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AGRICULTURAL DUALISM AND BRAZILIAN DEVELOPMENT

This research clearly demonstrated the disparities in agricultural growth between groups of farmers in Brazil, especially in the wheat region, and noted the broader interregional disparities which historically existed and appear to be even more accentuated in recent years. This process of growth has contributed to increased dualism in Brazilian agriculture: highly capitalized mechanized farms with low labor/land ratios, and under capitalized traditional small farms using large amounts of labor and little new technology. The dilemma appears to be the classic one of growth versus distributive equity, a theme of increasing importance in developing countries. As noted above, the policies affecting Brazilian agriculture to the greatest extent in the post World War II period are associated into two major sub-periods of development strategies in the country: the first characterized by general neglect and occasional discrimination against agriculture, especially in the 1947-61 period of intense import substitution industrialization, resulted in agricultural growth largely along the extensive margin; the second, beginning in the mid-1960's and continuing to the present, represents a period in which policies have been aimed at agricultural modernization and expanded traditional and nontraditional exports. In the first period, the objectives for agriculture were limited primarily to producing an adequate supply of reasonably priced food for urban wage earners and secondarily, generate foreign exchange to finance the importation of the industrial raw materials and capital goods. The assistance granted to agriculture consisted largely of improving extension and marketing services. Since the mid-1960's much greater emphasis has been given to modernization, and accelerating the growth of output and exportation. Emphasis on research increased in the early 1970's. Generally Brazil has been quite successful in meeting its economic objectives. In fact, the high growth rates since 1968 have caused people to speak of the "economic miracle" and make comparisons with countries like Japan. This euphoria may be a bit premature, particularly in view of current energy problems, but clearly the performance has been exceptional in the past few years, in large part due to expert decision making. The emphasis, at least in agriculture, however, has been largely on growth rather than growth with equity. Given the state of the economy when the military took power in 1964, it is easy to understand this orientation. But it is also necessary to call attention to the potential structural problems arising from this approach which may hamper future economic growth and development. The experience of other countries has demonstrated the difficulty in achieving equity, in spite of good intentions, once great inequities have arisen. Perhaps some loss in growth rate occurs when increased equity is pursued, but the results of this and other research, which suggest relatively constant returns to scale in agriculture over a wide range of output levels, imply that the losses might not be that great. If more broadly based growth is desired, the challenge to policy makers is clear and complex. It requires a fundamental rethinking of how millions of Brazilian farmers respond to policies. The tendency has been to view policy making as essentially a "top-down" activity with relatively little feedback about the dynamics of policy impacts. The observed inequalities in resource use, income and growth logically result. A growth-with-equity strategy would have to take into account the heterogeneity of farms and farmer response. Policy making would then involve identifying groups of farmers that are relatively more homogeneous and developing a specific set of policy incentives for each group. The recent efforts of the quasi-public national agricultural research institute (EMBRAPA) to develop region and crop specific technological packages is a promising attempt clearly in the right direction. The scientists and technicians of this institution are to be commended for this

initiative and their appreciation of the complexities of the agricultural development process. Another clear implication of this research is the crucial role which product and factor pricing has on the pattern of farm growth. Brazilian policy makers have consistently espoused the role of the market in allocating resources, yet continuously intervene in the market process in order to influence prices for some specific objective. Generally such intervention has been directed towards increasing the use of certain inputs, expanding output of selected products, or reducing consumer prices. The resulting distortions have helped meet the objectives, at least in the short-run, but have also contributed to resource misallocation and an unequal pattern of participation in the growth process by various groups of farmers. These inefficiencies and inequities could well frustrate future broad based rapid growth. Furthermore, the slow growth in effective demand of the marginalized segment of the rural population may frustrate the continued growth of the industrial sector. Solely removing pricing distortions, as important as that may be, may not constitute, however, the necessary and sufficient conditions for broader based agricultural development. Structural change needs to be attacked simultaneously. This research has shown how differential resource endowments and access to resources and policy incentives contributes to uneven farm growth. Land reform, credit for land purchases, effective land taxation, and improvements in the land market may be necessary to form the basis for more equitable growth where agricultural production is still largely a function of combining land with labor. More yield increasing technologies are also required so that increases in income are not restricted just to enterprise changes or mechanization. Rural education, now lamentably inadequate, must be improved and universalized so that farmers are better prepared to seek out and understand new information as well as provide a more productive source of labor when they choose urban employment. Extension workers must be provided with a larger stock of technological alternatives and must be freed of a myraid of administrative functions and a bias to concentrate their efforts on large farms. Lastly, signs are beginning to appear in Brazil that the past emphasis on the macro approach to the study of agricultural problems is waning and a new interest is emerging in the study of the microeconomics of the agricultural sector. The research reported in this volume has made a small dent in this vast uncharted field. Hopefully it will encourage some of the extremely talented young Brazilian men and women now studying at home and abroad to delve into the problems faced by farms and rural markets which have only been touched upon here. Studies related to such problems as the determinants of consumption and savings, creation of employment, returns from new technology, bottlenecks in input and product markets, impact of inflation and income distribution, exchange rate and other trade policy influences on agricultural trade, and financial market contributions to capital allocation and savings accumulation represent a few of the most crucial items in a long list of research priorities. Of immediate importance is the initiation of a nationwide system for the collection of farm level time series data absolutely essential to effective economic research. This research and the rapidly growing literature on economic and agricultural growth and development in Brazil show that the sleeping giant of the southern hemisphere awoke with a start in the latter half of the twentieth century and shows great potential for becoming a commanding influence in the economy and politics of Latin America. It holds untapped and underutilized agricultural resources that could become one of the important breadbaskets to help feed the hungry world. By achieving high growth rates for several years, it has demonstrated a capability to effectively draw some of these resources into production. But if it is to

realize its true economic potential and maintain long term high growth rates, it must begin to more effectively harness its most valuable resource, a resource largely overlooked in recent years - the growing quantity and quality of its peoples. When that occurs, we can justifiably refer to the "Brazilian Economic Miracle."

FINAL REPORT

June, 1975

**FARM GROWTH IN BRAZIL
CHAPTER THREE**

The Ohio State University Research Team

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Under Research Contract AID/csd-2501

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and

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PREFACE

In 1969 the U.S. Agency for International Development through its Technical Assistance Bureau contracted with the Research Foundation of The Ohio State University to conduct an "Analysis of Capital Formation and Technological Innovation at the Farm Level in LDC's," (hereafter referred to as the Capital Formation Project). USAID financial support covered the period July 1, 1969 through October 31, 1974.

Responsibility for the Capital Formation Project rested with the faculty of the Department of Agricultural Economics and Rural Sociology.

Norman Rask was the research team leader throughout the life of the project. Richard Meyer served in Brazil as Project Chief of Party coordinating the extensive primary data collection and preliminary analysis efforts. Upon return to Columbus, he served as a member of the research team and with Norman Rask coordinated the writing of this monograph which constitutes the final report of the project. Members of the research team, responsible for specific areas of project research included Dale Adams, David Francis, Terry Glover, Donald Larson and Inderjit Singh.

The principal project objectives were: (1) To investigate and describe capital formation and utilization at the farm level, including the impact of technological change on the need for capital and on the capital formation process, and (2) To evaluate the implications and impact of selected policies designed to stimulate capital formation. Research was initiated in Brazil and was limited to that country when conditions prevented expanding the research to India as originally planned.

The farm firm was the principal unit of analysis for the investigation and was viewed as the primary building block in the chain of production and marketing firms involved in development of the agricultural sector. The research procedure was to discover, measure and better understand the impact on farm firm decisions of major changes in government programs, world market conditions, and new technology. Such analysis required extensive farm level data and little existed in Brazil. As a result, collaborative research arrangements were established with several Brazilian institutions. The institutions were selected because of their knowledge of particular agricultural regions and expertise to assist in designing survey instruments and in collecting the data through personal interviews with farmers.

Utilization of the research results and improvement of local research capabilities were also important considerations. Thus during the course of the research, several efforts were made to communicate and interpret preliminary results for several Brazilian agencies and professionals and the local USAID Mission through seminars, meetings, and informal contacts. Furthermore, students and faculty at each of the collaborating institutions were involved in questionnaire design, sampling, interviewing, data manipulation and analysis, and in all cases a set of data was retained by the local institution as part of data banks that were being developed.

In any project of this scope many individuals play key roles and many institutions make significant contributions. We would like to mention some of those without whom the research could not have been initiated or conducted. In USAID/Washington Dr. Erven Long was an

instrumental force in the project's inception and provided counsel throughout its duration. Members of the USAID/Washington Technical Assistance Bureau who assisted were: Dr. Douglas Caton, Dr. Larry Witt, Dr. Arthur Coutu, Dr. Harold Jensen and Dr. Lehman Fletcher. In the USAID Mission to Brazil, William Ellis, Mission Director; Michael N. Galli, Deputy Chief of ARDO; William Rodgers, Chief of ARDO; Dr. Harlan Davis, Agricultural Economist; Ralph Miller, Deputy Chief USAID/PASA; Dr. Stanley Krause, Agricultural Economist; and David Cohen, Program Office; as well as several other members of ARDO and the USAID staff provided much appreciated in-country support and administrative backstopping.

The Central Bank and the Ministry of Agriculture served as official contact with the Brazilian government and provided encouragement for the initial studies. In particular Ary Burger, Director of the Central Bank provided valuable assistance. The Instituto de Estudos e Pesquisas Economicas da Universidade Federal do Rio Grande do Sul was the first institution to conduct a survey under the Project. We owe a great deal to the foresight and effort of Mauricio Filchtiner, Director and Eli de Moraes Souza, Chief of the Agricultural Economics and Rural Sociology Section, in getting that survey underway and to several other staff and students that so successfully completed subsequent surveys and analysis on the data collected in that state. Closely related to this first effort, a survey was conducted in the state of Santa Catarina in conjunction with the Instituto de Pesquisas e Estudos Economicos da Universidade Federal de Santa Catarina with Carlos Jose Gevaerd playing an important role in that work. An old friend and distinguished col-

league, Paulo F. Cidade de Araujo, was instrumental in assisting with the research that was conducted in Ribeirao Preto in the state of Sao Paulo in 1970. Several other staff members and students in the Departamento de Ciencias Sociais Aplicadas of the Escola Superior de Agricultura "Luiz de Queiroz," including Joaquim J. de Camargo Engler, who later became head of the department, were very supportive of the several economic and sociological studies conducted in Sao Paulo, and were patient and much appreciated counselors and hosts to the several OSU staff that resided in and passed through Piracicaba. The research conducted in the state of Minas Gerais owed much to Helio Tollini, then Director of the Instituto de Economia Rural, Universidade de Minas Gerais in Vicosa; H. Evan Drummond, Ph.D. student at Purdue University; and Julian H. Atkinson, Chief of Party of the Purdue-Vicosa Institution Building Project.

While analysis of the data collected in these four states moved forward, the USAID Mission contracted with Ohio State University to provide support to the newly created Escritorio de Analise Economica e Politica Agricola of the Ministry of Agriculture. The first director of that office, Francisco Vera Filho, and his successor, Alberto Veiga, along with Iby Pedroso organized a survey in the state of Ceara which collected data similar to the type collected in the four other states and made it available to the Project. Faustino de Albuquerque Sobrinho of the Universidade Federal do Ceara and Roger Fox of the University of Arizona - Ceara Institution Building Contract were instrumental in making local arrangements. The Banco do Nordeste contributed resources and staff to that survey as well.

Special appreciation is also extended to the many interviewers and drivers in each survey region that spent long, hot, dusty hours locating and interviewing farmers. The Brazilian farmers we interviewed displayed great patience and excellent cooperation by completing long interviews as accurately and thoroughly as possible. To them we extend special thanks.

The research that went into this report involved many staff and students at both OSU and several of the institutions just mentioned. The training of graduate students was an integral aspect of the Project, both in the U.S. and Brazilian Universities and will no doubt remain one of its chief benefits long after the findings of this research become outdated.

Clearly, the research findings summarized in this report emanate from a successful team effort. However, it is appropriate to recognize explicitly those individuals most directly responsible for major parts of the report.

Chapter 2	Douglas Graham
Chapter 3	Richard Meyer
Chapter 4	Norman Rask and Richard Meyer
Chapter 5	Norman Rask
Chapter 6	Terry Glover
Chapter 7	Donald Larson and Richard Meyer
Chapter 8	David Francis
Chapter 9	Donald Larson
Chapter 10	Dale Adams
Chapter 11	Inderjit Singh and Choong Yong Ahn

Chapters 1 & 12 Group Effort

In addition, significant contributions to the Project were made by several other OSU faculty members, in particular Bernard Erven, John Sitterley, Francis Walker, and Kelso Wessel. Kelso Wessel was a member of the OSU Institution Building Project at ESALQ, Piracicaba, during the initial phase of data collection in the state of Sao Paulo. He worked with Brazilian faculty and graduate students on questionnaire construction, survey design, and supervision of some of the interviewing.

Mrs. June Blind and Ms. Malinda Brenner shared most of the typing of the final version and were ably assisted by several other secretaries in the department on earlier drafts. Ms. Barbara Durman, and Mrs. Margie Butz were responsible for data organization and storage. Mark Hinnebusch did much of the computer programming during the latter part of the Project. The Statistics Laboratory helped with figures, tables and overload typing, while Ms. Marilyn Chute served as a most capable administrative assistant throughout the life of the Project.

While more than forty graduate students have assisted with the processing and analysis of data and many have used portions of the data for their own M.S. theses and Ph.D. dissertations, 9 individuals who were then Ph.D. candidates, deserve special recognition for contributions to the overall Project: John Stitzlein, William Nelson, Gerald Nehman, Hagop Kayayan and Solon Guerrero each spent a year or more in Brazil assisting with data collection and processing; Roger Baur and Choong Yong Ahn assisted with data processing and analysis in Columbus. Joaquim J. de Camargo Engler and Iby Pedroso worked with their respective institutions in data collection and used part of the data for their dissertations.

We would also like to express appreciation to G. Edward Schuh and Pan A. Yotopoulos for highly useful detailed comments each made on an earlier draft of this report. J. K. McDermott also contributed a helpful reaction as did several people in Brazil during a round of seminars conducted in October, 1974. Of course, the authors assume sole responsibility for the contents. The views and opinions expressed do not necessarily represent the views of any persons or institutions in Brazil or the U.S. that collaborated with the Project.

David Boyne
Project Supervisor

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CHAPTER 3

AGRICULTURAL POLICIES AND GROWTH, 1947-1974

INTRODUCTION

The previous chapter documented the political environment, economic growth strategies, and growth and development of the Brazilian economy during the post World War II period. This chapter reviews the growth and development of the agricultural sector during this same time period, outlines the overall policy treatment of the sector, and describes the evolution of key agricultural policy instruments. Specific policies were selected for detailed treatment because of their potential impact on farm level growth as specified in Chapter 1, their importance in Brazil in terms of resources employed in implementation and probable effect on the sector, and the extent to which they can be generalized to other developing countries. The chapter ends with an identification of key agricultural policy issues for detailed study to improve our understanding of farm level growth processes and capital formation of agriculture in Brazil, specifically, and developing countries generally.

Several points will be addressed in this chapter concerning key features of the Brazilian agricultural growth process and policy instruments employed. They include the following:

1. The agricultural sector has experienced a systematic pattern of discrimination as part of the Brazilian strategy to transfer resources to the rapidly expanding industrial sector. In spite of this treatment,

agriculture has grown at a rate roughly equal to domestic demand with some surplus left over for export. Intersectoral income differentials, however, have widened.

2. Most of the output expansion has occurred through increased use of land and labor. Yields have grown slowly and are low for many crops compared to several other major producing countries.

3. Until recent years, the country has underinvested in research, extension, and rural education. Structural reform has lagged compared to frequent intervention in the market undertaken largely with a view to aiding consumers rather than producers. The broad objectives of policies have remained stable but frequent short-run adjustments have been made in specific instruments.

4. The state of Sao Paulo stands out as an important exception in terms of contribution to total agricultural output, output expansion, yields, and investments in agricultural research and extension.

5. Agricultural policies have frequently benefited certain commodities (wheat, coffee, sugar cane), regions (South, Center West), and groups of farmers (large, monetized, commercial), more than others contributing to widening intra-sectoral and inter-regional income levels and growth rates of income.

AGRICULTURAL DEVELOPMENT STRATEGY

As a general overview, Brazilian agriculture has gone through two distinct phases in the post war period: the first characterized by general neglect and occasional discrimination, especially during the 1947-1961 period of intense import substitution industrialization, resulting in growth largely along the extensive margin, and the second beginning

in the mid-1960's and continuing to the present in which policies have aimed at agricultural modernization and expanded exports. Specific policy changes were frequently implemented in response to short-run needs within these two phases. These changes occurred so frequently and irregularly that they introduced considerable uncertainty into the economic environment faced by farmers.

The objectives for agriculture in the first period were primarily to produce an adequate supply of reasonably priced food for urban wage earners and secondarily, generate foreign exchange to finance the importation of industrial raw materials and capital goods. Agriculture was not considered a vital growth sector, but rather a reservoir for surplus labor not absorbed by rapid industrialization. This rationale was derived from an assumed lack of growth potential due to the low income elasticity of demand for most agricultural products, both in domestic and foreign markets, and an assumed continual shift in terms of trade toward industry. Policy makers may have also been influenced by a belief that industrialization was the quickest strategy to gain increased international stature for Brazil as well as the most promising avenue to exploit externalities for economic growth. Given the relative size of the economic sectors, only the agricultural sector was large enough to provide the resources required for accelerated industrialization. Incomplete knowledge about agriculture and limited public sector capability to develop and implement development policies and programs undoubtedly had a bearing as well. At certain times there existed doubts about agricultural response to policies even if they could be implemented. As will be made clear later, the efforts to discriminate against agriculture were not always completely successful and at times the terms of trade caused income flows from the non-agricultural

to the agricultural sectors.

In the 1950's and early 1960's, agriculture continued its historic trend of expanding output by pushing out the agricultural frontier. Compared to the wide range of policy instruments applied to industry, relatively few measures were taken for agriculture. Public sector investments in roads, transportation, communications and markets, and increased supplies of agricultural credit facilitated frontier expansion. Low rates of labor absorption in industry and internal migration provided the labor supply to open up and cultivate new land. Minimum product prices had little effect on output and the cheap food policy failed to prevent occasional shifts in terms of trade toward agriculture. Preferential treatment for importation of agricultural inputs offset some of the discrimination against agricultural exports caused by overvalued exchange rates, but these benefits were not realized equally by all farmers and agricultural regions.

The populist period of 1961 to 1964 was a watershed of sorts for agricultural policies. The structuralist argument for reform of a traditional inefficient agriculture reached its zenith when food supplies were low and the rise in food prices outstripped increases in minimum wages under accelerating inflation.^{1/} The political instability of the period carried over into frequent short-term policy adjustments to increase food supplies and calm urban unrest but with little impact on long-term agricultural growth. Little reform was actually accomplished,

^{1/} President Goulart had the noted economist Celso Furtado draw up a three year plan for economic and social development for the 1963-1965 period which contained provisions for agrarian reform to remove the agricultural bottleneck. See [61].

and the most lasting developments resulted from a spin off and extension of the import substitution program. First, domestic tractor production began based on the supply industries created for automobile manufacturing, and secondly the import substitution model was extended to domestic wheat production.

The military governments after 1964 brought a completely different perspective for the economy and for agriculture. The relative backwardness of agriculture was acknowledged, but the causes and cures were perceived quite differently. Farmers were believed to be price responsive^{2/} and the distortions and disincentives created in the past few years needed to be removed as part of the general strategy of restoring the price system and markets to their role in the allocation of resources. Modernization of agriculture was emphasized and the creation of the National Monetary Council, Central Bank and special agricultural development funds provided the resources and institutional means to control the growth of agricultural credit. Large quantities of subsidized credit were tied to the purchase of "modern" inputs such as improved seed, fertilizers, chemicals and machinery. Production of certain crops was encouraged by low interest loans for operating costs and investment expenditures. The minimum price program was expanded but the prices were always set with an eye to control of inflation. Tax credits increased the flow of resources into reforestation and regional investment programs, but the tax reforms did not substantially increase agricultural taxation nor

^{2/} Delfim Netto, who later became Minister of Finance, attempted to test price responsiveness in 1965 [13]. A more comprehensive test was made in 1968 by Pastore [46].

promote agricultural output and intensify resource use.

While many of these policies were initiated in the mid-1960's, their effect was not felt until after 1967. Recovery from the economic slump and the emerging export drive gave new impetus to agriculture as policy makers began to perceive a more expansive role for agriculture. The export program depended on expanding exports of both traditional and new agricultural commodities, and providing cheap industrial raw materials for firms exporting semi-processed agricultural products. Increasing quantities of agricultural credit were provided to finance agricultural production and marketing, and interest rates and loan repayment terms were frequently juggled to speed the adoption of modern inputs and stimulate exports. Export prices were made more attractive by frequent mini-devaluations which kept the cruzeiro more in line with foreign currencies. Tax reductions and rebates made exporting even more profitable. Agricultural research and advanced training of researchers received more attention as the development and adaptation of technology became important in the face of stagnant yields.

In summary, the 1947-1963 period featured continual expansion of the agricultural frontier. While this source of growth was still extremely important in the later 1964-1974 period and measures continued to be employed to facilitate such expansion, much greater emphasis was given to modernization. During this last decade, the government carefully expanded its intervention into agriculture. The market was espoused as the means to regulate production and resource use, yet by the 1970's the government had the policy measures, and frequently used them, to intervene in most markets. With respect to the factors influencing

micro level growth, as outlined in Chapter 1, governmental policies directly affected product and input prices, the supply and allocation of credit, agricultural taxation, and the price of import and export goods, and through the industrial sector indirectly affected the structure and efficiency of input and product markets, the supply and price of domestically produced agricultural inputs, and the alternatives for and returns from off-farm employment and investments. The impact of these policies is conditioned by farmer response but the role of the state had become so pervasive that it was no longer easy to understand and predict the impact of the change in any one policy on micro level growth. But it was obvious that the more commercialized the individual farm-household, the more its behavior was going to be influenced by sometimes complementary, sometimes conflicting public policies. Furthermore, although there is some uniqueness in the Brazilian case especially considering the size of the domestic market and the country's ability to mobilize domestic and foreign resources, these same policies are frequently used in various combinations in other developing countries. Therefore improved understanding of this case will improve our knowledge of the micro growth process generally. The following section reviews the key features of agricultural growth in the post World War II period.

KEY FEATURES OF AGRICULTURAL GROWTH

In spite of discriminatory treatment, the agricultural growth rate has been quite respectable compared to many other developing countries. Over the entire period from 1947 to 1965, agricultural output grew at a compound annual rate of 4.6 percent [23, p. 12]. Growth rates fell off

in 1966-67 with the general slump in the economy, then recovered and shot up to the 9 to 10 percent range in 1970 and 1971, followed by a return to the long term trend of 4 to 5 percent in 1972 and 1973. Lower rates these last two years were due to the disastrous wheat harvest in 1972 and declines in coffee and cocoa. A recovery in coffee in 1974 and larger crops of soybeans, sugar, and cocoa could bring the growth rate closer to the 7 percent level targeted for agriculture in order to attain overall economic growth rates of 9 to 10 percent [21].

Wide differences in regional growth rates, however, have characterized much of Brazil's history.^{3/} Table 3-1 gives the growth rate by region for 34 agricultural products accounting for 99 percent of agricultural output.^{4/} The South and Central-West have been the most dynamic regions and during the 1947-56 sub-period the difference in growth rates between these two regions and the North, Northeast and East was even greater. In spite of unfavorable production conditions and periodic droughts, the Northeast grew at a rate slightly above the national average over the en-

^{3/} Except where specifically noted otherwise, the regional categories include the following states and territories: North--Rondonia, Acre, Amazonas, Roraima, Para, Amapa; Northeast--Maranhao, Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas; East--Sergipe, Bahia, Minas Gerais, Espirito Santo, Rio de Janeiro, Guanabara; South--Sao Paulo, Parana, Santa Catarina, Rio Grande do Sul; Central West--Mato Grosso, Goias, Federal District.

^{4/} Patrick [47] conducted a similar analysis for the crop sector during the 1948 to 1969 period and arrived at a similar ranking of regions by growth rate, although his estimates were consistently somewhat lower due to the effect of coffee, which declined in absolute terms in the 1960's largely as a result of the eradication, and the omission of livestock and livestock products.

tire period. Considerable variation was also found among states. The historic trend in expansion of the agricultural frontier continued as output in the frontier states of Parana, Mato Grosso, Goias, and Maranhao

TABLE 3-1
Regional Growth Rates and Share of Agricultural Output
1947-65

Region	Growth Rate 1947-65 (Percent)	Distribution of Production	
		1947-49	1963-65
North	3.8	2	2
Northeast	4.7	15	16
East	3.2	31	24
South	4.8	48	50
Central-West	8.4	4	8
Brazil	4.6	100	100

Source: [23]

grew more rapidly than older settled areas. The state of Sao Paulo has been the most important single agricultural state although its proportion of total agricultural production fell from about 35 percent in the late 1940's to about 25 percent in the late 1960's [28].

Increases in farm numbers and cultivated area represent two dimensions of frontier expansion and agricultural intensification. Farm numbers grew at a rapid rate exceeding 60 percent in the decade of the 1950's. This

rapid growth was followed by another increase of almost 50 percent in the 1960's. Thus in a period of just two decades, farm numbers grew from just over two million to almost five million units (Table 3-2).

Once again the Central-West was the most dynamic region: farm numbers doubled in the first decade, and in the second decade increased by more than 50 percent while cultivated area more than doubled. The North was the second most rapidly growing region in both dimensions followed by the Northeast which had the largest absolute increase in farm numbers. The South, which is the largest region in terms of farm numbers and cultivated area and has the most intensive modern agriculture, expanded at roughly average levels but the increase represented an additional 5 million hectares of cultivated land from 1960 to 1970. Farm numbers increased in the East but there was only a six percent increase in cultivated area in the 1960's. The coffee eradication program undoubtedly affected this result.

Wide differences are also found among states in the growth of farm numbers and cultivated area (Appendix Table 3-1). Two recently settled states, Parana and Mato Grosso, expanded farm numbers considerably faster than their respective regional averages and by 1970 Parana had more farms and cultivated land than any other state. Rio Grande do Sul has small farms and increased farm numbers by only 35 percent in the 1960's, but intensified agriculture by increasing cultivated area 65 percent, largely due to wheat and soybean production. Sao Paulo experienced little change in farm numbers or cultivated area in the 1960's.

The 1970 census data is not yet available on distribution of land by farm size categories. In spite of legislation on agrarian reform and

TABLE 3-2

Number of Farms (1950-1970) and Cultivated Area^a (1960-1970) by Region

Region	Number of Farms			Percent Increase		Cultivated Area (Hectares)		Percent Increase
	1950	1960	1970	1950/60	1960/70	1960	1970	1960/70
North	78,227	138,241	261,692	76.7	89.3	201,706	322,928	60
Northeast	543,698	961,627	1,573,086	76.9	63.6	5,095,928	7,264,808	43
East	660,732	953,520	1,243,044	44.3	30.4	6,334,856	6,736,503	6
South	702,234	1,124,989	1,602,284	60.2	42.4	12,159,083	17,133,532	41
Central-West	79,751	159,392	253,261	99.9	58.9	1,230,823	2,582,329	110
Brazil	2,064,642	3,337,769	4,933,367	61.7	47.8	25,022,396	34,040,100	36

Source: 1950 data [57, p. 155]
1960/70 data [20, p. 21]

a/ Includes 15 of the most important crops: cotton, peanuts, rice, bananas, potatoes, cocoa, coffee, sugarcane, beans, tobacco, oranges, mandioc, corn, soybeans and wheat.

taxation of agricultural land to control subdivisions of small farms and encourage breaking up large units of under-utilized land, the pattern of highly skewed distribution of land is likely to have continued this past decade. In Table 3-3, census data show that the proportion of farms under 10 hectares grew by 10 percent from 1950 to 1960, representing a doubling in numbers from 711,000 to 1.5 million farms. These farms constituted about 45 percent of total farm numbers in 1960 yet held only 2 percent of the land area compared to the farms of 1,000 hectares or more which accounted for 1 percent of the farms and almost half the area. Of course, the varying quality of land and especially the large amount of poor land on many large farms is not considered in this type of data. Data for 1967 are from declarations used for tax purposes and refer to properties rather than landholdings but the concentration of ownership is equally clear. The CIDA study [9] went one step further in using the 1960 census data by relating employment potential to farm size. The results showed that 32 percent of the farms with 1 percent of the total area were minifundio that were too small to provide full-time employment year round for two people. Farms classified as latifundio which could employ more than 12 persons year round represented 3 percent of the area and 53 percent of the land. Family size farms made up the remainder.

When the growth in agricultural output in the 1947-65 period is examined by commodity, it was found that several traditionally important crops had lower than average growth rates. This was true for coffee, corn, cotton, beans, mandioca, potatoes and cocoa. Rice, sugar cane and bananas, however, grew at rates exceeding 5 percent. On the other hand, crops of lesser importance like peanuts, soybeans, tomatoes, sisal and jute grew

TABLE 3-3

Percent Distribution of Land by Farm Sizes
1950, 1960, 1967

Size in Hectares	1950		1960		Size	1967	
	Farms	Area	Farms	Area		Farms	Area
Under 10	34.4	1.3	44.8	2.2	10 and Under	35.9	1.8
10- 100	50.9	15.3	44.6	18.0	11 - 100	51.6	18.6
100-1,000	13.0	32.5	9.4	32.5	101 - 1,000	11.2	34.5
1,000-10,000	1.5	31.5	.9	27.4	1,001 - 10,000	1.2	31.7
Over 10,000	.1	19.4	.1	19.9	Over 10,000	.1	13.4
Unclassified	---	---	.2	---	---	---	---

Source: 1950 and 1960 data [57, p. 140, original data from Census],
1967 data [27, p. 40].

at rates in excess of 10 percent [23, p. 17]. Livestock growth rates were superior to crops during the first half of the period but fell in the second half. Livestock products generally grew faster than meats, while rapid expansion in poultry offset the slower growth of beef, which constitutes two-thirds of the meat category.

Two of the fastest growing crops in the latter part of the 1960's were soybeans and wheat. From 1965 to 1971, soybean output increased from just over 500,000 to 2,200,000 metric tons [9], while wheat production rose from 250,000 to over 2,000,000 metric tons [17]. In both cases, approximately 70 percent of the area and production has been located in the state of Rio Grande do Sul.

The overall conclusion which emerges from these data is that Southern

Brazil, the most important agricultural region in the 1900's, has continued to grow and even increase its share of total output. Historically the state of Sao Paulo has been the single most important state in terms of agricultural production. The Central-West has had the fastest growth since World War II but started with the smallest base. Logically many of the crops that expanded the most rapidly are concentrated in these two regions. The basic structure of highly skewed land distribution appears unchanged.

Another feature of Brazilian agriculture has been the relatively low yields and slow yield increases for many crops compared to other producing countries, with the notable exception of the state of Sao Paulo [26, pp. 56-59]. Over 90 percent of the growth in output of 23 principal crops between 1948/50 and 1967/69 was attributed to expansion in area and 20 percent due to yield increases, while a 12 percent decrease was attributed to changes in location and crop mix [47, p. 8]. The South led the way in yield increases estimated at 40 percent while the state of Sao Paulo was clearly ahead of all other states with a 91 percent yield increase. In the livestock sector, the productivity of meat production declined, while the productivity of livestock products like milk, eggs, and wool increased faster than crops [23].

Some of the interregional yield differences can be attributed to differences in input use. A concerted effort has been made in Sao Paulo and more recently at the national level to modernize agriculture through investments in research and by encouraging greater use of improved seeds, fertilizers, chemicals, and mechanization. From 1950 to 1970 tractor

numbers rose from 8,300 to almost 157,000 (Table 3-4). Mechanization in the 1950's was entirely attributed to tractor imports, while most tractors purchased in the 1960's were domestically manufactured. There were relatively large increases in all regions, but the South increased its share of the total from 76 to 80 percent. Since the rate of expansion in farm numbers and cultivated area was less than in other regions, by 1970 there were 13 farms and 136 cultivated hectares per tractor in the South. Comparing selected states (Appendix Table 3-2), by 1970 there were 5 farms and 78 cultivated hectares per tractor in Sao Paulo. Rio Grande do Sul ranked second with 13 farms and 138 cultivated hectares per tractor.

The use of chemical fertilizers gradually increased from about 100,000 metric tons of nutrients in 1950 to 300,000 tons in the mid 1960's. Then several policies described below were employed to increase domestic production and wider usage of fertilizers. By 1971, 1.1 million metric tons were being used [8, p. 20]. In several years sixty percent or more of the fertilizer was used in the state of Sao Paulo alone. Recently that proportion has fallen to just under 50 percent while the proportion used in the states of Rio Grande do Sul and Santa Catarina has risen to about 25 percent [59]. This expansion in fertilizer use has had two results. Some additional crops, especially wheat and soybeans, are now being fertilized in addition to the traditional export crops of coffee, cotton, and sugarcane. Secondly, more smaller and medium sized farms have begun to use fertilizer.

The use of insecticides and other agricultural chemicals represents a third dimension of modernization. From 1960 to 1965, annual chemical use ranged from \$U.S. 13 million to 18 million. By 1971 it had increased

TABLE 3-4

Total Number of Tractors, Farms Per Tractor (1950-1970) and Area Cultivated Per Tractor ^{a/}
(1960-1970) by Region

Region	Number of Tractors			Farms Per Tractor			Cultivated Area Per Tractor (hectares)	
	1950	1960	1970	1950	1960	1970	1960	1970
North	61	430	1,013	1,292	321	258	449	319
Northeast	324	2,456	4,293	1,678	392	356	2,075	1,692
East	1,463	7,633	15,573	452	125	80	830	433
South	6,385	48,632	126,264	110	23	13	250	136
Central-West	139	2,194	9,449	574	73	27	561	273
Brazil	8,372	61,345	156,592	247	54	31	409	217

Sources: 1950 data [57, p. 155]
1960/70 data [20 , p. 21]

^{a/} Includes 15 of the most important crops: cotton, peanuts, rice, bananas, potatoes, coconuts, coffee, sugarcane, beans, tobacco, oranges, mandioc, corn, soybeans and wheat.

to almost \$U.S. 50 million. Over 90 percent, however, was used in central and southern Brazil [59]. Thus, usage of all three types of modern inputs—machinery, fertilizer, agricultural chemicals—has rapidly expanded only in recent years and a large proportion of total usage has been concentrated in the South and particularly the state of Sao Paulo. This helps explain why aggregate data do not show much yield increase. Furthermore, the analysis of fertilizer in Chapter 7 suggests that the yield effect may not yet be that great even in Sao Paulo.

Another aspect of the structural transformation of agriculture has been the change in employment. From 1960 to 1970 the number of people employed in agriculture rose by 17 percent from 15.6 million to 18.2 million (Table 3-5). The fastest growth occurred in the North and Central-West while the East increased only 6 percent. These increases when related to cultivated land show an increase from 1.6 to almost 1.9 hectares cultivated per person. The South is the most mechanized region and had almost 3 hectares of cultivated land per person while the Central-West followed closely behind. Within the South, by 1970 the state of Rio Grande do Sul had 3.6 cultivated hectares per person (Appendix Table 3-3). The state of Sao Paulo had the distinction of being the first major state to experience an absolute decline in the number of persons employed in agriculture. By 1970, 200,000 fewer people were occupied in agriculture than in 1960, a decline of 12 percent.

The policy shift toward expanded exports plus fortuitous international price increases in the 1970's almost doubled the total value of agricultural exports from the average annual level of about \$U.S. 1.2 billion in the 1966/70 period to \$2.2 billion in 1972 and contributed to

TABLE 3-5

Population Occupied in Agriculture and Cultivated Hectares^{a/} Per Person by Region,
1960-1970

Region	Population Occupied in Agriculture			Hectares Cultivated Per Person		
	1960	1970	Percent Change	1960	1970	Percent Change
North	544,028	982,225	81	.37	.33	-10
Northeast	4,590,317	5,352,898	17	1.11	1.36	23
East	4,889,879	5,187,459	6	1.30	1.30	0
South	4,921,341	5,769,579	17	2.47	2.97	20
Central-West	688,420	957,108	39	1.80	2.70	50
Brazil	15,633,985	18,249,269	17	1.60	1.86	16

Sources: [20]

^{a/} Includes 15 of the most important crops: cotton, peanuts, rice bananas, potatoes, cocoa, coffee, sugarcane, beans, tobacco, oranges, mandioc, corn, soybeans and wheat.

Brazil achieving \$4 billion in total exports in that year (Table 3-6). Increased exports of sugar, meat, and soybean products have reduced reliance on traditional exports of coffee, cotton and cocoa in recent years. Brazilian policy makers concluded that growth in agricultural exports actually became too rapid in 1973, and export controls were tightened to increase domestic supplies and reduce inflationary pressures.

Relative price changes are another feature of recent growth and are important in understanding the effect of policies on prices. The effort to tax agriculture for industrial growth did not consistently result in income transfers from agriculture however. Kahil related contribution to real domestic product with income share, and concluded the income received by agriculture plus the differences in rates of effective taxation resulted in a redistribution from agriculture to urban sectors from the end of World War II to the early 1950's [29, p. 138]. The relationship reversed, however, in favor of agriculture from 1955 to 1962, the last year analyzed. Using the cost of living index in Guanabara, the city-state for Rio de Janeiro, Herrmann showed that the ratio of food prices to all consumer prices rose steadily from 1947 to a peak in 1962, dropped slightly in 1963, rose again in 1964, then began a steady decline [23, p. 50]. It is not clear how producers may have benefited from this increase. The index of producer prices rose less rapidly than either retail or wholesale prices suggesting that middlemen and traders may have captured the gains. Kahil argues that these profits in fact were probably achieved by people in a position to create artificial shortages whenever they expected an increase in urban wages controlled by minimum wage legislation [29, p. 144]. These interpretations ignore the effect of additional services the market-

TABLE 3-6

Brazilian Exports: Total and Principal Agricultural Products
1946-1972

Period	Total Value of Exports (FOB-U.S. \$ Millions)	Proportion of Total Exports						Total
		Coffee	Cotton	Cocoa	Sugar	Meat	Soybeans and Products	
1946/50	1,141.9	48	12	5	1			66
1951/55	1,542.1	65	9	5	1			80
1956/60	1,333.4	60	4	5	3			72
1961/65	1,409.9	51	8	2	4	1 ^b		66
1966/70	2,065.4	40	7	3	5	2	2	59
1971	2,881.6	28	5	2	5	5	4	49
1972	3,987.0	26	5	2	11	5	7	56

Sources: 1946/50 to 1961/65 [67].

1966/70 to 1972 Central Bank Reports.

ing sector added to the food which may have offset much of the higher prices.

A third study dealt with another aspect of agriculture's terms of trade by comparing the prices paid and received by farmers, from 1966 to 1972 [7]. With few exceptions, it showed a steady shift in favor of farmers over the period in all eight states studied. The increase ranged from a low of 18 percent in the state of Sao Paulo to 64 percent in Parana. In the absence of any marked changes in taxation, this analysis suggests that the profitability of agriculture increased. As further evidence, the general price index rose from 99.7 to 394 in the last half of 1973 but the index of prices received by farmers rose from 100 to 545 and the sale price of farm land rose from 95 to 580.^{5/}

As noted in Chapter 2, an area where inter-sectoral differences have been most marked is that of income differentials and their changes over time, and here the neglect of the agricultural sector is clearly manifest.^{6/} Langoni estimated monthly income per worker in agriculture at CR\$121 in 1960 (Table 3-7). The low was CR\$84 in the Northeast while the high of CR\$177 in the South was more than double the Northeast average. In the same year, average urban worker income of CR\$263 was more than double the agricultural level. The lowest estimate of CR\$158 in the Northeast was a bit less than the highest agricultural income in the South, while the highest urban income of CR\$348 was found in Rio de Janeiro and Guanabara.

During the 1960's the gap between agricultural and urban income sharply

^{5/} Data taken from *Conjuntura Economica*, Vol. 28, No. 6 (Junho, 1974).

^{6/} For examples of income distribution studies for the decade of the sixties, see [18, 24, 34].

TABLE 3-7

Income Changes and Concentration, 1960/1970^{a/}

Region	Gini Index of Income Concentration			Monthly Income Per Worker (1970CR\$)								
	1960	1970	Percent Change	Total			Agriculture			Urban		
				1960	1970	Percent Change	1960	1970	Percent Change	1960	1970	Percent Change
Brazil	.50	.57	+13.7	206	282	+36.9	121	138	+14.2	263	378	+43.4
North and Central West	.44	.49	+10.1	216	238	+10.2	164	160	- 2.5	260	323	+24.0
Northeast ^{b/}	.49	.56	+13.7	117	157	+34.2	84	94	+11.5	158	248	+56.3
MG & ES ^{c/}	.53	.55	+ 4.1	169	205	+21.3	107	131	+22.9	225	272	+20.9
South (minus SP)	.40	.50	+23.4	228	271	+18.9	177	186	+5.0	262	342	+30.7
Sao Paulo	.44	.54	+24.4	283	426	+50.5	156	202	+30.1	316	478	+51.6
Rio-GB ^{d/}	.45	.53	+16.7	334	448	+34.1	137	167	+22.4	348	474	+36.2

^{a/} Values taken from original source were rounded so percentages appear to be in error.

^{b/} Plus Sergipe and Bahia

^{c/} Minas Gerais and Espirito Santo

^{d/} Rio de Janeiro and Guanabara

SOURCE: [34, p. 172].

increased even though agricultural income rose in all regions except the North and Central West. Average agricultural incomes rose 14.2 percent to CR\$138, but urban incomes rose 43.4 percent to CR\$378. Thus average urban incomes rose from 2.2 to 2.7 times agricultural income. The sharpest differential increase occurred in the Northeast where urban incomes rose from 1.9 to 2.6 times agricultural income. Sao Paulo agricultural incomes increased by 30 percent to CR\$202 making it the highest income region for agricultural workers, but urban incomes rose by more than 50 percent so the income differential increased.

Langoni further observed that the concentration of income within agriculture was less in the less developed regions where traditional technologies are employed and inequality is largely a function of distribution of land. He also noted that inequality during the decade increased most rapidly in regions with the fastest growth rates [34, p. 166-168].

Both Langoni and Fishlow attempted to assess levels of absolute poverty. Comparing actual incomes with minimum salary levels established by region, Langoni's data showed that in 1970 a large proportion of rural workers' income fell below the minimum. Depending on the region, anywhere from 40 to 90 percent of the rural workers fell below the minimum, while in no region did more than 50 percent of the urban workers fall below that level [34, p. 165]. Using the 1960 minimum wage in the Northeast as a base and adjusting for family size, Fishlow [18] showed with 1960 census data that 31 percent of Brazilian families did not approach this minimum acceptable standard of income. These families tended to have low levels of education, resided in the Northeast, were engaged in agricultural activities, and had relatively smaller opportunities for education. Because of the re-

relationship between past illiteracy, present poverty, future illiteracy and probably future poverty, Fishlow doubted that present government policies would effectively break the poverty cycle and reduce future income inequality. Thus, Brazil's consistent underinvestment in human capital, especially in rural areas, locks a large proportion of the rural population into inescapable poverty.

Several general features of Brazilian post World War II agricultural growth can now be summarized. First, output growth rates have been reasonably high in spite of relatively greater emphasis given industrialization. Expansion along the extensive margin was the major source of growth, even though several policies were initiated in the mid-1960's to increase usage of modern inputs. Second, wide interregional differences in growth rates have continued. Third, fastest growth has occurred in crops of previously limited importance, especially wheat and soybeans. Fourth, the number of persons occupied in agriculture grew at a rate slightly above 1 percent per year during the 1960's indicating increased average labor productivity even though land productivity increases were limited. Fifth, exportation provided a major outlet for increased agricultural output in the the late 1960's and early 1970's. Sixth, there is some indication that the terms of trade were not consistently unfavorable for agriculture in spite of policies designed to tax agriculture for industrial development. Furthermore, the benefits channeled to agriculture appear to have not been spread very equitably within the sector. Seventh, average income levels in agriculture have been roughly one-half of urban income levels and this intersectoral difference widened between 1960 and 1970.

The next section describes in detail the most important policy instru-

ments which affected agriculture during this post war period.

POLICY INSTRUMENTS FOR AGRICULTURE

When reviewing individual policies, it is useful to understand some general aspects of policies and policy making in Brazil.

1. The general shift in policy making from state and local authorities to the federal government, noted in Chapter 2 for the general economy, clearly occurred for agricultural policies as well.

2. A reliance on market incentives has been more predominant than structural reform. Institutional changes for agricultural research, extension and advanced training of agricultural technicians have far outweighed agrarian reform, for example, and even these changes have been most important only in recent years.

3. Policies have commonly been aimed at increasing agricultural production and productivity through higher profitability and reduced risk, while at the same time holding down consumer prices.

4. Additional physical capital has been viewed as the crucial agricultural input, initially to facilitate expansion along the extensive margin, and since the mid-1960's, through capital deepening and the use of modern inputs.

5. Foreign capital and technology have played a relatively small role in agriculture compared to the industrial sector. The few exceptions have been largely limited to marketing and processing firms.

There is no clear way of separating interrelated policy instruments in terms of their objectives and impacts. For our purposes, the principal policies and programs have been grouped according to what appears to have

been their primary impact. The categories are 1) product oriented programs, 2) factor pricing programs, 3) trade policies, 4) federal and regional investments, and 5) agricultural taxation.

Product Oriented Programs

Like many developing countries, Brazil has used several product oriented programs to influence output and product prices. The minimum price program which affects several crops, the semi-autonomous commodity institutes (autarquias), and special programs for wheat, beef and milk fall within this category. There are several differences in the objectives of the programs, the treatment given commodities, the extent of governmental intervention, and who bears the program's cost.

The minimum price program operates through government purchases and loans to farmers and processors for several important commodities including rice, cotton, corn, peanuts, manioc flour, and edible beans with little or no direct control over production or marketing. The objective has been to set prices at levels high enough to encourage production but not so high as to rapidly raise consumer prices. Price setting has been largely a function of short run response to insufficient supply and only recently has a somewhat longer run supply strategy been considered [62]. During the 1950's, minimum prices were usually fixed below market levels, were frequently announced after planting had been completed, and farmers had to transport the product to an assembly point, usually the state capital, where the price was paid. Following the food supply crisis of 1962, prices for rice, corn, and beans were increased and established at the farm gate. Large purchases of these three commodities were made in 1963 and 1965. Fears of excess production and a subsequent easing of market

prices led to re-enactment of more conservative minimum prices during the rest of the decade. In 1973, minimum prices on food crops were again substantially raised to offset increasing profitability of soybean production.

Up to 1960, the program had made little impact on agricultural production, with the possible exception of cotton [62]. An evaluation of impact on rice, corn, and beans after 1963 suggested that the price effect was perverse, that is, it reinforced market incentives rather than counter-balance them as expected in a price stabilization program. Furthermore, the supply agency (SUNAB) introduced additional uncertainty and instability by periodically rolling back prices for the benefit of consumers [45].

Three autarquias have been created for important export crops: the Brazil Coffee Institute (IBC), the Executive Commission for Recuperation of Cocoa Production (CEPLAC), and the Sugar and Alcohol Institute (IAA) for sugar cane. They are attached to federal ministries and carry out government policies, but are also powerful voices for producer interests.

When the federal government began to implement coffee policy beginning in the 1920's, the impact of policies on foreign exchange earnings became an important consideration besides higher producer prices. Other potential policy impacts like expansion into new markets and discouragement of competitors have not been properly considered [43, p. 154]. A key assumption underpinning coffee policy has been that aggregate demand was relatively price inelastic; therefore, it was believed that total income could be increased by reducing quantities supplied.

The IBC was created in 1952 and has attempted to control the movement and marketing of coffee with little direct control of production. The

Institute guaranteed to buy all production at established prices causing highly erratic prices as large coffee stocks were accumulated and destroyed. Plantings were reduced in the 1960's by paying farmers to eliminate old unproductive plantations and diversify into other farming activities.^{7/} Other major producing countries expanded output, however, and took some of Brazil's traditional markets so new plantings are now encouraged through low interest rate loans. Funds for the coffee program have come from taxes on sales through special exchange rates for coffee, exchange quotas or confiscation, and fixed assessments.

A definitive assessment of coffee policy has not yet been made. On some occasions, it probably caused producer price increases and prevented price falls. Furthermore, it created employment and generated foreign exchange used for development of other sectors of the economy. On the negative side, it contributed to the uncontrolled destruction of good forest land, established expensive administrative control and storage systems, and resulted in a loss of international markets. Prior to 1960 it may have been especially important for Sao Paulo by expanding agriculture while furnishing savings, a domestic market and foreign exchange for industries expanding through import substitution [38]. Furthermore, the several subsidies granted the agricultural sector may have more than compensated for any discrimination thereby contributing to inflation that stimulated industrialization [6, pp. 117-118].

Sugar policies, unlike coffee, attempt to balance production and

^{7/} Anderson reports that payments to producers for uprooting trees resulted in a reduction in 34 percent of the coffee area between 1962 and 1967. [2, p. 54].

consumption; therefore, consumers pay the program's cost when prices are raised above free market levels. The IAA, created in 1933, was authorized to reduce production by establishing sugar production quotas and to regulate transactions between cane mills and suppliers. Eventually, the IAA began to establish annual marketing plans based on growth in domestic consumption and exports, and the status of regulatory reserve stocks. The production target is divided between the Northeast and Central South, quotas are allocated to specific mills, and cane prices are fixed. Sugar prices are set based on production costs, the value added tax (ICM) and a fixed contribution to the IAA operating fund. The direct effect of export prices on producers is neutralized through a fund which receives and pays differences between domestic and export prices.

Sugar policies have probably been most effective in increasing exports; by 1980 Brazil may be the world's largest sugar producer and exporter. Drastic short term price fluctuations have been avoided but quotas have not completely avoided under- and over-production. A supply shortfall led to unrestrained sugar planting after 1964 when producers received guarantees that mills would buy all production at stipulated prices. Production shot up so rapidly that quotas were reimposed in 1966-67 [43]. Some sugar production has been preserved in the Northeast even though cane prices must be 20 percent higher than in southern Brazil to cover production costs. It is argued that a large proportion of production must be retained in the Northeast due to the region's unemployment problems, limited potential for other crops and slow growth of urban employment. Thus, more rapid expansion has been controlled in the South in spite of favorable soils and climate, adequate labor supplies, modern transportation, and large energy supplies.

A consistent IAA problem has been the regulation of relations between independent cane producers and sugar mills. Concern for maintaining viable small cane producers and preventing an urban exodus of farm population led to the 1941 Statute for Sugar Cultivation which, among other things, established that 50 percent of a mill's cane quota should come from independent suppliers [50, pp. 119-123]. Some benefits have been achieved from subsequent social legislation but the desirable impact on the number of small and medium sized production units has not been realized. For example, in 1967-68, 70 percent of the Sao Paulo suppliers had quotas of less than 1,000 metric tons and produced 20 percent of the cane, while over 42 percent was produced by 5.1 percent of the suppliers with quotas over 5,000 tons, [50, p. 133]. The economics of cane production and the pricing policies of the IAA have obviously affected this outcome. Several studies show that only the larger producers using modern technology generate profits at established prices ^{8/} and cane prices were fairly constant in real terms between 1948 and 1970. Economies of scale are assumed to exist in cane milling, and in 1971 legislation was passed to encourage modernization of mills, to reorganize plantations, and to promote greater efficiency among suppliers who were given larger supply quotas [43, p. 169].

CEPLAC was created in 1957 to modernize cocoa production in the state of Bahia, and in 1962 the Cocoa Research Center was created to raise productivity [33, pp. 253-277]. Some improvements in productivity are now occurring. The impact is limited to a small geographic area, however, and

^{8/} See [26] for an example of these cost studies and a review of several others.

the applicability of the CEPLAC model is questionable for the general productivity problems of Brazilian agriculture.

Brazil's long history of policies and programs to increase wheat production and reduce imports began with the establishment of the Wheat Expansion Service (Servico de Expansao do Trigo) in the late 1930's to promote domestic production. Minimum producer prices were set for the first time in 1938, and millers had to purchase minimum quotas of domestic wheat in order to purchase imports [55]. The preferred milling qualities of imports led millers to inflate reported domestic purchases resulting in large amounts of "paper wheat". This abuse forced the government to take complete control of wheat pricing, purchasing, and importation. To stimulate production, the Bank of Brazil was given the responsibility beginning in 1962 to purchase all domestic wheat at prices frequently fixed at double FOB import prices during the 1960's. Just enough wheat was imported to complete established consumption targets, and mills received a blend of imports and domestic wheat. Most of the cost was passed directly to consumers in the form of higher prices.

In addition to higher prices and a secure market, farmers benefited by large amounts of credit given to cooperatives to build facilities for wheat storage and distribution of production inputs. New seed varieties were also introduced, lime and fertilizer supplies were increased, and concessional operating and investment credit was tied to adoption of approved production practices. Agricultural mechanization quickly spread to facilitate converting range land to wheat and, later, soybeans. These favorable policies contributed to an expansion in production from 300

thousand metric tons in 1962/63 to approximately 2 million metric tons in 1971/72. Domestic production as a percent of total consumption rose from 10 to just over 50 percent. In spite of modernization efforts, average yields continued in the range of 900-1,000 kilograms per hectare.

Soybeans became increasingly important as a complementary and competitive crop to wheat in the late 1960's. Double cropping of wheat and soybeans developed in regions where topography favored mechanization and climatic conditions permitted later soybean planting. Soybean yields fell 10-30 percent when planted after wheat, however, and soybean price increases of the early 1970's and disastrous 1972 wheat yields prompted farmers to shift more land into soybeans. Additional wheat price incentives were granted in 1973 to keep acreage at high levels.

Most of the wheat and soybeans have traditionally been produced in central and western Rio Grande do Sul where soil and climate are not ideal for either crop. In recent years, experimental and modest farm level plantings of wheat have occurred in the Central-West. This region could eventually become an important wheat producer, while the states of Sao Paulo and Parana are rapidly shifting into more soybeans.

Although the wheat program expanded domestic wheat production and contributed to the development and growth of Rio Grande do Sul, it has been with high social costs, increased concentration of farm incomes, and perhaps lower growth rates than if a joint livestock and wheat strategy would have been pursued. Subsequent chapters treat these issues in detail.

With a cattle herd numbering over 70 million head, ample opportunities for expansion into new frontier areas, and favorable long term demand prospects for meat, the future of Brazil's livestock sector would seem bright.

Growth in the cattle sector in recent years, however, has not kept pace with demand. Production measured in carcass weight grew from an average of 1,050,000 metric tons per year in the 1947-51 period to an average of 1,743,000 tons in 1967-71. Taking into account population growth, this implied that per capita production declined from 19.7 to 18.3 kilograms. Exports rose five times between 1947-49 and 1971-72 reaching approximately 205,000 tons in 1971 so domestic per capita consumption declined even more [35, p. 10]. Meeting future export targets is likely to be achieved only through reduced domestic consumption.

Three general groups of cattle policies have been employed: policies designed to expand output, regulations of meat packing, and beef pricing, [43, p. 195]. One set of measures aims at expanding the cattle raising frontier through improving roads and meat packing facilities in the Central-West, fiscal incentives for new cattle ranches in the North, and development of the Amazon along the Transamazonian Highway. Another set is directed towards improving productivity through disease control programs, and producer credits for modernizing production and herd improvement. Another objective is to even out the seasonality of production caused by reductions in winter pastures due to cold weather in some regions and dryness in others. Cattle gain weight in the summer and lose part of it in the winter; thus they require three or more years to reach slaughter weight, slaughtering and meat packing is highly seasonal, and excess summer beef must be frozen for winter use.

For the meat processing sector, government policy has been directed toward establishment of hygienic standards, federal inspection of slaughter houses and packing firms, and the construction of new modern facilities,

Meat pricing in conjunction with regulations over slaughter, exports and domestic storage has caused great controversy. Beef prices represent a major component of the consumer price index, so control of inflation often focuses on holding down beef prices. Another justification for government intervention in beef prices is to protect consumers against price fluctuations caused by speculation [43, p. 198]. Several measures have been employed to control prices. Retail meat prices have been established with severe inspection and export controls to insure adequate supplies at fixed prices. Demand on slaughter houses has been regulated through restricted quotas on supplies to meat packing companies. Targets for slaughter and cold storage have been set for packing companies to insure adequate winter supplies. Resistance from ranchers has been overcome sometimes with extreme measures such as in 1969 when the government directly purchased and expropriated cattle, slaughtered in private or rented plants, and distributed meat directly to private butchers and government owned retail stores. Direct price controls diminished in 1970, but international price increases for oils and meat subsequently forced the government to impose an export tax on meat, and reduce export quotas on meat and products used in livestock rations.

Economic implication of these policies include a reduction in meat prices in the short run at the expense of lower producer prices, consistent disequilibrium in the beef sector with the accompanied resource misallocations, and frequent policy changes which affect farm level investment plans which ultimately determine long run supply [35].

The recent price effect of these policies on farmers can be seen by analyzing the indices of prices received by farmers for crops versus

livestock and livestock products at both the national level and for the important beef producing state of Rio Grande do Sul.^{9/} Using 1966 as the base year, livestock and livestock products price increases lagged behind crop prices until 1973 for both the national and Rio Grande do Sul indices. Furthermore, the national beef price index grew more slowly than the overall livestock index until 1971. The national wheat price index has lagged behind the national crop price index but led the beef index and the Rio Grande do Sul livestock index until 1971. Thus compared to beef, the relative price of wheat increased from 1966 to 1971 while the advantage for crops generally continued to 1973, and this relationship helps explain the rapid growth of wheat and soybeans in Rio Grande do Sul.

Milk represents the last major commodity for which there has been considerable government intervention in pricing and distribution. Milk and meat policies should be related but in practice they are treated separately. Milk policies are important to the beef sector because much of the milk consumed in several urban centers comes from cross-bred Zebu cattle. They are largely pasture fed with some sugar cane as supplement feed so production is highly seasonal. Cows produce little milk and farmers shift between milk and calf production depending on relative prices. The balance of the milk comes from a few specialized dairymen whose cost of production is highly dependent on the price of supplemental feeds [43, pp. 148-149].

Government intervention has concentrated on improving sanitary conditions in production, transport, and processing, and controlling consumer

^{9/} Conjunctura Economica, Vol. 28, No. 4, April, 1974, pp. 171-176.

and producer prices. The policies have not reduced the seasonality of supply and typically part-time producers have helped assure an adequate fresh milk supply at established prices during the summer, and winter shortages have been met by processed milk. In recent years, there have also been summer shortages in the major Sao Paulo and Rio de Janeiro markets because past price policies slowed expansion of dairying. Thus policies oriented to the benefit of consumers have actually resulted in not having sufficient milk on the market. Recent concessional credit programs have been directed at stimulating investment in specialized dairy farms.

This summary of product oriented programs and policies demonstrates the difficulty the Brazilians have had in avoiding under-and over-production of several major commodities. Prior to 1960, coffee, sugar, and beef were the major commodities affected by government intervention with other crops largely unaffected by the minimum price program. In the 1960's wheat producers gained compared to cattle ranchers with special impact on Rio Grande do Sul while sugar cane producers primarily in Sao Paulo received larger quota increases than those in the Northeast.

Factor Pricing Programs

Programs and policies to affect the farm level supply and price of productive inputs represent a major effort to change factor proportions in Brazilian agriculture. These efforts have been especially important from the mid-1960's onwards, which is relatively recent compared to some commodity programs as seen in the previous section. One major set of recent activities has been directed at modernizing agriculture by increasing the supply and reducing the cost of certain so-called "modern inputs." Con-

cessional agricultural credit has been used to further lower the real cost of such inputs as well as encourage the expansion of selected commodities. Capital/labor price ratios have been altered further by labor policies.

Factor subsidies have taken the form of preferential import exchange rates, freight rebates, tax exemptions, and highly concessional agricultural loans for producers and users of chemical fertilizers, lime, agricultural chemicals, machinery, and livestock feeds. The rationale for subsidies generally depends on three assumptions: the price elasticities of farmer demand are high for these inputs, the marginal social productivity of input use exceeds the marginal social cost of subsidization, and the input demand function will shift because of favorable experience with the input's use [62, p. 226]. If these assumptions do not hold, subsidies will not induce greater use, or the return will be small and if the subsidies are later withdrawn, the use of the input will fall to pre-subsidy levels.

The Brazilian motivation for employing subsidies may include additional reasons. For example, subsidies may be justified as indirect income transfers to farmers in return for reduced profitability through product price controls to maintain low food costs for industrial workers. The impact such policies have on demand for inputs produced by domestic industry is also surely considered, first to protect infant industries and second to generate sufficient demand to achieve economies of scale in production. It is probably not accidental that some input subsidy changes coincide with industrial needs and capabilities. It is worth noting in passing that protection for the tractor industry was put into effect in the early 1960's when domestic supplies for production were available from

the automobile industry, but significant protection for the fertilizer industry came much later.

Veiga [68, p. 142] emphasized that the subsidies offered through import preferences for agricultural inputs could not have been that important since Brazil was a minor consumer during much of the period. Most of the imported fertilizer, for example, was confined to small areas in Sao Paulo and Rio Grande do Sul primarily for export crops. Yet until recent years, the government chose to counteract agricultural pressures by facilitating imports rather than protect the development of a national fertilizer industry.

As noted in Chapter 7, fertilizer is an input that has received increased attention in Brazil and other developing countries in recent years. Imports have provided 60 to 80 percent of the fertilizer used in Brazil so exchange rates and tariffs have been important in determining farm level fertilizer prices. In the intensive import substitution period from 1947-1961, fertilizer was given preference under the import control and multiple exchange rates system. Federal and state sales tax exemptions were instituted in 1957-1958 along with highly preferential rail freight rates and port fees [62, p. 228]. An even more important stimulus was credit to producers and consumers at concessional rates, especially after 1966 when farmers paid little or no interest on fertilizer loans while inflation ranged up to 30 percent per year.

Fertilizer use increased from about 100,000 metric tons in 1950 to 250,000 in 1958, and varied between 250,000 and 300,000 tons through 1966. Then the combination of adoption incentives and declines in international fertilizer prices rapidly accelerated the growth of fertilizer use, and

total useage exceeded 1 million tons in the early 1970's. Given the magnitude of the subsidies compared to the total value of the fertilizer, it is possible that subsidization accounted for 5 percent of the increase in total use, and assuming a production elasticity of .04, gross agricultural output may have increased by 0.2 percent per year [2, p. 49]. It will be shown in Chapter 7, however, that the impact on output may have been less than anticipated, and even today the majority of fertilizer is used by the most advanced farmers. Domestic fertilizer production rose from 13,000 metric tons by 1970 [3, pp. 19-20] but major stimulus to the domestic industry was granted only in recent years.

The total usage of other agricultural chemicals varied during the early 1960's but concessional agricultural credit contributed to a steady increase beginning in 1968, and the total value of chemicals used exceeded \$40 million by 1970, roughly double that of the previous year. Insecticides represent 60 percent of total chemicals used in agriculture [54]. Imports represent about 80 percent of total supplies and it is doubtful if subsidies to chemical producers had much impact on production since they rarely exceeded 1 percent of the total value of chemicals used [2, p. 50]. The impact of chemicals on the output of certain crops may be quite important; in fact there may be excessive usage on cotton. But chemical use is probably highly correlated with the use of fertilizers implying that large numbers of farmers still do not use either input.

Producer and consumer subsidies for farm machinery production and purchase have primarily affected farm tractors, and most data is available on tractor numbers. Due to the obvious correlation between sales of tractors and tractor drawn implements, these data give some indication

of farm mechanization generally. An important dimension of mechanization which is overlooked is the rapid increase in self-propelled combines used in wheat and soybean harvesting.

Prior to 1960, Brazil imported all tractors in numbers varying from about 2,000 to over 12,000 units per year depending on the import policies in effect each year. The import licensing and multiple exchange rate systems gave preferences to tractor imports from 1947 to 1961. The exchange rate subsidy from 1953 to 1961 was estimated to equal an average 17 to 18 percent reduction in tractor price [53, p. 178]. Farm machinery imports through barter arrangements with countries that had a trade surplus with Brazil causing a multiplicity of brands and problems of spare parts and maintenance. As further stimulus for mechanization, the Import-Export Bank lent \$18 million to Brazil in 1952 for tractor purchases [53, pp. 172-186]. In spite of these policies, only 60,000 farm tractors were recorded in the 1960 census.

The number of tractors had increased to more than 156,000 by 1970, however, because of domestic manufacture and agricultural modernization efforts of the 1960's. The domestic industry began in 1960 linked to input suppliers created for the automobile industry a few years earlier as part of import substitution industrialization. Furthermore, tariffs and restrictions on imports were imposed to protect the local tractor industry, and farm loans with negative real rates of interest were available for purchasing the tractors. Domestic production rose to 12,000 by 1964, and imports had fallen to almost zero by 1970.

The downturn of the economy in the mid-1960's jolted the industry, and the drop in sales to 6,500 units in 1967 prompted several policy

changes. Duties and taxes were reduced on imports by machinery manufacturers, and the industrial products tax (IPI) and the sales tax (ICM) together representing about 17 percent of the tractor purchase price were eliminated. Efforts to bring down the cost of credit carried over into agriculture as interest rates on tractor loans were reduced from 18 to 15 percent in 1968, and loan repayment periods were extended from four to five years. Farmers were permitted to accelerate tractor depreciation to reduce income taxes. Tractor sales recovered with these measures and exceeded 21,000 units by 1971.^{10/} The average size of tractors manufactured has steadily increased. The proportion of heavy tractors with 60 or more horsepower recently reached 60 percent, while the production of tractors with less than 40 horsepower has been completely discontinued.

A demand study for tractors in Brazil concluded that in contrast to studies of England and the U.S. the variable for amount of tractor credit swamped the influence of relative tractor and labor prices [49]. Another conclusion was that tractor purchases could have had a significant impact on agricultural labor use and absorption.

Agricultural credit policy merits additional comment as this policy instrument emerges as one of the most important used in Brazil since the early 1950's. In the 1950's and early 1960's, concern focused on additional supplies of credit while in the mid-1960's the practice increased of tying credit to specific uses to accelerate modernization and output of specific commodities. The lack of credit was assumed to inhibit more rapid growth and the frequent practice of pre-harvest contracting of crops and large

^{10/} Unofficial sources place total tractor production in 1973 at 43,560 units [61, p. 18].

quantities of informal credit were taken as evidence of credit shortages by farmers [62, p. 239]. Furthermore it was assumed that on-farm investments were being retarded by capital shortages. For these reasons, agriculture was provided with ever increasing supplies of credit with interest rates set lower than price level increases resulting in negative real rates of interest.

The institutional innovations of the mid-1960's and especially the creation of the Central Bank and National Monetary Council in 1965 provided greater control over the money supply and credit to the agricultural sector.

Subsequently, legislation was passed to regularize rural credit operations of the banking system and increase credit availability for agriculture.

In recent years credit policy has been adjusted so frequently that individual banks even have difficulty keeping current in their practices. The obvious intent has been to increase the attractiveness of loans for certain purposes. As noted above, purchases of modern inputs have been eligible for credit with especially attractive repayment terms and interest rates.

Special lines of credit have been established for certain crops like coffee, wheat, cocoa, and livestock in order to stimulate adequate expansion. On

the other hand, the amount of wheat land financed for any one farmer has been limited to a proportion of the area planted in the previous year to avoid too rapid expansion. Recently, credit for rapidly expanding crops like soybeans has been contingent upon minimum plantings of certain food crops.

These agricultural credit policy changes imply a great potential impact on agriculture and in fact, the recent rapid growth of output and use of modern inputs coincides with sharply increased formal credit sup-

plies. However, the correlated effect on informal credit markets must also be analyzed, as shown in Chapter 10. Three additional questions must also be addressed. The first concerns the distribution of credit and the associated subsidies when loans to small farmers clearly increase bank costs and risks. Secondly, credit for land purchases has never been available in any large quantities. Thus, the demand for land is reduced, at the same time that the supply is low due to low land taxes, speculative purchases, and difficult access and uncertain tenure in frontier regions. Thirdly, credit tied to specific uses may simply substitute for a farmer's own resources.

While factor subsidies and agricultural credit have effectively cheapened the price of certain capital inputs, agricultural labor policies have increased the relative cost of labor. On the one hand, the moderate increases granted in industrial minimum wages during part of the 1960's and the low labor absorption of industrialization referred to in Chapter 2 contributed to keeping labor dammed up in agriculture. On the other hand, several policies like the introduction of minimum wages, social welfare programs financed through payroll taxes, and social regulations such as the one requiring the establishment of schools when a farm employs a minimum number of workers have raised labor costs.^{11/} These relative price shifts have two effects on agriculture. The first is the use of capital intensive production technology and the premature displacement of agricultural workers when industrial labor absorption is limited by the same

^{11/} No study is available for measuring the magnitude of these non-salary costs in agriculture, but studies of the urban sector show how declines in real wages offset some of the increase in cost of these social benefits [5].

bias toward capital intensive techniques. The result is the rapid increase in the urban service sector. Secondly, farmers replace permanent laborers with day laborers (volantes). Many provisions of the labor legislation do not apply to day laborers and labor contractors for volantes can easily circumvent legislation. In Sao Paulo, for example, the number of resident farm laborers fell from 288,000 in 1955 to 32,000 in 1969, while the number of volantes grew from 226,000 in 1964 to 350,000 in 1970 [40, pp. 218-221]. There are indications that these shifts have been most evident in the least developed regions with abundant labor supplies.^{12/}

This review of factor pricing programs demonstrates heavy government intervention, especially from the mid-1960's onward, in factor markets. The strategy has clearly been one of reducing the relative cost of capital in order to stimulate agricultural modernization through increased use of certain capital inputs and agricultural credit has been one of the key policies within this strategy. Future chapters will test the economic impact of such a strategy on micro-economic growth.

Trade Policies

Brazilian trade and foreign exchange policies have attempted to protect the domestic market and lower the cost of imported raw materials and capital goods for import substitution industries. Import and export controls have been freely used, and the exchange rate has been consistently overvalued and the cause of much speculation, although less so since the

^{12/} Greenfield and Barros [22] offer some insights as to why this displacement process has not proceeded even more rapidly on traditional farms.

introduction of the crawling peg system. Exporters were penalized particularly hard during the 1947-1963 period, and less after that until the export promotion period. Since agriculture was the primary export sector, it was hardest hit. On the other hand, the preferences for importing certain inputs, as noted in the previous section, partially offset this discrimination and farmers benefitted from the creation of domestic machinery and fertilizer industries although the short run effect was higher input prices than prevailed in the international market.

Coffee policy is a case in point. When Brazil was the principal world coffee supplier, exports were restricted to increase total revenue but this encouraged output in competing countries and caused a loss of traditional markets. It appears that since 1953, the U.S. demand for Brazilian coffee was elastic and foreign exchange could have increased by selling more coffee [54]. By retaining a 50 percent share of the U.S. market, an estimated additional 48 million bags would have been sold between 1953-69 with a gain of almost \$700 million in earnings. Secondary impacts would have included a smaller displacement of rural laborers estimated at 600,000 persons due to coffee eradication programs [31, quoted in 54], and reduced the need for the current replanting program estimated to cost \$800 million.

Another study estimated the impact of more liberal trade policies for cotton, the commodity that has been second only to coffee in agricultural exports in several years [3]. An assumed 8 percent increase in fiber price would have increased average annual exports during the 1958-1969 period by 45,000 tons, equal to a 36 percent increase. For each cruzeiro in consumer surplus gained through trade restrictions, two and one half

cruzeiros were foregone in export earnings. A similar estimate for potential corn exports showed that if the exchange rate had been set closer to its equilibrium rate and other export restrictions lifted, yearly corn exports would have increased an average of 830,000 metric tons valued at \$50 million in the 1947-70 period when average exports were only 130,000 tons [65].

Although disease problems and limited supplies have contributed to preventing Brazil from becoming a major beef exporter, export policies have also had an effect. Overvalued currency, various export controls and the recent special tax on exported beef have undoubtedly damaged incentives for producing large quantities of high quality exportable beef.

With the exception of periodic crises, Brazil produces most of its food supplies so import policies have been of limited importance. Two exceptions are the occasional importation of dairy products and beef and consistent purchases of foreign wheat. Dairy imports and domestic pricing policies helped maintain low domestic prices which retarded modernization of the sector. The wheat import substitution program unquestionably subsidized wheat farmers, partly at the expense of livestock producers as analyzed in Chapter 11. It was estimated that it cost \$2.20 in domestic resources in 1967 for each dollar of foreign exchange saved [32, p. 100]. An overall evaluation of the program, however, must take account of the impact on the Rio Grande do Sul economy and the backward linkages to industrial firms producing agricultural inputs.

A definitive assessment of the effect of trade policies on agriculture would need to analyze the intersectoral resource flows and the differential impact on various groups within agriculture. For example, sub-

sidies to coffee growers in the form of credit at negative interest rates and preferential treatment of imports partially offset the confiscation in export earnings. Wheat growers obviously gained vis-a-vis livestock producers in recent years. All farmers lost due to lower export prices while only the larger farmers that use a higher proportion of purchased inputs and have access to credit gained from factor subsidies. These are probably the same farmers that gained the most in the last 4-5 years when agricultural exports were stimulated through fiscal incentives.

National and Regional Investment Programs

Several investment programs to 1) alter private investment behavior, and 2) implement public sector investment programs are another important policy instrument. Some are national programs while others are sponsored and supported at the regional level; some affect a special problem area and others affect agriculture only indirectly. The activities of the semi-autonomous commodity institutes described earlier represent investments by the federal government, but the focus here is on broader programs in transportation and communication, marketing services, agrarian reform and colonization, irrigation projects, and agricultural extension and research.

Brazil has faced serious transportation and communication problems including few paved roads,^{13/} limited integration of interior cities, little interregional integration of the rail system, slow inefficient water transportation, and inadequate phone and mail service [57, pp. 308-314].

^{13/} For example, in the IBRA survey of 1965, 25 percent of more of the farmers in Acre, Roraima, Ceara, and Mato Grosso reported that their roads were impassible for more than 60 days per year [27].

Massive investments the last couple of decades alleviated some of the problems, and large operating deficits of the railroads have been covered by the public treasury. Investments in highway construction and road transportation and related transportation policies led to a rapid expansion in the trucking industry [1, 25]. Attention has been directed toward railroad improvement and port modernization as part of a recent program to modernize export corridors.

The few studies available give insights into how these improvements affect agriculture. A reduction in farm to market transportation costs has encouraged expansion of the agricultural frontier, changes in cropping and livestock activities, and increased population density. For example, the rapid settlement of Parana noted above has been attributed to the introduction of highly profitable coffee production and investments in transportation and marketing facilities [39]. Settlement in Goias was advanced by new highways linking it to major urban markets for food crops and beef [30, 37]. Paving the Rio-Bahia highway in 1960-63 is reported to have led to a rapid rise in the area's milk and meat production for the Rio de Janeiro market [69, reported in 25]. A little studied, but potentially important, contribution has been the elimination of local monopolies and reduction of marketing margins by improved market information and the appearance of independent truckers and traders [63]. Traveling salesmen for agricultural inputs serve as important sources of information about improved technology in the absence of well organized extension systems [37].

Product marketing systems have been improved by investments in storage facilities, but shortages still exist. Private and public ware-

houses and silo capacity grew from 5 to 12 million metric tons from 1955 to 1964, yet an unrealistically high estimate of 40 percent of the value of agricultural production was supposedly lost to inadequate storage in 1962 [2, p. 73]. Even the advanced region of the Central South was estimated to face a 4 million ton deficit in storage for grains and potatoes in 1970 [41, p. 178]. The wheat crop so overtaxed storage in the late 1960's that some of it was piled in the streets and the same problem occurred with soybeans in the 1970's. Large investments are currently being made in building modern urban wholesale markets but no studies are yet available to demonstrate the impact on producer income and consumer costs.

Agrarian reform can essentially be ignored in the Brazilian context because it has been a subject of much theoretical debate, some social agitation, especially in the early 1960's, but little effective achievements [43, p. 213]. The constitutional impediment to rapid land expropriations was removed after 1964 but in the 1964-1971 period only 4,327 agricultural workers benefited from land distribution in 13 projects in 8 different states [43, p. 214]. Furthermore, the complicated land tax system introduced at the same time has not stimulated more rational land use nor subdivision of large properties. The PROTERRA agrarian reform project announced in 1971 for the North and Northeast does not seem to be faring any better. Colonization is preferred because of political reasons and the assumed lower cost per family benefited compared to agrarian reform, irrigation, or industrialization projects [63, pp. 110-118]. Thus colonization is supported along the new Transamazonica road, but this approach ignores the limited number of families involved compared to the total land-

less population of Brazil [60, pp. 256-263], the real problems of past colonization projects [12, 64] and possible efficiency and income gains from broader agrarian reform when agriculture appears to have constant returns to scale [10].

In spite of some government programs, much of the irrigation developed in the country has been by private rice producers in Rio Grande do Sul [2, p. 72]. In 1960, only 1.0 percent of the cultivated land in the dry Northeast was irrigated, with much of it devoted to sugar cane, and several projects faced economic and technical problems. It is estimated that there are about 800,000 hectares of potentially irrigable land in the Northeast. But in an analysis of 86 proposed projects, only 72 with 195,000 hectares were considered economically viable using a 10 percent discount rate, and employment creation was estimated at only 70,000 workers or less than 2 percent of the region's agricultural work force [11, pp. 273-275].

In a broad evaluation of Brazilian agricultural extension, research and education programs, Schuh concluded that great strides had been made in some areas, and a good base had been developed for research and extension. A general lack of research relevant to local problems, and high rural illiteracy complicate the ability of the extension service to effectively increase agricultural productivity [51]. The state of Sao Paulo is distinguished for a longer history of emphasis on research and extension but the relative neglect of these sectors in other states has been partially recti-

fied in recent years. ^{14/} Domestic programs assisted by AID, Ford, and Rockefeller have rapidly expanded graduate education in the agricultural universities. Research, teaching, and extension activities have already benefited from technicians trained in Brazil and abroad. A major institutional change was made in 1973 to restructure research within the Ministry of Agriculture and coordinate research among state and federal organizations and commodity institutes.

Research and extension have been largely concentrated on selected crops, especially coffee, sugar cane, cotton, and hybrid corn. For example, cotton research in the state of Sao Paulo resulted in an estimated 89 percent rate of return [4]. However, other empirical results suggest a smaller than expected impact on production from investments in education and extension [48]. Other studies of the extension service have also shown limited impact on farmers but a complete evaluation of the system has yet to be made [14, 51]. ^{15/}

At the regional level, six development agencies have been created to coordinate and stimulate regional economic development. These agencies channel public and private resources into priority investments, and an important function has been the administration of private investment through recent tax incentive programs. The programs in the North and Northeast have been relatively more important than their southern coun-

^{14/} In a thoughtful analysis, Schuh [58] proposed an explanation of why Sao Paulo led the rest of the nation in its support for research and extension.

^{15/} Paiva's analysis of technological dualism could help explain the lack of greater impact by an extension service [4]. Several comments on the Paiva article appear in the March 1973 issue of Pesquisa e Planejamento Economico.

terparts. But the emphasis has been on industrialization with little effect on agriculture, and the impact of investments in cattle farms and reforestation now taking place has yet to be felt except for limited short-term employment creation.^{16/}

In summary, the few studies available suggest that federal investments in transportation, communication, and marketing services have had the most impact on agriculture due to their contribution to expanding the agricultural frontier. Agrarian reform, colonization, and irrigation projects have had little effect. Recent public investments in research, extension, and advanced agricultural education to improve the technological base for modernizing agriculture, and private tax incentive investments in cattle farms and reforestation will only begin to produce a payoff in the next several years.

Agricultural Taxation

Besides the implicit export tax represented by the overvalued exchange rate, a wide variety of federal and state taxes and related exemptions enacted in the post 1964 period represent a potentially important impact on agriculture. However, as of 1968, it appeared that direct federal taxes could not yet have had much impact. Federal land taxes and agricultural income taxes represented approximately two and one percent, respectively, of agricultural taxes that year. Social security contributions to FUNRURAL, a fund managed by the Ministry of Labor to provide retirement benefits and

^{16/} See [2, 52, 57] for information on the agricultural impact of the programs of SUDENE, SUVALE and DNOCS.

medical attention to farmers and farm workers, amounted to 2.7 percent [2, pp. 77-78]. Other potentially important, but difficult to quantify, federal taxes are those on petroleum and industrial products which affect the cost of agricultural inputs.

State sales (ICM) taxes and export taxes are relatively more important; the former represented 39.9 percent of total agricultural taxes in 1968 and the latter 55.2 percent [2, pp. 77-78]. The export taxes refer primarily to the contribution quota on coffee. The ICM introduced in 1967 levies taxes on the value added at each stage of production and the rates have varied from 15 to 18 percent. As noted in Chapter 2, the more developed states exact a substantial tax levy from less developed states through the ICM due to the higher value of goods traded. Furthermore, the exemptions granted by individual states on certain commodities and exports contribute to the growth pattern distortions found among commodities and regions, and encourage a shift in production from domestic to exportable commodities. Thus the overall level of agricultural taxes is not a problem, but the present system creates inequities and heavy indirect taxation penalizes rather than encourages production.

Tax policies in the industrial sector affect agriculture indirectly in other ways. The fiscal incentive program allowing tax credits for approved investments is a clear example. Obviously, only firms with large tax liabilities can benefit, and although desirable agricultural investments may have occurred, two negative effects can result. First, the long term effect on employment creation can be great when the cost of capital is so sharply reduced relative to labor, and secondly, these investments increase inequities in income and ownership of the country's wealth.

AGRICULTURAL POLICY ISSUES

An admittedly brief and sketchy review of the Brazilian experience, as contained in this and the previous chapter, cannot expect to include more than the key features of economic and agricultural growth and policies in the post World War II period. The Brazilians have been increasingly active in policy making and institutional reform of the economy in recent years, and these actions clearly affect microeconomic growth processes as identified in Chapter 1. Several broad issues can be raised about the impact and consequences of these policies, and a better understanding of them will give us insights into growth processes in developing countries. Several of these are listed below and a number were studied in the research reported in the following chapters.

1. Southern Brazil has had one of the highest growth rates of any region in the country in the post World War II period. Wheat, soybeans, coffee, sugar cane and beef are important in the region, and the prices of all these commodities have been affected by product pricing policies and international price changes. How have these price changes affected farm output and resource use? What kinds of changes have occurred in farm enterprise combinations and how sensitive are they to product price changes? Have these enterprise changes led to real increases in productivity or simply increased income?

2. Modernization of agriculture has been encouraged through capital cheapening subsidies for fertilizer, machinery, chemicals and other purchased inputs. Many of these inputs have been imported and there has been relatively little research leading to development of indigenous technology.

Several labor policies have tended to raise agricultural labor costs relative to capital inputs. How have changes in input prices led to shifts in resource use, farm asset structure, and farm productivity? Has the use of capital inputs been carried beyond optimum levels? Has there been a change in the production function or simply a movement along existing functions? How do economic and non-economic factors contribute to explaining the adoption and intensity of usage of modern inputs? Is the use of modern inputs likely to increase because of greater intensity in usage or expanding adoption?

3. Concessional agricultural credit has been closely related to several commodity programs and factor pricing policies. Since the mid-1960's, much of the credit has been tied to specific uses. How important is credit compared to product and factor pricing policies in explaining changes in output and resource use? Has the credit and associated subsidy been distributed among various types and sizes of farms? Have concessional interest rates reduced credit supplies to riskier borrowers? Does tied credit simply substitute for owned resources? Is credit use related to operating expenses, consumption, on-farm investments, and off-farm investments? Has the distribution of credit and other subsidies exacerbated inequities in income and wealth distribution? What non-economic factors help explain credit allocation and use? What have increased formal credit supplies done to informal credit markets?

4. Of all the investment programs in effect in Brazil, those related to agricultural marketing appear to have been most important. How does the expansion and improvement of product markets relate to producer prices and the growth of output of certain commodities? Has the improve-

ment in input markets simply increased availability at the local level, or reduced input prices, or both? Has marketing efficiency improved and affected prices, or has the system simply passed on subsidies and price changes originating outside the sector? To what extent have markets helped speed and finance the adoption of new inputs?

5. Increased output and subsidization imply changes in farm income. How have farm incomes changed, and how have the changes been distributed? How has consumption, savings and investment behavior been affected? Have investment opportunities kept pace with increased disposable income? What has happened to the price of farm and non-farm assets?

Several other issues could be raised but these seem to be some of the primary ones in the Brazilian experience. The next chapter reviews the general strategy used for data collection for this research, and subsequent chapters report how the data were used to analyze some of the questions raised above.

TABLE A 3-1

Number of Farms and Cultivated Area^{a/} for Selected States, 1960-1970

State	Number of Farms		Percent Increase 1960/70	Cultivated Area (Hectares)		Percent Increase 1960/70
	1960	1970		1960	1970	
Ceara	122,576	246,179	101	1,081,274	2,141,208	98
Minas Gerais	371,859	455,007	22	3,745,956	3,896,174	4
Sao Paulo	317,374	327,695	3	5,065,582	5,105,823	1
Parana	269,146	554,836	106	3,117,134	5,529,897	77
Santa Catarina	158,268	207,331	31	763,669	1,199,033	57
Rio Grande do Sul	380,201	512,422	35	3,212,698	5,298,779	65
Mato Grosso	48,104	106,191	121	375,549	683,779	82
Goiás	111,015	145,157	31	855,274	1,892,567	121

Source: [20]

^{a/}Includes 15 of the most important crops: cotton, peanuts, rice, bananas, potatoes, cocoa, coffee, sugarcane, beans, tobacco, oranges, mandioc, corn, soybeans and wheat.

TABLE A 3-2

Number of Tractors and Farms Per Tractor (1950-1970) and Area Cultivated Per Tractor^a
(1960-1970) for Selected States

States	Number of Tractors		Farms Per Tractor		Cultivated Area Per Tractor (Hectares)	
	1960	1970	1960	1970	1960	1970
Ceara	208	577	589	427	5,198	3,711
Minas Gerais	4,772	9,245	80	49	785	421
Sao Paulo	27,176	65,731	12	5	186	78
Parana	5,181	17,190	52	32	602	322
Santa Catarina	1,106	5,026	143	41	690	239
Rio Grande do Sul	15,169	38,317	25	13	212	138
Mato Grosso	838	3,926	57	27	448	174
Goiias	1,349	5,265	82	28	634	359

Sources: [20]

^a/ Includes 15 of the most important crops: cotton, peanuts, rice, bananas, potatoes, cocoa, coffee, sugar cane, beans, tobacco, oranges, mandioc, corn, soybeans and wheat.

TABLE A 3-3

Population Occupied in Agriculture and Cultivated Hectares ^{a/} Per Person in Selected States
1960-1970

State	Population Occupied in Agriculture			Hectares Cultivated Per Person		
	1960	1970	Percent Change	1960	1970	Percent Change
Ceara	801,492	1,085,186	35	1.35	1.97	46
Minas Gerais	2,092,027	2,127,335	2	1.79	1.83	2
Sao Paulo	1,727,310	1,512,964	-12	2.93	3.38	15
Parana	1,284,698	2,015,151	57	2.43	2.74	13
Santa Catarina	575,294	774,012	35	1.33	1.55	17
Rio Grande do Sul	1,334,039	1,467,452	10	2.41	3.61	50
Mato Grosso	186,703	380,180	104	2.01	1.80	-10
Goiias	499,207	569,374	14	1.71	3.32	94

Source: [20]

a/ Includes 15 of the most important crops: cotton, peanuts, rice, bananas, potatoes, cocoa, coffee, sugar cane, beans, tobacco, oranges, mandioc, corn, soybeans and wheat.

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