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ECONOMIC GROWTH CENTER

Interim Report to the Agency for International Development

CSD/2492, January - June 1971

I. PROGRESS TO DATE

A. Papers Prepared

Discussion Paper 107. "Land Reform and the Agricultural Income Distribution," R.A. Berry, March 1971

Discussion Paper 108. "Land Distribution, Income Distribution and the Productive Efficiency of Colombian Agriculture," R.A. Berry, March 1971

Discussion Paper 110. "Development and Employment in the Open Dualistic Economy," J.C.H. Fei and Gustav Ranis, April 1971

Discussion Paper 116. "Industrial Sector Labor Absorption," Gustav Ranis, July 1971

Papers in Preparation

"Investment in Agricultural Research and Extension: A Study of International Data," Robert Evenson and Yoav Kislev

"The Role of the Industrial Sector in Korea's Transition to Economic Maturity," Gustav Ranis

"Disguised vs. Open Unemployment: A Trade-Off," Richard Brecher

"Growth and Employment in South Korea and Taiwan," Gustav Ranis and J.C.H. Fei

B. Seminars and Workshops

On May 19 and 20 a selected group of investigators from the Growth Center met with staff members at AID in Washington to discuss research progress to date and plans for the future. Representing the Center at these meetings were Gustav Ranis, Albert Berry, Hugh Patrick, Howard Pack, Markos Mamalakis, Ronald Soligo, and Werner Baer. Agreements and actions arising from these discussions included

1) a written exchange among the participants in the research outlining the directions each would pursue and the data and sources to be utilized:

2) a written report by the principal investigator describing the interrelationships of the individual projects, their contribution to the whole, and the substantive progress to date·

3) the scheduling of a larger conference, to be held at the Growth Center in the fall, where all the researchers would update their outlines, comment on the synthesis (see 2 above) and report on preliminary results.

Growth Center Seminars dealing with general problems of development, and particularly with problems of employment/unemployment and income distribution in developing countries, were continued on a regular basis, open to Yale faculty, research staff, students and visitors with professional interest in these areas. Speakers for this series generally come, on invitation, from other research-oriented agencies and institutions, bringing their unique theories and experience to bear on specific subjects of mutual concern. Occasionally Growth Center staff members contribute their own findings to the series in order to expose them to comment and criticism from other economists. Among the dates, topics, and speakers for this series were

February 1 - "Income Distribution and the Relative Efficiency of Large and Small Farms in Colombia," R. Albert Berry, Economic Growth Center

February 8 - "Optimal Commercial Policy for Minimum Wage Countries," Richard Brecher, Harvard University

March 1 - "Comparative Productivity Growth: COMECON-OECD Since 1950," Abram Bergson, Harvard University

March 8 - "National Planning and Economic Development, A Critical Review of the Japanese Experience," Tsunehiko Watanabe, Kyoto University

April 12 - "Seven Sins of Economic Planners," Mahbub ul Haq, International Bank for Reconstruction and Development

April 19 - "Labor Productivity and Other Characteristics of Cement Plants: An International Comparison," Carlos Diaz Alejandro, Economic Growth Center

April 26 - "Rural-Urban Migration, Surplus Labor, and the Relationships Between Urban and Rural Wages," Joseph Stiglitz, Yale University

May 10 - "Socialism and Development in Tanzania," Gerald Helleiner, University of Toronto

A second seminar series, usually conducted by Growth Center staff, included the following discussions:

January 21 - "Modernizing Agricultural Research in Spain," Robert Evenson

February 18 - "The Family-Owned Conglomerate As a Major Characteristic of Industrial Organization in LDCs," Hugh Patrick and Vahid Nowshirvani

April 8 - "Unemployment in Colombia," R. Albert Berry

April 15 - "Income Distribution and Growth in Puerto Rico," Richard Weisskoff

May 13 - "Evaluating the Impact of an International Manufacturing Firm on a Developing Country," Benjamin Cohen

May 20 - "Regional Impact in Thailand of Rubber," Laurence Stifel

June 3 - "An International Comparison of Agricultural Research and Productivity," Robert Evenson and Yoav Kislev

June 24 - "Risk-Taking and Farmers' Crop-Growing Decisions," Howard Kunreuther

C. <u>Changes in Approach</u> - None

D. Staffing Progress

1. Country and Comparative Studies:

   Two additions to the list of country studies were negotiated during this period and personnel to undertake the new projects were designated, effective July 1, 1971. James McCabe, recipient of a Ph.D. from the University of Pennsylvania and, at the time, employed by AID, agreed to undertake research on employment in the Congo. Richard Brecher, a Ph.D. recipient at Harvard University, simultaneously commenced work on his subject country, Ghana.

2. Sectoral and Functional Studies:

   No Change

E. Difficulties Experienced

1. Data Collection:

   Ronald Soligo's scheduled visit to Pakistan in summer 1971, planned in order to collect data and data sources, was indefinitely postponed due to political developments in the subject country. Markos Mamalakis (Chile) and Werner Baer (Brazil) reported pending delays in the collection of 1970 census data which they consider crucial to their studies but which will not be available until early 1972.

II. SUBSTANTIVE PROGRESS

A. Country and Comparative Studies

See Appendix.

B. Sectoral and Functional Studies

See Appendix.

The recently revised version of Howard Pack's paper on employment and industrial growth indicates that there is surprisingly little difference in employment elasticities between LDC's and developed countries. Since technological progress has been estimated to be much greater in the developed countries than in the LDC's, we would expect the employment elasticities to be correspondingly lower. The LDC's have compensated for the lack of technological progress by large increases in the capital-employment ratio.

This, he points out, may not be entirely due to rapid increases in the price of labor relative to capital. Due to the labor saving bias of economies of scale encountered at the early stages of development, it may be possible to reduce the capital ratio by adopting a larger scale plant with a higher capital employment ratio. Also, capital intensive techniques may be a means of offsetting the depressing effects which a shortage of skilled labor may have on productivity.

III. FUTURE COURSES OF ACTION

A. New Phases or Fields of Research

See Appendix.

B. Proposed Meetings, Reports

On November 26 and 27 all investigators under the contract will meet at the Growth Center for a two day conference intended to provide a forum for the presentation of findings to date, an update on plans and schedules for future research, and a commentary on the "Synthesis of EGC Research" attached here as Appendix.

On November 29 and 30, five or six researchers from this group will travel to AID to meet with staff members there to further explore the same topics.

C. Application of New or Additional Research Techniques

See Appendix.

D. Changes in Personnel

In September 1971 Professors Hugh Patrick and Marsha Goldfarb terminated their participation in the program. Professor Robert Evenson is continuing his research activities while on leave from Yale.

E. Contract Schedule

Levels of activity and expenditure through June 1971 correspond closely to those estimated in the November 1970 budget revision. Underexpenditures for "Consultants" and "Travel" relate to the non-participation of Ronald Soligo. Underexpenditure in "Publications" relates to delays in the issue and billings for reprints.

1970-71 FISCAL SUMMARY

AID/CSD - 2492

LINE ITEM	FIRM BUDGET	ACTUAL EXPENDITURES
SALARIES	$(95,148)	$(98,046)
Professional	37,750	34,561
Research Assistants	29,049	32,721 [1]
Adm., Sec., Cler.	28,349	30,764 [2]
FRINGE BENEFITS	7,789	7,965
OVERHEAD	54,234	56,309
CONSULTANTS	19,195	13,447
TRAVEL & ALLOWANCES	12,500	8,281
PUBLICATIONS	3,000	135
OFFICE SUPPLIES	12,000	14,448 [2]
COMPUTER FEES	6,000	3,357 [2]
CONFERENCES	2,000	--
MISCELLANEOUS	100	35
	$211,966	$202,023

[1] Includes payment of "fees for service" to off-campus research personnel exempted from fringe benefit and overhead assessments.

[2] Internal accounting procedures necessarily reassign some EDP costs to "Clerical" and "Supplies" lines.

Employment, Unemployment and Growth:

A Tentative Synthesis of EGC Research

Gustav Ranis
Economic Growth Center
Yale University

The above subject has become a major focus of Growth Center research in recent years. This brief note represents an attempt to present a bird's eye view of our approach to a problem which is receiving the sharply increasing attention of academicians and policy-makers. In this process I will try to lay out the problem in general and to indicate how the various pieces of individual and group research we are engaged in fit into that general framework.

It should be emphasized at the outset that the state of our understanding on this subject remains very much in flux and that any one conception of the problem and of how the various pieces fit together is not necessarily shared by all the researchers, at Yale or elsewhere. It is, rather, my hope that this attempt at synthesis will elicit constructive, even if contrary view's, along with suggested modifications, and thus contribute towards a synthesis of our understanding of the problem, at least at this stage of our effort.

A few more substantive points should also be clarified early in the game. One, we start with the assumption that, in the economies we are concerned with, there exists an actual (or prospective) surplus of labor defined as a substantial portion of the labor force whose marginal product lies below its income--a condition caused by a combination of the absence or mal-allocation of the complementary scarce factors of production (and not a deficiency of demand). Second, our research effort is putting relatively little energy into the difficult, and thus far generally elusive, task of attempting a measurement of just exactly what portion of the total labor force suffers from this condition in any particular case. Thirdly, most of our effort focuses on the reallocation of this labor force from inefficient (or non-existent) pursuits to areas of efficient utilization, where compensation and contribution to output tend towards equality, as lying at the heart of the unemployment problem. Thus, at least at this stage, we have been mainly concerned with the demand for labor and relatively less with factors affecting its supply, including the demographic dimensions of the problem.

Our work consequently focuses heavily on the production conditions, as modified by growth and technology change over time, in each of the major sectors of the developing economy. This in turn leads us to focus heavily on the availability of the complementary factors, including capital and land and, to some extent, skills, relative to the abundant supply of unskilled labor, as well as on the efficiency of organization which includes considerations of scale, entrepreneurial capacity and policy environment.

A sectoral view is required, moreover, because each sector is likely to differ markedly from the others with respect to the aforementioned production conditions, and because the relative role of the various sectors is bound to undergo marked change in the course of development. The major sectoral sub-divisions are not cast in the smooth input-output tradition, at least at the outset, but rather with sensitivity to differential behavior patterns in, for example, traditional agriculture, commercialized agriculture, manufacturing and the services. Within manufacturing and the services further disaggregation may be appropriate and useful, depending on the country under consideration.

This sector-intensive analysis of the forces of demand for unskilled labor must, moreover, be imbedded in some conceptual framework in which relationships among the major sectors over time and marked changes in their relative roles and output mixes are analyzed. The construction of such frameworks, simple or more complicated, will inevitably be heavily influenced by such factors as the overall size of the country under consideration, the relative weight of its traditional agricultural sector, the quality of its colonial heritage (in terms of both physical and human infrastructure) and its natural resource endowment, relative to the pressures of population and of population growth.

This may seem like a somewhat tall order, but it is also a necessary one since any attempt to somehow treat the employment problem separately from the output generation and development issue is both artificial and likely to be unproductive. While different country investigators are, of course, bound to focus on somewhat different aspects of what is basically a dynamic general equilibrium problem, the ultimate objective of our research is a better understanding of how various types of developing economies have solved, and how others could solve (or at least minimize), their unemployment problem in the course of their transition to economic maturity.

For a variety of reasons,[1] the nine country-intensive studies are currently at very different stages of progress. While preliminary findings are emerging from some, the focus of the current and future effort of others is, consequently, only now emerging.

The Korean (Ranis) and Taiwanese (Fei) country studies which are being examined in a comparative setting focus on the performance of these two systems, in terms of both employment and output generation, during two major sub-phases of transition, namely import substitution and export substitution.

[1]Including determination and timing of country choice, selection of researchers, other (i.e. teaching), obligations of researchers, in-country, e.g. census, timing problems, etc.

The analysis clearly indicates that the so-called conflict between output and employment objectives in the open labor surplus type of economy necessarily holds only during the import substitution phase when a number of key relative prices are severely distorted--for some good and other not so good reasons--and the veil between factor endowment and factor use is consequently most pronounced. During this period, the development process is fuelled (at least domestically) largely via traditional agricultural exports, with output mixes changing mainly through the substitution of consumer goods imports while technology in the rapidly growing industrial sector is mainly of the imitative or transplanted variety. Once entrepreneurial maturation and the creation of the requisite overheads have been achieved and the economy is capable, politically as well as in the changing resources endowment sense, to adjust the crucial relative prices in the direction of their equilibrium values, the system is in a position to enter its export substitution sub-phase. In this period, radical changes in output mix, via the exportation, for the first time, of labor-intensive industrial goods, become possible; moreover, indigenous technological ingenuity, working in a labor-using direction becomes an important phenomenon.

The analysis of Korea and Taiwan at both the aggregative and firm levels indicates that the common interpretation of the need to contemplate trade-offs between GNP growth and employment is based on the erroneous assumption of the continued inflexibility of technology choices and output mixes which has been characteristic of most LDC's during import-substitution. It no longer holds once changes in the resource endowment coupled with changes in the policy environment have enabled the economy to move into export substitution. These two country studies, especially when pitted against the longer run historical experience of Japan, will demonstrate that, at least for this type of an economy, chronic employment/output conflicts are not necessary in nature but largely man-made. Once the transition to export substitution has been effected, the combination of maturing entrepreneurs and cheap labor can lead to rather dramatic changes in technology and in output mix. What results is more growth--and a better distribution of income for the economy as a whole--through (rather than in spite of) the reduction of unemployment.[1]

Berry's study of Colombia is in a similar framework and seems to be moving towards somewhat similar conclusions. In labor surplus LDCs where social security systems and the fiscal capacity of government are limited, unemployment and the maldistribution of income tend to fade into each other. While, as Lewis and Kuznets have pointed out, labor's share within the growing industrial sector may fall, this is not likely to be true for labor's share in the economy as a whole, as workers are transferred out of low or zero productivity jobs in agriculture.

In the course of his work on the demand for labor during Colombia's current tentative transition from import substitution to a more open economy, Berry is concentrating on the question of efficiency by scale of establishment, in both Colombia's agricultural and non-agricultural sectors. This question is particularly relevant because the already referred to inter-sectoral dualism in most LDCs at this stage of their development is usually accompanied by an intra-sectoral dualism in which, given any overall distortion of relative prices, larger firms are usually at a much greater distance from the equilibrium values.

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[1]Turnham, for example, has data which indicate not only that Taiwan's distribution of income was the most equal of all the LDCs examined, but more equal in the mid-60's, during the export substitution sub-phase, than in the mid-50's, during import substitution (see his paper on Income Distribution in the LDC's prepared for the S.I.D. Conference in Ottawa, May, 1971).

Berry's work to date already clearly indicates that smaller scale farmers in Colombia are much more efficient in terms of the more intensive use of the scarce factors while larger units apply both land and capital wastefully. His findings, that small farms which have the lowest labor productivity (output/labor ratios) also have the highest capital cum land productivity (output/capital cum land ratios) are unambiguous--and supported by work on Brazil, India, etc. Dynamically as well, there is evidence that the small farmer is more receptive to technology change and willing to accumulate capital--thus denying the validity of the Galenson/Leibenstein hypothesis which is so frequently raised by the proponents of scale and capital intensity. In Colombia's industrial sector Berry once again finds a positive association between firm size and labor productivity with the evidence on capital productivity not yet complete but indicating that a pattern similar to that found in agriculture is likely.[1]

Baer's study of the Brazilian case likewise focuses on the sectoral choice of technology and output mix and its effect on labor absorption patterns. While the 1970 Demographic Census, required especially for the projected work on agriculture and services, will not be available till mid-1972, individual industry studies to which he has access will permit him to focus initially on the role of technology transfer, and of consulting firms, as well as that of relative factor prices, in determining factor proportions and output mixes. With the help of the unusually rich data sources available to him, he intends to extract from the analysis of labor absorption, by sector, in the past, an understanding of the basic causes of the apparent historical conflict between output and employment as well as some projections of alternative employment/

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[1] Empirical evidence on other countries, e.g. India and Pakistan, indicates that the medium-scale firm may be most efficient in the use of scarce capital resources.

output growth patterns for the future in the presence or absence of structural change, facilitated by changes in policy.

The study of employment and unemployment in Chile by Mamalakis again focusses on the relationship between output growth and employment in each sector and, via the analysis of inter-sectoral relations, in the economy as a whole. As a first step, inter-sectoral labor productivity and employment/unemployment differentials, over time, have been calculated. His next step is to determine whether or not the conflict between employment and output is, in fact, less pronounced, as we would expect, in the export than in the domestically-oriented sectors and industries. The objective is to examine the links between efficient labor absorption, output generation and the distribution of income, by sector and for the economy as a whole. Moreover, the Galenson/Leibenstein question of the impact of alternative technology and output mixes on the generation of saving over time is being examined.

The Soligo study of Pakistan tackles the same problem of the consistency or inconsistency of output and employment objectives from a somewhat different initial perspective. The basic hypothesis here is that a predetermined, or politically determined, unequal distribution of income determines a demand pattern which is unduly capital (as well as import) intensive and thus puts severe constraints on the economy's ability to efficiently absorb a larger portion of its surplus labor.

A more equal distribution of income, on the other hand, would place income elasticity of demand pressures on more labor-intensive output mixes. Thus, even if saving rates could be raised through a policy favoring large income disparities, which itself is doubtful,[1] investment resources would be drawn increasingly to capital-intensive industries. By assuming a given income

[1]See Ranis, "Production Functions, Market Imperfections and Economic Development," Economic Journal, June 1962.

distribution at the outset and tracing its consequences, for employment and output generation, by sector, this study turns the problem on its head, but addresses the very same issue as the other country studies. Issues of alternative technology choices, given demand-determined output mixes, and the impact of trade which presumably permits the importation of the capital intensive consumer goods demanded by the rich must, however, still be integrated into the analysis.

The three African country studies, on Kenya by Pack, Ghana by Brecher and Congo (K) by McCabe, are still at an early stage, but are expected to follow the same general pattern indicated earlier: emphasis on the production conditions as they affect employment/output choices, sector by sector, within the framework of a general equilibrium, inter-sectoral view of the economy over time. The question to be addressed in all cases is the same: how can different types of LDCs increase their overall levels of labor productivity, or income per head, without sacrificing, indeed by pursuing a strategy which refuses to sacrifice the employment objective. Exclusive concentration on labor productivity increase <u>in any one sector</u> cannot tell the story since it may well have been achieved at the price of allocating large amounts of scarce capital and the release of labor not efficiently absorbed elsewhere. Output and employment trade-offs which can be analyzed for any given sectoral "island" are likely to be quite irrelevant--and, worse, misleading--certainly as long as an overall unemployment problem exists. No matter what the special focus of each country investigator may be, there is thus relatively little choice but to imbed the sectoral analysis in what is happening in the economy as a whole as it moves in transition to economic maturity.

In this context, the role of the sector-intensive studies, either within or among countries, is to analyze at a more disaggregated level the specific behavioral relationships whose strength or weakness is so crucial to the better understanding of the workings of the LDC as a whole. For example, the cross-sectional studies of the agricultural sector, by Evenson, of the industrial sector, by Pack, and of the services sector, by Berry, are intended to enrich our understanding of the relationships between such variables as initial economic structure and endowment, trade and exchange policy, technology transfer mechanisms, and the extent of factor price distortions, on the one hand, and the demand for unskilled labor and the generation of output, on the other. While many of these efforts, quite properly, start out with cross-sectional work within the specific sector of a given country where data comparability and other conceptual problems are less severe, the intention in all cases is to test and broaden the analysis to ensure the relevance of these particular findings in the context of the analysis of other countries, even other country types.

Evenson's first target, for example, will be to test the impact of the seed/fertilizer revolution in the Indian Punjab on the demand for labor, both of the family and wage variety. Having gotten access to some rather rare micro data based on household observations drawn from farm management studies, as well as to some detailed repeat village surveys, he expects to be in a position to estimate the elasticity of substitution between land, labor and capital both before and after the "Green Revolution." Moreover, at the macro level, he has collected from a variety of district level sources data for 256 districts over the past 12 years. The impact of major technology change during this period has already been seen to have clear regional implications, including for the mobility of labor, for income distribution, and for legitimate vs. illegitimate demands for increased mechanization in relation to multiple cropping, peak season land preparation, and harvesting. His early results for the Punjab and Haryana indicate that, in spite of the overall labor surplus condition, marked technology change, given the imperfections in the labor market, at least in the short run, has been accompanied by rising rural real wages, if by less than labor productivity. He also has some evidence to the effect that the short run labor displacement, where less selective tractorization has occurred (partly in response to officially distorted import prices) is likely to be quite different (probably greater than) the "final" outcome, after learning-by-doing along the new production functions has had a chance to make itself felt.

Pack has carried out a cross-country study of labor absorption in manufacturing industries. He finds a rapid growth of labor productivity in the 13 LDCs under observation during the '53-'63 period. As we noted earlier, if such increases in labor productivity on the industrial islands are due to growing capital intensity, as opposed to rapid technological progress, the analytical and policy conclusions are quite different. Pack's first effort was to try to isolate the extent to which differential labor productivity growth has been due to differential capital/labor ratios and to "other factors" (presumably technology change) by means of a general Cobb-Douglas production function estimation. There are obvious, largely unavoidable, difficulties here, including the use of wage/rental ratios (which assume market equilibrium) as a proxy for capital intensity, the use of the rate of growth of output as a proxy for technology change, not to speak of the use of the same production function across countries. Consequently his inability to come up with any clear findings on the first run should not be too surprising. He is currently proceeding to test the same approach for particular industries within a country, both historically and by cross-section, across scales. He, moreover, intends to carry out a detailed study of a small number of industries in Kenya, using engineering data where possible as a more promising approach to the important issue he has posed.

Berry intends to follow up on some of the statistical findings of Bhalla by testing a number of hypotheses relating to the labor absorption and output generating properties of the services sector. While his objective is to do a cross-sectional study of the role of this sector across a number of Latin American countries, he intends to sharpen his analytical framework by an examination of the Colombian situation as a first step. He has already concluded that some disaggregation of the "catch-all" services sector into its commercialized components, e.g. financial institutions, utilities, professional services, etc., where labor is presumably efficiently employed, and its "spongy" components, e.g. distribution, retail trade, personal services, etc., where labor is undoubtedly underemployed by our (above) definition, is necessary.

The attempt will be made to understand the role of this large (and often neglected) sector as an important buffer zone between agriculture and industry, including changes in that role over time as "labor push" gives way to "demand pull" forces in determining the size and efficiency of that sector.

Closely related to this examination of the functions of the services sector in the course of the transition process are two other pieces of research already under way which represent perhaps the only contribution of the Growth Center's work to date on the supply side. Berry's work on Colombia, for example, has already clearly indicated that the questions of "who are the urban unemployed" and "what are their motivations" may be crucial to an understanding of what is going on in the "spongy" urban areas of most LDCs. Berry has found that the openly unemployed may be largely voluntarily unemployed. They are primarily young people who either "wait" until the kind of job they want (or they feel their primary education entitles them to) opens up, or re-emigrate to the rural areas. Many choose to wait in the services sector and thus really join the underemployed. In any case, we know that the proportion of openly unemployed urban males in the 25-45 age group is remarkably low.

These findings are relevant to a number of important conceptual and policy issues. For example, the socio-political implications of a given pool of urban unemployed would seem to be much less, if after a reasonable waiting period (during which the extended family provides support) most people move on to jobs which they find acceptable, while the pool (which may even be growing in total size) is filled by a new cohort. A better understanding of individual and family decision-making under uncertainty, with respect to migration, waiting time, support levels etc. is likely to substantially enrich the Todaro view of the rural-urban employment *cum* migration problem. Certainly Berry's finding that a substantial sub-set of the unemployed are likely to be better off (in terms of either the level of consumption or psychic utility) than a substantial sub-set of the employed tends to substantially complicate our traditional analysis of unemployment--especially with regard to the relationship between an individual's education, the nature of the work and his total level of satisfaction.

The role of the average educational level and mix is likely to be particularly relevant for the question of what kind of a job a migrant is willing to accept--quite aside from the more traditional issue of how well he has been prepared for the jobs required by the economy at any given stage of development. Goldfarb is looking at this issue of the relationship between education level and employment/unemployment status as part of her study of the Santiago, Chile labor market. She is analyzing detailed information on 3,000 individuals with respect to their educational background including general and vocational, formal and on-the-job, plus their occupations and occupational histories. This puts her in a position to relate a proxy for unemployment (days unpaid) to various educational variables. While changes in the overall unemployment plus underemployment rate for Santiago between 1965 and 1969 reveal no overall systematic trend, she hypothesizes that, at a more disaggregated level, there have been significant changes in the types of jobs available and the average skill requirements per specified job.

As part of the same study of unemployment in Santiago, Goldfarb is also looking at education as an industry, i.e. by using detailed information on the educational plant, its quality, student-teacher ratios, etc. to inquire into the capital-labor substitution possibilities and the skilled labor absorption potential of this sub-sector. She has been examining trends in schooling demands and teacher supplies, and projects a change from an excess demand to an excess supply situation--and consequent unemployment--for teachers within a few years.

Finally, several E.G.C. researchers are examining the process of technological transfer, innovation and adaptation at both the macro and firm levels. Nelson has been tackling the problem on two fronts: first, he is investigating the consequences of the existence of a technology gap between countries at different stages of development and the role of science and technology policy, especially in the laggard countries, in taking advantage of such gaps for purposes of output and employment generation. Secondly, he has been studying in considerable detail how R & D decisions are made at the micro or firm level, with an eye to achieving a better understanding of the process of innovative and adaptive response among entrepreneurs. Fei and Ranis are approaching the same problem from two other directions. On the one hand, at the aggregative level, they have constructed a theoretical framework, which incorporates the concept of a technology shelf available for borrowing by LDCs with the process of technological assimilation within the developing country, and tested it in the Japanese historical context. On the other, they have conducted firm interviews, in the context of their work on Korea and Taiwan, to determine the nature of this important assimilation process and how it can be more rigorously related to profit maximizing behavior at the individual entrepreneurial level. The results to date indicate that the process of technological transfer differs in the import and export substitution sub-phases of development, i.e. that the importance of inefficiencies, (relative to the shelf) caused by pure transplantation is much diminished, as well as the potential for indigenous capital stretching innovations much enhanced, in the second phase; that different types of entrepreneurial and labor qualities are required to ensure that the initial act of borrowing is not unduly capital-intensive and that there is maximum scope for the important labor-using adaptations to follow. The more detailed work on Korea and Taiwan has demonstrated that the scope for the latter type of innovations, both machine-centered and plant-centered, is usually grossly under-estimated. Entrepreneurs--even within different branch plants of the same company--seem to be extremely responsive to factor price differentials and evidence considerable adaptive ingenuity in terms of the longer use and speeding up of machinery, the up-grading of lower quality raw materials via the increased use of labor, the use of sub-contracting, and of human conveyor belts and other peripheral activities. The evidence to date seems to indicate that a high point of adaptive efficiency is reached 6-8 months after the installation of the borrowed technology.

In summary, the EGC's research effort, both at the country and inter-sectoral and at the functional and cross-sectional levels, emphasizes better understanding of the relationships, over time, among a small number of major sectors as they generate output and employment. This relatively small number of sectors permits us to emphasize important asymmetries among sectors as well as to be concerned with inter-sectoral labor and financial flows. (This is in distinction to the inter-sectoral approach in the input-output tradition which focusses on the horizontal allocation and consistency among a relatively large number of homogeneous sectors and has more difficulty in analyzing productivity change endogenously and in integrating into the analysis inter-sectoral labor and financial reallocation mechanisms.) Starting with the initial condition of a labor surplus--or one threatened by population growth at the margin--the country studies focus mainly on, first, an understanding and second, the solution of the unemployment problem through labor realloca-tion via changes in the demand pattern for unskilled labor. The precise behavioral relationships underlying this pattern, in terms of the changing stock of complementary factors, changes in technology, in the use of trade, and in the policy and institutional environment, are examined in the course of the functional and cross-sectional studies. Their ultimate purpose is to provide better building blocks for the dynamic general equilibrium analysis of how different types of economies function--and can be made to function better--in respect to the causes of productivity change, by sector, and of output and employment generation for the system as a whole.