing, resting as it does on simple specifications of the way the labor market works. More important, they are ill-suited to analyze dynamic processes involving accumulation and inflation. Skillfully used, however, they may improve resource allocation by facilitating the formulation of medium-term development plans. They can assess the resource pulls exerted by policy reforms and development plans, and they yield shadow prices appropriate to distortion-ridden economies. Their fruitful application to the analysis of dynamic processes may, however, have to await the laying of more satisfactory theoretical foundations than those available to applied model builders in the past.

3. Technology and Patents

Though the shortcomings of current patent protection are widely recognized, serious proposals for patent reform are relatively rare. Two new, related proposals for protecting private production of innovations are critically examined by Brian Wright in his paper, "On the Design of a System to Improve the Production of Innovations," prepared for inclusion in W. Kingston, ed., Direct Protection of Innovation. The proposals are intended for consideration by the European Economic Community, but they have features relevant for less developed countries as well. Common features of the two proposals, by Kingston and Kronz respectively, are that (1) any saleable object not yet "available in the ordinary course of trade" qualifies, that (2) the monopoly grant has a variable term, (3) that third parties be heavily involved in approval ex ante, and that (4) the grant be contestable ex post only on grounds of fraud.

Wright notes two great advantages of the current patent system: there is no need to devote public resources to the task of evaluating the worth of a discovery prior to its award, and the patentees are self-selected. But great disadvantages exist in the administrative cost, private expense, and general uncertainty (especially for small firms) engendered by the current practice of ex post testing of validity through legal challenges. Wright argues that the new proposals might avoid these problems, but at the expense of the aforementioned advantages of the current system. However, the proposals contain other elements that could be fruitfully incorporated in the current system. Assistance by the state in defense of patents held by small firms or individuals could increase the ability of these groups to obtain protection against infringement by more powerful competitors. If their security were thus increased, patents might be given a shorter (common) life, to the benefit of society at large. And the "non-obviousness" criterion for patenting could be changed to a test of the following type: If the elements of the innovation

have been available for a reasonable time, and if the patent is valuable enough to justify the cost of application, then the innovation should be considered "non-obvious."

A related topic in Robert Evenson's research is the relationship between R&D and technical change in agriculture and other sectors of the economy. In particular, he is concerned with learning how R&D expenditures are related to certain intermediate inventive outputs, such as patents. This relationship can be valuable in measuring international competitiveness because patent counts are readily available. In "International Invention: Implications for Technology Market Analysis" (in Zvi Griliches, ed., R&D Patents and Productivity, University of Chicago Press, 1984), Evenson studies the patenting patterns of OECD and newly-industrialized countries. A more detailed analysis will rely on OECD data related to R&D expenditures by industry; this information will then be matched with patenting data for these countries. The problem in such a comparison is that there is no readily available concordance within the industry in which a patent originates, the industry in which it is used (distinctions which are often difficult to determine), and the class to which the domestic patent office assigns it. Thus, matching R&D expenditures to patent counts by industry has heretofore proved quite difficult. However, Evenson is working to construct such a concordance for the United States using Canadian Patent Office data which assigns Standard Industrial Codes to each of its patents, about 60 percent of which originate in the United States.

4. Public Finance, Economic Institutions and Sectoral Analyses

In a paper with Joseph Stiglitz of Princeton, Raaj Kumar Sah analyzes the consequences of changing the terms of trade between agriculture and industry for capital accumulation and for the welfare of workers in different sectors (American Economic Review, March 1984). This issue was central to the Soviet industrialization debate and it remains important in today's

developing world. Through a simple general equilibrium model, the authors show that a price squeeze on peasants increases accumulation (as Evgeny Preobrazhensky argued), but that it makes both urban and rural workers worse off (contrary to Preobrazhensky's contention). The desirable changes in terms of trade are shown to depend on intertemporal valuations, but, within a range, not on the rural-urban welfare trade-off. The characterization of the optimal terms of trade is simple, one in which the role of welfare weights and of relevant empirical parameters are easily ascertained. The authors then extend the analysis to economies with labor mobility and unemployment and, using a simple model with rigid industrial wages, show that the optimal terms of trade entail a tax on the urban sector, a subsidy to the rural sector, and a level of urban employment such that the urban wage exceeds the marginal product of urban workers.

In another paper with Jere Behrman, Sah develops models to explore the donor's absolute and relative inequality aversion--and therefore the equity-productivity trade-off--implicit in the international distribution of aid (Center Paper No. 369). The approach has three strengths: the economic model can distinguish between equity and efficiency; relations estimated are based explicitly on the theoretical modeling; and estimating forms are parsimonious in data requirements.

A general framework for analyzing shadow wages in LDCs is developed by Sah and Stiglitz (Discussion paper No. 470). The paper focuses on (1) the differences between domestic and international prices, (2) equilibrating mechanisms in the economy, (3) endogeneity of earnings in industry and agriculture, (4) consequences of the creation of industrial employment for agriculture, and (5) migration and unemployment. The reduced-form relationships, which are central in determining the shadow wage, are identified and used to obtain general formulas for the shadow wage. These formulas can be specialized to alternative technological, behavioral, or institutional settings. This approach yields new results concerning the relationship between the shadow wage and the market wage.

Ijaz Nabi, a Fulbright scholar visiting at the Center, completed several papers on Pakistani development that analyze the early phase of industrialization in a developing country through a focus on the light engineering industry in Pakistan. He examines the role of markets, such as those for labor and capital, as well as the role of entrepreneurs in investment decisions and firm efficiency.

Subcontracting as a form of industrial organization is widespread in the engineering industry in Pakistan. The nature, incidence, and importance of subcontracting are described in Nabi's Discussion Paper No. 480. The study is based on a survey of parent firms (those that subcontract work out) and vendor agricultural machinery firms (those that subcontract work in) in the Punjab province of Pakistan in the spring of 1984.

Earlier studies of agricultural machinery in Pakistan reported that large and small firms coexist, producing a homogenous product. This view of the industry implies that there are no scale-related barriers to entry. The existence of widespread subcontracting arrangements that Nabi observed, however, suggests that there is process (or component) specialization rather than product homogeneity in the industry. This finding is consistent with Adam Smith's view that with expansion in market size, process specialization (division of labor) follows. In a growing agricultural machinery industry, which does not require a continuous production process, large firms find it attractive to subcontract processes or components to small firms.

Nabi focuses on the linkages and complementarities that exist between small vendor firms and large parent firms. These linkages operate primarily in the credit market and in the exchange of technical know-how. The main complementarity is in terms of process or skill specialization. All of these are important, but in many ways the most important linkage is the one forged in the credit market. It is quite certain that many vendor firms would be unable to continue operations, given that credit markets function so poorly, without credit arrangements

with their parent firms. The advantage to parent firms, of course, is that it enables them to contract-out processes--thus saving labor, capital and organizational costs--to firms that they can supervise closely, which ensures that contract specifications and delivery schedules are met. This is important in the absence of a formal legal machinery for enforcing contracts. Thus, subcontracting arrangements suggest that both small and large firms coexist in the industrialization strategies of developing countries. Viewed in this light the debate that sees the emergence of small and large firms as competing strategies for industrialization ignores important underlying issues.

It has been argued that government intervention in financial markets results in costly misallocation of capital. Favored firms obtain capital often at negative real interest rates and, as a result, tend to over-capitalize, which leads to excess capacity. Firms that are unable to borrow in these markets face very high real costs of investment and are often under-capitalized. While this argument has been challenged at the macro level, there are few micro studies that examine the issues directly. A study by Nabi (Discussion Paper No. 481) attempts to test these hypotheses using firm-level evidence that he collected in 1982-1983 in a survey of 119 firms manufacturing farm machinery in Pakistan, 23 percent of the 514 firms in the industry.

The objective of this paper is to investigate the difference in investment behavior of firms with unequal access to the capital markets. In the absence of complete information, bankers attach importance to such observable features of firms as past capital stock and profits, product specialization, entrepreneurs' education and biradri (kinship). It appears that firms based in small rural towns are more successful in borrowing in the formal market, perhaps because bank branches are few and managers can easily spot firms likely to succeed.

Nabi hypothesizes that firms that can borrow successfully in formal capital markets invest according to the standard flexible

accelerator model, while those unable to borrow simply invest past profits. This hypothesis is statistically tested using a two-stage switching regression model with a criterion function that differentiates firms by whether or not they have access to formal capital markets. The results show that compared to non-borrowing firms, borrowing firms invest more, have a higher capital-output ratio and find it less difficult to adjust to their desired capital stocks.

Given the central role of savings and investment in theories of economic development, surprisingly little attention has been given to the microeconomic foundations of savings behavior in low-income countries. Theoretical and empirical work on this topic is being planned by various faculty members at the Economic Growth Center and should evolve in the next few years as a major focus of research activity. It has long been believed that during development a conflict arises between rapid growth and capital accumulation on the one hand, and equity in the distribution of income and/or capital ownership concentration on the other. When rigorously formulated, a conflict thesis involves a relationship between the rate of growth of capital stock (a macro-economic magnitude) and the direction and rate of change in the pattern of capital ownership (i.e., the rapidity and direction of change in the degree of inequality of capital ownership by families). Purely theoretical research by John Fei emphasizes the dynamic relation between the patterns of family savings and the pattern of capital ownership (in subsequent periods). The rules of savings constitute the focal point of his theoretical inquiry.

T. Paul Schultz plans to explore the distribution of physical assets and human capital by family in Malaysia. The objective is to estimate how unanticipated and presumably unwanted fertility may affect wealth inequality and intergenerational bequests of both formal education and physical wealth by parents to their children. Data from Malaysia will be studied with Mark Rosenzweig. Since a negative consequence of rapid population growth is its presumed capacity to reduce

capital formation per head and hence slow economic growth per capita, this research on personal savings in Malaysia may provide some evidence about an unsubstantiated but potentially important linkage of rapid population growth to economic development.

5. Agricultural Economics

Robert Evenson is currently working on a project for the U.S. Department of Agriculture with former Growth Center visitor Wallace Huffman. As part of the project, they are writing a book that documents the impact of agricultural research in the United States from 1890 to the present. Among the questions they address are: how has the scientific personnel of agricultural experiment stations changed; how has the training of scientists changed; what biological, mechanical and postharvest inventions has agricultural research produced (and why does it produce some much more easily than others); what has been the effect of research spending by each state on the productivity of its crops and livestock; what are consequences of research, extension, and schooling on the output supply and factor demand; and how has public political support for agricultural research changed, especially following the one-man, one-vote reapportionment mandated by the Supreme Court in 1964.

The book breaks new ground in several areas. In the training of agricultural scientists, Huffman shows that the proportion of scientists graduating with degrees in basic sciences has fallen during the 1970s, while the number of foreign-born agricultural science graduates has risen steadily. In analyzing the effects of research on output supply and input demand, Huffman and Evenson use a relatively new production function technique to disaggregate agricultural outputs. This technique makes possible an important improvement in agricultural productivity estimates because many outputs, such as corn and swine, are jointly produced. Joint production implies that an improvement in the technology used to produce

one output will affect the production decisions regarding the other.

In another paper by Evenson and Susan Rose-Ackerman ("The Political Economy of Agricultural Research and Extension: Grants, Votes, and Reapportionment," American Journal of Agricultural Economics 67 (1), February 1985) the reapportionment ordered by the Supreme Court is shown to reduce the demand for expenditures on agricultural research since it reduced the overrepresentation of rural citizens (usually farmers) in state legislatures. They also find that the matching-grants system employed for federal-state grants lowers the perceived price of these state expenditures and stimulates state spending over and above that required to match fully the federal allotment.

Research fellow Daniel Landau and graduate student Dale Ballou are constructing a total factor productivity index of United States agriculture. By calculating the productivity growth of each factor input, this project will account for the total agricultural productivity growth during the last 35 years (the agricultural sector has had one of the highest productivity growth rates of any United States sector) by calculating the productivity growth of each factor input.

Evenson has also produced two papers on the impact of research done by International Agricultural Research Centers (IARCs) on the domestic research spending by developing countries. The first of these, "IARC Investment, National Research and Extension Investment and Field Crop Productivity," was presented at a conference on agricultural research at the University of Minnesota. In it, Evenson reports econometric estimates of impacts of national and international investment in research on five cereal grains and five staple crops for 24 countries between 1962 and 1982. The most visible impact of IARC spending has been the so-called "green revolution" development of high-yielding rice and wheat varieties. However, the international nature of the research shows much broader effects for the other grains and staples for which an IARC has

been established. Evenson shows that IARC spending has a significant impact on crop productivity in all crops except sweet potatoes. These effects are particularly important for countries with the same geo-climatic characteristics. While on the one hand, national research is highly productive, with internal rates of return that vary between 30 and 70 percent, both national and international research on the other hand appear to be substitutes for national extension programs. This fact indicates that the extension programs are not well suited to channeling research results to farmers.

Evenson has also produced two studies for the World Bank on the impact of commodity research in a group of West African countries. In "Investment in Agricultural Research in West Africa," Evenson tests a model of investment in research and extension and finds that, contrary to the broader study of IARC impacts discussed above, IARC spending appears to substitute for, rather than complement, national research programs. In fact, IARC spending has a positive impact on total research activity only in rice, wheat and groundnuts. National research, in contrast, has a positive impact on total research activity in all commodities.

Finally, a book is being assembled under the editorship of Evenson, Carl Pray of the University of Minnesota, and former Growth Center fellow Jaime Quizon of the World Bank. Based on papers presented at the Economic Growth Center's 1984 Conference on Asian Agricultural Research, in which T. Paul Schultz, Gustav Ranis and former Growth Center fellow Hans Binswanger (now Quizon's colleague) also participated, the book is titled Research, Extension, Productivity and Incomes in Asian Agriculture.

The use of public storage schemes as agricultural market stabilization devices is common in developed and less-developed economies. In "An Assessment of the United States Farmer-Owned Reserve and Commodity Credit Corporation Storage as Market Stabilization Policies" (American Enterprise Institute Occasional Paper, December 1984), Brian Wright uses a

combination of statistical evidence, econometric analysis, and numerical modeling developed from previous theoretical work to study the performance of United States' storage-based policies for the major grains since the 1950s. He finds that public storage is most effective in stabilizing prices when stocks are very large, as in the late 1950s. When stocks are of moderate size, additions to public storage tend to be substantially offset by reductions in private stocks. The result is that, in recent years, the response of wheat storage to changes in supply has been similar to that predicted by a model of profit-maximizing private storage. Further, to the extent that public wheat storage may have stabilized prices, the major beneficiary may well have been foreign countries. From the United States' viewpoint, destruction of excess grain may well have been more efficient and more favorable to farmers.

For corn, the other major crop, the evidence is more mixed. Public market stabilization may have been more effective for this grain though it is again by no means clear that a more stable market favors United States producers. Furthermore, theory tells us that, in the long run, none of these programs can improve farmer welfare, since the benefits are capitalized in the price of land, which is part of the cost of entry into farming.

The most persuasive argument for public storage is for creation of a moderate-sized emergency foodgrain reserve. Drawdown should be allowed only in pre-defined, severe emergencies, such as occurred worldwide during the early 1970s. Given the recent development of sophisticated hedging instruments in private financial and commodity markets, public attempts, via storage or other means, to furnish farmer insurance are increasingly redundant in the United States. Nor have they been notably successful in countries with less sophisticated economies.

In a related paper, "Commodity Stabilization in Farm Programs," Wright also addresses the question of appropriate policy to combat the current distress in the United States

farming sector. He argues that the current problem can be traced, not to product market instability per se, but principally to dislocations engendered by exceptionally high real interest rates and the related problem of the over-valued exchange rate. Since neither of these phenomena could reasonably have been foreseen by economists, much less by farmers, the financial stress on farmers who entered farming in the last decade cannot be attributed to incompetence or irresponsibility. A strong argument can be made for direct credit market intervention to assist these farmers; indeed this argument is much stronger than current justifications for assistance to the steel and automobile industries, to banks threatened with failure by injudicious loans to foreign countries, and to domestic energy producers. However, the paper emphasizes that attempts to channel assistance for distressed farmers via product price stabilization schemes are entirely inappropriate.

Brian Wright and Jeffrey Williams, at Brandeis University, studied the accuracy of different methods of welfare assessment under uncertainty in "Measurement of Consumer Gains from Market Stabilization." They show that conventional measures of expected consumer surplus can be accurate when the budget share of the commodity is in its usual range. For larger budget shares they show that simple approximations are accurate for many cases, relative to exact measures computed numerically. But when the budget share is large, the difference between the exact partial equilibrium results and the true general equilibrium effects may well be much more important than the error involved in using expected surplus rather than the exact partial measure.

Terry Roe, Professor of Economics at the University of Minnesota and visitor at the Economic Growth Center, worked with his colleague Theodore Graham-Tomasi on a paper that illustrates how yield risk in a dynamic setting might affect farm production decisions. Numerous studies have found that farmers in developing countries prefer lower but certain levels of income

to marginally higher but uncertain income levels. Since contingency markets are surely imperfect in developing economies, risk averse farmers tend, in an effort to reduce income uncertainty, to allocate resources to activities with lower expected marginal value products than they would in the absence of uncertainty.

In spite of these findings, the relationship between depressed income due to risk and household consumption has not been studied in models of the agricultural household. The problem is to determine the misleading inferences that might be drawn because risk is neglected. Moreover, failure to consider how risk affects household choices implies a limitation to our analyses of market imperfections, such as those that inhibit households from allocating resources to off-farm activities or to crop insurance, or imperfections that provide limited access to production technologies and other risk-reducing inputs.

In an Economic Growth Center Discussion Paper (No. 479), Roe and Graham-Tomasi incorporate production risk into a dynamic version of the agricultural household model in which there are lagged production responses to input use. Dynamic programming is used to characterize the optimal solution to the model. In order to derive more explicit comparative static properties, a specific form of the direct utility function is given. Then, explicit forms of the household's demand, supply and factor demand functions are derived. To provide insights into the quantitative implications of risk and risk-aversion on the household's choices, a numerical illustration of the model based on household data from the Dominican Republic is provided.

Due to the lack of a contingent claims market, separability between production and consumption decisions does not hold in general. A special case of separability is demonstrated, however, when households' choices can be characterized as, first, finding those levels of inputs that maximize the expected utility of full income, and, second, selecting the levels of goods and leisure that maximize utility subject to the level of full income initially determined. Parameter restrictions on

estimating equations derived from models of the agricultural household that neglect risk may be inappropriate if risk and risk-aversion are important. In particular, the effect on income of a change in price of a staple commodity will be overestimated. Moreover, the responsiveness of the farmer's allocation of his own resources to farm production will be overestimated, while the importance of off-farm markets to the welfare of the household will be underestimated.

Current research by Elmar DaCruz, visiting research economist at the Economic Growth Center from the Brazilian Agricultural Research Agency EMBRAPA, is focused on the productivity of agricultural research in Brazil. He concludes that technology is not fully transferable among regions. There are many reasons for this: (1) Biological constraints. Differences in climate and soil may be important, among others. (2) Market constraints. For many non-perishable commodities such as cotton, cereals, coffee and so on, a less developed region, with a less efficient cost structure, may be adversely affected in its adoption of new technologies from a more advanced region. (3) Institutional constraints. Sometimes institutional arrangements in a less developed region, such as sharecropping, will deter the adoption of a new technology, if the landlords (or the tenants) see no net benefit for themselves.

Factors favorable to transfer of technology include agricultural research expenditures in a given region, a rising demand for the commodity (hence better prices), and yield differences among regions, subject to the constraints mentioned above. Empirical data are drawn from six regions in Brazil, from the 1940s to 1984. DaCruz's study will provide us with a better understanding of the process of technology transfer inside a large and regionally diverse country. The methodology should be applicable to other countries, like Brazil, with substantial regional differences.

6. Household Production and Consumption

John Strauss, Inderjit Singh and Lyn Squire are editing a collection of papers entitled Agricultural Household Models: Extensions, Applications, and Policy, which will be published in 1986 by Johns Hopkins University Press. Semicommercial farms that produce multiple crops make up a large part of the agricultural sector in developing countries. These farms or agricultural households combine two fundamental units of microeconomic analysis: the household and the firm. Traditional economic theory has dealt with these units separately, but in developing countries in which peasant farms dominate, their interdependence is of crucial importance. Researchers have developed models of agricultural households that combine producer and consumer behavior in a theoretically consistent fashion. Recent empirical applications of these models have extended the models in various ways and expanded the range of policy issues which can be investigated within this general framework.

The first part of the volume reports the results of empirical applications of this model in Japan, Korea, Malaysia, Nigeria, Sierra Leone, Taiwan, and Thailand. A comparative analysis of the policy implications is presented for the welfare of farm households, their marketed surplus, the demand for nonagricultural goods and services, the demand for hired labor, government budget revenues, and foreign exchange. The second and larger part of the volume contains nine case studies, each of which extends the basic model in a new direction. The studies cover a variety of countries, including China, the Dominican Republic, India, Indonesia, and Senegal, and explore several new policy questions and methodological issues. In sum, the volume provides an assessment of this analytical approach to the production and consumption decisions occurring in agricultural households.

John Strauss and Robert Evenson are collaborating with William Bateson and other economists in the Sudanese Ministry of Agriculture to undertake a multipurpose survey of farm

households in western Sudan. Strauss and Evenson traveled to Sudan to plan and execute this first household survey to provide information on production, consumption, sales, labor, water use, health, nutrition and fertility. These data should permit the researchers to consider many questions of policy, such as how do household output and market sales respond to price and program variation. The addition of data on food consumption, morbidity, weight and height, and water use will allow them to study important questions concerning the nutrition and health impacts of government crop pricing policies, investments in water supplies, expansion of schools and health facilities. This data should allow an assessment of the effectiveness of various government programs and policies affecting health and nutrition, as well as those aimed at increasing production and incomes.

In 1986 Strauss, together with four other economists and an anthropologist, will start a project sponsored by the Center for Population Research at NIH on health and nutrition in low income countries. They will estimate the effects of government food pricing policies and health and educational investments on nutrition and health outcomes in a variety of countries. This undertaking will be the first comprehensive and comparative study of these relations. Several data sets from Africa and Asia will be analyzed; Strauss will work on two bodies of data from Africa. One is a nationwide household survey from the Ivory Coast that is presently being collected with support from the World Bank, while the other is a survey of farm households in Burkina Faso, that is currently being collected under the auspices of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Strauss, supported by the Hewlett Foundation, was involved in the design this year of data collection instruments in these projects; the actual empirical research should start next year as these data become available.

Robert Evenson resurveyed a sample of agricultural households in 1985 in Laguna, Philippines, with the assistance of the General Service Foundation. These households have been surveyed periodically since 1973. The resulting panel data

provide the basis for a number of studies. Currently, Evenson is conducting joint work with former Center visitor Cayetano Paderanga and with research fellow James Roumasset of the East-West Center. A paper with Roumasset integrates the optimizing behavior assumed by the new household economics with the theory of organizational choice implicit in the new institutional economics (which has heretofore only been applied to firms). They are using this hybrid theoretical framework to explain the transition in developing economies from the self-sufficient farm to a system that relies on markets to capture the full gains from specialization and trade. Evenson spent the summer of 1985 at the Philippine Institute of Development Studies compiling the materials from past and current studies based largely on the continuing Laguna panel sample survey. These studies will be consolidated into a book about the consumption, production, fertility and labor supply decisions of Philippine households, and the impact of government policies on these household decisions.

7. Economic Demography and Labor

Since the time of the Reverend Malthus a concern that rapid population growth may outstrip the capacity of societies to feed themselves adequately has been a recurring theme. Periodic crises such as famines in parts of the globe accentuate this concern. In the same vein, the alleged exhaustibility of vital natural resources and the limited capacity of the environment to absorb insults are often cited as arguments to curb population growth.

In a background paper on population and food for a national Academy of Sciences working group, T. N. Srinivasan evaluated this perennial question in light of recent forecasts and model projections for the balance of food demands and supply in the next several decades (Discussion Paper No. 482). One can distinguish cross currents of influence in each direction in the relationship between population and food: (1) Population growth

and hence the size of the population in the future obviously affect the demand for food. Without a change in the growth of income or its distribution among socio-economic groups, an exogenous increase in the rate of growth of population of any group will imply a slower growth of its income per person and hence a slower growth of food demand per person. However, as long as the income elasticity of demand for food per person is less than one, the rate of growth of total demand for food of each group will increase with an increase in the rate of growth of its population. (2) To the extent that income elasticities of demand for food differ across socio-economic groups, changes in income distribution will have an impact on demand, even if aggregate income growth is kept constant. The process of population growth could itself alter income distribution and thereby food demands. (3) Population growth could affect food supplies in several ways: by changing the quantity as well as the quality of the labor force, by changing the availability (per worker) of other inputs such as land (through changes in the size distribution of farms and the extent of land fragmentation), by influencing the technology of cultivation, by degrading the environment through soil erosion, etc. There is of course also a potential Malthusian relationship between the availability of food, on the one hand, and fertility and mortality, on the other, that would presumably operate in the opposite direction, checking population growth in the event of a shortfall in the supply of food. A majority of the world's poor are either landless agricultural laborers or cultivators with small land holdings. It is also suggested that during a demographic transition the poor have higher fertility rates compared to those of the population as a whole, and fertility is influenced by alternative sources of household income. To the extent that the process of growth of agricultural output affects land tenure, farm-size distribution, and income-earning opportunities, fertility rates, mortality rates, and thus population growth rates may be affected by the structural changes as well.

In modeling the food population nexus, we find at one extreme an approach that exogenously projects the likely size of population at some future date (or, alternatively, its time path from some initial date). This population size influences food supply (as well as real income) only through its relationship to the size of the work force, and it affects total food demand which is identical to population size times per capita demand. In this approach, per capita demand for food is assumed to be a function of per capita income. Such projections made independently for several countries or regions are aggregated to yield the likely excess supply or excess demand for food for groups of countries or for the world as a whole. At the other extreme, we find models that deal with interdependence among population growth, technological and environmental change, the evolution of outputs, prices, incomes, and trade (among individuals, firms, and other entities within and across countries and over time). This approach, while attractive in theory, is too complicated to be fully implemented in a consistent fashion.

Recently several attempts have been made to model the global food economy, ranging from population-carrying-capacity studies devoid of any economic behavior to dynamic general equilibrium models. A study sponsored by the Food and Agriculture Organization (FAO), the United Nations Fund for Population Activities, and the International Institute for Applied Systems Analysis (IIASA), puts together a soil and climate map of the world on the basis of which the likely output of food in each soil, climate, and length-of-growing-season cell (100 sq. km. per cell) is estimated under three levels of farming technology: low, intermediate, and high. The study concludes that several countries in Africa will not be able to feed their growing populations even if all their arable land were devoted to food and a high level of farming technology were adopted. But the study finds that the world as a whole could feed more than three times its anticipated stationary population. Because this analysis is not based on responses of farmers to incentives

afforded them by policy makers, it has to be viewed cautiously. Without microeconomic agents or policies, the model is one of technological possibilities without a means to realize them.

The analysis of the world food system contained in "The Global 2000 Report to the United States President" concludes that the demand likely to arise from projected income and population growth can be met even if real energy prices were to double compared to their 1974-76 levels and the weather were not particularly favorable. However, the projected demand in many parts of the world, particularly Africa, does not involve any improvement in diets compared to current levels.

The linked system of dynamic general equilibrium models of several countries and regions of the world put together by IIASA shows similar results. The India model of the IIASA system shows that reducing the projected population of India in year 2000 from 1048 to 927 millions leads to virtually no change in macroeconomic variables, though the income distribution and diet of the poor improve slightly.

It would appear from these and other studies that the demand for food likely to arise from the anticipated growth of income and of population during the next two or three decades can be met. In all these models population growth is exogenous. For a long-run analysis, the process of population growth has to be made endogenous and provision made for its impact on the process of technical change and adaptation. Unless the interaction of these dynamic behavioral responses is understood, mechanistic and meaningless pessimistic conclusions in studies like Limits to Growth are likely to emerge. At present and in the near future, food shortage and starvation in many developing countries are due more to inappropriate public policies towards agriculture than to the pressure of rapid population growth or limited agricultural resources.

Robert Evenson examines the question of population-induced institutional and infrastructure change in a paper, "Population Growth, Infrastructure and Real Incomes in North India," presented to a conference in New Delhi on Population, Food and

Rural Development. The approach taken in the paper is to first specify the relationship between infrastructure investment at the state, district, and farm level in North India as determined by long-term characteristics of the political and economic environments. Population density is specified as one of these determinants, along with the importation of high-yielding varietal technology, adult literacy, and climate. In a second stage of estimation the relationship between infrastructure investment and agricultural output and input demand is estimated. In a third stage of the analysis, a general equilibrium model is developed to compute the effects of population density on real incomes of farmers and real incomes of urban consumers in India.

The study concludes that population-induced infrastructure investment effects were important and that they tended to affect partially the per capita income-reducing impact of population growth. If population-induced investments were not made, a ten-percent increase in population in rural areas is associated with a seven-percent reduction in income per capita. When population-induced investments were taken into account, the real income reduction is less than five percent. Of course, India made infrastructure investments that were not population-induced. When these are considered, India did not suffer actual real income losses over the past two decades, but would have done so in the absence of such investment. Evenson plans to extend this study and use more recent data from India. Birth rates and population growth will then be endogenized to respond to income and price changes. The goal is to incorporate in one micro-macro model of development both the macro benefits and costs of the consequences of population growth, and the micro determinants of fertility and population growth.

T. Paul Schultz and Mark Rosenzweig from the University of Minnesota adapted their approach in their study of determinants of child health to an analysis of the household's demand for, and biological supply of, births. Their framework provides a new empirical approach for evaluating the personal life-cycle

consequences of unwanted fertility and estimating the social consequences of excess population growth. Schultz and Rosenzweig plan in the next two years to assess quantitatively the personal and social benefits of public policies that disseminate voluntary family planning technologies and thereby slow population growth.

In their model, the birthrate is analyzed at the household level as the dynamic interaction of exogenous variation in the biological supply of births or fecundity, and the endogenous behavioral demand for births or what economists seek to explain by prices, income, and preferences for children. The joint roles of biological supply and behavioral demand in determining fertility under a regime of costly fertility control are widely recognized by social scientists. But implementing satisfactorily a realistic statement of the problem in empirical studies of fertility is a new and unsettled field. There are two obvious persistent variables that affect fertility outcomes for an individual couple, namely, fecundity causing exogenous variation in the biological supply of births, and preferences of parents for children causing the demand for births to vary, neither of which can be directly observed by the researcher or controlled by the couple. To disentangle these underlying components of fertility supply and demand, it is useful, and perhaps essential, to have longitudinal histories of couples' behavior and outcomes, couples' residential location, and other exogenous conditioning variables. If statistical identification of exogenous supply variability is thereby achieved, it is then possible to evaluate the technical effectiveness of contraceptive methods for an "average couple" and to determine how much of the exogenous excess supply of births, or the burden of unwanted fertility, is borne by mothers (Discussion Paper No. 490). This model of fertility demand and supply was first developed and empirically estimated on the basis of unusually rich panel data for the United States. In 1985 Schultz and Rosenzweig were awarded a three-year grant from The Center for Population Research of NICHD to adapt their

framework to the study of fertility determinants in Malaysia and Puerto Rico as well as to analyze further recent data for the United States.

Future improvements in birth control technology, and perhaps more important, the spread of existing birth control methods to women who are now likely to have births that are "unwanted" could generate substantial welfare gains as well as contribute to some reduction in fertility. On the basis of current evidence, such a diffusion of improved birth control methods in the United States might induce a reduction of at most ten per cent in overall fertility levels, with most of the reduction occurring among less educated women. In the aggregate, this long-run tendency for excess fertility to diminish will, of course, be partly offset by medical advances that will reduce infertility and thereby reduce excess demands for children.

To the extent that the education and market wage rates of women account for their effective understanding of birth control technology, any observed negative partial correlation between fertility and women's education or market wage rates may embody not only different demands for children but also different capacities to anticipate and to control exogenous excess fertility supply. Unless new birth control technologies are introduced, this supply source of fertility differential by education of women (or by other groupings of the population) is likely to diminish in relative importance over time as effective birth control information becomes more widely and uniformly understood in high-income societies. But in low-income societies, differentials in contraceptive knowledge may remain substantial, and public policy may be able to benefit many couples and significantly slow unwanted population growth by hastening the diffusion of improved birth control technology.

Steven Stern, a visiting assistant professor at the Center, has developed an integrated dynamic theory of "Promotion and Mandatory Retirement" (Discussion Paper No. 491) that provides a potential explanation for the existence of mandatory retirement in more developed countries. It is proposed that a firm may

impose mandatory retirement on its employees in order to increase the promotion possibilities of its young employees. The firm chooses an optimal wage schedule, pension program and mandatory retirement age in order to maximize long-term profits. Within such constraints, it is shown that: (1) when capital markets are perfect, for any given optimal wage and pension schedule there is another wage schedule with no pension benefits that is beneficial for both the firm and its employees. This mutual benefit occurs because employees can save as effectively as the firm; (2) pensions may play a role in inducing employees to retire when there is a ban (a) on mandatory retirement and also (b) on lowering older employees' wages. The firm can effectively reduce the total value of employment either by reducing wages or by reducing the present value of pensions. The firm reduces the present value of pensions to its oldest employees by providing large early retirement benefits, that has the same effect on employee retirement behavior as wage reductions would have, had they not been illegal; (3) the wage schedule is more a function of an employee's opportunities outside of the firm than of his marginal product; (4) the optimal mandatory retirement age is a function of the reservation-value function, the productivity schedule, and the reduction in training costs resulting from having an older workforce; and (5) a Social Security system, such as that in the United States, causes firms to make the mandatory retirement age 65 and induces many employees to retire before age 65.

A classic feature of developing countries is rapid urbanization fostered by an influx of migrants from rural areas. This rural-to-urban migration continues even as agricultural development proceeds. Research by postdoctoral fellow Joyce Cooper focuses on characteristics of the rural sector as motivating forces in these migration flows. Two explanations for outmigration are examined in her research. First, agricultural households face output price uncertainty for their cash crops which translates into income uncertainty for the producing-consuming household. The literature on risk in

agricultural production has linked this price uncertainty to decisions about farm production. This source of uncertainty may also affect the allocation of family labor and consequently the rate of rural-to-urban migration. Evidence of income repatriated from the urban to the rural sector suggests employment of a family member in the urban sector may also act as a form of insurance for the rural household faced by income uncertainty in rural production activities. This uncertainty about income may explain some of the rural-urban-rural repeat migration sequences we observe. Commodity-price-stabilization schemes may thus affect rural-to-urban migration. Second, technological change aids rural-to-urban migration. Improving agricultural yields may have two effects. Increased productivity may make farming a more attractive occupation, but it may also free up family labor for urban employment or for alternatives such as education which in turn contribute to rural-urban migration. Cooper's research focuses on the relationship between the adoption of yield-increasing technology and output price uncertainty, while providing a household framework within which to examine rural-to-urban migration.

Postdoctoral fellow Charles Griffin's research has focused on questions of health-care financing in low-income countries and the economic determinants of the choice of feeding methods for infants. The theme of a coauthored book published in 1985 (The Demand for Primary Health Services in the Third World, John S. Akin, Charles C. Griffin, David K. Guilkey, Barry M. Popkin; Totowa, N.J.: Roman & Allanheld) is that primary care programs based on the barefoot doctor concept in China may not be economically appropriate in many low income countries. The authors argue that by taking advantage of existing expenditure and travel patterns, current resources can finance higher quality health care in many rural areas. To design such programs, however, health planners must have detailed information about existing health expenditure patterns and medical resources, which is beyond the scope of currently collected statistics in most developing countries.

As a first step in collecting such data, Griffin has attempted in a related project to quantify the provincial and urban/rural distribution of health facilities and practitioners in the Philippines. He describes the extent to which private and public medical systems compete with each other, serve separate geographical areas, and leave some areas uncovered. Also being considered in the Philippines are alternative financing mechanisms for primary health programs, based on both household survey data and accounting data from the national health insurance system.

In a series of articles published in the past year, Griffin and various coauthors examine issues connected with breast-feeding practices in low-income countries, again using household data from the Philippines. Families are modeled as choosing feeding methods for infants within an environment constrained by economic, biological, and community factors. Breast-feeding is treated as a temporary feeding practice, with a critical choice for a mother being when to introduce other liquids and semi-solid foods into an infant's diet. The timing of supplementation and weaning is extremely important in low-income countries because there is little variation in breast-feeding per se (for the Filipino sample, 75 percent of the babies were still being breast-fed at 12 months), even though there is considerable variation among households in the timing of supplementation. Moreover, weaning and supplementation practices are strong determinants of infant health and mortality patterns in low-income countries.

In explaining the choice of feeding method, Griffin finds that variables other than "education" and "distance to a store" have little effect in explaining the probability of breast-feeding. However, "mother's work patterns," the "presence of helpers in the household," and "distribution of baby formula" are strongly related to the timing of the introduction of other liquids and weaning foods, which in turn are correlated with changes in breast-feeding behavior.

Griffin has also been estimating more adequately from household surveys the effects (1) of income and (2) of mother's opportunity wage rates on child nutrition and health. Households in low-income countries are engaged in many different economic activities--often including farming, fishing, wage labor, and family-owned enterprises--that usually involve unpaid family labor and many noncash transactions. It is not surprising to find that nutrient intake is often insensitive to measures of cash income if a farm family is producing most of its own food. Similarly, if cash is reserved for such items as physician visits, relatively high health expenditures (as a share of cash income) might be found among the poorest families. Investigation of such possibilities, however, requires careful disaggregation of income into its cash and noncash components.

Economic models of household behavior also generally require estimates of the opportunity cost of time in order to understand time-allocation decisions. While the associated estimation problems have been recently debated by labor economists in the United States, the diversity of economic activities and payment methods in low-income agriculture complicates the task of directly applying these research methods to low-income countries. Household studies usually center on the mother, because researchers are interested in the effects of women's work patterns and their potential wages on fertility, health care, and home production choices. Griffin's research examines alternative approaches to the problem of estimating wages for a sample of Filipino mothers, comparing the results of health-care behavior conditioned on the mother's indirectly estimated opportunity cost of time versus that behavior conditioned on the mother's subjective appraisal of her labor productivity.

CONCLUSION

In 1986 the Economic Growth Center will mark its 25th Anniversary. A symposium has been organized for this occasion, for which support has been granted from the Ford and Rockefeller Foundations and the United Nations University. Special lectures are also scheduled for the fall of 1986. New research programs will be initiated, and funding will be sought for new training fellowships, research activities, and appointments.

The style and substance of development economics has changed in this quarter century. Knowledge about the process of Modern Economic Growth, as Simon Kuznets called it, has grown by leaps and bounds, opening many new questions to study and challenging many established assumptions. The tension between abstract theory and concrete fact contributes controversy to the field, and strengthens it to the extent that a real dialogue emerges between the two. Microeconomic foundations for macroeconomic models are sought, and static theories of equilibrium behavior are extended to deal with agents making dynamic choices under conditions of disequilibrium. These are central problems of modern economics, and they increasingly have their counterparts in development economics.

APPENDIX A

SEMINARS AND DISCUSSION GROUPS

JULY 1984 - JULY 1985

MICROECONOMICS WORKSHOP IN LABOR AND POPULATION

September 14	Robert Miller, Carnegie-Mellon University, "Economics of Family Planning."
September 19	Steven Stern, Yale University, "Search, Vacancies, Applications and Equilibrium Labor Markets."
September 25	Jan Hoem, Yale University and Stockholm University, "Event-History Analysis: Statistical Methods to Investigate Determinants of Individual Behavior."
September 28	John Abowd, University of Chicago, "Intertemporal Labor Supply in the Presence of Long-Term Labor Contracts."
October 5	Larry Neal, University of Illinois, "Population and History."
October 10	Jan Hoem, Yale University and Stockholm University, "Social and Geographic Determinants of Early Cohabitation and Childbearing Among Current Swedish Women."
October 19	Kenneth Burdett, Cornell University, "Labor Market History."
October 26	Robert Evenson, Yale University, "Fertility, Mortality and Child Health in Panama."
October 30	William Lang, Yale University, "Deferred Wage Settlements in Canada."
November 9	Douglas Downing, Yale University and University of Oregon, "Micro-Analytic Model of Teenage Unemployment."
November 16	Joseph Altonji, Columbia University, "Do Wages Rise With Seniority?"
November 30	James Heckman, University of Chicago, and G. Sedlacek, Carnegie-Mellon University, "An Equilibrium Model of the Industrial Distribution of Workers and Wages."

December 7	Lakshmi K. Raut, Yale University, "Capital Accumulation, Income Inequality and Endogenous Fertility in an Overlapping Generations Model."
December 14	Charles Griffin, Yale University, "Estimating Women's Opportunity Costs in the Bicol, Philippines."
January 18	William Johnson, University of Virginia, "Divorce and Women's Labor Supply."
January 28	Colin Cameron, Stanford University, "An Aggregate Empirical Model of Hours of Work and Participation."
February 1	John Donohue, Yale University, "Job Turnover, Labor Market Attachment and Male-Female Wage Differences."
February 15	Christopher Robinson, University of Western Ontario, "Theory of Union Membership."
March 1	Robert Topel, University of Chicago, "Early Career Job Mobility."
March 8	Zvi Griliches, Harvard University, "Errors in Variables in Panel Data."
March 25	William Lang, Yale University, "Expectations in Union Wage Settlements in Canada."
April 3	Paul David, Stanford University, "The Marshallian Dynamics of Industrial Location: Chicago, 1850-1890"."
April 4	George Grantham, McGill University, "Labor Supply in Agriculture in France in the Mid-Nineteenth Century."
April 5	Steven Stern, Yale University, "Promotion and Mandatory Retirement."
April 12	Gary Fields, Cornell University, "Retirement, Pensions, and Social Security."
April 19	Dorothy Seavey, Yale University, "Land and Labor Markets in India."
April 29	Charles Griffin, Yale University, "Estimating Earnings Functions for Married Women in the Philippines."

May 10	Lori Gladstein Kletzer, Yale University, "Losses from Layoff Unemployment."
May 17	Albino Berrera, Yale University, "Child Health and Nutrition."
May 24	Terry Roe, Yale University, "Yield Risk in a Dynamic Model of the Agricultural Household."

IRVING FISHER RESEARCH PROFESSOR LECTURES
by
James J. Heckman

October 8	"Alternative Methods of Estimating the Impact of Training on Earnings: Introductory Outline."
October 15 October 22	"The Dummy Endogenous Model of Cross Section and Longitudinal Data."
November 5 November 22	"Identification Problems in Econometric Models for Duration Data."
November 26 December 10	"Multistate Duration Models."

TRADE AND DEVELOPMENT WORKSHOP

September 17	Willem Buiter, London School of Economics, "Fiscal Policy in Open Interdependent Economies."
September 24	John Strauss, Yale University, "Agricultural Household Models: A Survey of Recent Findings and Their Policy Implications."
October 8	Brian Wright, Yale University, "The Incidence of Commodity Price Supports."
October 15	Paul Sullivan, Yale University, "Technology Choice in Indian Textiles."
October 22	Mohsen Fardmanesh, Yale University, "The 'Dutch Disease:' The Case of Oil Price Increase."
October 29	Cappy Hill, Yale University, "Commercial Policy in Macro-Economic Models with Flexible Exchange Rates: Tariffs versus Export Subsidies."

November 5	T. Paul Schultz, Yale University, "Population Growth, Public Educational Expenditures, and School Outputs Across Countries and Over Time (1950-1980)."
November 12	Michael Jones, Yale University, "Time Consistent Open Economy Macro Policy."
November 26	James Rauch, Yale University, "A Heckscher-Ohlin-Samuelson Model of the Product Cycle."
December 3	Kenneth Kletzer, Yale University, "External Borrowing and Real Adjustment."
January 14	Moshe Syrquin, Bar-Ilan University and Harvard University, "Productivity Growth and Factor Reallocation."
January 21	Lewis Alexander, Yale University, "Sovereign Lending and Sectoral Bias."
January 28	Yasukichi Yasuba, Osaka University and Woodrow Wilson Center, "Some Observations on the History of Modern Economic Growth."
February 4	Michael Ferrantino, Yale University, "Geographic Distribution of Indian MNC's."
February 11	Louka Katseli, Yale University, "Discrete Devaluation as a Signal to Price Setters: Suggested Evidence from Greece."
February 18	Charles Griffin, Yale University, "The Demand for Primary Health Services in Low-Income Countries."
February 25	William R. Cline, Institute for International Economics, "A Model of International Debt."
March 4	Romeo Bautista, University of the Philippines and IFPRI, "Evaluating the Effects of Alternative Trade and Agricultural Policies: A Multi-Sectoral Framework Applied to the Philippines."
April 1	Daniel Landau, University of Connecticut and Yale University, "Government Expenditures and Economic Growth in LDC's."

April 8 — Julie Anderson, Yale University, "Farmers' Decisions Under Credit Constraints: A Preliminary Econometric Analysis of Brazilian Agricultural Policy."

April 15 — Paolo Sylos-Labini, Universita Degli Studi di Roma, "Factors Affecting Changes in Productivity."

APPENDIX B

ECONOMIC GROWTH CENTER PUBLICATIONS

JULY 1984 - JULY 1985

BOOKS

Contractual Arrangements, Employment, and Wages in Rural Labor Markets in Asia, edited by Hans P. Binswanger and Mark Rosenzweig. New Haven: Yale University Press, 1984.

Japan and Developing Countries: A Comparative Analysis of Development, edited by Kazushi Ohkawa and Gustav Ranis. London: Basil Blackwell, 1985.

Lloyd G. Reynolds, Economic Growth in the Third World: 1850-1980. New Haven: Yale University Press, 1985.

CENTER PAPERS

355. John Strauss, "Joint Determination of Food Consumption and Production in Rural Sierra Leone" Journal of Development Economics, Vol. 14 (1984), 77-103.

356. Kenneth Kletzer, "Asymmetries of Information and LDC Borrowing with Sovereign Risk" The Economic Journal, Vol. 94 (June 1984), 287-307.

357. John Strauss, "Marketed Surpluses of Agricultural Households in Sierra Leone" American Journal of Agricultural Economics, Vol. 66, No. 3 (August 1984), 321-331.

358. T. Paul Schultz, "Studying the Impact of Household Economic and Community Variables on Child Mortality" Population and Development Review, A Supplement to Vol. 10 (1984), 215-235.

359. Mark Rosenzweig and T. Paul Schultz, "Market Opportunities, Genetic Endowments, and Intrafamily Resource Distribution: Reply" The American Economic Review, Vol. 74, No. 3 (1984), 521-522.

360. Brian D. Wright, "The Effects of Price Uncertainty on the Factor Choices of the Competitive Firm," Southern Economic Journal, Vol. 51, (October 1984), 443-455.

361. Brian D. Wright and Jeffrey Williams, "Anti-Hoarding Laws: A Stock Condemnation Reconsidered" American Journal of Agricultural Economics, Vol. 66, No. 4 (November 1984), 447-455.

362. Kenneth Wolpin, "An Estimable Dynamic Stochastic Model of Fertility and Child Mortality," Journal of Political Economy, Vol. 92, No. 5 (1984), 852-874.

363. John C. H. Fei and Gustav Ranis, "Task Orientation and Technology Change: A Suggested Approach," Comparative Development Perspectives, essays in honor of Lloyd G. Reynolds, edited by Gustav Ranis, Robert L. West, Mark W. Leiserson, and Cynthia Taft Morris (1984), 1-16.

364. Jagdish Bhagwati, Richard Brecher and T. N. Srinivansan, "DUP Activities and Economic Theory" European Economic Review, Vol. 24 (1984), 291-307.

365. T. N. Srinivasan and Jagdish Bhagwati, "On Transfer Paradoxes and Immiserizing Growth: Part II", Journal of Development Economics, Vol. 15 (1984), 111-115.

366. T. N. Srinivasan and Jagdish Bhagwati, "A Rejoinder, Journal of Development Economics, Vol. 15 (1984), 173-175.

367. Raaj Kumar Sah and Joseph Stiglitz, "The Economics of Price Scissors," The American Economic Review, Vol. 74, No. 1 (March 1984), 125-138.

368. T. N. Srinivasan, "Hunger: Defining It, Estimating Its Global Incidence, and Alleviating It" The Role of Markets in the World Food Economy, edited by D. Gale Johnson and G. Edward Schuh (1983), 77-108.

369. Jere R. Behrman and Raaj Kumar Sah, "What Role Does Equity Play in the International Distribution of Development Aid?" Economic Structure and Performance, (1984), 295-315.

370. Zvi Eckstein, T. Paul Schultz and Kenneth I. Wolpin, "Short-Run Fluctuations in Fertility and Mortality in Pre-Industrial Sweden" European Economic Review, Vol. 26 (1985), 295-317.

371. Raaj Kumar Sah and Joseph E. Stiglitz, "Human Fallibility and Economic Organization", The American Economic Review, Vo. 75, No. 2 (May 1985), 292-297.

372. Gustav Ranis, "Can the East Asian Model of Development Be Generalized? A Comment," World Development, Vol. 13, No. 4 (1985), 543-545.

DISCUSSION PAPERS

460. T. Paul Schultz, "Studying the Impact of Household Economic and Community Variables on Child Mortality," July 1984.

461. Jorge Requena Blanco, "Import Demand Functions Revisited," August 1984.

462. Mark R. Rosenzweig and T. Paul Schultz, "The Demand for and Supply of Births: Fertility and Its Life-Cycle Consequences," August 1984.

463. Mark R. Rosenzweig and Kenneth I. Wolpin, "Heterogeneity, Intrafamily Distribution and Child Health," September 1984.

464. Mark R. Rosenzweig and Kenneth I. Wolpin, "Migration Selectivity and the Effects of Government Programs," December 1984.

465. Mark R. Rosenzweig and Kenneth I. Wolpin, "Externalities, Heterogeneity and the Optimal Distribution of Public Programs: Child Health and Family Planning Interventions," December 1984.

466. Brian D. Wright and Jeffrey C. Williams, "The Incidence of Market-Stabilizing Price Support Schemes," December 1984.

467. Louka T. Katseli, "Discrete Devaluation as a Signal to Price Setters: Suggested Evidence from Greece," January 1985.

468. Willem H. Buiter,"International Monetary Policy to Promote Economic Recovery," March 1985.

469. Charles Engel and Kenneth Kletzer, "Optimal Foreign Borrowing of Capital in a Two-Sector Model," March 1985.

470. Raaj Kumar Sah and Joseph Stiglitz, "The Social Cost of Labor and Project Evaluation: A General Approach" March 1985.

471. Steven Stern, "Search, Applications and Vacancies," April 1985.

472. Leslie A. Laufer, "The Substitution Between Male and Female Labor in Rural Indian Agricultural Production," April 1985.

473. T. Paul Schultz, "Changing World Prices, Women's Wages, and the Fertility Transition: Sweden 1860-1910," April 1985.

474. Inderjit Singh, Lyn Squire and John Strauss, "Agricultural Household Models: A Survey of Recent Findings and Their Policy Implications," May 1985.

475. Raaj Kumar Sah and Joseph E. Stiglitz, "The Taxation and Pricing of Agricultural and Industrial Goods in Developing Economies," May 1985.

476. Raaj Kumar Sah and Joseph E. Stiglitz, "The Architecture of Economic Systems: Hierarchies and Polyarchies," May 1985.

477. Charles Engel and Kenneth Kletzer, "Current Account Policies," May 1985.

478. Raaj Kumar Sah and Joseph E. Stiglitz, "Price Scissors and the Structure of the Economy," May 1985.

479. Terry Roe and Theodore Graham-Tomasi, "Yield Risk in a Dynamic Model of the Agricultural Household," May 1985.

480. Ijaz Nabi, "Firms' Investment Decisions in Imperfect Capital Markets," May 1985.

481. Ijaz Nabi, "Subcontracting and Industrialization in Developing Countries," May 1985.

482. T. N. Srinivasan, "Population and Food," June 1985.

483. T. N. Srinivasan, "The National Defense Argument for Government Intervention in Foreign Trade," June 1985.

484. Raaj Kumar Sah, "What Affects the Level of Honesty in an Economy," June 1985.

485. Raaj Kumar Sah and Joseph E. Stiglitz, "The Invariance of R&D to the Number of Firms in the Industry: Equilibrium and Efficiency Under Bertrand Competition," June 1985.

486. Raaj Kumar Sah and Joseph E. Stiglitz, "Economics of Committees," June 1985.

APPENDIX C

OTHER PUBLICATIONS BY FACULTY OF THE ECONOMIC GROWTH CENTER

1984-1985

Colin I. Bradford, Jr., "Natural Autonomy and the New Globalism" in Europe and Latin America in the World Economy, Colin I. Bradford, Jr. (ed.), Yale Center for International and Area Studies, 1985.

Robert E. Evenson, "Investing in Agricultural Supply" (with M. Ann Judd and James K. Boyce), in Economic Development and Cultural Change, forthcoming.

"Observations on Institutions, Infrastructure, Technology and Women in Rice Farms," in Women in Rice Farming Systems, L. Unnevhr (ed.), International Rice Research Institute, 1984.

"The Political Economy of Agricultural Research and Extension: Grants, Votes, and Reapportionment" (with Susan Rose-Ackerman), American Journal of Agricultural Economics Vol. 67, No. 1, February 1985.

"The Pre-Technology Agricultural Sciences," The University of Kentucky, forthcoming.

"IARC Investment, National Research and Extension Investment and Field Crop Productivity," The University of Minnesota, forthcoming.

"The Potential for Transfer of U.S. Agricultural Technology," with C. Pray and J.D. Putnam, report to the Office of Technology Assessment, forthcoming.

"Poverty, Fertility, Infant Mortality and Malnutrition in Panama," forthcoming in a volume on poverty in Panama.

John C. H. Fei, Inflation in East Asian Countries (co-edited with S. H. Chiang Chung), Taipei: Hua Institute of Economic Research, 1984.

"Determinants and Consequences of Indigenous Technological Activity," Conference Volume, Edinburgh, M. Fransman and K. Kings (eds.), 1984.

"Task Orientation and Technology Change: A Suggested Approach" (with G. Ranis), Comparative Development Perspectives, Essays in Honor of Lloyd G. Reynolds, G. Ranis, R.L. West, M.W. Leiserson, C. Taft Morris (eds.), Westview Press, 1984.

"Employment, Income Distribution and Growth in the East Asian Context: A Comparative Analysis," Conference Volume on Open Economies, Santiago, Chile, November 1981, Vittorio Corbo and Anne Krueger (eds.), Part II, March 1985.

"Economic Development in Historical Perspective: Japan, Korea, and Taiwan (with G. Ranis, K. Ohkawa), Japan and the Developing Countries: A Comparative Analysis of Development Experience, K. Ohkawa and G. Ranis (eds.), Basil Blackwell, 1985.

"Taiwan: Markets in the Mixed Economy" (with G. Ranis) Modern Capitalism, Peter Berger (ed.), forthcoming.

"The NIC's, the Near-NIC's and the World Economy", Conference volume on the NIC's, East-West Center, Hawaii, forthcoming.

Louka T. Katseli, "Real Exchange Rates in the 1970s," Exchange Rate Theory and Practices, J. Bilson and R. Marston (eds.), University of Chicago Press, August 1984.

"Discrete Devaluation as a Signal to Price Setters: Suggested Evidence from Greece" Structural Adjustment and Exchange Rate Policy, L. Ahkamed and S. Edwards (eds.), University of Chicago Press, forthcoming.

"Emigration, Repatriation and Economic Policy: A Greek Perspective," Paper presented at CEPR/RIIA Workshop on International Labour Migration, London, March 1985.

Gustav Ranis, "Needed: Commitment to Structural Adjustment," Challenge Magazine, July/August, 1984.

"Task Orientation and Technology Change: A Suggested Approach" (with John C. H. Fei), Comparative Development Perspectives, Essays in Honor of Lloyd G. Reynolds. G. Ranis, R.L. West, L. W. Leiserson, C. Taft Morris (eds.), Westview Press, 1984.

"Determinants and Consequences of Indigenous Technological Activity," Technological Capability in the Third World, (M. Fransman and K. King (eds.)) Edinburgh, MacMillan, 1984.

"The NIC's, The Near NIC's and the World Economy," in Conference Volume on the NIC's, East-West Center, Hawaii, forthcoming.

"Typology in Development Theory: Retrospective and Prospects," Economic Structure and Performance, Essays in Honor of Hollis B. Chenery. M. Syrquin, L. Taylor, L.E. Westphal (eds.), Academic Press, 1985.

"Can the East Asian Model Be Generalized: A Comment," World Development, Vol. 13, No. 4, April 1985.

"Employment, Income Distribution and Growth in the East Asian Context: A Comparative Analysis," Conference Volume on Open Economies, Santiago, Chile, November 1981, Vittorio Corbo and Anne Krueger (eds.), Part II, March 1985.

"Introduction and Overview" (with K. Ohkawa), Japan and the Developing Countries: A Comparative Analysis of Development Experience, K. Ohkawa and G. Ranis (eds.), Basil Blackwell, 1985.

"Technology Choice and the Quality Dimension in the Japanese Cotton Textile Industry" (with Gary Saxonhouse), Japan and the Developing Countries: A Comparative Analysis of Development Experience, K. Ohkawa and G. Ranis (eds.), Basil Blackwell Publishing, 1985.

Lloyd G. Reynolds, "Economic Growth in the Third World, 1850-1980," Journal of Economic Literature, September, 1984.

Economic Growth in the Third World, 1850-1980, Yale University Press, 1985 (excerpts forthcoming in paperback).

Raaj Kumar Sah, "What Role Does Equity Play in the International Distribution of Development Aid?" (with Jere Behrman), Economic Structure and Performance, M. Syrquin, L. Taylor and L.E. Westphal (eds.), Academic Press, 1984.

"The Economics of Price Scissors," (with Joseph Stiglitz), American Economic Review, Vol.74, 1984.

"Tropical Economies and Weather Information," Monsoons, J.S. Fein and P. Stephens, (eds.), John Wiley, 1985.

"Human Fallibility and Economic Organization" (with Joseph Sitglitz) American Economic Review Papers and Proceedings, Vol.75, 1985.

"The Social Cost of Labor: A General Approach" (with Joseph Stiglitz), Journal of Public Economics, forthcoming.

"The Taxation and Pricing of Agricultural and Industrial Goods in Developing Economies" (with Joseph Stiglitz), Modern Tax Theory for Developing Countries, D.M.G. Newbery and N.H. Stern (eds.), Oxford University Press, forthcoming.

T. Paul Schultz, "Household and Community Variables as Determinants of Mortality," International Population Conference, Florence, Italy, June 1985, International Union for the Scientific Study of Population. Ordina Press: Leige, Belgium, 1985.

"School Expenditures and Enrollments, 1960-1980: The Effects of Income, Prices and Population Growth," background paper for the National Academy of Sciences study on Population Growth and Economic Development, forthcoming.

"Changing World Prices, Women's Wages, and the Fertility Transition: Sweden 1860-1910," Journal of Political Economy, Vol. 93, No. 6 (December).

"The Supply and Demand of Births, and Their Life-Cycle Consequences" (with Mark Rosenzweig). American Economic Review, forthcoming, December 1985.

T. N. Srinivasan, "On the Uses and Abuses of Economy-Wide Models in Development Policy Analysis" (with Clive Bell), Economics Structure and Performance: Essays in Honor of Hollis Chenery, M. Syrquin, et al. (eds.), New York: Academic Press, 1984.

"DUP Activities and Economic Theory" (with Jagdish Bhagwati), European Economic Review Vol.24, 1984, 291-307. Also in Neoclassical Political Economy: The Analysis of Rent-Seeking and DUP Activities, D. Colander (ed.) Cambridge: Ballinger Publishing Company, 1984.

"On Transfer Paradoxes and Immiserizing Growth: Part II" (with J. Bhagwati), Journal of Development Economics, Vol.15, 1984.

"A Rejoinder" (with Jagdish Bhagwati), Journal of Development Economics, Vol. 15, 1984.

"Indian Development Strategy: Some Comments" (with Jagdish Bhagwati), Economic and Political Weekly, November 24, 1984.

"Remembrance of Studies Past: Retraining First Steps," Comment on Lord Bauer, Pioneers in Development, G. Meier and D. Seers (eds.), Oxford University Press, 1984.

Rural Poverty in South Asia (co-edited with P.K. Bardhan), New York: Columbia University Press, forthcoming.

General Equilibrium Trade Policy Modeling (co-edited with J. Whalley), Cambridge: MIT Press, forthcoming.

Handbook of Development Economics (co-edited with H. Chenery), Amsterdam: North Holland Publishing, forthcoming.

"Religion as DUP Activity" (with Jagdish Bhagwati), Public Choice, forthcoming.

Comment on the Paper of Marcus Berliant and Robert Strauss on "The Horizontal and Vertical Equity Characteristics of the Federal Individual Income Tax, 1966-1977," Horizontal Equity, Uncertainty and Economic Well-Being, Martin David and Timothy Smeeding (eds.), University of Chicago Press, forthcoming.

John Strauss, Book Review of Jeffrey James, Consumer Choice in the Third World, in Journal of Development Economics, 1985.

Agricultural Household Models: Extensions, Applications and Policy (co-edited with Inderjit Singh and Lyn Squire), Baltimore: Johns Hopkins University Press, forthcoming.

Brian Wright, "The Effects of Price Uncertainty on the Factor Choices of the Competitive Form," Southern Economic Journal, October 1984.

"Anti-Hoarding Laws: A Stock Condemnation Reconsidered" (with Jeffrey C. Williams), American Journal of Agricultural Economics, Vol.66, No. 4, November 1984.

"On the Design of a System to Improve the Production of Innovations," in W. Kingston (ed.), Direct Protection of Innovation, forthcoming.

"Commodity Market Stabilization in Farm Programs,"U.S. Agricultural Policy: The 1985 Legislation, Bruce Gardner (ed.), Washington, D.C.: American Enterprise Institute for Public Policy Research Occasional Paper, December 1984.

Review of Social Justice and Public Policy by A.B. Atkinson, Journal of Economic Literature, forthcoming.

APPENDIX D

RELATED PROFESSIONAL ACTIVITIES

1984-1985

Colin I. Bradford, Jr.

Lecturer or Conference Participant:

Overseas Development Conference on Development Strategies: A New Synthesis, Racine, Wisconsin

Workshop on the Political Economy of Development in Latin America and East Asia, University of California, San Diego

International Private Investment and Technology Transfer Seminar, Banco de la Provincia de Buenos Aires, New York

The Foreign Policy of Latin America in the Long Run VI, Annual Meeting of RIAL, El Colegio de Mexico, Mexico City

CEPAL Workshop on Development Issues, New York

Council on Foreign Relations Study Group on Advanced Developing Countries in Latin America, New York

Economic Prospects for the Third World Conference, Overseas Development Institute, London

SAIS Conference on The Position of Middle Income Countries in International Cooperation: The Case of Brazil, Washington, D.C.

UNCTAD Panel on International Trade Issues and Developing Countries, Geneva

OECD Development Center, CEPII, and the UN Economic Commission for Latin America Conference on Prospects for Latin America in the World Economy of the 1980s, Paris

United Nations Association of the United States Panel on the U.S. and Japanese Role in the Global Economy, Tokyo

UNA-USA Major Powers in East Asia Project on Security and Arms Control Issues, Tokyo

UNA-USA Economics Panel on the NICs and the Global Economy, New York

Consultant:

UNCTAD Secretariat, Geneva

OECD, Paris

Robert E. Evenson

Lecturer or Conference Participant:

American Economic Association-USSR Conference on Structural Change of the Economy, Moscow
AAAS Meetings, New York
Resources for the Future Conference, Washington, D.C.
Consulting Group on International Agricultural Research Conference, Paris
Economics Institute, Boulder
World Bank, Washington, D.C.
International Rural Sociology Meetings, Manila
International Union for the Scientific Study of Populations Conference, New Delhi
American Economic Association Meetings, Dallas
International Rice Research Institute Seminar, Los Banos, Philippines
World Bank Conference on Agricultural Extension, Yamousoukra, Ivory Coast
Agricultural Research Conference, University of Kentucky
Northeastern Universities Development Conference, Williams College
Agricultural Research Conference, University of Minnesota
NBER Conference on Technology, Cambridge

Consultant:

EMBRAPA, Sao Paolo, Brazil
Panama Ministry of Planning, Panama City
University of Khartoum, Sudan, USAID project

John C. H. Fei

Visiting Scholar: Sun Yat-Sen Research Professor of China Studies, Georgetown University

Lecturer or Conference Participant:

American Association for Chinese Studies 26th Annual Meeting, Wilmington, Delaware
Regional Approach to Chinese Economic History Conference, Taipei
University of Virginia
William Patterson College of New Jersey
Academia Sinica Conference Taipei

Commentator:

Voice of America Election Night Broadcast, November 1984

Michael Jones

Visiting Fellow: Institute for International Economics, University of Stockholm, Sweden

Lecturer or Conference Participant:
Georgetown University
The University of Stockholm
The Stockholm School of Economics
The University of Goteborg
The University of Helsinki

Kenneth Kletzer
Lecturer or Conference Participant:
The University of Western Ontario
McMaster University
National Bureau of Economic Research

Gustav Ranis
Distinguished Visitor, National Academy of Sciences/CSC-PRC Program to travel and teach in China
Lecturer or Conference Participant:
Vienna Meeting of the North South Round Table on International Monetary Problems and LDC Debt
CDB/EDI/IARM/ILPES sponsored seminar on National Economic Management Issues in the Caribbean, Barbados
The Boston Club of Yale Alumni
Harvard Institute for International Development
Northeastern Universities Development Conference, Williams College
North-South Round-Table Core Group on World Monetary Problems and Debt, Washington, D.C.
Committee on Foreign Affairs, U.S. House of Representatives, testimony on the Philippine Economics before the Subcommittee on Asian and Pacific Affairs, Washington, D.C.
Committee and Service Activities:
Steering Committee, Institutes of Economic and Social Research of the Caribbean Basin
Brandeis University, Board of Trustees
International Labor Office, Committee on Employment
Distinguished Visitor, Asian Development Bank
Consultant:
Florida State Regents
The World Bank
Food and Agricultural Organization
U.S. Agency for International Development
Appropriate Technology International

Lloyd G. Reynolds
Lecturer or Conference Participant:
Visiting Lecturer, Nanksai University, Tiajin, China

Committee and Service Activities:
Committee on U.S.-Soviet Exchanges, American Economic Association
Editorial Board, Journal of Comparative Economics
Advisory Board, Pakistan Institute of Development Economics
External Examiner, Department of Economics, University of Malaysia

Raaj Kumar Sah
Honorary Scholar, Center for Analysis of Developing Economies, University of Pennsylvania
Lecturer or Conference Participant:
Econometric Society Meetings, Dallas
American Economic Association Meetings, Dallas
The University of Pennsylvania
Virginia Polytechnic Institute
Committee and Service Activities:
Faculty Group on Economics of Organization, Yale School of Organization and Management

T. Paul Schultz
Lecturer or Conference Participant:
Princeton University
Brown University
University of Minnesota, Development Conference
American Economic Association and Econometric Society, Dallas
Population Association of America, Boston
Northeast Universities Development Conference, Williams College
International Population Conference, Florence, Italy
European University Institute, Florence, Italy
Committee and Service Activities:
National Academy of Sciences: Working Group on Population Growth and Economic Development, Committee on Population; Working Group on Causes and Consequences of Demographic Change, Committee on Basic Research in Behavioral and Social Sciences
National Science Foundation, Panel on Methods, Materials and Data Improvement in the Social Sciences
American Association for the Advancement of Science, Committee on Population, Resources and the Environment
Population Association of America, Nominating Committee, Public Affairs Committee, and Tauber Award Committee
Census Bureau Advisory Committee on Population Statistics, Chair
The World Bank, Research Advisor in Education, Labor Market and Living Standard's Study

Editor, Research in Population Economics, JAI Press
Co-editor, Johns Hopkins University Economic Development Series

Consultant:
North Carolina Population Center
Rockefeller Foundation
The World Bank

T. N. Srinivasan

Lecturer or Conference Participant:
Institute of Economic Growth, Silver Jubilee Lecture Series, Delhi, India
University of Pennsylvania
International Union for a Scientific Study of Population, New Delhi, India
National Research Council, Working Group on Population Growth and Economic Development, Washington,D.C.
University of Michigan Conference on U.S. Trade Policies in a Changing World, Ann Arbor, Michigan
American Association for the Advancement of Science, Los Angeles
American Economic Association, Dallas

Consultant:
U.S. Agency for International Development
The World Bank

John Strauss

Lecturer or Conference Participant:
Brown University
McMaster University
North Carolina State University
University of Toronto
University of Western Ontario
International Food Policy Research Institute /United Nations University Workshop
American Economic Association, Dallas
Economic Demography Workshop, PAA, Boston

Consultant:
The World Bank
U.S. Agency for International Development

Brian Wright

Lecturer or Conference Participant:
Michigan State University
Virginia Polytechnic Institute
University of California at Berkeley
American Enterprise Institute for Public Policy Research, Conference on United States Agricultural Policies, Washington, D.C.

Northeast Universities Development Conference, Williams College

Consultant:

American Enterprise Institute for Public Policy Research

European Economic Community Project on Protection of Innovations

Brazilian Agricultural Research Enterprise Project on Agricultural Research Evaluation