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# THE FUTURE OF AGRICULTURE

*Technology, Policies  
and Adjustment*

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PAPERS AND REPORTS

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## *Contributed Papers*

### **Session No. 1 AGRICULTURAL TRADE AND PRICE POLICY\***

Trade Policy and Factor Returns, Geoffrey H. Jackson, Australia. This paper was written while the author was a graduate student at Cornell University, U.S.A. The author wishes to acknowledge the valuable comments made by K. L. Robinson.

Sugar Export Prices, K. A. Ingersent, University of Nottingham, England.

Andean Integration: Potentials and Limitations, Stephen C. Schmidt and Rene I. Vandendries. Stephen C. Schmidt is Professor of Agricultural Marketing and Policy and Rene I. Vandendries, Assistant Professor of Economics, University of Illinois at Urbana-Champaign, U.S.A.

Agriculture and Scientific Approach to the Price Policy of Agricultural Products, Dusan Tomic, Scientific Adviser, Economic Institute, Belgrade, Yugoslavia.

The first three of the above papers discuss current situations and issues in international trade. They focus on some results of barriers to international trade and make estimates of the potential benefits to be achieved by moves to lower some of the barriers. The last paper listed above is not specifically concerned with international trade, but does discuss various issues and problems associated with agricultural prices. It is, however, related to the other three by its concern with making agricultural markets more effective.

Mr Jackson (Trade Policy and Factor Returns, Geoffrey H. Jackson) points out that restrictions on international trade in commodities are often imposed for the purpose of benefiting a particular input used in the production of the commodity protected by the restrictions. His paper attempts to show the effect that such protection is likely to have upon the prices of, and total returns to, each of the factors used in the production of the commodity. He does this with a theoretical model which expresses the returns to inputs as functions of elasticities of demand, the elasticities of supply of inputs, and the change in tariff (or tariff equivalent of a quota).

\* Prepared by Joseph W. Willett, Economic Research Service, U.S. Department of Agriculture.

He concludes that 'the greater the elasticity of supply of a factor of production the less will be the effect of an import duty imposed on a commodity derived from that factor. This suggests that returns to those factors with an inelastic supply such as land, will bear most of the burden of changes in tariffs on farm commodities, *ceterus paribus*'.

He also points out that: 'In most cases the change in factor returns will be in the same direction as the change in the tariff.'

Mr Jackson uses his model to examine the possible effects on factors of production used in producing meat in the United States if U.S. meat import quotas should be 'reimposed in 1975 at a level consistent with the trend established from 1965 to 1970'. He estimates the tariff-equivalent of the quota restriction and concludes that the quota imposition would cause consumers to pay slightly higher prices for meat especially the low grade beef imported by the United States. On the basis of an assumption that a higher proportion of low grade beef is consumed by families with low incomes, he suggests that reintroduction of the quota would have an unfavorable effect on distribution of real income in the U.S.

In Mr Jackson's analysis the returns to all factors used in producing meat in the United States increase as a result of imposing the quota, but the increased returns to labor would be very small. Farm land values would be expected to increase moderately.

It is worth noting that the Economic Research Service of the U.S. Department of Agriculture has published a study of the 'Effects of Alternative Beef Import Policies on the Beef and Pork Sectors' in the U.S. (Agricultural Economic Report No. 233, October 1972). This study differs from Mr Jackson's in assumptions and methodology, but it estimates price effects in the same direction as Jackson's, although of different magnitudes.

Mr Ingersent in his paper (Sugar Export Prices, K. A. Ingersent) calculates the variations in average export prices for sugar among various sugar exporting countries in a particular year. He analyzes the reasons for these variations, and discusses some of their economic implications.

Mr Ingersent points out that nearly three-fifths of the world's exports of raw sugar are sold in preferential markets where the importing country undertakes to purchase up to a pre-arranged amount at a predetermined price. The remaining exports are sold on the 'world market' at a price determined by market forces, except for restrictions observed by signatories of the International Sugar Agreement. The principal preferential arrangements under which sugar trade takes place are the United States Sugar Act, the Commonwealth Sugar Agreement and the sugar pact between Cuba and the Soviet Union. The author notes that: 'In 1968 well over half of total world exports of raw sugar were traded under these three agreements.' The quota provisions of the International Sugar Agreement were not enforced in 1968, the year on which most of his analysis focuses.

Mr Ingersent finds a wide variation in the average value of the exports of different countries and finds the causes of these variations to be: (a)

differences in the relative quantities of sugar sold in preferential markets and in the world market, (b) differences in price between preferential markets, (c) differences in the timing of sales on the world market, and (d) sugar quality differentials. He concludes that the principal reason for the variation in the average prices for raw sugar exports is the differing degrees of access to restricted markets in importing countries which pay preferential prices. He argues for getting rid of these inequalities by the progressive removal of restrictions on international trade in sugar. He believes that improved access to markets will be a great benefit to developing sugar-exporting countries and would also benefit consumers generally.

Mr Ingersent does not analyze in depth the sugar cycle or the wild gyrations in world sugar prices which to some extent have provided an impetus to countries to seek special arrangements for sugar. However, he does observe that '... in years of unusually high world prices such as 1963, 1971 and 1972, the customary gap between preferential and free market prices narrows or may even be reversed'.

In a postscript to his paper, Mr Ingersent adds that: 'During the period in which this paper was prepared there was a steep upward trend in world sugar prices ... the upward trend of world prices has been so strong that, for the time being, the customary gap between preferential and non-preferential prices scarcely exists.' He does not believe that these recent developments invalidate the basic arguments of his paper because the current price situation cannot be expected to persist indefinitely. High world prices will eventually stimulate increased sugar production whereas rising demand is likely to be checked by them. When this happens he thinks that the customary gap between preferential and non-preferential sugar prices will in all probability reappear.

Professors Schmidt and Vandendries (*Andean Integration: Potentials and Limitations*, Steven C. Schmidt and Rene I. Vandendries) have analyzed the Andean Common Market (ANCOM) which started in 1969, and which now consists of Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela. They examine the patterns of trade of these countries in 1969 and discuss the prospects for further expansion of trade and economic integration of the group.

They find that from 1960 to 1969 the intra-group trade had generally increased substantially, so that in 1969 there was already a considerable intra-group trade. On the other hand during the 1960 to 1969 period some of the trade flows between these countries declined. This was especially true of Peru's exports to the other countries.

The authors have taken a more detailed look at the intra-group trade in agricultural commodities in 1969. In livestock and meat products, Colombia was the chief supplier although Argentina was the major source of cattle and meat imports by the group. Apart from Chile, the countries of the Andean Common Market are exporters of sugar and coffee. Fish meal and oil are leading export products for Chile and Peru, while Colombia imports them. All the countries except Bolivia were net

exporters of oilseed cake and meal. Intra-group trade in cereals was small.

Schmidt and Vandendries have compared the actual agricultural trade patterns of the group of countries in 1969 with hypothetical trade flows that they estimate would have taken place had there been no particular propensity of the countries to trade with each other. They find a considerable development of intra-group agricultural trade in a number of commodities, but are not willing to conclude that such trade has yet reached optimum or potential levels. They expect that expanded intra-regional trade in agricultural products will be limited. They believe that 'difficult geography, inadequate infrastructure, and political divisions both within and between member countries are likely to slow the momentum of the Andean integration process'. They point out that the present size of the market is still limited and they suggest that the Andean Common Market 'should be looked on primarily as a step towards eventual integration in a wider Latin American market'.

The authors conclude that: 'Agriculture apparently will continue to have a single-country focus. Key factors inhibiting the formulation of regionally coordinated agricultural policies and establishment of common markets are similar to those encountered in relation to industry, but with the difference that they seem almost insuperable. These inhibitions are rooted in (1) wide inter-country differences in production efficiencies, costs and farm prices; and (2) the reluctance of member countries to accept a divestiture of national sovereignty over domestic agriculture. Agricultural interests figured prominently in the postponement of the LAFTA time-table for free trade and in the suspension of the Common List.

'Based on existing trade and production, expanded intra-regional trade in agricultural products is primarily limited to cotton, cattle, beef, sugar, tobacco, fruits, and vegetables. Indications are that increased agricultural production is of high priority for ANCOM governments, especially Bolivia, Chile, and Colombia. It remains to be seen whether the Andean countries will follow national import-substitution policies or embark on agricultural diversification based on regional comparative advantages.'

Dr Tomic (Agriculture and Scientific Approach to the Price Policy of Agricultural Products, Dusan Tomic) points out that during 1946-56, agriculture in Yugoslavia was subordinated to industrial growth. A compulsory delivery system based on low administered prices dominated agricultural marketing. The result was a low level of investment, and stagnation in agriculture.

From 1956-65, there was a gradual abandonment of administered prices and a shift toward a market economy.

Although there has been an improvement in agricultural prices, their level has remained inferior to industrial prices and to the cost of credit. Of the total growth in agricultural production, 60 per cent was real growth and 40 per cent the effect of price increases.

Distortions in price relationships between feed and livestock have dampened growth in output. The cost of other inputs also increased

relative to livestock prices. Furthermore, a growing gap between producer prices and retail prices has limited demand and had a negative effect on production.

The formulation of price policy is hampered by the neglect of research on price and demand elasticities. Dr Tomic emphasizes the need to study factors that influence supply response for individual commodities. He also recognizes the need to gather reliable data on costs to serve as a basis for contractual agreements between producers and processors and middlemen.

Dr Tomic notes that the most difficult task is the collection of cost, price, and credit data in the highly fragmented small-holder sector, the dominant form of agriculture in Yugoslavia. The traditional concept that 'profit equals price minus cost' is not very helpful in collecting data on small-holders who do not pay wages to themselves or to their families. In fact, it is highly unlikely that operators of small farms in some areas are able to estimate with any precision the man-hour input required to produce a unit of corn or a unit of milk.

## Session No. 2 AGRICULTURAL MARKETING\*

Alcaide, Jose J. Rodriguez, Model of Interregional Analysis of Agrarian Sector of the Province of Granada. Dr Alcaide is Consejo superior de investigaciones cientificas, Instituto de Zootecnia Facultad de Veterinaria, Cordoba, Spain.

Krishnaswamy, L. The Degree of Competitiveness in Agricultural Marketing. Dr Krishnaswamy is Deputy Director (Marketing), Directorate of Cashewnut Development, India.

Patel, A. U. and Anthonio, Q. B. O. Farmer's Wives in Agricultural Development: The Nigeria Case. Drs Patel and Anthonio are members of the Department of Agricultural Economics and Extension, University of Ibadan, Nigeria.

Smith, Eldon D. Competitive Structure of Agricultural Markets and Development of Smallholder Agriculture. Dr Smith is Professor of Agricultural Economics, University of Kentucky, U.S.A.

Two of the papers happen to treat the same hypotheses but with different approaches and with interesting empirical illustrations. One set of observations treats India and the other Thailand. The other two papers, however, are both topically and geographically more diverse. I shall report the papers by Messrs Krishnaswamy and Smith first and the ones by Messrs Patel, Anthonio, and Alcaide second.

Both Krishnaswamy and Smith contest the commonly held hypotheses that: (1) agricultural marketing in developing nations is 'monopolistic and exploitative' and (2) general excess profit margins are taken by commodity dealers, farm input and consumer goods merchants, and money-lenders. Both studies agree few currently applicable empirical reports have been made and each of these papers helps to remedy this situation. Both

\* Prepared by W. T. Manley and P. E. Nelson, Economic Research Service, U.S. Department of Agriculture.

concentrate upon processors and merchandisers of farm products, omitting farm input and most consumer goods (retail level) dealers.

Dr Krishnaswamy used three quantitative indicators in two markets to test these hypotheses. These were: (1) the degree of concentration in marketing; (2) the coefficients of correlation between price movements in a large number of markets in a contiguous free trade area; and (3) economies of scale in marketing.

In Ganganagar, size of firm and extent of firm concentration was measured by the volume of food grains sold by farmers through commission agents for 1966–67 and 1967–68. In Sumerpur, the total value of ALL agricultural commodities sold by farmers through commission agents for 1968 was used. The frequency distributions and Lorenz curve coefficients for both markets were typical of distributions and coefficients of 'fairly competitive' markets. In Ganganagar, the Lorenz coefficient actually dropped from 0.55 in 1966–67 to 0.45 in 1967–68. For calendar year 1968 the coefficient for Sumerpur was 0.51.

Correlations were run between the price movements of the same commodity in different markets in the region of Rajasthan to test the extent of competition for this area. In 1000 out of 1035 cases the correlation coefficients exceeded 0.90; in 70 instances they fell between 0.80 and 0.89; and in three comparisons between 0.70 and 0.79. Such a set of high coefficients led the author to contend that spatial competitiveness of grain marketing, not monopoly, characterizes the Rajasthan region of India.

Marketing costs likewise were examined along with several profit indicators. The sample of firms was so small within many size categories it was impossible to report firm conclusions for these aspects. The data suggest that unit operating costs fall as turnover increases. However, there was no evident difference of substance in the net profit to working capital ratio for firms of different sizes, although most of the reported ratios fell between 12 and 24 per cent.

Policy-related conclusions stressed included: (1) the commonly alleged existence of monopoly in agricultural marketing in developing nations should not be taken for granted *a priori* and (2) a large volume of disguised unemployment in the market sector keeps profit margins equally low for small and large firms; and small traders will continue to successfully compete with large ones because of their willingness to accept low incomes. If demographic pressure upon the market sector should decline substantially, then economies of scale may result in larger, more efficient business units.

Three Northeastern provinces of Thailand provided Dr Smith the opportunity to empirically test similar hypotheses. In his paper Smith focused upon ease of entry as a fundamental characteristic of competitive structure. He documented ease of entry with data from Khon Kaen Province. He points out that kenaf bailing firms rose from 12 in number in 1962 to 45 in 1970. In the 1968–70 period large rice mills grew in number by five. However, the number of *licensed* cattle and buffalo dealers



dropped from 41 to 18 during the 1968–70 period. He presented no data on unlicensed dealers, and the decline in the number of licensed dealerships does not necessarily mean that the number of dealers available to farmers declined.

Dr Smith concentrated upon kenaf processing in three Northeast provinces. He reports that despite ease of entry, the market institutions were poorly developed and that supply and demand conditions were poorly articulated at the farm level. He showed these conditions exist in an industry where there was a close association ( $r = 0.9$ ) between movements of price at the farm and higher levels of the marketing channel. Farmers without the basic skills required to calculate the total proceeds due them from the price and weight information supplied them obtained somewhat lower prices than farmers with such skills. Also, farmers who were indebted to a particular dealer received less than those with numerous dealer alternatives. Size of offering by farmer also was positively correlated with price received by each.

Factor lumpiness was associated with capital needed for processing facilities (e.g., a new large rice mill in 1970 cost about \$150,000 (U.S.)); and with family and labor and management for assemblers of farm commodities. This is consistent with the thesis of disguised unemployment presented by Krishnaswamy in his paper. Commodity assemblers typically have diversified to obtain sufficient volume at a social cost of foregone economies of specialization.

The result of conditions of easy entry, economies of scale, and less than perfectly elastic supply confronting the marketing firms is high average costs without long-run excess profits; under-developed market institutions and the communications infrastructure support: impure competition with high margins; some exploitation of farmers; and a few rich merchants. However, aggregate profits are either normal or non-existent. The lack of aggregate profits may partially explain why there has not been any substantial development of cooperatives. Unless there is an evident surplus to be redistributed to the farmer cooperative membership, cooperatives have difficulty in maintaining membership.

Our third paper has two authors—Messrs A. U. Patel, and Q. B. O. Anthonio. They are concerned about increasing the supply of agricultural products in western Nigeria to meet domestic needs. They believe the efforts of the rural population must improve, perhaps even be transformed. To accomplish this goal they believe a necessary first step is to understand the historic agricultural roles of the men and women of western Nigeria. Thus, they have studied and identified and here analyze: (1) the role played by the rural women of western Nigeria; (2) how the role of these women is influenced by their personal characteristics; and (3) how to effectively expedite increases in agricultural production.

They make their analyses by relying upon data gathered from a sample survey of wives of tobacco farmers from 46 villages in the Oshun and Oyo Divisions. A two-stage stratified sample of 131 farmers and 128 wives was employed. The production associated role of the women was identified

according to eight operations, ranging from clearing bush to marketing (includes grading and transport of product). Also, the role of women in decision-making, particularly with emphasis upon decisions relating to agricultural production, was identified.

The authors conclude: (1) The Yoruba women play an important role in agriculture. (This role includes actual physical assistance, participation in production-related decision formulation, and the supply of money in helping to finance activities. The latter is less important than the preceding two activities.) (2) The age of the women and their involvement in trading as an independent activity are the primary factors which influence the character of the role played by a specific woman. (Most of the women over 40 work more on the farm and become more involved in the decisions related to agricultural production.) (3) Agricultural planners, to maximize their success, must take the role of the women into consideration, and (4) more women extension workers are needed to teach Yoruba wives how to grade tobacco correctly and to pack it properly for transport.

Alcaide, in contrast, treats the problem of increasing agricultural production from the macro perspective of 'overall programming'. He wishes to establish production targets for eight zones within the Province of Granada upon a crop by crop, livestock by livestock activity basis. Performance will be judged efficient if actual results match the proposed production targets. There is an empirical justification in the sense that the targets have been established by utilizing a minimum cost 'linear programming approach'. Alcaide, however, does not identify his cost minimizing model in any greater detail although his gross production maximizing model is introduced somewhat more formally.

Alcaide summarizes the purpose of his models as follows:

Using as productive activities the optimum plans of each type of enterprise, two economic interzonal models with different objectives have been worked out.

1. Fulfil the needs for each product... in each zone... at minimum cost...

2. Fulfil the demands for each product in each zone and in exports, maximizing the net profit for the province.

He presents results of the linear programming approach for establishing zone by zone targets for each crop and livestock activity. His results suggest: (1) More persons are employed in farming in Granada than will be needed to achieve the established production targets. He estimates that, according to this model, 66,000 persons active in farming (or 32,250 families) can leave farming without changing the dimensional structures; and (2) a change over to livestock and green root vegetables is necessary.

Finally, the author justifies his plan as being, '... nearer the present reality, so we can admit the economic rationalization of the agrarian enterprise in Granada under the present variables which govern it.'

**Session No. 3****RISK AND THE THEORY OF THE FIRM\***

Cone, Bruce W., 'The Riskiness of Adopting the Use of Fertilizer—A Brazilian Example'. Cone is an agricultural economist with Batelle's Pacific Northwest Laboratories, Richland, Washington, U.S.A.

Dean, Gerald W., 'Firm Theory Incorporating Growth and Risk: Integration into Farm Management Research'. Dean is Professor of Agricultural Economics, University of California, Davis, California, U.S.A.

Drummond, H. Evan, and T. Kelley White, 'Income Risk in Agriculture: A Cross-Country Comparison'. Drummond is Assistant Professor of Agricultural Economics at the University of Georgia, Athens, Georgia, U.S.A., and White is Associate Professor of Agricultural Economics at Purdue University, Lafayette, Indiana, U.S.A.

Eltonbary, A. A., A. A. Guoeli, and N. T. Habashy, 'Some Models for Determining the Optimum Cropping System in A.R.E. Agriculture Under Certain Environmental and Organizational Conditions'. Eltonbary is Professor of Agricultural Economics, University of Ain Shams, Cairo, Egypt. Guoeli is Associate Professor, Faculty of Agriculture, University of Ain Shams, Cairo, Egypt. Habashy is Expert, Egyptian Agricultural Organization, Cairo, Egypt.

Maruyama, Yoshihiro, 'A Behavioral Revolution of Agriculture'. Maruyama is Associate Professor of Agricultural Economics and Forestry Economics, Kyoto University, Kyoto, Japan.

This section of contributed papers covers a range of topics concerned basically with resource adjustments and investment decision-making. The papers include a variety of analytical techniques which provide additional insight on understanding economic adjustments in both the developed countries (DCs) and lesser-developed countries (LDCs).

The paper by Cone deals with current operating decisions using micro-production theory with some extensions to include the implication of variations in prices and yields.

*Summary.* The author uses production theory in suggesting the optimum levels of fertilizer use for several crops and production areas in Brazil. Drawing further upon the sample information, yield and price frequency distributions are generated. A Monte Carlo sampling of the distribution allows the calculation of probable rates of return for a specific level of fertilization. This analysis can provide the farmers of the several areas with quite useful information; it can greatly reduce the technical risk referred to in the Drummond and White paper.

Dean's paper is concerned primarily with firm investment and growth decisions; utility concepts which involve risk and time dimensions are integrated with production theory to form a more comprehensive model of firm behavior.

*Summary.* Dean's argument is that a firm's investment decision

\* Prepared by Jimmy L. Matthews and Steven Guebert, Economic Research Service, U.S. Department of Agriculture, Washington, D.C.

problem can only be solved with a knowledge of the entrepreneur's time preference for consumption and his risk preference, i.e., the firm's utility function. Unfortunately, constraints as to the length of the contributed papers precludes Dean from giving much more than a brief review of firm investment theory, a taste for some of its weaker assumptions, and an exposure to some concepts of utility and preference ordering. This establishes the need for integrating relevant utility concepts into the modeling of investment decisions for firms.

Drummond and White draw on some micro concepts and risk measures in order to compare investment risks in LDCs and DCs which have macro-policy implications.

*Summary.* The authors desire to shed some light on the factors explaining low investment rates in the agriculture of less-developed countries. One hypothesis is that the return on such investments is high relative to both the cost of capital and the returns to such investments in developed countries, but that these investments are subject to relatively higher risks. To test this hypothesis the authors investigated the variability of income streams caused by price and yield risks for a sample of farm firms in two regions of Brazil and one region of the U.S. An annual income series is simulated for each firm; risk is taken to be a function of that stream's variance. Their empirical findings lead to rejection of the hypothesis, i.e. they conclude that low rates of investment in Brazilian agriculture relative to Indiana agriculture should be attributed to relatively low rates of expected return rather than to relatively high rates of risk.

Maruyama's paper draws several macro-type conclusions about firm behavior as an LDC develops based on a set of specific assumptions.

*Summary.* The author's thesis is that economic development of agriculture can be characterized as a transformation of family farm behavior from that of a wage-earner's household to that of a capitalist firm. The change occurs because of an increasing availability of off-farm employment which permits greater choice in the family's allocation of time between leisure and work. Very purified and well-behaved theoretical conceptions of an individual producer and consumer are integrated into a behavioral unit which can be readily investigated as one changes its environment (economic setting). The family's decision setting is represented as a quasi-concave programming problem. Optimality is assured by the author's initial assumptions; the Kuhn-Tucker Lagrangian conditions are available for investigating properties of the optimal solutions.

The final paper by Eltonbary, Guoeli and Habashy is an application of a static linear programming model to a macro-allocation question.

*Summary.* The authors select an LP framework for determining the optimum allocation of land, water, and human resources in ARE agriculture under three given settings. The first involves an array of physical constraints on the three resources. The latter settings incorporate institutional as well as marketing constraints. Their findings suggest that substantial increases in net income could be attainable if it were possible to alter existing institutional and marketing conditions. The agriculture labor force is found to impose no constraint under each of the settings while irrigation water generally does during certain months.

#### **Session No. 4** **MEASURING AGRICULTURAL DEVELOPMENT\***

Kahlon, A. S. and Bal, H. K., 'Measures and Determinants of Inequality in Farm Income Distribution in Indian Agriculture.' Dr Kahlon is Dean, College of Basic Sciences and Humanities. Mrs Bal is Assistant Professor of Statistics, Department of Mathematics and Statistics. Both are at the Punjab Agricultural University, Ludhiana, India.

Price, Edwin, 'An Empirical Test of the Z-Goods Model of an Agrarian Economy.' Dr Price is an economist, Board of Governors of the Federal Reserve System, Washington, D.C.

Sethuraman, S. V., 'Mechanization, Real Wage and Technological Change in Indian Agriculture.' Dr Sethuraman is a Senior Fellow, the Food Institute, East-West Center, Honolulu, Hawaii.

Weber, Adolf, 'Expected Developments of the Power-Labor Ratio in Agriculture through Inter-country Comparison.' Dr Weber is a professor, Institut für Agrarpolitik und Marktlehre der Christian-Albrechts-Universität, Kiel, Federal Republic of Germany.

Each of the papers in this session focuses on particular aspects of the complex process of agricultural development. A common denominator is their attempt to predict, or at least anticipate, the consequences of agricultural development with emphasis on mechanization. Sethuraman looks at the effects of new technology on wage rates and mechanization; Kahlon and Bal examine income distribution over time; Weber focuses on expected power-labor ratios in agriculture; and Price analyzes substitution between goods as agriculture becomes more commercialized.

Sethuraman poses the question as to whether the green revolution and mechanization serve to expand or restrict employment opportunities. The author utilizes data from two States in India (Punjab and Haryana) to show (1) that relative factor prices have played a vital role in encouraging mechanization, and (2) how change in relative factor prices was brought about in part by technological change.

Mechanization has been more rapid in Punjab and Haryana than in India as a whole. Since 1966, the growth in the numbers of power

\* Prepared by Gerald Feaster, Economic Research Service, U.S. Department of Agriculture.

pumpsets and tractors exceeded the growth rate of population and land input. Tractors have become cheaper relative to human and animal labor. Apparently the rise in wage rate was due to the widespread use of new technology, which created significant shifts in demand for labor and other inputs in the agricultural sector. The author suggests that factors affecting the supply of labor could also contribute to wage rate variations.

Sethuraman postulates a model where the agricultural wage rate on the *demand* side is a function of the price of output, area under high yielding varieties, fertilizer consumption, aggregate demand for labor per gross irrigated area, number of working animals, land area in crops, and number of tractors.

On the *supply* side, the agricultural wage rate is posited to be a function of the non-agricultural wage rate, aggregate supply of labor, potential labor force, per capita agricultural income (and/or gross domestic product per capita in non-agricultural sector), and net out-migration of labor.

The author tested empirically the reduced form of the equation relating wage rate of agricultural labor to the exogenous variables of the model. Included in the paper are results from three regression equations whose variables explained 72 per cent or more of the variation in agricultural wage rates. On the *demand* side, area under high yielding varieties (an index of the rate of adoption of new technology) was found to be the most significant determinant of agricultural wage rates. The non-agricultural wage rate and total rural workers (proxy for potential labor force) were found to be the most significant explanatory variables on the supply side.

According to the author, the results imply that the spread of high yielding varieties and increase in non-agricultural wage rate are important causes of wage increases during the period 1965/66 to 1970/71. On the basis of the analysis, Sethuraman concludes that change in relative prices is a key determinant of farm mechanization and that new technology *per se* is not necessarily biased in factor of mechanization. According to him, the findings indicate that:

1. Much of the rise in the agricultural wage rate was due to spread of new technology and rise in the non-agricultural wage rate; and that new technology has made a significant contribution to labor productivity. This implies that new agricultural technology, while capital-using, is also highly biased in favor of labor.

2. Much of the rise in real wages necessary to induce mechanization came from technological changes within agriculture rather than 'pull' factors operating in the non-agricultural sector.

3. Technological change can affect factor markets and hence their prices, which in turn affect the factor proportions.

Sethuraman concludes that mechanization can be discouraged without impeding the spread of technology, if policies are adopted to neutralize the impact of technology on relative factor prices. He suggests that this can be done by encouraging in-migration to prevent sharp increases in wage rates; and making mechanical inputs more expensive, e.g., import duties

and excise taxes. Although new technology increases the demand for both labor and capital, it is unlikely to encourage farm mechanization when there is a pool of under-employed labor.

The Kahlon and Bal paper focuses on the distribution of farm income in India. Specifically, they address themselves to the question of whether changes resulting from the green revolution have promoted greater equality or accentuated inequality in farm income by increasing concentration in hands of farmers with large holdings. A second objective was to identify factors affecting the inequality of farm income distribution and quantify their relative contribution to inequality.

The first half of the paper gives a very detailed and mathematical treatment of the methodology and models used in the study. They specified two basic models, A and B, for the purpose of examining the relative contribution of various factors to the disparity in distribution of farm income between farm groups. Farm income was expressed as an identity in each model. Under the assumption of lognormality the variables in the model were then expressed in logarithmic form. The third step in the model formulation was to define the concentration ratio of farm income in each of the models as being equal to the sum of the concentration ratios of each of the respective terms on the right hand side of each equation.

Model A was specified to show the relative contribution of farm size and farm income per hectare on the disparity of farm income distribution between farm groups. Model B was specified to show the relative contribution of returns to total costs, fixed costs, variable costs per hectare, man-land ratio, and family size.

In their analysis the authors used data from farm management surveys in four states in India, where average size holdings ranged from 1.1 to 8.6 hectares. They found that farm income per holding increased with farm size, but income per hectare decreased with size of farm. Approximately 50 to 60 per cent of the smallest holdings comprised 20 per cent of the total cultivated area; these holdings received about 20 to 25 per cent of total farm income.

The highest disparity in farm size distribution the authors reported was 0.51 and 0.53, resulting in farm income concentration ratios of 0.43 to 0.48. They concluded that disparity in farm income distribution could be mostly attributed to disparity in farm size. The analysis showed a 10 per cent increase in farm size increased farm income from 8 to 10 per cent.

The authors used Model B to show contribution of selected factors to inequality of income distribution between farm groups. The man-land ratio accounted for 83 to 100 per cent of the inequality of farm income distribution. Next was family size which accounted for 20 to 36 per cent of the farm income inequality. Higher variable costs per hectare tended to reduce inequality in farm income, indicating that small farmers invested more per hectare and were able to increase their incomes.

The results showed that inequality in farm income distribution

generally increased from one year to the next. The major contributing factor turned out to be the returns to total cost effect. Higher fixed costs further increased income inequality; however, higher variable costs per hectare were associated with small reductions in income inequality.

Kahlon and Bal conclude that (1) size of farm contributed most towards inequality in farm income, (2) incomes of small farms increased over time. However, incomes of large farms grew at a faster rate, further increasing income disparity. This increase in disparity resulted mostly from the increase of infrastructure (fixed costs) on large farms.

Weber hopes to stimulate discussion and insight into the process of agricultural mechanization which he conceptualizes as '*tractorization*' and '*electrification*'. He hypothesizes that the amount of power used per agricultural worker, or the power-labor ratio, depends on the degree of economic development. To test this hypothesis he made comparisons of the power-labor ratio of countries in the process of agricultural mechanization.

Weber postulates that labor productivity might be expressed as a function of natural power per worker, human power per worker, animal power per worker, tractor power per worker, and electric power per worker. To make the model operational for empirical testing, Weber found it necessary to eliminate animal, human, and natural power from the model because of information voids. One of his two final equations specifies *tractor power* as a function of gross national product per capita, and the other specifies *electric power* as a function of gross national product per capita. Weber fitted the double log form of the tractorization equation for different groupings of countries. The multiple  $R^2$ s ranged from 0.49 to 0.96. A good fit was obtained when China, India, and Japan were added to the American and European countries—96 per cent of the variation was explained.

Weber also plotted ratios of the tractor horsepower per agricultural worker to help quantify and compare the different power levels among countries. He found that high-income countries normally have 0.5 to 2 tractor horsepower per agricultural worker for each \$100 of GNP per capita, while low-income countries have around 0.1 tractor horsepower per agricultural worker.

Weber points out that neglect of electricity as a power source can bias designation of an efficient mechanization policy. In the few nations with data available, he found a positive relationship between electricity consumption and GNP per capita with  $R^2$ s around 50 per cent.

Weber contends that to become a more efficient producer, every agricultural worker needs more power. And that, for large-scale tractorization, the mass of farmers must work under condition of high price of labor, a condition favorable to tractorization.

Weber concludes from his analysis that Gross National Product per capita can be considered a relatively reliable indicator to estimate the tractor horsepower requirement per agricultural worker. However,



electricity consumption probably depends on many more factors. Another important benefit from the study is that mechanical technologies can be measured with the concept of tractorization and electrification, because power is the common denominator.

Price's objective in this paper is to test the Z goods model formulated by Hymer and Resick. In this model the agrarian sector produces both F (agricultural) and Z (non-agricultural) goods. Z goods include the processing, manufacturing, construction, transportation, and service activities which satisfy the needs for food, clothing, shelter, entertainment, and ceremony. Production of Z goods is seen to limit expansion of commercial agriculture. However, as manufactured goods (M goods) substitute for Z goods, labor can be allocated for Z to F goods, some of which can in turn be traded for M goods.

Price studied village economics in Malaysia to see whether Z goods, M goods, and F goods are identifiable in an actual economy. Also to determine if observed relationships among them demonstrate the hypothesized system of trade and substitution. Specifically, he used regression analysis to test if there was a positive relationship between commercial agriculture and M goods; and an inverse relationship between commercial agriculture and Z goods. He also tested to see if labor constraints to commercial agriculture could be confirmed.

In the regression analysis, 4 labor associated measures of commercial agriculture were used as dependent variables; (1) number of households with no rubber, (2) number with some immature improved stock, (3) number with some immature and mature improved stock, and (4) number with more than 3 acres of rubber. A fifth dependent variable, number of households which often sell rubber, was included as a measure of income.

Price specified M and Z goods as independent variables in the models. Z and M goods and activities were distinguished according to their primary use and place of manufacture. M or manufactured goods included in the equations as independent variables were boat engines, shotguns, linoleum rugs, manufactured whiskey, and manufactured fishnets.

Price tested 5 regression models. Coefficients of determination ranged from 0.24 to 0.87. In most cases, the signs of the coefficients were as hypothesized. He had postulated that M goods would be positively related and Z goods negatively related to those dependent variables which represented labor-associated levels of commercial agriculture. That is, the more a village is involved in commercial agriculture, the more M (manufactured) goods residents will have and fewer Z goods, for which M goods are substituting. He hypothesized converse relationships for the non-commercialization measure. The findings from the regression analysis indicated that M goods substitute for Z goods as commercial agriculture expands.

The author had postulated that if a labor constraint existed, then M goods confirmed as inferior in an income relationship would be positively related to labor-associated measures of commercial agriculture. Price had

determined that manufactured whiskey and manufactured fishnets—both M goods—were inferior. The inferiority of these goods was confirmed, in that both were negatively related to the income measure. Also both of these goods were positively related to the labor-associated measure of agriculture, indicating labor constrains commercial agriculture. If there were no labor limitations, inferior labor-saving (M) goods would not be used as commercialization increased, i.e. they would have sufficient labor to make the superior Z goods.

### Session No. 5

#### PUBLIC INVESTMENT IN RESEARCH, EDUCATION AND TECHNOLOGY\*

1. *Costs and Returns of Vocational Agricultural Education*; B. R. Eddleman, Associate Professor, and Jose Dearing, formerly Research Assistant, Food and Resource Economics, University of Florida, U.S.A.
2. *Agricultural Research Productivity—An International Analysis*; Robert E. Evenson, Yale University, New Haven, Conn., U.S.A., and Yoav Kislev, Hebrew University, Rehovot, Israel.
3. *Unforeseen Consequences of Introducing New Technologies in Traditional Agriculture*; Peter E. Hildebrand, Visiting Professor, Food and Resource Economics, University of Florida, U.S.A., and Edgar T. Luna, Agricultural Economist, Faculty of Agriculture, University of Narino, Pasto, Colombia.
4. *Oriental-Traditional and Occidental-Modern Background and the Economic Performance of Family Farm Operators*; Ezra Sadan, Chairman, Agricultural Economics and Management Studies, Hebrew University, Rehovot, Israel.

Public investment in research and education is generally regarded as a prerequisite to sustained technical and economic development. In both lesser and more developed economies such investments have increased rapidly during the last quarter century. Yet, relatively little is known of the process by which such investments contribute to development or the magnitude and distribution of associated costs and benefits.

It is, therefore, appropriate and encouraging that four of our contributed papers focus upon such subject matter. Three of the four papers contain empirical evidence of favorable benefit-cost ratios associated with public investment in agricultural research and education. The fourth paper brings to our attention unforeseen consequences of the application of new technology emanating from agricultural research.

Evenson and Kislev, employing highly aggregated cross-section and time series data for 36 countries derive a series of regression equations relating investments in agricultural research to productivity in agriculture.

Among the observations and findings reported in the paper are the following:

\* Prepared by Kenneth R. Farrell, Deputy Administrator, Economic Research Service, U.S. Department of Agriculture, Washington, D.C.

—in 1965 close to 60,000 scientist man-years and \$1.1 billion (U.S.) were being invested in agricultural research in the world excluding the People's Republic of China. Although the less-developed nations accounted for 30 per cent of the world's agricultural output, their investments in agricultural research represented only 17 per cent of the world's total scientist man-years and 11 per cent of annual monetary expenditures. Those data probably underestimate substantially total investments in part because the authors apparently excluded investment in social science research in agriculture. In addition, data reported by the authors are country estimates of public investments only. Investments by the private sector in developed countries, particularly investments in adaptive research are large and in some countries exceed public investment. For both these reasons, the developing countries' current shares of world research investments are likely lower than indicated by Evenson and Kislev.

The author's analyses of relationships between research investment and agricultural productivity are based primarily on three sets of regression equations:

1. A Cobb-Douglas 'knowledge-production' function generated from cross-country data for 1962 in which total number of publications in agricultural sciences is treated as the dependent variable (that is, as a proxy of knowledge) and scientific man-years and number of publications in plant physiology are treated as independent, knowledge-generating variables.

2. A research allocation behavioral equation, also of the Cobb-Douglas type in which a series of variables including value of product, share of production exported and number of plant physiology publications are regressed against total number of publications in agricultural sciences. Data were again cross-section (country and crop sector) for the year 1962.

3. A Cobb-Douglas production function in which inputs per farm (land, labor, livestock, fertilizer and machinery), a variable representing level of technical education in agriculture and a research input variable defined as a stock of knowledge were regressed against value of output per farm with and without country specific and trend variables. The analysis, involving 36 countries, was an extension of earlier work by Hayami and Ruttan of the U.S.

From those equations the authors draw several conclusions:

—it is not low income that affects productivity (as measured by number of scientific publications) in applied agricultural research but the poverty or absence of general biological scientific work;

—the mean elasticity of production (value of output per farm) with respect to scientific publication (stock or accumulated sum of publications) lies between 0.04 and 0.14;

—the mean marginal benefit-cost ratio for research outlays is 2.0 (lower bound);

—from the same bundle of inputs, output (value per farm) differs widely among the 36 nations included in the study. For example, India accrued only 38 per cent of West German output and 29 per cent of the output achieved by Japan from the same set of inputs;

—the gap in productivity (value of output per farm) between the 20 'rich' and 16 'poor' countries included in the analysis has been widening over time. If the poor and low efficiency countries are to close the productivity gap, they have to institute technology and efficiency advancing policies—research, for example.

Some of the authors' production functions incorporated an education variable (number of college graduates in agricultural sciences per 10,000 in the farm labor force). Although 't' values of the education coefficient were low the association between education and productivity was positive in three of their four equations. In each case, however, the elasticity of production with respect to education was substantially lower than for other variables considered.

Eddleman and Dearing, utilizing El Salvador data for the period 1959–69, estimate costs and returns of post-high school vocational agricultural education by analysis of data pertaining to paired sets of students—those having and not having post-high school education but with similar grades and ages while in high school.

Their regression equation, linear in logarithms, posits the annual stream of personal income to students as a function of seven variables—scores on final high school examinations, age of student when entering job market, years in present employment, years of schooling completed by father, father's income at time of student's entrance into the labor market, a migration variable and a trend variable. Variables having statistically significant association with income of post-high school trained students were age (negative for program-related reasons), seniority or years in present employment (positive), father's education (positive) and the time trend variable (positive). For those not having post-high school training neither age nor seniority were statistically significant although both the father's income and education as well as time were positively and significantly associated with student's income.

Based upon these regressions, Eddleman and Dearing conclude that personal incomes of post-high school trained students might be expected to increase over time at a rate approximately 25 per cent higher than that of high school students—the independent, partial effects of three years of training in vocational agriculture beyond the high school level. The income stream of the two groups of students was then projected from age 21 to 65 years using the regression equations just described. The difference between the two streams was calculated and discounted to reflect the probability of students surviving to each age between 22 and 65 years.

Private costs of post-high school training (direct costs of training plus forgone annual income during training) and social costs

(forgone annual income during training plus per student costs of school facilities, staff and supplies) were estimated as a basis for calculating private and social rates of return to the training program. The social rate of return (interest rate at which social costs of program was equal to the discounted sum of the differences over time between the two groups of students' incomes) was estimated to range between 11.4 and 13.4 per cent: private rates of return to students graduated from the training program ranged between 16.6 and 19.2 per cent.

Professor Sadan, drawing upon 1969 and 1970 Israeli farm survey data, analyzes empirically the comparative economic performance (productivity) of farm operators having different social, educational and agricultural experiences in Israel. His hypothesis is that the quality of human resources (quality in the sense of skills and knowledge possessed by the individual to influence factor productivity) bears importantly upon agricultural productivity and development.

Employing covariance-regression techniques he develops Cobb-Douglas production functions for poultry-dairy farms and fruit crop farms with output (gross value added) of each posited as a function of farm endowment of labor, capital and irrigation water resources, a random error variable, time effects and operator's background (occidental settlers, oriental settlers and Israel-born operators of occidental descent). Israel-born operators had achieved the highest level of schooling and agricultural experience in Israel: oriental settlers ranked lowest with respect to schooling and agricultural experience.

Major conclusions reported by Sadan are:

—among farms equally endowed in terms of labor, capital and water and identically specialized the oriental settlers achieved a total factor productivity equivalent to 76 per cent of that achieved by the occidental settler and about 60 per cent of that achieved by Israel-born operators. Sadan associates these differences in performance as being strongly linked to... 'better schooling and training directed at modern agrotechnology...' on the part of the Israel-born operators relative to first generation occidental and oriental settlers.

—capital/labor ratios which were positively associated with total factor productivity were highest for Israel-born operators and lowest for oriental settlers. As a result, the marginal rate of return to labor on farms operated by oriental settlers was 69 per cent of that on farms operated by occidental settlers and about 50 per cent of that on farms of Israel-born operators. Differences among rates of return to labor among the three operator groups were roughly comparable to differences in incomes of urban employees having the same types of backgrounds.

Hildebrand and Luna describe unforeseen consequences or side effects which may flow from introduction of new technology in an agricultural economy dominated by small, subsistence-type farms. The paper draws upon results of a study conducted by the authors in a minifundio area of

southern Colombia.

A major premise of the Hildebrand-Luna paper is that '...the introduction of one or more new factors in an otherwise stable and traditional farm economy adversely influences the economic balance of other traditional factors which are not being changed'. Based on their Colombian study the authors conclude '... that serious maladjustments have been created in resource combinations (on small farms in the Department of Narino) such that some factors of production are in Stage I and others are in Stage III (of their production functions)'.

The major cause of such resource maladjustments is the introduction of incomplete 'packages' of technology thereby altering the shape and/or position on the production functions for traditional and unchanged factors. They believe such maladjustments may be unseen at the time that the new technology is introduced and may be common in all traditional economies subjected to incomplete 'packages' of new technology. Asserting that it is not possible to supply complete 'packages' (e.g. management) they conclude that maladjustments will always exist so long as traditional agriculture is subjected to the development process.

A phase of their analysis examines the economic implication of specialization compared to diversification on small farms. They conclude that specialization on farms of up to 10 hectares yielded higher net incomes than diversification: beyond 10 hectares the relationship is reversed. Their analysis, however, did not explicitly take into account risk aversion of operators.

Two principal recommendations for action and research programs are set forth: (1) consider the desirability of developing specialized rather than diversified farms. A corollary recommendation is to guarantee markets to small producers to reduce riskiness and thereby encourage specialization which in the study area would increase incomes at least on farms up to 10 hectares; (2) increased emphasis on research concerning the process of development of small farms on which new technologies are being applied to better guide the introduction of those technologies.

### **Session No. 6**

#### **AGRICULTURAL AND RURAL DEVELOPMENT\***

1. The Impact of Agricultural Migration on the Rate of Improvement in the Living Conditions of the Population, Victor Herer and Władysław Sadowski, Warszawa, Instytut Planowania, Poland.
2. An Economic Analysis of Peasant Agriculture Under Risk, Peter B. Hazell and Pasquale L. Scandizzo, Development Research Center, International Bank for Reconstruction and Development.
3. The Impact of Planning on Agricultural Development: The Case of Brazil, Marvin S. Anderson, University of Alberta, Canada.

\* Prepared by Dr Gary C. Taylor, Economic Research Service, U.S. Department of Agriculture.

4. Application of a Macro-Economic Demographic Simulation Model to Planning in Paraguay, James R. Simpson and Ray V. Billingsley, Texas A & M University, U.S.A.

The purpose of the synopsis is to (1) present a theme associating the four contributed papers, (2) expose some of the major ideas in the papers, and (3) highlight some of the issues presented or implied by these contributions.

The papers discuss important aspects of agricultural and rural development. The Herer and Sadowski paper discusses consequences of various conditions of rural to urban migration for general economic development. Hazell and Scandizzo examine peasant agriculture under risk and the consequences for economic welfare ensuing from the various perceptions of risk by the agricultural producer whether under systems of share cropping or in situations of developing agricultural markets. Anderson raises the question as to the direct impacts of various government policies on the development of agricultural production. The paper by Simpson and Billingsley discusses the use of a macro-economic simulation model to identify emerging difficulties in economic development, incorporating important variables such as technological change and population growth. The theme of the session then is agricultural and rural development.

In the first paper Herer and Sadowski from the Warsaw Planning Institute accept the proposition that migration from agriculture is an indispensable condition for better utilization of available manpower for faster growth of a national economy and for improvement of living standards. But they warn that migration is accompanied by a number of processes that counteract the acceleration of economic growth. It is necessary therefore to view the migration phenomenon in a comprehensive way and to assess rural-urban migration in terms of its impact on the whole economy.

The authors reason rigorously from a simple closed economy model with a fixed fund for investment during a period of years into the future. The objective of their analysis is 'to consider the influence of variants of migration on the total increase in consumption in the long-term period under consideration, assuming that the policy of maximization of increase in consumption is subject to the following limitations:

1. Migration cannot result in unemployment in the non-agricultural sector.

2. A decrease in labour force in agriculture cannot affect the value of the increase in final production in agriculture assumed in the long-term program.

3. An increase in consumption cannot be accompanied by a deterioration in the living conditions of the urban population.

4. Migration cannot increase the total investments which means the advantages resulting from migration do not increase profits and accumulation but raise consumption.'

They note that with migration and a fixed rate of investment in the urban sector, two opposing forces are created. Migration increases employment and production in the urban sector but reduces investment

per worker and thereby the rate of increase in productivity per worker.

Two conditions of agricultural employment are considered. First, under conditions of disguised unemployment in the agricultural sector the productivity of migrating workers is increased. However, migration increases the amount of the fixed investment fund that is needed to provide additional urban infrastructure and services, such as water and recreation, and investments for environmental protection, such as sewage treatment. Migration not only increases the need for investment to provide new jobs but it also increases the need for investments to accommodate new urban residents. These investments reduce funds available to increase the productivity of workers already employed in urban areas. They conclude, in the case of disguised unemployment, that migration can be so substantial as to eliminate all the production advantages obtained through the migration.

The authors next consider the case of full employment in agriculture. In this situation migration may increase the demand for agricultural products due to rising incomes but it may also significantly limit the potential rate of growth in agricultural production. Thus, in addition to the infrastructure and environmental investments required under conditions of disguised unemployment, in the full employment case the fund for investing will be called upon for appropriate outlays to substitute capital for labor in the agricultural sector. In this case the desirable rate of migration is much lower.

They emphasize the point that under conditions of rapid growth of the urban-industrial sector, one should carefully distinguish between two components in the statistics of increased consumption: an increase in real consumption and an increase in consumption not leading to a real increase in the quality of life. This is an important point and one which is neglected in the statistics of most countries.

The central point of the paper is that one should consider the net benefits that migration will bring to the whole economy and not only the migrant specifically. Analyses should take into account the higher social costs of maintaining the same quality of living within an urban society as compared with the rural society.

In the second paper Hazell and Scandizzo from the International Bank observe that because conventional wisdom is based largely on deterministic micro-economic theory, resulting policies may be inappropriate given the considerable risk involved in peasant agricultural production. The authors apply micro-economic models including risk in order to provide a better understanding of the implications of risk to the economic behavior of peasant farmers.

The authors reason from formal mathematical models that under conditions of risk in the peasant agriculture, the demand for factors of production is lower and that the optimal size of farms will be smaller. An analysis of the markets under conditions of risk, the first model employed is a naïve stochastic cobweb model which employs last year's price as the expected price under this year's conditions. The result is then even with the



market in equilibrium the production demands for inputs, and market prices will vary stochastically within a given range of variation.

Next the authors consider conditional expectation models where price expectations are more broadly based than simply information on last year's price. The results of these analyses are still of course stochastic but the variance in price is dampened somewhat and the behavior of product and input markets is somewhat more stable.

Consideration of the impact of risk on social product leads to the conclusion that broad-based calculations of price expectation lead to both smaller price variation and larger social gain.

In conclusion, the paper shows that the peasant farmer is quite rational in using smaller amounts of inputs and operating a smaller farm than classical analysis would suggest. At the market level, the nature of the resulting conditions of price variability, input demands and social welfare depend in large measure on the way in which price expectations are formed over time. The implications of risk certainly deserve additional attention since it is an extremely important factor in world agriculture.

The third paper by Anderson, University of Alberta, Canada, considers the important problem of how to analyze the actual impact of agricultural development programs. He employs the Timbergen framework to examine the Brazilian experience.

The central question is stated as follows: 'Is it possible to quantitatively identify the direction and magnitude of structural linkages on a regional basis within the agricultural sector given the secondary data which are currently available?' The tasks then are to identify policy objectives, to identify policy instruments and then to link them with appropriately specified models within the constraints of available or obtainable data. This is a formidable job.

Policy objectives were tentatively identified, defined, and weighted based on interviews with a wide variety of policy-makers. Policy instruments were identified through screening of government programs relevant to the central identified objective of increasing agricultural output. A number of hypotheses concerning linkages were tested for various crops important in the three major regions delineated.

It was found that significant empirical relationships could be established with respect to increased agricultural production for these variables when expressed in real terms. These were last year's price received, the 'minimum' product price announced by the government and the amount of credit made available for agricultural production by the federally controlled banking system. The second and third variables are determined directly by government policy.

The fourth paper by Simpson and Billingsley, Texas A & M University, U.S.A., takes up the question of long-range planning for economic development. They question the premise that countries with a small man/land ratio should follow a strategy of increasing the population base

in order to enlarge the size of the market thereby gaining the economies of large-scale production and distribution. The authors argue that the appropriate strategy is one which focuses on increasing the effective demand for goods and services. Thus the goal should be to increase the buying power of the population rather than simply the size of the population.

Population is an important variable in economic development and normally changes slowly over time. In order to consider the relationships of population and development the authors have developed a simple and inexpensive model for projecting to planning horizons extending beyond 20 years.

The planning strategy is to project a minimum number of key economic variables into the future and to determine if serious constraints or 'bottlenecks' are indicated under the conditions simulated. If such constraints are found, policy planning and implementation can be initiated well in advance of serious problems.

The authors indicate that their macro-economic demographic simulation model is based on the Cobb-Douglas production function and utilizes only highly aggregated data. The use of aggregated data is considered both a strength and a weakness. The strength is the ability to employ the model under conditions of limited funding, personnel and data even though a number of micro relationships must be ignored.

The model was found to be sensitive to three basic parameters. These are technological change, the marginal propensity to consume and population. In their paper they apply the model to the situation in Paraguay. The results over a 50-year projection period demonstrate striking changes in the level of economic development from minor changes in the three basic variables.

The authors believe that the situation in Paraguay is similar to that of many developing countries where present population pressure is relatively light; where one or two commodities are the major sources of foreign exchange; and where the level of technology is currently relatively low.

All three basic parameters, technological change, marginal propensity to consume, i.e. level of savings, and population are subject to change, conceptually at least, through policy initiatives of the government involved. The model presented allows a convenient procedure to determine the results from various 'what if' proposals for policy implementation.

Finally the paper demonstrates that a good estimate of effective demand can be obtained through use of the model. The rate of technological change can be estimated for current periods if the rates of population growth and marginal propensity to consume are known with some degree of certainty. In the opinion of the authors, the flexibility, low cost and simplicity of this type model recommends its use in developing countries where funds and trained people available for planning are limited.

## *Discussion Groups*

### LIST OF PARTICIPANTS

| <i>Last name</i> | <i>Initials</i> | <i>Country</i> | <i>Group</i> | <i>In Photo</i> |
|------------------|-----------------|----------------|--------------|-----------------|
| ABDELSAMIE       | H.M.            | Egypt          | 15           | *               |
| ABREV            | A.C.F.          | Brazil         | 17           |                 |
| ACKERMAN         | E.J.            | U.S.A.         | 18           | *               |
| ACKERMAN         | J.              | U.S.A.         | 18           | *               |
| AFZAL            | M.              | Pakistan       | 11           | *               |
| AGOSTINI         | D.              | Italy          | 2            |                 |
| AGRAWAL          | R.C.            | W. Germany     | 12           | *               |
| AGUIAR           | G.A.            | Brazil         | 8            |                 |
| AGUIAR           | H.              | Brazil         | 8            | *               |
| AIRES-FILHO      | G.              | Brazil         | 2            | *               |
| AKTAN            | R.              | Turkey         | 1            | *               |
| ALAMIT           | M. A.           | Brazil         | 3            |                 |
| ALCAIDE          | J. R.           | Spain          | 13           | *               |
| ALCANTARA        | R. B.           | Brazil         | 12           | *               |
| ALENCAR          | M. H.           | Brazil         | 9            |                 |
| ALFONS           | H.              | Austria        | 12           | *               |
| ALI              | R.              | Trinidad       | 12           | *               |
| ALLEGER          | D.              | U.S.A.         | 17           |                 |
| ALLEGRI          | P.              | Brazil         | 16           | *               |
| ALLEN            | G. R.           | U.K.           | 16           | *               |
| ALMEIDA          | L. L.           | Brazil         | 6            | *               |
| ALMEIDA          | M. H. B.        | Brazil         | 3            |                 |
| ALMEIDA          | P. I. R.        | Brazil         | 5            | *               |
| ALVARES-AFONSO   | F. M.           | Brazil         | 11           |                 |
| AMARAL           | C.              | Brazil         | 6            |                 |
| AMATO            | M. R.           | Brazil         | 18           | *               |
| AMERASINGHE      | N.              | Ceylon         | 11           | *               |
| ANDERSEN         | P. P.           | Colombia       | 4            | *               |
| ANDERSON         | A.              | Sweden         | 10           | *               |
| ANDERSON         | D. G.           | U.S.A.         | 18           | *               |
| ANDERSON         | M. S.           | Canada         | 5 & 14       |                 |
| ANDREAE          | B.              | W. Germany     | 6            | *               |
| ANTHONIA         | Q. B. O.        | Nigeria        | 13           | *               |
| APEDAILE         | L. P.           | Canada         | 7            | *               |
| ARAUJO           | M. O. C.        | Brazil         | 17           |                 |
| ARCUS            | P. L.           | Canada         | 13           |                 |
| ARRUDA           | M. L.           | Brazil         | 13           | *               |
| ASHTON           | J.              | U.K.           | 15           | *               |
| ASSUMPCCO        | O. A.           | Brazil         | 1            |                 |

*Discussion Groups*

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| <i>Last name</i> | <i>Initials</i> | <i>Country</i> | <i>Group</i> | <i>In Photo</i> |
|------------------|-----------------|----------------|--------------|-----------------|
| ATSU             | S. Y.           | Ghana          | 18           | *               |
| ATZ              | A. J.           | Brazil         | 18           |                 |
| AYER             | H. A.           | U.S.A.         | 9            |                 |
| AZIZ             | U. A.           | Malaysia       | 6            | *               |
| BACHMAN          | K. L.           | U.S.A.         | 3            | *               |
| BAIARDI          | A. B.           | Brazil         | 8            |                 |
| BAILEY           | C. C. R.        | U.S.A.         | 7            | *               |
| BAILLET          | C. L.           | Belgium        | 12           | *               |
| BALBO            | C. A.           | Brazil         | 11           | *               |
| BALLESTEROS      | J.              | Mexico         | 8            | *               |
| BAPTIST          | A.              | Belgium        | 11           | *               |
| BARBERO          | G.              | Italy          | 4            | *               |
| BARRERA          | I. D.           | Mexico         | 12           |                 |
| BARRICO          | J. S.           | Portugal       | 17           | *               |
| BARROS           | W. J.           | Brazil         | 3 & 16       |                 |
| BATES            | W. R.           | Australia      | 1            | *               |
| BEHRMANN         | H. T.           | South Africa   | 8            | *               |
| BENEDICTIS       | M. DE           | Italy          | 11           | *               |
| BERENGUI         | G.              | Brazil         | 5            | *               |
| BERRY            | A.              | U.S.A.         | 5            | *               |
| BESSER           | H.              | E. Germany     | 4            | *               |
| BETKOWSKI        | R. R.           | Brazil         | 3            |                 |
| BEZERRA          | E. C.           | Brazil         | 1            | *               |
| BHATTACHARJEE    | J. P.           | India          | 6            | *               |
| BIERE            | A.              | U.S.A.         | 5            | *               |
| BIRAL            | M. A. DE M.     | Brazil         | 6            |                 |
| BIROWO           | A. T.           | Indonesia      | 17           | *               |
| BOEV             | V. R.           | U.S.S.R.       | 10           |                 |
| BOKLIN           | A.              | Brazil         | 6            | *               |
| BOLLMAN          | F. H.           | Australia      | 17           |                 |
| BONFIM           | N. A.           | Brazil         | 1            |                 |
| BORDEAUX         | A. F.           | U.S.A.         | 9            | *               |
| BORROS           | A. A. A.        | Brazil         | 8            |                 |
| BORTON           | R. E.           | U.S.A.         | 8            | *               |
| BOSE             | S. R.           | Bangladesh     | 17           | *               |
| BRANDES          | W.              | W. Germany     | 11           | *               |
| BREIMYER         | H. F.           | U.S.A.         | 5            | *               |
| BRITTON          | D. K.           | U.K.           | 6            | *               |
| BRIZ             | J.              | Spain          | 14           |                 |
| BROOKS           | E. M.           | U.S.A.         | 18           | *               |
| BRUN             | ROJAS           | Paraguay       | 1            | *               |
| BUBLLOT          | G. E.           | Belgium        | 7            | *               |
| BUENO            | M.              | Spain          | 6            | *               |
| BURKES           | M.              | U.S.A.         | 1            | *               |

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|------------------|-----------------|----------------|--------------|-----------------|
| BUTLER           | C. P.           | U.S.A.         | 11           |                 |
| CAMARGO          | C. J. A.        | Brazil         | 10           |                 |
| CAMARGO          | J. E.           | Brazil         | 15           | *               |
| CANAUD           | J.              | Brazil         | 15           | *               |
| CANDIDO FERREIRA | A. O.           | Portugal       | 8            |                 |
| CAMTO            | W. L.           | Brazil         | 14           | *               |
| CAPSTICK         | C. W.           | U.K.           | 15           | *               |
| CARRICO          | J. S.           | Portugal       | 17           | *               |
| CESAR            | S. P.           | Brazil         | 2            | *               |
| CHAMI            | J. K.           | Lebanon        | 15           | *               |
| CHANG            | Y. T.           | Taiwan         | 8            | *               |
| CHAVEZ MICHUE    | C. A.           | Brazil         | 2            | *               |
| CHIES            | J. B.           | Brazil         | 17           | *               |
| CHRISTENSEN      | J.              | Denmark        | 11           | *               |
| CHRISTIANINI     | W.              | Brazil         | 1            |                 |
| CHUCHART         | C.              | Thailand       | 8            | *               |
| CIBANTOS         | J. S. C.        | Brazil         | 11           | *               |
| CINTRA           | O. L. C. F.     | Brazil         | 3            |                 |
| CLEAVE           | J. H.           | U.K.           | 7            | *               |
| CLELAND          | G. R. J.        | New Zealand    | 4            | *               |
| COIMBRA          | S. C.           | Brazil         | 10           | *               |
| CONE             | B. W.           | U.S.A.         | 4            |                 |
| COSTA            | L. J.           | Brazil         | 8            | *               |
| COSTA            | N. C.           | Brazil         | 4            |                 |
| COUTINHO SANTOS  | C. S.           | Brazil         | 8            |                 |
| COWDEN           | T. K.           | U.S.A.         | 18           | *               |
| CRACKNELL        | B. E.           | U.K.           | 9            | *               |
| CUADRA           | M. A. P.        | Mexico         | 9            | *               |
| CUNHA            | H.              | Brazil         | 3            | *               |
| CUNHA FILHO      | O. G.           | Brazil         | 13           | *               |
| CURCIO, JR       | J.              | Brazil         | 17           | *               |
| DAMS             | T. J.           | E. Germany     | 7            |                 |
| DANTAS           | W.              | Brazil         | 12           | *               |
| D'APICE          | M. L. B.        | Brazil         | 14           |                 |
| DASILVA          | J. F. G.        | Brazil         | 9            | *               |
| DASILVA          | W. R. S.        | Brazil         | 3            | *               |
| DE ANGELIS       | L.              | Italy          | 12           | *               |
| DEEN             | S. S.           | Sierra Leone   | 1            | *               |
| DE FARCY         | H.              | France         | 5            | *               |
| DE FELIPE        | I.              | Spain          | 14           |                 |
| DEGAND           | J. H.           | Belgium        | 5            | *               |
| DENSLEY          | D. R. J.        | New Guinea     | 18           | *               |
| DESAI            | B. M.           | U.S.A.         | 9            | *               |

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|------------------|-----------------|----------------|--------------|-----------------|
| DESAI            | D. K.           | India          | 1            | *               |
| DIAS             | D.              | Brazil         | 11           |                 |
| DIAS             | M. L.           | Brazil         | 9            | *               |
| DILLON           | J. L.           | Australia      | 4            | *               |
| DOBLADO          | J. M.           | Spain          | 16           | *               |
| DORNER           | P.              | U.S.A.         | 9            | *               |
| DRUMMOND         | H. E.           | U.S.A.         | 17           |                 |
| DUARTE           | F.              | Brazil         | 5            |                 |
| DUCOFF           | L. J.           | U.S.A.         | 18           | *               |
| DULLEY           | R. D.           | Brazil         | 3            |                 |
| DUNCAN           | B. H. G.        | Rhodesia       | 15           | *               |
| DUNCAN           | R. C.           | Australia      | 9            | *               |
| DUNCAN           | R. G.           | Australia      | 4            |                 |
| DUNN             | J. M.           | Scotland       | 3            |                 |
| EASTER           | K. W.           | U.S.A.         | 5            | *               |
| ECHEVERRIA       | L. C. R.        | Brazil         | 3            |                 |
| ECHEVERRIA       | T. M.           | Brazil         | 17           | *               |
| EDDLEMAN         | B. R.           | U.S.A.         | 5            | *               |
| EGBERT           | A. C.           | U.S.A.         | 7 & 8        |                 |
| ELSTRAND         | E.              | Norway         | 6            | *               |
| ENSMINGER        | D.              | U.S.A.         | 18           | *               |
| ERDMANN          | H. H.           | U.S.A.         | 16           |                 |
| EXGUEIREDO       | N. M. S.        | Brazil         | 13           |                 |
| FADEL            | G. A.           | Brazil         | 3 & 8        |                 |
| FALCAO           | M. J. M.        | Brazil         | 17           | *               |
| FARRELL          | K. R.           | U.S.A.         | 10           | *               |
| FEASTER          | F. G.           | U.S.A.         | 14           | *               |
| FEKETE           | F.              | Hungary        | 10           | *               |
| FERNANDEZ Y F.   | R.              | Mexico         | 1            | *               |
| FINNEY           | C. E.           | U.K.           | 17           |                 |
| FISHEL           | W. L.           | U.S.A.         | 4            | *               |
| FISHER           | N. E.           | Brazil         | 10           |                 |
| FLEMING          | J. A.           | Brazil         | 16           | *               |
| FONSECA          | M. O.           | Brazil         | 2            |                 |
| FRANCA           | J. P. M.        | Brazil         | 7            | *               |
| FRANK            | W.              | Belgium        | 3            | *               |
| FRANULOVIC       | R.              | Brazil         | 13           | *               |
| FREAN            | N. H.           | South Africa   | 11           | *               |
| FREITAS          | C. T.           | Brazil         | 8            | *               |
| FRIEDMANN        | S. I.           | Chile/Mexico   | 9            | *               |
| FURNISS          | I. F.           | Canada         | 9            | *               |
| GAETANI          | G.              | Italy          | 15           | *               |

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|------------------|-----------------|----------------|--------------|-----------------|
| GAGO             | P. G.           | Italy          | 8            | *               |
| GALVAO           | C. A.           | Brazil         | 17           | *               |
| GAMBOA           | J.              | Colombia       | 1            |                 |
| GAVA             | E.              | Brazil         | 10           | *               |
| GERALDO          | G. A.           | Brazil         | 8            | *               |
| GILES            | A.              | Peru           | 8            | *               |
| GILES            | A. K.           | U.K.           | 3            |                 |
| GILLIN           | E. F.           | Australia      | 1            | *               |
| GIMENES          | A. C. F.        | Brazil         | 17           | *               |
| GIRAO            | J.              | Portugal       | 10           | *               |
| GODERO           | F. P.           | Brazil         | 8            | *               |
| GOLDENBERG       | I.              | Brazil         | 13           | *               |
| GOMEZ            | J.              | Spain          | 16           | *               |
| GONCALVES        | A. S.           | Portugal       | 1            | *               |
| GOUELI           | A. A.           | Egypt          | 12           |                 |
| GROENEWALD       | J. A.           | South Africa   | 11           | *               |
| GRONBECH         | G.              | U.S.A.         | 16           | *               |
| GUBBINS          | K. E.           | U.K.           | 5            | *               |
| GUERRA           | G. S. C.        | Portugal       | 17           | *               |
| GUERREIRO        | A. D.           | Portugal       | 3            | *               |
| GUERRERO         | S. J.           | Nicaragua      | 2            | *               |
| GULBRANDSON      | O.              | Switzerland    | 15           | *               |
| GUNHA-FIHO       | O. G.           | Brazil         | 13           | *               |
| GUPTA            | R. K.           | India          | 6            | *               |
| GUSTAFSSON       | B. S. H.        | Sweden         | 12           | *               |
| HALL             | P. J.           | Australia      | 1            | *               |
| HANSEN           | D. E.           | U.S.A.         | 5            | *               |
| HAQ              | M.              | Pakistan       | 6            | *               |
| HARDAKER         | J. B.           | Australia      | 17           | *               |
| HARKINS          | J.              | U.K.           | 12           | *               |
| HARTMANN         | T. T.           | W. Germany     | 17           | *               |
| HATHAWAY         | D. E.           | U.S.A.         | 9            | *               |
| HAWKINS          | M. H.           | Canada         | 13           | *               |
| HEDLUND          | F. F.           | U.S.A.         | 14           | *               |
| HEIDHUES         | T.              | W. Germany     | 15           |                 |
| HELME            | W. H.           | U.K.           | 4            | *               |
| HENRICHSMEYER    | W.              | W. Germany     | 17           | *               |
| HERER            | V.              | Poland         | 6            |                 |
| HILDERBRAND      | P. E.           | El Salvador    | 9            | *               |
| HILDRETH         | R. J.           | U.S.A.         | 10           | *               |
| HJELM            | L.              | Sweden         | 4            | *               |
| HOFFMAN          | A. C.           | U.S.A.         | 16           | *               |
| HOFFMANN         | R. H.           | Brazil         | 9            | *               |
| HOKAS            | G. O.           | Sweden         | 9            | *               |

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| <i>Last name</i> | <i>Initials</i> | <i>Country</i> | <i>Group</i> | <i>In Photo</i> |
|------------------|-----------------|----------------|--------------|-----------------|
| HOLMSTROM        | S.              | Sweden         | 5            | *               |
| HOMMA            | A. K. O.        | Brazil         | 9            |                 |
| HOSSAIN          | H.              | Bangladesh     | 5            |                 |
| HOWELL           | J. D.           | U.S.A.         | 11           | *               |
| HUDSON           | R.              | South Africa   | 11 & 18      |                 |
| HUNT             | C. A. G.        | Australia      | 1            | *               |
| IMAT             | K. M.           | Japan          | 8            | *               |
| IMLER            | H.              | W. Germany     | 5            | *               |
| INFELD           | J. A.           | Brazil         | 12           | *               |
| INGERSENT        | K. A.           | U.K.           | 16           | *               |
| IRIAS            | L. J. M.        | Brazil         | 8            |                 |
| ISLAM            | N.              | Bangladesh     | 15           | *               |
| JACKSON          | G. H.           | Australia      | 15           | *               |
| JAKHADE          | V. M.           | India          | 1            | *               |
| JANTZEN          | J. C. B.        | Brazil         | 3            |                 |
| JARVESOO         | E.              | U.S.A.         | 6            | *               |
| JENSEN           | E.              | Denmark        | 16           | *               |
| JENSEN           | N.              | Denmark        | 16           | *               |
| JODHA            | N. S.           | India          | 1            |                 |
| JOHANNEN         | U.              | Germany        | 9            | *               |
| JOHANSSON        | I.              | Sweden         | 5            | *               |
| JOHNSON          | D. G.           | U.S.A.         | 15           | *               |
| JOHNSON          | S.              | U.S.A.         | 18           | *               |
| JONES            | J. O.           | U.K.           | 5            | *               |
| JOSI             | J. J. S.        | Brazil         | 1            |                 |
| JOSLING          | T. E.           | U.K.           | 15           | *               |
| JUNQUEIRA        | J. R. C. DE M.  | Brazil         | 6            | *               |
| JUNQUEIRA        | M. E. B.        | Brazil         | 13           | *               |
| JUNQUEIRA        | P. C.           | Brazil         | 14           | *               |
| KADDAR           | G.              | Israel         | 1            | *               |
| KADHI            | M.              | Tunisia        | 17           | *               |
| KAKLI            | M. S.           | Pakistan       | 5            | *               |
| KALIL            | M. N.           | Brazil         | 10           |                 |
| KAMALINAFAR      | A.              | Iran           | 1            |                 |
| KAMINSKY         | M.              | Chile          | 12           |                 |
| KEINE            | W.              | Austria        | 10           | *               |
| KHAN             | A. S.           | Pakistan       | 2            | *               |
| KIBLER           | W. E.           | U.S.A.         | 3            |                 |
| KIM              | H. T.           | Korea          | 9            | *               |
| KIM              | S. H.           | Korea          | 18           | *               |
| KISLEV           | Y.              | Israel         | 4            | *               |
| KLATILOVA        | F.              | Brazil         | 2            | *               |



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|------------------|-----------------|----------------|--------------|-----------------|
| KNIGHT           | P. T.           | Peru           | 9            | *               |
| KOLSHUS          | H. J.           | U.S.A.         | 5            | *               |
| KOTZE            | H. A.           | South Africa   | 9            | *               |
| KRAAL            | A.              | Holland        | 2            | *               |
| KRASOVEC         | S. I.           | Yugoslavia     | 18           | *               |
| KRESTOVSKI       | V. G.           | U.S.S.R.       | 10           | *               |
| KRISHNASWAMY     | L.              | India          | 13           | *               |
| KUDO             | T.              | Brazil         | 12           | *               |
| KULTHONGKHAM     | S.              | Thailand       | 10           | *               |
| LADOSKY          | M.              | Brazil         | 12           | *               |
| LAMBERT          | G. R.           | Australia      | 1            | *               |
| LANGFORD         | G. L.           | U.S.A.         | 14           | *               |
| LAZZARINI        | M. I.           | Brazil         | 13           | *               |
| LE ANGELIS       | L.              | Italy          | 12           | *               |
| LEITE            | G.              | Brazil         | 8            | *               |
| LEOURDES         | M. L. C. A.     | Brazil         | 13           |                 |
| LEPSCH           | S. L.           | Brazil         | 14           |                 |
| LEVI             | J. F. S.        | U.K.           | 9            | *               |
| LEWIS            | A. B.           | U.S.A.         | 4            | *               |
| LIBRERO          | A. R.           | Philippines    | 9            | *               |
| LIMA             | M. L. P.        | Brazil         | 14           |                 |
| LIMA             | V. F.           | Brazil         | 4            | *               |
| LINGARD          | J.              | U.K.           | 5            | *               |
| LINHARES         | N.              | Brazil         | 1            | *               |
| LINK             | J. E.           | U.S.A.         | 17           | *               |
| LISTER           | C. A.           | Iran           | 6            | *               |
| LITJENS          | J. T. A. B.     | Brazil         | 2            | *               |
| LOHOAR           | J. S.           | Canada         | 15           | *               |
| LOMBARDO         | H. A.           | Panama         | 7            | *               |
| LONDHE           | S. R.           | India          | 6            | *               |
| LOPES            | L. C.           | Brazil         | 2            | *               |
| LORENA           | C.              | Brazil         | 8 & 18       | * & *           |
| LOVE             | H. C.           | Canada         | 12           | *               |
| LUXTON           | H. W. B.        | U.K.           | 7            | *               |
| MACHADOFILHO     | F.              | Brazil         | 2            | *               |
| MACKENZIE        | J. W. S.        | Australia      | 10           | *               |
| MACKIE           | P. L.           | U.S.A.         | 15           | *               |
| MAC PHILLAMY     | C. H.           | Australia      | 1            |                 |
| MAGRISIO         | I. M.           | Brazil         | 3            | *               |
| MALASSIS         | L. H.           | France         | 16           | *               |
| MANDAL           | G. C.           | India          | 7            | *               |
| MANGER           | S.              | Bolivia        | 9            | *               |
| MANLEY           | W. T.           | U.S.A.         | 14           | *               |

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|------------------|-----------------|----------------|--------------|-----------------|
| MARTEN           | P. C.           | Kenya          | 1            | *               |
| MARTENS          | L. R.           | Belgium        | 12           | *               |
| MARTINEZ GARZA   | A.              | Mexico         | 12           |                 |
| MARUYAMA         | Y.              | Japan          | 12           | *               |
| MASON            | J. P.           | U.S.A.         | 15           | *               |
| MATOBA           | T.              | Japan          | 6            | *               |
| MATTHEWS         | J. L.           | U.S.A.         | 14           | *               |
| MATTHEWS         | T. H.           | U.S.A.         | 9            | *               |
| MAXON            | R. C.           | U.S.A.         | 7            | *               |
| MAYERS           | J. M.           | Barbados       | 13           |                 |
| MCFARQUHAR       | A. M. M.        | U.K.           | 15           | *               |
| MCINERNEY        | J. P.           | U.K.           | 12           | *               |
| MCINTYRE         | A. J.           | Australia      | 1            |                 |
| MENDES           | L. E.           | Brazil         | 12           |                 |
| MENDONCA         | J. O.           | Brazil         | 9            |                 |
| MENEZES          | J. A. DE S.     | Brazil         | 6            | *               |
| MENON            | A.              | India          | 5            |                 |
| MEYER            | R. L.           | U.S.A.         | 1            |                 |
| MIOTTO           | C. F.           | Brazil         | 6            | *               |
| MITRA            | A.              | India          | 15           | *               |
| MOHTASHEM-NOURI  | H. M. N.        | Iran           | 17           | *               |
| MOKHZANI         | B. A. R.        | Malaysia       | 1            |                 |
| MOLINA           | J. M. F.        | Brazil         | 6            | *               |
| MOLINA           | M. I.           | Brazil         | 18           | *               |
| MONCURE          | R. C.           | U.S.A.         | 15           | *               |
| MONTEIRO         | A. C. C.        | Brazil         | 1            |                 |
| MONTEIRO         | A. D.           | Brazil         | 8            | *               |
| MONTEIRO         | J. R.           | Brazil         | 8            |                 |
| MONTGINO         | J. R. M.        | Brazil         | 8            |                 |
| MONTIEL          | R. L.           | Paraguay       | 17           | *               |
| MOREIRA          | R. J. M.        | Brazil         | 6            | *               |
| MORGAN REES      | A. M.           | U.K.           | 4            | *               |
| MORIMOTO         | P. T.           | Brazil         | 3            |                 |
| MOUNT            | T. D.           | U.S.A.         | 9            | *               |
| MUBYARTO         | D.              | Indonesia      | 5            | *               |
| MUDAHAR          | M. S.           | U.S.A.         | 9            | *               |
| MUTHIAH          | C.              | India          | 1            | *               |
| MYERS            | J. K.           | U.S.A.         | 9            | *               |
| MYERS            | M. S.           | U.S.A.         | 15           | *               |
| NADAL            | R. D. N.        | Brazil         | 3            | *               |
| NAITO            | M.              | Japan          | 6            |                 |
| NAITO            | M. N.           | Japan          | 7            |                 |
| NAMEKATA         | Y. N.           | Brazil         | 9            | *               |
| NAPOLITAN        | L.              | U.K.           | 18           |                 |

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|------------------|-----------------|----------------|--------------|-----------------|
| NARAIN           | D.              | India          | 3            | *               |
| NAZARENKO        | V. T.           | U.S.S.R.       | 10           | *               |
| NEGRU-VODE       | A. S.           | U.S.S.R.       | 10           | *               |
| NELSON           | M.              | New Zealand    | 17           | *               |
| NELSON           | W. C.           | U.S.A.         | 5            | *               |
| NGUYO            | W.              | Kenya          | 1            | *               |
| NICHOLLS         | N. M.           | Australia      | 12           | *               |
| NICOLETI         | G. H.           | Brazil         | 13           |                 |
| NIETO-OSTOLAZA   | N. DI C.        | Spain          | 4            | *               |
| NILO             | N. A. B.        | Brazil         | 1            |                 |
| NIX              | J. S.           | U.K.           | 11           | *               |
| NOBREGA          | B. S.           | Brazil         | 13           | *               |
| NORBY            | R. R.           | Canada         | 13           | *               |
| OGDON            | M. E.           | U.S.A.         | 16           | *               |
| OHTANI           | S.              | Japan          | 6            | *               |
| OKANIOTO         | C.              | Brazil         | 1            |                 |
| OLATUNBOSUN      | D.              | Nigeria        | 9            | *               |
| OLIVEIRA         | A. G.           | Brazil         | 2            | *               |
| OLIVEIRA         | A. J.           | Brazil         | 9            |                 |
| OLIVEIRA         | J. G. DE        | Brazil         | 11           | *               |
| OLIVER           | G. D.           | Australia      | 18           | *               |
| ONG              | S. E.           | U.S.A.         | 4            | *               |
| ONODY            | O.              | Brazil         | 8            |                 |
| ONOFRIO          | P.              | Brazil         | 6            |                 |
| OOHANNEN         | V.              | Germany        | 9            |                 |
| ORTA             | C. S.           | Venezuela      | 2            | *               |
| PAARLBERG        | D.              | U.S.A.         | 16           | *               |
| PALAEIO          | G. P.           | Colombia       | 8            |                 |
| PALMA            | J. C.           | Brazil         | 13           | *               |
| PANIAGO          | E.              | Brazil         | 9            | *               |
| PARIADIREAJA     | A.              | Indonesia      | 1            |                 |
| PAUL             | A. B.           | U.S.A.         | 14           | *               |
| PEDERSON         | H. C.           | U.S.A.         | 6            | *               |
| PENNA            | J. A.           | Argentina      | 4            |                 |
| PEREIRA          | M.              | Portugal       | 8            | *               |
| PEREIRA          | S. M. P.        | Brazil         | 2            | *               |
| PERNERSTORFER    | J. P.           | Chile          | 2            |                 |
| PEROSA           | A. P.           | Brazil         | 8            | *               |
| PETIT            | M. J.           | France         | 4            | *               |
| PETRINI          | F.              | Sweden         | 7            | *               |
| PHILLIPS         | T. P.           | Canada         | 15           | *               |
| PINHEIRO         | A.              | Brazil         | 8            | *               |
| PINHEIRO         | A. C. A.        | Portugal       | 11           | *               |

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|---------------------|-----------------|----------------|--------------|-----------------|
| PIRES               | V. M.           | Brazil         | 3            |                 |
| PIVA                | L. H. O. P.     | Brazil         | 3            | *               |
| PLANTE              | J. P.           | Canada         | 9            | *               |
| PLATH               | C. V.           | U.S.A.         | 9            | *               |
| POPP                | H. W.           | Switzerland    | 18           | *               |
| PORTEOUS            | W. L.           | Canada         | 3            | *               |
| PORTER              | H. G.           | U.S.A.         | 3 & 18       |                 |
| PRICE               | E. C.           | U.S.A.         | 3            | *               |
| PUECH               | L. C. R.        | Brazil         | 17           | *               |
| RABOT               | L. G.           | Belgium        | 15           | *               |
| RACKHAM             | T. S.           | Canada         | 17           | *               |
| RAFAEL              | J. R. S.        | Brazil         | 14           |                 |
| RAJAGOPALAN         | V.              | India          | 12           | *               |
| RAMOS DE SOUZA      | H.              | Brazil         | 3            |                 |
| RAMOS               | J. A. B.        | Brazil         | 3            |                 |
| RANDALL             | A.              | U.S.A.         | 5            | *               |
| RANK                | C.              | Brazil         | 5            |                 |
| RANKINE             | L. B.           | Trinidad       | 12           | *               |
| RAO                 | V. M.           | India          | 3            | *               |
| REESER              | E. M.           | Tunisia        | 6            | *               |
| REIS                | P. R.           | Brazil         | 3            | *               |
| REISS               | F. J.           | U.S.A.         | 5            | *               |
| RELJIN              | T. S.           | Yugoslavia     | 14           |                 |
| REUTLINGER          | S.              | U.S.A.         | 4            |                 |
| RICCI               | G.              | Italy          | 3            |                 |
| RIEDER              | P.              | Switzerland    | 15           | *               |
| ROBERTSON           | C. J.           | U.K.           | 5            | *               |
| ROBINSON            | H. F.           | U.S.A.         | 15           | *               |
| ROBINSON            | R. R.           | U.S.A.         | 4            | *               |
| ROCHA               | S.              | Brazil         | 10           | *               |
| ROCHE               | J. J. DE        | Brazil         | 11           |                 |
| ROCHIN              | R. I.           | U.S.A.         | 9            | *               |
| RODRIGUES           | P. C.           | Brazil         | 3            | *               |
| ROGERS              | R. O.           | U.S.A.         | 4            | *               |
| ROLON               | V. A. R.        | Paraguay       | 13           | *               |
| ROUTA               | F. A. S.        | Brazil         | 2            |                 |
| ROZENTAL            | M. R.           | Brazil         | 15           | *               |
| RUBIENO DE P HMERDA | P.              | Brazil         | 5            |                 |
| RUTKOWSKI           | R.              | Brazil         | 2            | *               |
| RUTTAN              | V. W.           | U.S.A.         | 4            |                 |
| SALIM               | A.              | Malaysia       | 1            | *               |
| SALLES              | L. A. B. DE     | Brazil         | 8            |                 |
| SARMA               | J. S.           | India          | 3            | *               |

| <i>Last name</i> | <i>Initials</i> | <i>Country</i> | <i>Group</i> | <i>In Photo</i> |
|------------------|-----------------|----------------|--------------|-----------------|
| SANTOS           | D. B.           | Brazil         | 17           |                 |
| SANTOS           | P. R.           | Brazil         | 10           | *               |
| SARAN            | R.              | India          | 9            | *               |
| SAWADA           | S. S.           | Japan          | 4            | *               |
| SAYLOR           | R. G.           | U.S.A.         | 11           |                 |
| SCHATTAN         | S.              | Brazil         | 3            |                 |
| SCHIECK          | H.              | E. Germany     | 4            | *               |
| SCHMIDT          | S. C.           | U.S.A.         | 15           |                 |
| SCHMITT          | G.              | W. Germany     | 4            | *               |
| SCHOFIELD        | J. M.           | Australia      | 1            | *               |
| SCHWANTES        | A. S.           | U.S.A.         | 6            |                 |
| SCOBIE           | G. M.           | Colombia       | 17           | *               |
| SCULLY           | J. J.           | Ireland        | 2            | *               |
| SEBESTYEN        | F.              | Hungary        | 17           | *               |
| SEN              | S. R.           | India          | 10           | *               |
| SENA REBOUCAS    | P.              | Brazil         | 10           |                 |
| SENDA            | S.              | Japan          | 6            | *               |
| SENDIN           | P. V.           | Brazil         | 3            | *               |
| SEPEHRI          | H.              | Iran           | 17           | *               |
| SERRANO          | O.              | Brazil         | 10           |                 |
| SEVERINO         | J. S.           | Brazil         | 13           | *               |
| SEVERO           | A.              | Brazil         | 8            | *               |
| SHAH             | S. L.           | India          | 2            | *               |
| SILVA            | J. C. O. G.     | Brazil         | 13           | *               |
| SILVA            | J. L.           | Brazil         | 1            |                 |
| SILVA            | M. F.           | Brazil         | 17           |                 |
| SILVA            | Z. P. DA        | Brazil         | 1            |                 |
| SIMANTOV         | A.              | Greece         | 15           |                 |
| SIMOES           | R.              | Brazil         | 17           |                 |
| SIMON            | S. R.           | U.S.A.         | 17           | *               |
| SIMPSON          | J. R.           | U.S.A.         | 9            |                 |
| SINCLAIR         | S.              | Canada         | 5            |                 |
| SINHA            | D. P.           | India          | 10           | *               |
| SISNANDO         | P. S. L.        | Brazil         | 1            | *               |
| SLAMA            | A.              | Tunisia        | 14           | *               |
| SMITH            | C. N.           | U.S.A.         | 7            | *               |
| SMITH            | C. W.           | U.S.A.         | 15           | *               |
| SMITH            | E. D.           | U.S.A.         | 3 & 13       | *               |
| SMITH            | P. G.           | U.K.           | 7            | *               |
| SOARES           | J. A. C. B.     | Brazil         | 7            | *               |
| SOBREIRO         | J. R.           | Brazil         | 9            |                 |
| SOSA             | H. F.           | Brazil         | 9            |                 |
| SOUZA            | C. A.           | Brazil         | 11           |                 |
| SOUZA            | E. M.           | Brazil         | 10 & 11      |                 |
| SOUZA PINTO      | A. DE           | Brazil         | 8            | *               |

# Discussion Groups

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| <i>Last name</i> | <i>Initials</i> | <i>Country</i> | <i>Group</i> | <i>In Photo</i> |
|------------------|-----------------|----------------|--------------|-----------------|
| SPINDLER         | H. G.           | U.S.A.         | 14           | *               |
| STA IGLESIA      | J. C.           | Philippines    | 8            | *               |
| STEINHAUSER      | H.              | Germany        | 6            | *               |
| STELMASCHUK      | P.              | Canada         | 7            | *               |
| STEPHENS         | K. O.           | U.S.A.         | 13           |                 |
| STRACHAN         | L. W.           | Brazil         | 9            | *               |
| STREET           | P. R.           | U.K.           | 12           | *               |
| SUCKOW           | A. A.           | Brazil         | 14           |                 |
| SUMMERS          | S.              | Peru           | 5            | *               |
| SZMRECSANYI      | T.              | Brazil         | 17           | *               |
| TAL              | H. T.           | Brazil         | 14           |                 |
| TAMAKI           | T.              | Brazil         | 13           | *               |
| TANAKA           | O.              | Japan          | 10           | *               |
| TANAKA           | Y. T.           | Japan          | 2            | *               |
| TAYLOR           | G.              | U.S.A.         | 16           | *               |
| TAYLOR           | R. W.           | Brazil         | 2            | *               |
| TAYRA            | K.              | Brazil         | 8            | *               |
| TEFERTILLER      | K. R.           | U.S.A.         | 5            | *               |
| TEIXEIRA FILHO   | A. R.           | Brazil         | 4            |                 |
| TEIXEIRA         | A. J. S.        | Brazil         | 13           |                 |
| TEIXEIRA         | N. M.           | Brazil         | 12           | *               |
| TENMA            | T.              | Japan          | 6            | *               |
| TEWARI           | R. N.           | India          | 1            |                 |
| THAME            | A. C. M.        | Brazil         | 11           | *               |
| THISYA-MONDOL    | P.              | Thailand       | 1            | *               |
| THOMPSON         | R. L.           | U.S.A.         | 4            |                 |
| THOMSEN          | C. C.           | Denmark        | 6            | *               |
| TIONGSON         | F. A.           | Philippines    | 7            | *               |
| TJIKMAT          | Z. T.           | Indonesia      | 17           |                 |
| TOLLINI          | H.              | Brazil         | 9            | *               |
| TOMIC            | D. T.           | Yugoslavia     | 4            | *               |
| TOMITA           | A.              | Brazil         | 16           |                 |
| TONGPAN          | S.              | Thailand       | 14           | *               |
| TORVELA          | M.              | Finland        | 11           | *               |
| TREBECK          | D. B.           | Australia      | 13           | *               |
| TRELOGAN         | H. C.           | U.S.A.         | 14           | *               |
| TRUE             | A. W.           | U.S.A.         | 18           | *               |
| UENO             | L. H.           | Brazil         | 14           | *               |
| VALDES           | A.              | Colombia       | 4            | *               |
| VAN DEN NOORT    | P. C.           | Holland        | 15           | *               |
| VAN DER MEER     | C. L. J.        | Netherlands    | 12           | *               |
| VANORE           | O. R.           | Italy          | 2            | *               |

| <i>Last name</i> | <i>Initials</i> | <i>Country</i> | <i>Group</i> | <i>In Photo</i> |
|------------------|-----------------|----------------|--------------|-----------------|
| VAN REIMSDYK     | J. F.           | Netherlands    | 6            | *               |
| VASCONCELOS      | M. DA G.        | Brazil         | 6            | *               |
| VENEZIAN         | E. L.           | Chile          | 11           |                 |
| VERGARA          | O. V. F.        | Brazil         | 14           |                 |
| VILLELA          | F. V.           | Brazil         | 10           | *               |
| VON BLACKENBURG  | P.              | W. Germany     | 9            | *               |
| VON URFF         | W.              | W. Germany     | 17           | *               |
| WALKER           | H. V.           | Canada         | 13           | *               |
| WARE             | D. W.           | Canada         | 4            | *               |
| WARMENHOVEN      | B.              | Netherlands    | 16           | *               |
| WARREN           | F. G.           | U.S.A.         | 1            | *               |
| WEBER            | A.              | W. Germany     | 4            | *               |
| WEISS            | J.              | U.S.A.         | 14           |                 |
| WEST             | Q. M.           | U.S.A.         | 5            | *               |
| WESTERMARCK      | N. C.           | Finland        | 7            | *               |
| WHETHAM          | E. H.           | U.K.           | 8 & 9        | * & *           |
| WIENDL           | M. L.           | Brazil         | 18           | *               |
| WILGES           | I. J.           | Brazil         | 3            |                 |
| WILLETT          | J. W.           | U.S.A.         | 15           | *               |
| WILLIAMS         | T. T.           | U.S.A.         | 6            | *               |
| WISEBLAT         | A.              | U.S.A.         | 8            | *               |
| WITTENBERG       | J. I.           | U.K.           | 5            | *               |
| WOLTERS          | N. W.           | Belgium        | 5            | *               |
| WOLTERS          | S. S.           | Peru           | 5            |                 |
| WYCKOFF          | C. C.           | U.S.A.         | 5            | *               |
| WYCKOFF          | J. B.           | U.S.A.         | 5            | *               |
| YALTAMI          | G.              | Italy          | 15           | *               |
| YAMAGUISHI       | C. T.           | Brazil         | 4            | *               |
| YOKOMIZO         | C.              | Brazil         | 14           |                 |
| YOST             | L. E.           | U.S.A.         | 2            | *               |
| ZAMPAULO         | J. R.           | Brazil         | 8            | *               |
| ZAPATA           | J. P.           | Argentina      | 5            | *               |