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Brazil
Human Resources Special Report

Annex III: Health, Nutrition, and Education

July 13, 1979

LAC II

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CURRENCY EQUIVALENTS

Currency Unit: Cruzeiro

Exchange Rates Effective June 12, 1979

Selling Rate	US$1.00	=	Cr$25.655
	US$1 million	=	Cr$25,655,000
	Cr$1 million	=	US$38,978
Buying Rate:	US$1.00	=	Cr$25.615

Average Exchange Rates

	1970	1971	1972
US$1.00	Cr$ 4.593	Cr$ 5.228	Cr$ 5.934
US$1 million	Cr$ 4,593,000	CR$ 5,228,000	Cr$ 5,934,000
Cr$1 million	US$ 217,723	US$ 191,278	US$ 168,520

	1973	1974	1975
US$1.00	Cr$ 6.126	Cr$ 6.790	Cr$ 8.129
US$1 million	Cr$ 6,126,000	CR$ 6,790,000	Cr$ 8,129,000
Cr$1 million	US$ 163,239	US$ 147,275	US$ 123,016

	1976	1977	1978
US$1.00	Cr$ 10.675	Cr$ 14.144	Cr$ 18.047
US$1 million	Cr$ 10,675,000	CR$ 14,144,000	Cr$ 18,047,000
Cr$1 million	US$ 93,677	US$ 70,701	US$ 55,410,000

PREFACE

This report is based on findings of a mission which was in Brazil in October-November 1977 composed of:

Peter T. Knight (Chief of Mission)

Ricardo Moran (Deputy Chief of Mission)

Constantino Lluch (Senior Economist)

Dennis Mahar (Health and Nutrition Consultant)

Francisco Swett (Education Consultant)

The report consists of a summary volume and four annexes. The title and principal authors are as follows:

Summary Report	Peter T. Knight and Ricardo Moran
Annex I: Population	Thomas W. Merrick and Ricardo Moran
Annex II: Employment, Earnings, and Income Distribution	Constantino Lluch
Annex III: Health, Nutrition and Education	Peter T. Knight, Dennis Mahar, and Ricardo Moran
Annex IV: Housing, Water Supply, and Sewerage	Peter T. Knight and Ricardo Moran

Substantive contributions to this report were also made by health consultant Ernesto Calderon (Annex III); education consultants Claudio de Moura Castro, Ernesto Schiefelbein, and Francisco Swett (Annex III); and nutrition statistics consultant Joseph Quinn (Annex III). Joseph Quinn and Roger Bove of the U.S. Bureau of the Census contributed to the development of the Long Run Planning Model used for the demographic and other simulations and assisted Thomas W. Merrick with the demographic work. Research assistance was provided by Julie Otterbein.

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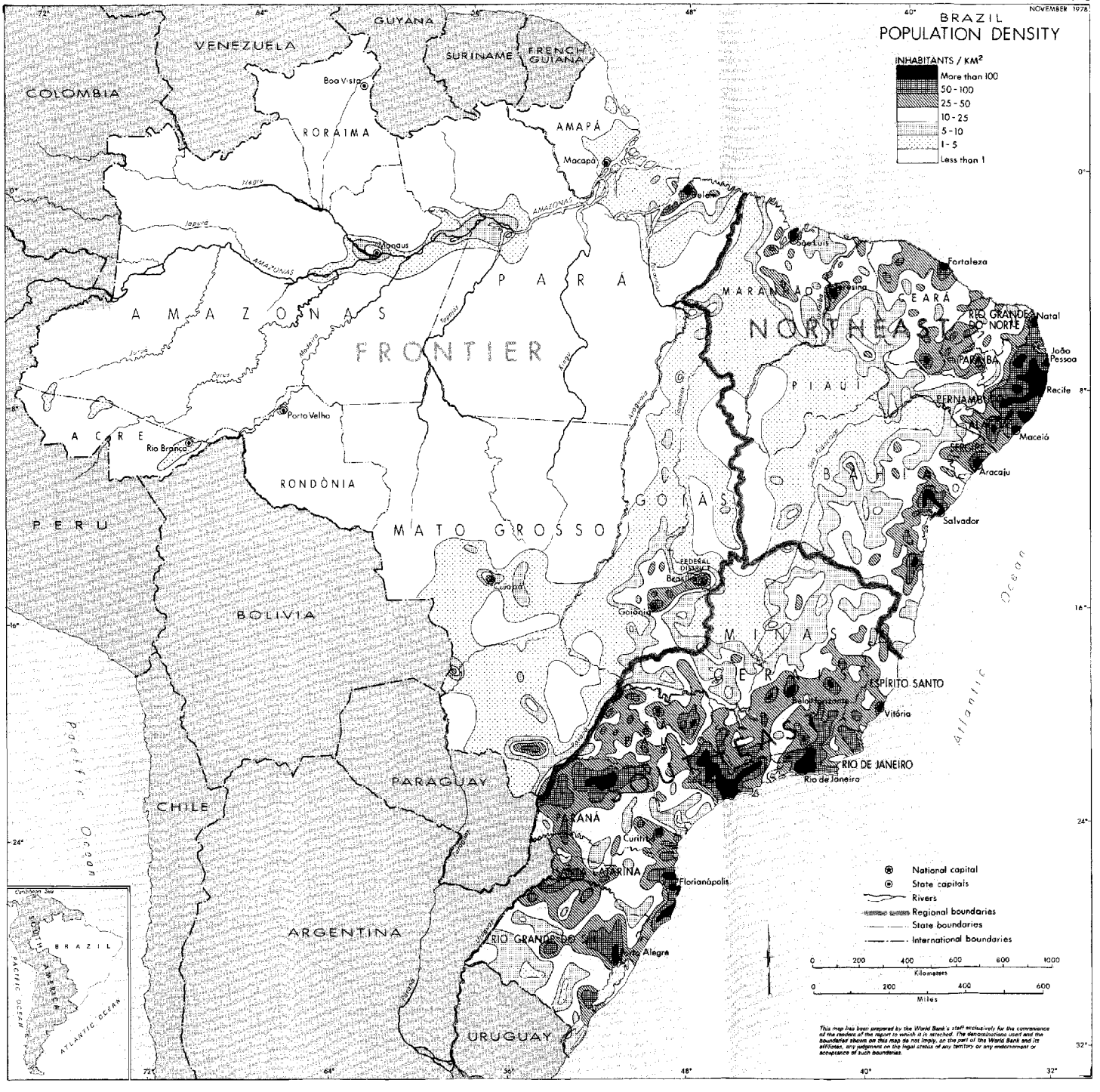

GLOSSARY OF ACRONYMS

ABCAR	-	Associacao Brasileira de Credito e Asistencia Rural (Brazilian Rural Credit and Assistance Association)
BNH	-	Banco Nacional da Habitacao (National Housing Bank)
CAP	-	Compra Antecipada da Producao (Anticipated Production Purchase)
CDS	-	Conselho de Desenvolvimento Social (Social Development Council)
CFP	-	Comissao de Financiamento da Producaco (Production Finance Commission)
CIBRAZEM	-	Companhia Brasileira de Armazenamento (Brazilian Storage Company)
COBAL	-	Companhia Brasileira de Alimentacao (Brazilian Food Company)
COFAP	-	Comissao Federal de Abastecimento e Precos (Federal Supply and Price Commission)
DAU	-	Departamento de Asuntos Universitarios (Department of University Affairs)
ECIEL	-	Programa de Estudios Conjuntos Sobre Integracion Economica Latino-Americana (Program of Joint Studies on Latin American Economic Integration)
EMBRATER	-	Empresa Brasileira de Assistencia Tecnica e Extensao Rural (Brazilian Technical Assistance and Rural Extension Enterprise)
ENDEF	-	Estudo Nacional da Despesa Familiar (National Family Expenditure Study)
FAO	-	United Nations Food and Agriculture Organization
FGV	-	Fundacao Getulio Vargas (Getulio Vargas Foundation)
FIPE	-	Fundacao Instituto de Pesquisas Economicas, Universidade de Sao Paulo (Institute of Economic Research Foundation, University of Sao Paulo)
FNDE	-	Fundo Nacional de Desenvolvimento da Educacao (National Education Development Fund)
FSESP	-	Fundacao Servicos de Saude Publica (Foundation for Public Health Services)

GLOSSARY OF ACRONYMS (Continued)

FUB	-	Fundacao Universidade de Brasilia (University of Brasilia Foundation)
FUNRURAL	-	Fundo de Asistencia ao Trabalhador Rural (Rural Workers's Social Assistance Fund)
GDP	-	Gross Domestic Product
GNP	-	Gross National Product
IAMPS	-	Instituto Nacional de Asistencia Medica e Previdencia Social (National Institute for Medical Assistance and Social Security)
IBGE	-	Fundacao Instituto Brasileiro de Geografia e Estatistica (Brazilian Institute of Geography and Statistics Foundation)
IBRD	-	International Bank for Reconstruction and Development (World Bank)
INAN	-	Instituto Nacional de Alimentacao e Nutricao (National Food and Nutrition Institute)
INPS	-	Instituto Nacional de Previdencia Social (National Social Security Institute)
IPASE	-	Instituto de Previdencia e Assistencia dos Servidores do Estado (Social Security and Welfare Institute for Public Servants)
IPEA	-	Instituto de Planejamento Economico e Social (Institute for Economic and Social Planning)
IPLAN	-	Instituto de Planejamento (Planning Institute)
LBA	-	Legiao Brasileira de Assistencia (Brazilian Assistance Legion)
LRPM	-	Long Run Planning Model
MEB	-	Movimento de Educacao de Base (Movement for Basic Education)
MEC	-	Ministerio da Educacao e Cultura (Ministry of Education and Culture)
MOBRAL	-	Movimento Brasileiro de Alfabetizacao (Brazilian Literacy Movement)
MPAS	-	Ministerio de Previdencia e Assistencia Social (Ministry of Social Security and Welfare)
NFET	-	Non-formal education and training

GLOSSARY OF ACRONYMS (Continued)

PAHO	-	Pan American Health Organization
PECE	-	Programa Especial de Controle da Esquistossomose (Special Program for the Control of Schistosomiasis)
PIASS	-	Programa de Interiorizacao das Acoes de Saude e Saneamento no Nordeste (Program for Grass Roots Health and Sanitation Actions in the Northeast)
PINS	-	Programa Integrado de Nutricao e Saude (Integrated Nutrition and Health Program)
PIPMO	-	Programa Intensivo de Preparacao de Mao de Obra (Intensive Program for Manpower Training)
PLANASA	-	Plano Nacional de Saneamento (National Sanitation Plan)
PNAD	-	Pesquisa Nacional por Amostra de Domicilios (National Household Sample Survey)
PND II	-	II Plano Nacional de Desenvolvimento (Second National Development Plan)
PNS	-	Programa de Nutricao em Saude (Nutrition in Health Program)
POLONORDESTE	-	Programa de Desenvolvimento de Areas Integradas do Nordeste (Development Program for Integrated Areas in the Northeast)
PRONAN	-	Programa Nacional de Nutricao (National Nutrition Program)
SALTE	-	Plano de Saude, Alimentacao, Transporte, e Energia (Health, Food, Transport and Energy Plan)
SEEC	-	Servicio de Estatistica da Educacao e Cultura (Education and Culture Statistical Service)
SENAC	-	Servicio Nacional de Aprendizagem Comercial (National Service of Commercial Training)
SENAI	-	Servicio Nacional de Apredizagem Industrial (National Service of Industrial Training)
SUCAM	-	Superintendencia de Campanhas de Saude Publica (Superintendency of Public Health Campaigns)
SUNAB	-	Superintendencia Nacional de Abastecimento (National Supply Superintendency)
USDA	-	United States Department of Agriculture
WHO	-	World Health Organization

SUMMARY AND CONCLUSIONS

i. This annex analyzes the health, nutrition and education of the Brazilian population in separate sections, each organized in essentially the same way. First, the available statistical indicators concerning the population's health or nutritional status over recent decades are reviewed and evaluated. Then the evolution of relevant government policies and programs is examined. This leads to an analysis of current policy issues, and finally to projections, or simulations which attempt to delineate plausible upper and lower bounds for the evolution of certain health, nutrition, or education-related variables. While health, nutrition, and education are studied in separate sections of this annex, an effort is made in each section to show the interrelations between the three. Likewise, other annexes of the Brazil Human Resources Special Report deal with material that is closely related to matters of health, nutrition, and education in Brazil. For example, Annex I (Population) contains a statistical analysis of the relation between access to water and female literacy on one hand and infant mortality on the other, while Annex IV (Housing, Water Supply, and Sewerage) analyzes the organization and implementation of government programs to provide safe water supplies and adequate excreta disposal which could be considered public health programs. Wherever possible in the present annex as in other parts of the report, statistical material and projections are presented according to a three region breakdown--Northeast, Southeast and Frontier. 1/

General Health Conditions

ii. On the basis of estimates presented in the World Bank, World Tables 1976, it appears that general health conditions are poor compared to countries at similar per capita GNP levels. Though life expectancy in 1970 as given in this source was slightly higher than the group average (63.0 years vs. 61.4 years), the infant mortality rate was nearly twice as high (110 vs. 55.6). Both indicators have improved substantially in recent decades; significant interregional and income class differentials still persist. For the 1960s the estimates presented in Annex I show life expectancy in the Southeast to have been 15 years greater than in the Northeast, while the infant mortality rate in the latter region was two thirds higher than that prevailing in the former. Life expectancies vary by more than 12 years between the highest and lowest income groups (62.0 vs. 49.9 years), averaging 55.7 years. 2/

iii. Patterns of mortality (and by implication of morbidity) differ markedly from region to region. The Northeast and Frontier both exhibit

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1/ The Northeast is defined as the nine states normally assigned this label by the Brazilian statistical agency, the Southeast merges the regions normally called the Southeast (Minas Gerais, Espirito Santo, Rio de Janeiro, and Sao Paulo) and the South (Parana, Santa Catarina, and Rio Grande do Sul), while the Frontier includes the remainder of Brazil usually referred to as the Central West and North.

2/ The Brazil average given in World Tables 1976 is for 1970, while these estimates are for the period 1960-1970. Nevertheless, the estimates presented in Annex I are not consistent with those presented in World Tables 1976. See the footnote on pages 9 and 10 of Annex I for an explanation.

the classical characteristics of underdevelopment, i.e., a high proportion of total deaths occurring in children under five years of age, and high mortality due to infectious and parasitic diseases and perinatal causes. Mortality patterns in the Southeast, in contrast, are closer to those observed in developed nations, where a relatively large proportion of deaths occur after 55 years of age, and the leading causes of death are diseases of the circulatory system and neoplasms (tumors). Further, data on proportional mortality rates attributable to infectious and parasitic diseases disaggregated into those reducible through immunizations (e.g., tuberculosis, diphtheria, polio, smallpox, measles, whooping cough) and through improved basic sanitation (e.g., typhoid, dysentery, enteritis, plague, malaria) indicate that about 80% of all deaths from infectious and parasitic diseases may be reduced or prevented by appropriate interventions. This relationship varies little between major regions, though in general basic sanitation programs have a greater potential to reduce mortality than do immunizations. However, basic sanitation is also more costly.

iv. Relatively little is known about the incidence of various diseases in Brazil, aside from indirect evidence provided by mortality data. Judging from the fragmentary information available, morbidity attributable to malaria, Chagas' disease, and schistosomiasis remains high within wide geographic areas. Of these three parasitic diseases, it appears that only malaria has been successfully contained over the past three decades. While the mosquitos which transmit malaria are found over 80% of Brazil's territory (containing 40% of the national population), in 1978 less than 9% of the national population was exposed to the risk of malaria. The Ministry of Health foresees complete eradication by 1980 in all but the Amazon region (accounting for 74% of the potential malarial zone, but only 20% of its population).

v. Until recently, Chagas' disease (the American form of trypanosomiasis) and schistosomiasis received comparatively little official attention. Chagas' disease has been detected in most of the Atlantic coastal states but the focal points of the disease appear to be the inland states of Minas Gerais and Goias, with 30% or more of the population infested in some municipios (counties). Since there is no known cure for this disease, government programs have been directed at reducing human exposure to the principal vector (a nocturnally active blood-sucking insect) by spraying and rural housing improvements (see Annex IV). The range of schistosomiasis, like Chagas' disease a debilitating and sometimes fatal affliction, is similar -- it is endemic to all seaboard states from Para to Parana (except Piaui) plus Minas Gerais. Another similarity is that no control measure has yet proven effective in mass campaigns. While inadequate statistical data prevent a clear determination, it is likely that important migratory flows from the Northeast to the Frontier have widened the disease's range in recent years. The control of schistosomiasis through improvements in sanitation, elimination of the principal vector (a fresh water snail), chemotherapy, education, end epidemiological surveillance is high on the Ministry of Health's list of priorities, although to date no control measure has proven effective in mass campaigns.

vi. While yellow fever, rabies, and plague have been virtually eliminated from Brazil, leprosy, trachoma, and especially tuberculosis continue to be endemic. However, there has been considerable progress in the control and cure of trachoma and tuberculosis over the postwar period. Spinal menengitis has

always been endemic, but from time to time has assumed epidemic proportions. The most recent epidemic began in 1971 and was effectively halted during 1975 through a very effective campaign beginning in 1974 which resulted in the vaccination of 81.7 million Brazilians in less than ten months. This experience shows that when a relatively cheap technology suitable for mass campaigns is available and political priority is high, Brazil's Ministry of Health can organize and administer rapid and effective programs of a preventive nature. Progress has been slower if substantial in the National Immunization Program initiated in 1973 which includes measles, poliomyelitis, diptheria, whooping cough, teatnus, and smallpox. In 1978 well over half the infant population was still not being reached by this program, in large part due to the lack of a broad and dense network of basic health facilities, especially in rural areas.

vii. According to the census, there was one physician for every 2,167 Brazilians in 1970. This ratio is considerably better than average when viewed in a Third World context, but worse than the average prevailing in industrialized countries. The population per nursing person (nurses plus nursing auxiliaries) and population per hospital bed ratios prevailing in Brazil also compare favorably with those of most developing countries. However, the quality and distribution of health personnel is uneven. As in many other countries, physicians and other health personnel show a marked locational preference for state capitals as opposed to smaller towns and rural areas. In addition, the health care system is far more developed in the industrial Southeast than in either the Northeast or Frontier.

viii. The available data strongly suggest that lack of access to medical care constitutes a formidable barrier to improved health conditions in Brazil. This problem seems to be most serious in the Frontier and Northeast, where the proportions living in municipios without a resident physician were 20.8% and 16.3% respectively.

The Public Health Sector: Structure and Growth

ix. Despite notable progress achieved during World War II, public activity in the health sector was still at a low level in the immediate postwar period. As of 1949, total resources devoted to this end amounted to only slightly more than 1% of GDP. Over the past 25 years, however, public expenditures on health have grown fifteen-fold in real terms and in 1976 equaled about 2.5% of GDP. The organizational structure remained essentially the same during this period, but its two principal components, which may be called the "collective-preventive" and "individual-curative" subsystems, grew at widely divergent rates. The former subsystem is composed of the Ministry of Health and the state Secretariats of Health, which concentrate on endemic disease control at the federal level and other types of disease prevention and cure at the state level, and the latter is comprised of the social security institutes and funds which are now grouped under the Ministry of Social Security and Welfare. This phenomenon has had an important impact on the nature of health care.

x. Since World War II the collective-preventive subsystem has lagged increasingly behind the individual-curative subsystem. The former's share of total public health expenditure fell from 87.1% in 1949 to about 30% in 1975. If all

investment expenditures on water supply and sanitation under the National Sanitation Plan (see Annex IV) were included, the 1975 figure would rise to 39%. The clear trend has been the progressive marginalization of the Ministry of Health, whose budgetary allocation declined in real terms over the period 1965-1975. One plausible explanation of this phenomenon is the generally low priority accorded to preventive health care (especially in rural areas) observed in post-war plans and budgets. Starting in 1976, however, the Ministry of Health began implementation of two major new programs, the first to provide a system of rural health posts in the rural Northeast staffed by locally-recruited paramedical personnel, and the second to control schistosomiasis. These two programs alone would double the real Ministry of Health expenditures over the four year period 1976-1979, so that implementation capacity rather than funding may now be the effective constraint on expansion of the collective preventive subsystem.

xi. The vacuum left by the decline of the Ministry of Health has been progressively filled by the social security institutes, i.e., the National Social Security Institute (INPS) and the Social Security Institute for Public Servants (IPASE), and more recently by the Rural Worker Welfare and Social Security Fund (FUNRURAL). From 1949 to 1975 their combined real expenditures on medical assistance, which started from a relatively small base, have risen at an average annual rate of nearly 19%. Over the decade 1965-1975 the real rate of increase was over 11%. The factors explaining this phenomenon may be classified in three broad categories: financial, demographic, and philosophical-administrative. First, in contrast to the Ministry of Health and state Secretariats of Health (which fund their programs from general revenues), the three components of the individual-curative subsystem derive their financial resources from earmarked taxes (payroll taxes from INPS and IPASE and a combination of urban payroll taxes and rural products taxes for FUNRURAL). This has provided the individual-curative subsystem with a guaranteed and highly elastic revenue base, which has effectively shielded it from the vagaries of legislative review. The basic demographics of the postwar period favored the expansion of INPS and IPASE since their clientele (the urban labor force) has increased at a considerably faster rate than the population as a whole. Finally, successive reorganizations have extended the potential coverage of the individual-curative subsystem from selected occupationally defined urban groups to the entire urban and then rural populations. By 1975 79% of the urban population was covered and available statistics for FUNRURAL suggest that up to 40% to 60% of the rural population (depending on the region) may have received some health services (usually urban-based) from FUNRURAL.

xii. The growth pattern described above has given rise to a public health sector biased toward relatively high cost, urban-centered, curative care. This allocation pattern for health resources is not peculiar to Brazil. It is common to many developing countries and even to the United States. The fragmentation of health resources among numerous administrative entities also constitutes an important barrier to the formulation of a national health policy. Over 70 such entities operate at the federal level alone, giving rise to an institutional setting characterized by overlapping jurisdictions and interagency antagonisms. Fragmentation of the public health sector has also constituted an important barrier to the formulation of a national health policy.

Emerging Health Policy Issues

xiii. Though public expenditures on health have grown rapidly, it is evident that the Brazilian health sector has serious problems. Among the most important identified are (i) a lack of coordination between government agencies responsible for health matters, (ii) a bias towards high-cost curative care, (iii) an urban and regional concentration of facilities and manpower, and (iv) a lack of success in reducing the incidence of certain endemic diseases, especially schistosomiasis and Chagas' disease. Recent government documents and pronouncements show that officials are aware of these problems. The central policy issues of the late 1970s concern the appropriate manners in which to deal with them. One of the most difficult problems to solve will be that of coordinating public activity in the health sector. As a first step a 1975 federal law formally established a national health system. But this "system" appears to simply formalize the allocation of responsibilities which have evolved informally over the past decades. At present, it is difficult to ascertain whether the new health system will solve the coordination problem and thus permit the formulation of a coherent national health plan. Even if it does, questions will arise as to the nature and direction of future growth in the system.

xiv. Two broad options appear to be open: (i) a continuation of past trends, with the urban-based individual-curative subsystem increasingly dominating the collective-preventive subsystem; or (ii) a new strategy giving more emphasis to primary health care for rural inhabitants and/or poorer regions. There is some official willingness to experiment with the second option. The Program for Grass Roots Health and Sanitation Actions in the Northeast (PIASS) was established in 1976 and is directed by an interministerial committee under the coordination of the Ministry of Health. The guiding principles of PIASS are that a large variety of health problems may be successfully prevented and/or treated at the community level, without recourse to expensive hospitalization in urban areas, and that preventive and simple curative services should be integrated with more complex curative services through well-defined institutional channels.

xv. As originally conceived, PIASS would operate at three levels. The first level of the system would be composed of rural health posts to be established in communities of 500-2000 inhabitants and staffed by locally-recruited auxiliaries. The second level of the system would be the health center, which, on the average, would serve three health posts (4500 people) and normally be staffed by a nursing attendant, a sanitation auxiliary, and a doctor who would visit one day per week. The third level of the system would consist of a larger regional health center attached to a hospital also serving the urban population where it is located. Each regional health center would serve an average of four second-level health centers and 12 health posts -- about 18,000 rural dwellers -- and be staffed by several doctors (one of which would travel daily to second level centers on a rotating basis), a nurse, dentists, auxiliary nurses, attendant nurses, administrative auxiliaries, and a driver.

xvi. In practice, the PIASS program appears to be evolving along somewhat different lines, with two rather than three levels in most areas (health posts and health centers). The health centers apparently vary considerably in degree

of sophistication and staffing, and often serve as the entry point to the FUNRURAL "individual-curative" system. In most cases the centers are located in the county seats with health posts being established in smaller towns. The health centers are sometimes staffed at least part time by a doctor who visits the health posts. Data for 1978 show that the density of the network of operating health posts and health centers was still considerably short of the original goals for the 25% of the target population considered as covered. For this "covered" population there was on the average one health post per 5100 people and one health center per 9900.

xvii. Start-up problems and difficulties in interagency coordination have slowed the implementation of PIASS, and it is highly unlikely that the program will be fully and effectively implemented by the end of 1979 as planned. The key problems involve management and training of medical and paramedical personnel. The problems are in principle resolvable, but this will require time and political priority for PIASS at all levels to ensure better quality management personnel and adequate financial resources. The success or failure of PIASS is likely to influence the future direction of health policy, since it is viewed by many as a possible model for a national rural health system.

xviii. The appropriate manner in which to deal with the continued high incidence of the major endemic diseases has also emerged as an important policy issue in the late 1970s. In this area, the Ministry of Health's first priority is the containment and eventual eradication of schistosomiasis. To achieve this goal, a special program was inaugurated in 1976. The eventual success of this program hinges on its ability to treat a proportion of the infested population large enough (probably over 80%) to control transmission. This is likely to be an extremely difficult task. The drug being used for chemotherapy does not prevent reinfestation of people who have already been cured. Hence, the key to effective schistosomiasis control is the construction of adequate sanitation facilities and their use by the affected population.

The Cost of Extending Basic Health Care Coverage: Simulations

xix. The purpose of this section is: (i) to determine likely upper (optimistic) and lower (pessimistic) limits to the extent to which the Brazilian population's needs for basic health care would be met at different points in time through the end of this century; and (ii) to estimate in broad orders of magnitude the costs which would be incurred by the public sector in providing basic health care under these two alternative scenarios. The two simulations should not be considered as forecasts, but rather as upper and lower bounds of what may reasonably be expected assuming no radical changes in Brazilian development strategy are forthcoming. The actual outcome is likely to lie somewhere between the optimistic and pessimistic simulations.

xx. The basic assumptions underlying the optimistic simulation are: (i) that GDP growth averages 7% per year over the period 1980-2000; (ii) that a strong effort is made to extend to the entire rural population of Brazil a rural health care delivery system similar to that originally envisaged under the PIASS program; and (iii) that the coverage of the urban population is completed through a restructured urban health care system. The pessimistic simulation assumes that GDP growth averages 4% per year over the period

1980-2000 and that the effort to extend both the urban and rural health systems is less intense. The simulations of both rural and urban basic health care costs are made in four steps. First, the type of service considered as meeting basic needs is defined. Second, the percentage of the population in each of the three regions to be covered is estimated for each year from 1976 through 2000 for each simulation. Third, unit costs for each component of the health care delivery system are estimated by region and year in 1976 US dollars. The final step is to multiply the per capita cost estimates for each year by the covered population using the "baseline" demographic projections (described in Annex I) to simulate total basic health care system costs. In estimating costs, an effort is made to err on the high side so that the possibility of underestimating total costs is reduced.

xxi. The problem of extending basic health care to the full urban population is neither coverage (since the INPS/IPASE system already covers over 85% of the target population) nor financial resources (which are already being mobilized), but rather restructuring so as to place less emphasis on doctors and hospitals (the most expensive part of the system) and more on paramedical personnel, preventive medicine, and outpatient care (which are not only cheaper, but more efficient at delivering many services to the persons who most need them). The cost per capita of covered population should be less in the restructured system than the present one, but in line with the determination to make cost estimates at the upper end of the plausible range, the actual 1976 per capita costs were used as the base for the simulations. A 1% per year increase in real per capita costs is assumed in the pessimistic simulation and a 2% increase in the optimistic (faster growth) simulation. Coverage of the urban population reaches 100% in 1980 in the optimistic simulation, and in 1990 in the pessimistic one.

xxii. The greatest opportunities for increasing coverage, and hence the principal differences between the optimistic and pessimistic simulations, are found in the rural sector. Here the approach adopted was to assume that a PIASS-type system will be progressively implemented in all regions, starting in the Northeast (where the effort began in 1976) and spreading to the other regions beginning in 1981. Cost estimates are based on World Bank experience in rural development projects in the Northeast; but the basic costs are augmented by a 30% administrative overhead charge to allow for better management of the system, and substantial regional cost differentials are assumed in the Southeast and Frontier regions (in line with differences in average minimum wages between these regions as compared with the Northeast). In the rural system both current and capital costs (including training) are considered explicitly. The rate of implementation is essentially a function of per capita GDP growth and development strategy. Both lead to faster implementation in the optimistic simulation, with full coverage attained in all regions by 1990. In the pessimistic simulation full coverage is not attained in all regions even by the year 2000.

xxiii. Total (rural and urban) basic health care system costs would not exceed 2.6% of GDP in any five year period between 1976 and 2000 for either simulation. Since public health systems already cost about 2.5% of GDP in 1976, money does not appear to be the main problem in extending the basic health care system at the rates indicated in the two simulations. Indeed,

given the deliberate upward bias in the cost estimates, it is quite likely that the percentage of GDP required would at no time before the end of the century exceed that observed in 1976. Thus, if the public health care system grew at the estimated rates, and assuming unitary income elasticity of the taxes which now finance public health care, there could be a dividend left over for further acceleration of coverage increases and/or average quality improvements without any increase in taxation rates.

xxiv. The real challenge in improving Brazil's health care system is organizational rather than financial. Increasing access to the system by the poor, especially in rural areas, and strengthening the collective-preventive components so as to raise overall system efficiency are the major measures required. They are not costless, but the costs are likely to be offset, at least in part, by efficiency improvements. Once full coverage is realized, the real financial effort required to provide basic health care, expressed as a percentage of GDP, should fall.

The Relationship between Nutrition, Other Basic Needs, and Economic Development

xxv. The nutritional status of a population is closely related to both demographic factors and the satisfaction of other basic needs. Indeed, the interrelationships between nutrition, family size, health, sanitation, shelter, and education are multiple. For example, poor sanitation is a major cause of gastrointestinal disturbances which can diminish the body's ability to assimilate what food is ingested. A child's mental capacity and energy, and hence capacity to learn, are affected by serious malnutrition. And, with any given family income, the larger the family, the higher the probability of malnutrition. Overcrowding of dwelling space and lack of basic residential services such as sewerage and potable water are sources of sanitation and health problems, which in turn may have adverse nutritional consequences. Unraveling and quantifying these complex interrelationships in any precise way is not an easy task.

xxvi. Research on the consequences of malnutrition in Brazil is considerably less developed than that aimed at measuring its nature and magnitude. This situation is largely explained by the lack until recently of an appropriate data base but also by methodological difficulties. Nevertheless, there is a strong indication that malnutrition is an important cause of child mortality and stunted physical development. It may also impede full mental development and hence of educational attainment and productivity, though the evidence on this point is not incontrovertible.

xxvii. A study published by the Pan American Health Organization showed that between 60% and 70% of all deaths of children under five years of age were nutrition-related, and that such causes of death were especially prevalent in the under one year age group. Another important finding of this study was the high degree of interaction between malnutrition and infection, with 60-75% of all deaths from infectious and parasitic diseases having nutritional deficiency as an associated cause. Breastfeeding is declining in Brazil, as in many other countries, with negative nutritional consequences. These consequences are compounded by contaminated water supplies, unsanitary preparation of powdered milk or milk substitutes, and nutritionally harmful customs (e.g., the substitution of cassava gruel, lacking in any protein, for mothers' milk at the age of five to six weeks, a common practice in Northeast Brazil).

The Extent of Malnutrition

xxviii. Malnutrition in Brazil has long been the subject of studies and concern by both Brazilian and foreign experts. But the National Household Expenditure Study (ENDEF) conducted in 1974/75 by the Brazilian statistical agency (IBGE) is by far the most complete and carefully executed survey on nutrition and family expenditure ever done in Brazil. Most of the analysis in this report is based on the early publications of the ENDEF and some unpublished ENDEF tabulations, though earlier national estimates based on food balance sheets and surveys conducted by the Getulio Vargas Foundation are reviewed along with some surveys which cover only a single city. When all the ENDEF results are available, it will be possible to find out a great deal more about the causes and consequences of malnutrition in Brazil. The analysis in this report concentrates on calorie consumption because numerous surveys, including the ENDEF, have shown that if calorie intake is adequate, protein requirements are almost always met given the foods normally consumed by Brazilians.

xxix. The ENDEF data show average per capita daily calorie consumption (food served on the plate) in 1975 of 2208 in rural areas and 2051 in urban areas, or 2123 for Brazil as a whole. According to ENDEF estimates of calorie requirements, adjusted upward slightly for food not ingested, this would mean average surpluses of 151, 44, and 93 calories per capita per day for rural, urban, and all Brazilians respectively. But the preliminary ENDEF publications warn that these "minimum requirements" are "not optimal levels for promotion of a better nutritional state and much less for nutritional recovery." Since in this report requirements are needed which are suitable for projecting the needs of a healthy population, two other estimates of requirements by major region and urban/rural location were prepared using FAO/WHO guidelines. These estimates differ only with regard to the assumed weight of the population more than 12 years of age (the guidelines fix calorie requirements for children through age 12 independent of weight). The first, called FAO/WHO High, assumes that well-nourished Brazilians aged 20-39 have the standard weights used by FAO/WHO (65 kg for men and 55 kg for women). The second, called FAO/WHO Low, is based on estimates of the weight of healthy Brazilian adults derived from the ENDEF anthropometric data. Both use the FAO/WHO recommendations for adjusting requirements for young adults to estimate requirements for older adults and teenagers. Both are adjusted by ENDEF estimates of food not ingested so as to be comparable to the ENDEF consumption data. The "baseline" demographic projections (see Annex I) were used to provide the age-sex breakdown of the population for urban and rural areas of the three regions necessary to make these alternative estimates.

xxx. By either of these new estimates, average daily consumption in Brazil is below requirements. Rather than a surplus, there is a deficit which averages 198 calories per person per day using the FAO/WHO High requirements and 119 using the FAO/WHO Low requirements. This is equivalent to a 9% (High) or 5% (Low) shortfall.

xxxi. Using unpublished tabulations of normalized per capita consumption for 22 ENDEF subregions and 9 classes of global family expenditure, estimates of the number of people obtaining adequate diets (defined here as diets satisfying the FAO/WHO Low calorie requirements) and those with three levels of calorie deficits (0-200, 200-400, and more than 400 calories per day) were made. Only 33% of the 1975 Brazilian population met the FAO/WHO Low calorie requirements. This average hides strong (but not unexpected) regional and urban/rural differences -- the low is 9% in the urban Northeast and the high 70% in the rural Southeast. 19% of all Brazilians had small calorie deficits up to 200 calories per day) the nutritional significance of which is highly debatable given the controversy among experts concerning the proper way to estimate requirements and the possibility of measurement errors. But another 31% of the population had moderate calorie deficits which probably represent real nutritional problems. Finally, 17% of the population had deficits over 400 calories averaging 543 calories. The deficits over 400 calories are unmistakable evidence of serious nutritional problems since they average 2.7 times a margin or error of 200 calories in deficit estimation. Twenty-nine percent of the population in the Northeast (49% in urban areas and 14% in rural areas), 9% in the Southeast, and 32% in the Frontier are estimated to be suffering from these serious deficits, which total over 10 billion calories per day.

xxxii. ENDEF anthropometric data may be used to estimate the extent of malnutrition using the Gomez indexes (first degree malnutrition, 76-90% of normal weight for age; second degree malnutrition, 61-75% of normal weight; and third degree malnutrition, 60% of normal or less). From birth to 17 years of age, only 42% of all Brazilian children reached normal weights for their age. The corresponding figures are 32% in the Northeast, 48% in the Southeast, and 37% in the Frontier region. First degree malnutrition affected about 17% of Brazilian children from birth to six months of age (the period of maximum breast feeding), but increased to 40% two years after birth. For all children through age 17 the average was 37% and regional differences were small.

xxxiii. Nutritionists differ on the amount of harm caused to a child by mild malnutrition. But there is little debate concerning prolonged second degree malnutrition (as opposed to short bouts). It stunts growth, and the growth deficit will become permanent if not made up before adolescence. Many nutrition experts also suspect that brain growth may also be impaired with lasting effects on mental capacity, but this position is not supported by incontrovertible statistical evidence. For all Brazil, 20% of children under 18 years of age were estimated to have been suffering from second degree malnutrition in 1975. The regional averages were 28% in the Northeast, 15% in the Southeast, and 23% in the Frontier. Third degree malnutrition usually leads to death. For this reason, and because the ENDEF data cleaning process eliminated from the final tabulations data for persons who were obviously ill or abnormal, only about 500,000 Brazilian children (about 1% of the population under age 18) show up as afflicted by third degree malnutrition.

xxxiv. The cost of adequate diets was estimated for each of the 22 ENDEF subregions by estimating the costs of the food mixes consumed and prices paid by people just meeting the FAO/WHO Low national average calorie requirements in each subregion. The unweighted average cost per person per year for these

diets (called Type 1 diets) was US$289 for the nine metropolitan areas plus Brasilia, US$264 for the seven other urban subregions, and US$149 for the five rural subregions at the average prices and exchange rates of August 1974. The costs of calorie-adequate diets composed of the mix of foods consumed and prices paid by families at the (lower) 20th percentile of the ENDEF subregional family expenditure distributions (Type 2 diets) for the same groupings of subregions were US$199, US$155, and US$137 respectively. As a control, calorie-adequate diets composed entirely of cereals and cereal derivatives (Type 3 diets) were also estimated.

xxxv. The meaning of these adequate diet costs in the context of a poor family's budget is better grasped if they are expressed in terms of the cost for feeding a Type 2 diet to a family of five measured in annualized Rio de Janeiro minimum wages (the minimum wage in Rio de Janeiro is the highest in Brazil). Only in the rural areas outside of Sao Paulo and the South (Parana, Santa Catarina, and Rio Grande do Sul) would this adequate "poor family's diet" cost less than one minimum wage. In fact, it is closer to two minimum wages in Rio de Janeiro, Sao Paulo, Porto Alegre, and Brasilia. The significant diet cost differences found between subregions even for Type 2 diets suggest that, at least as far as the food component of family expenditure is concerned, using national average income, wage, or expenditure data to identify the absolute or relative poor may be quite misleading, tending to underestimate the number of poor in high food cost areas and overestimate them in low food cost areas.

xxxvi. A preliminary analysis of family expenditure, calorie consumption, and durable goods ownership patterns at four points in the 22 ENDEF subregional distributions of global family expenditure shows some striking features. First is the relatively low proportion of total expenditure devoted to food purchases in urban areas. Even at the (lower) 20th percentile, the unweighted mean for the nine metropolitan areas and Brasilia was only 45%. For seven other urban subregions it was 53%, and for five rural subregions, 63%. The percentages tend to fall as one moves up the expenditure distribution, but much less in rural than in urban areas. In general, the analysis suggests that after deflating by food costs, the rural poor are still poorer than the urban poor, but better fed.

xxxvii. Another significant fact is that even families with large calorie deficits spend about one fifth of their food budget on meat and fish, despite the very high cost of calories from these sources compared with cereals, for example. There are undoubtedly strong cultural factors underlying this phenomenon, and of course meat and fish are important sources of proteins and other nutrients as well as calories. But when calorie deficits are large, the ingestion of protein from meat and fish appears economically wasteful since most of the protein will be converted into energy rather than body tissue. The ENDEF data also suggest that for large numbers of poor and not so poor urban families, owning consumer durables such as television sets, refrigerators, blenders, and even automobiles may be preferred to meeting calorie requirements.

xxxviii. Perhaps the most significant conclusion which may be drawn from the preliminary analysis of Brazilian expenditure patterns is that unless consumption habits change, reliance on increases in income alone to improve the nutritional status of the poor will involve either massive transfers of income or allowing serious nutrition to persist well into the 21st century. This is because the elasticity of per capita calorie consumption with respect to per capita expenditure appears to be quite low -- on the order of 0.2 for (lower) twentieth percentile families in urban areas and 0.3 in rural areas -- despite the fact that these families generally have deficits well above 400 calories per capita in urban areas and 300 per capita in rural areas.

xxxix. The basic conclusion which emerges from the preliminary analysis of the ENDEF data is inescapable. Comparisons of the ENDEF food consumption data with requirements for a healthy Brazilian population, the growth patterns of Brazilian children with those of healthy children of similar ethnic background in other countries, and the ENDEF age/weight data with the normal standard using the Gomez classification, all suggest that malnutrition in Brazil is more widespread and severe than earlier analyses based on food balance sheets or the family budget studies of the early 1960s had indicated. This conclusion is also supported by the estimates of the number of Brazilians with moderate and severe calorie deficits. The cost of calorie-adequate diets for a family of five containing foods in the same proportions and at the same prices paid by the (lower) 20th percentile families in each ENDEF subregion, when measured in terms of the highest minimum wage prevailing in Brazil in August 1974 is such that except in some rural areas, at least one full minimum wage would have been required simply to feed the family adequately -- in a number of urban areas the cost would have been closer to two minimum wages. But the patterns of family expenditure, calorie consumption, and durable goods ownership revealed by the ENDEF data suggest that reliance on plausible increases in income alone will not allow rapid progress in reducing malnutrition.

Evolution of Policies Affecting the Nutritional Status of the Population

xl. Assuring an adequate supply of food at reasonable prices has been an ongoing concern of policy makers in postwar Brazil. Until very recently, however, the nutrition problem was viewed almost entirely in terms of production and marketing considerations. As a consequence, the important causal relationships between nutrition status and poverty received scant attention, at least explicitly. This posture has changed markedly during the present administration. Though a preoccupation with supply (abastecimento) still persists, policies of the mid 1970s explicitly recognize that malnutrition is most severe among the poor and that direct interventions designed to increase food consumption of the poor are justified. The clearest manifestation of this new thrust is the National Food and Nutrition Program (PRONAN) first established in 1973, but upgraded and restructured in February 1976.

xli. Since the early 1960s the agricultural sector has been increasingly viewed in terms of its contribution to the national balance of payments. While this goal was considered important by the writers of the Second National Development Plan of 1975-1979, it has since been accorded even greater priority due to greater balance of payments difficulties (particularly through rising petroleum prices, an uncertain demand for Brazilian manufactured exports, and a buoyant

international market for certain agricultural products such as soybeans, cocoa, and fruit juices. The Brazilian government has sought to avoid potential conflicts between policies to increase foreign exchange earnings through agricultural exports and those aimed at assuring an adequate, reasonably priced domestic food supply.

xlii. In recent years internal food prices have been rising at a faster rate than the general price index. Furthermore, the per capita supply and yields of some important food products have been stagnant or falling. The data strongly suggest some major components of the domestic food supply are subject to inelasticities, and that price increases may have had a negative impact on the poor. Recent Brazilian research reviewed in this annex suggests that important government efforts to promote agricultural exports, as well as price controls on foods, may to some extent have conflicted with efforts to assure an adequate domestic food supply. The issues remain controversial, however, and considerably more research is needed. In any case, the survey data reviewed above indicate that even relatively poor people often spend less than half their income on food, and even the relatively well off are inefficient in meeting recommended nutritional standards. To the extent this remains the case, a better supply would not necessarily produce better nutrition.

xliii. In contrast to general food production and marketing policies, specific nutrition programs of the mid 1970s reflect a growing concern with the distributional aspects of development. They also acknowledge the shortcomings of national agriculture policies which give preference to landholders producing crops for export, and the limited success so far achieved in establishing cooperatives and agricultural colonies. The principal new program in the nutrition area is PRONAN. This program, administered by the National Food and Nutrition Institute (INAN) has a budget of Cr$1.5 billion at 1975 prices for the 1976-1979 period. The World Bank is helping support PRONAN through INAN's Nutrition Research and Development Project.

xliv. PRONAN combines the "shortcut" approach to alleviating malnutrition through provision of food supplements directly to "biologically vulnerable" target groups (i.e., pregnant and lactating women and preschool-aged children from low-income families) with a longer-term approach aimed at improving the viability of small-scale food production in Brazil's poorer regions. Official documents make it clear that the food supplement subprogram is only temporary and that the long-term social content of PRONAN lies in its attempt to redirect agricultural policy. Owing to its newness, it is probably premature to make any assessment of PRONAN.

xliv. The most cost-effective way to promote calorie-adequate diets may be to decrease the prices of those basic foods which account for large share of poor people's expenditures. Based on 12 ENDEF subregions for which detailed expenditure data were available at the time of writing, 16 of the 52 items of food expenditure in the most detailed published breakdown constitute 63-75% of total food expenditures for families in the same ENDEF brackets as the 20th percentile families. With the exception of wheat-based products, virtually the entire supply of this preliminary selection of basic foods is obtained from domestic production. Of these, four staples of the Brazilian diet -- rice,

cassava, beans, and maize -- which are grown by almost all small farmers (who themselves usually among the poor) account for roughly one third of food expenditures in rural areas and one fifth in urban areas for families at about the 20th percentile of the subregional expenditure distributions. The proportion of calories consumed by these same families which are derived from these four commodities is twice as high.

xlv. Policies aimed at reducing the cost of producing, processing, and marketing these four staples alone could trigger an agricultural development process with significant nutritional benefits, so long as it is assured that production is profitable for the farmers. In addition to providing for increases in the supply of these foods, demand would also be generated for other foods with higher income elasticities. Such a strategy is implicit in several PRONAN subprograms dealing with production, marketing, food processing technology, and food distribution. Hence, careful monitoring and evaluation of PRONAN should be most helpful in planning future Brazilian nutrition programs.

xlvi. At the consumption end of the food chain, the major issues which should be resolved are: first, the definition of the basic food needs of the population, and second, the design of programs which would be most effective in meeting these needs. The analysis of ENDEF data suggests that low and moderate income Brazilians do not consider meeting calorie requirements as important as the consumption of meat, coffee, cigarettes, and consumer durables. Certainly there are strong cultural traditions as well as contemporary commercial pressures underlying these phenomena, which merit further research. But there is no doubt that any program to reduce or eliminate malnutrition will be cheaper the more the population is willing to fulfill their calorie intake requirements before satisfying other needs. The issue then is whether an effort should be made to change these consumption habits in conjunction with other actions aimed at reducing malnutrition.

xlvii. As dietary habits are largely the result of tastes and preferences, the acceptability of public intervention in the formulation of these habits is clearly a political question. Nonetheless, it could have important economic consequences. Even without any other nutrition intervention or further growth in incomes, both of which could contribute importantly to the reduction of malnutrition, the nutritional status of the Brazilian population could be significantly improved simply by modifying the way families spend their income. This suggests that increasng the population's awareness of the nutritional consequences of their consumption habits should be part of public nutrition policy. Education, is already a component of most PRONAN programs. It is especially important in two types of programs currently in the experimental stages: targeted food subsidy programs (such as food stamps) and direct distribution of food supplements. Two major problems inherent in such programs are first, the potential for substitution of free or subsidized food for that which would have been purchased anyway and second, the diversion of free or subsidized food to persons less needy than the intended beneficiaries. These problems are minimized with the nutritional motivation and awareness of the target population.

Nutrition Simulations

xlviii. Given that defining basic nutrition needs in the Brazilian context and designing socially acceptable, cost-effective nutrition programs are issues which should be resolved before a truly massive national effort is made to eliminate or reduce malnutrition, projecting the costs of programs with these objectives is an even more hazardous endeavor than in the case of extending basic health services to the urban and rural population. The simulations which follow must therefore be considered highly tentative. They are intended simply to explore the orders of magnitude of costs which meeting certain goals (which are themselves tentative) might imply, under certain conditions.

xlix. Two major assumptions underlie these simulations. The first is that diets typical of families just meeting their calorie requirements and also diets composed of the same mix of foods as consumed by 20th percentile families, but in sufficient quantities to meet full calorie requirements (Type 1 and Type 2 diets respectively) will also guarantee sufficient proteins, vitamins and minerals. That is, in the Brazilian context, adequate calorie consumption is the binding constraint on achieving satisfactory nutrition. This assumption appears to be supported by the ENDEF data and other less comprehensive surveys.

l. The second assumption is that unless there are changes in Brazil's relative income distribution (in the direction of increasing equality), and/or significant changes in dietary habits, income growth and additional "basic" food output alone will not be sufficient to wipe out malnutrition (defined here as consumption below the FAO/WHO Low calorie requirements) by the end of the century. This assumption is itself based on two "baseline" simulations. They assume no large-scale nutrition interventions are undertaken, that the relative income distribution and consumption patterns at different expenditure levels shown in the ENDEF expenditure distributions do not change, and that GDP grows at 4% (pessimistic simulation) or 7% (optimistic simulation). The pessimistic baseline simulation shows that 42% of the Brazil population in the year 2000 would have calorie deficits under 400 calories per person per day, but only 4% would have deficits over 400 calories. The absolute number of Brazilians with small deficits would increase by 61% and compared with 1975, but the population with large deficits would fall to 47% of its 1975 level. In the optimistic simulation the picture is much brighter, but 22% of the population would still have deficits up to 400 calories, and only 0.5% would have deficits above 400 calories. These findings suggest that even if the goal is only to eliminate the deficits over 400 calories per person per day by the end of the century, some kind of government intervention will probably be necessary.

li. Four additional simulations were performed (using the "baseline" simulations as a starting point) to estimate the cost of eliminating calorie deficits through direct distribution of diet supplements during the period 1980-2000, using first Type 1 diet supplements (the mix of foods consumed at the prices paid by families in each ENDEF subregion who met their calorie requirements in 1974/75) and then the cheaper Type 2 supplements (the mix of foods consumed at the prices paid by families at the 20th percentile of each

subregional expenditure distribution). It is assumed that no diversion or substitution takes place, but that the real costs of supplements are increased by 50% over the real prices actually paid by consumers in 1974/75. This allows a margin for administrative costs, price increases, and educational campaigns.

liii. For each type of supplement, two simulations were performed. In the first, labeled "pessimistic", it is assumed that food supplements sufficient to eliminate all calorie deficits are distributed and GDP grows at an annual rate of 4%. In the second, labeled "optimistic", it is assumed that supplements sufficient to eliminate all calorie deficits are distributed and GDP grows at 7% per year. In all four simulations it is assumed that income distribution is "neutral" and that no changes occur in consumption patterns observed in the ENDEF data other than increased food consumption from supplements and the changes associated with higher incomes. Gradual implementation of the distribution programs is assumed, and this is arbitrarily defined as spending 10% of full coverage costs in 1980, 40% over the period 1984-85, 80% over the period 1986-1990, and 100% from 1991-2000.

liii. On these assumptions, the highest financial effort (defined as percentage of GDP required to carry out the programs) in any period between 1980 and the year 2000 would be in the pessimistic simulation for the periods 1986-1990 and 1991-2000 when about 1.0% of GDP would be required for Type 1 supplements and about 0.7% with Type 2 supplements. Potential costs have been deliberately and consistently stated on the high side to avoid under-estimates. First, the measure of requirements may be slightly high for the adult Brazilian population. Second, relatively cost-inefficient foods were included in the supplements, in accord with observed Brazilian dietary habits. Third, a full 50% was added to the retail prices observed in each subregion. Finally, direct distribution of food supplements is more expensive than food stamp programs or other forms of partial subsidy. Any improvement in relative income distribution would reduce costs further.

liv. It may be concluded that the costs of massive nutrition programs, with the objective of eliminating calorie deficits by 1990 would probably not require inordinate expenditure even if totally free distribution was used, assuming real GDP grows at least 4% per year for the remainder of this century. But much remains to be learned about how to organize and administer such programs so as to achieve their objectives efficiently.

Trends in Educational Indicators

lv. During the period 1940-70 the share of the population aged 10 and over classified as "literate" grew from 43% to 67%./1 Progress was quite

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/1 "Literacy" and "literacy rates" refer here to the official census (or "standard") definition of literacy which is a positive response to the question of whether the respondent can read or write a short paragraph in any language. A common convention is to judge as functionally literate those who have completed more than four grades of primary schooling. Neither criterion is ideal.

uneven between the three intervening decades and was substantially faster for women. Relative to the group average of 26 other countries in Brazil's per capita income class (70%), Brazil's adult literacy rate in 1970 was slightly lower. While this group average literacy rate increased by 19 percentage points between 1960 and 1970, Brazil increased its rate during the same period by only 6 percentage points -- less than one third of the group average increment. In absolute numbers, the 1960-70 net increase in Brazil's literate population among persons 10 years of age and older amounted to over 14 million. The total population in this age group, however, grew by an even larger amount. Thus, the absolute number of illiterates increased by almost 2.5 million.

1vi. The evolution of educational opportunities is reflected in the age distribution of literacy. In 1970, the literacy rate for the population aged 10-19 was around 73%. The age-group rates decline gradually for older cohorts, to a low of 43% for the population aged 70 and above. The overall literacy rate in urban areas was 73% while the rural rate was 40%.

1vii. The extent of literacy varied widely across regions and between urban and rural areas in 1970. The lowest literacy levels are consistently in rural areas of the Northeast, where state-level literacy rates ranged from 19% to 27%. Urban areas of the Southeast show the highest state levels: from 73% to 82%. In the country as a whole, 22% of the men and 21% of the women aged 15 and over had attained more than four years of schooling, the conventional measure of achievement of functional literacy. In the urban areas, the corresponding proportions were 36% and 32% respectively. For rural areas they were about 5% for both sexes. In comparison, literacy rates (according to the standard definition) for the same age group are about three times as high as the functional rates. Again there are major differences between urban and rural areas.

1viii. Increases in literacy have been accompanied by improvements in the educational profile of the adult population. In 1940, in the group aged 20 and over, 88% of the literate population had not completed elementary schooling, while 96% had not completed 4 years of middle-level schooling and less than 1.5% had completed higher education. By 1970, 68% had not completed elementary, 87% had not completed middle, and about 2% had completed higher education. The proportion of the working age population having completed at least 12 years of schooling can be used as a crude index of a country's per capita accumulation of human capital (or analogously, of the productive "quality" of its human resources). Though estimates indicate that such an index grew from about 2% in 1940 to 4% in 1950 to 10% in 1970, extrapolating the rate of (percentage point change) in this indicator between 1950 and 1970 would carry it to about 28% in 2000. Doubling the rate would carry it to about 46% in 2000. The historical trends are thus clearly too slow if the objectives of a predominantly skilled work force are to be achieved within the next hundred years or so.

Formal Education

lix. During the period 1960-73, the total student population increased from 9 million to 19 million; the proportion of students in the first eight grades decreased from 96 to 86%. There are significant differences among regions - particularly between the Northeast and the Southeast.

lx. Progress in basic education coverage since the early 1950s has been apparent in all regions. This is particularly striking in the Southeast, where rates approaching universal coverage now exist. The Northeast has lagged behind all other regions but there, again, the enrollment rate increased from 34% in 1955 to 67% in 1974, while absolute enrollment went up from 1.3 million to 4.5 million. For Brazil as a whole, the enrollment rate went up from 54% to 85% while enrollment increased from 6.2 million to 18.6 million during the same 1955-74 period. The population in basic education age (7-14 years) grew at a rate of 3.4% per year from 11.5 million in 1955 to 21.7 million in 1974.

lxi. Despite this effort, educational opportunities still remain limited and are related to the social and economic status of the client population. Rural education lags behind urban to a very substantial degree. Enrollment rates for grades 1-8 in rural areas in the year 1974 were about half the level in urban areas. The schooling experience of rural children in the Northeast and Frontier is largely limited to one grade. Enrollment in first grade in the rural locations of the Northeast and Frontier account for at least 60% of their respective totals. In the rural Southeast, this share is very much lower (44%). In the urban areas, however, the enrollment profile is similar in all three regions. Though showing some improvement over each of three successive periods (1951-58, 1958-65, 1964-71), grade progression for the class finishing in 1971 was still very inadequate. Only 24% of all entrants into first grade in 1964 had made it to the fourth grade by their fourth year in school, for those who had entered in 1951, the corresponding proportion was 16%.

lxii. Although individual traits and socioeconomic characteristics of students play a major role in determining schooling and learning achievement, it is clear that the quantity and quality of educational services offered also play an essential role. The supply of education is largely the result of policy. In terms of supply, the realities of Brazilian formal education in the rural areas are bleak. Consider the following stylized description of the typical rural school. The school is a one-room house where groups of students (officially in different grades) sit and stare. The instructor is unlikely to have advanced beyond basic level education and is paid less than the minimum wage. She is supposed to teach the entire program of studies in all grades, but her knowledge of the subjects is, at best, a product of sheer repetition. The room is overcrowded. There are no textbooks: some volumes were produced but have not been distributed; they are too expensive. Unquestioning repetition of the teacher's words is equated with learning. When this is achieved, the reward is moving to the intermediate or back rows in the classroomm (a sign of grade promotion). The price of failure is to stay in the same row or drop out.

lxiii. The magnitude of the problem is large. Seven out of ten of the 165,000 school buildings in Brazil in 1972 were one-room, one-teacher school houses. These were the schools attended by nine out of ten rural students. In these schools about 12% of the students drop out during the school year, an even greater proportion drop out between grades and an additional 25% fail the course at the end of the year. Only 50% of students in the first grade are promoted at the end of the year. Since not all those who are promoted enter the second grade in the following year, the loss exceeds 50%.

lxiv. From 267 thousand in the year 1960, total enrollment in secondary education (grades 9-12) grew at an average rate of 13.4% per year in Brazil to just over 2 million students in the year 1976. These 2 million students, however, were less than 17% of the estimated number of persons aged 15-19 in the year 1976. In 1960 the comparable percentage was less than 4%. Regional differences in this indicator narrowed from 2.6 to 1 in 1960 to 2.0 to 1 in 1976. In both years the maximum value was for the Southeast and the minimum for the Northeast.

lxv. Great care is required in interpreting these statistics. There may be fewer differences in quality of instruction than in the case of primary education, but differences in the content and orientation of the intruction are greater. It should be generally true, however, that the bulk of individuals who have made it to secondary education (grade 9 or above) can be regarded as being functionally literate and potentially capable of productive work using modern technology.

lxvi. In 1971 substantial changes were initiated in both the length and content of secondary education. Its first cycle (grades 5 to 8) was officially shifted into primary education, thus leaving its length reduced from 8 to a maximum of 4 grades (9 to 12; corresponding to ages 15 to 18). In practice secondary education is often only 2 to 3 years in duration. Since the reform, the educational system has been gradually phasing out the pure general education stream in favor of curricula leading to "sub-professional" certification level (teacher training, agriculture, industry and commerce) or to a general curriculum with considerable practical activites in a so-called family of skills. This new structure is still in process of adoption by the various states so that all kinds of intermediate and transitional structures are to be found.

lxvii. Enforcement of this controversial program has been very uneven. Some schools have not complied, being too poor to afford the added costs. The best schools set up higher quality programs, but few students took interest in the vocational content of the program, the university entrance being their only goal. In between, diverse combinations are found. Data are poor, but there is no doubt that considerable change is taking place in the direction of a larger proportion of vocationally oriented enrollment, even though the latter's efficacy has not been sufficiently demonstrated. The 1971 Educational Reform initiative intended to turn the middle level into one large sector of technical education. Since 1974 this extreme position has changed perceptibly. It was recognized that available resources were insufficient to provide all the prescribed specialisations. The current orientation is to organize instruction around occupational clusters and to focus on basic skills which are expected to be complemented with on-the-job training.

lxviii. Many unanswered questions remain about how far to go in orienting education to specialized labor markets or what might be a reasonable timetable for implementing any such strategy. Nevertheless, progress in developing a strong function-oriented middle-level educational program in the coming years will be hampered by strong competition from a rapidly expanding higher educational system. The preferences of students are bound to be crucial in resolving these issues.

lxix. The demand for higher education gathered momentum in the 1940s. By 1960, enrollment in Brazilian universities stood at 93 thousand; by 1975 it had mushroomed to almost 1 million. Especially since the passage in 1968 of a law reforming higher education, pressures to improve its quality were added to the ever increasing demands for expanding its availability. The 1968 law envisaged a process for meeting both objectives. In the event, the surge in demand for higher education overwhelmed the trade-off between quantity and quality; with some notable exceptions, quality has suffered.

lxx. In varying degrees, the intended quality improvements have been met in the public universities, which achieved high academic excellence. This has not been generally the case in the "isolated institutions." This latter group has been absorbing the major portion of incremental enrollment since 1968. They offer comparably few disciplines and most of them are in the social sciences, administration, and law. Their academic standards are often lax. Typically, students admitted to public universities belong to the higher socioeconomic strata. There they receive the best education available at a highly subsidized private cost, which naturally exacerbates their original social and economic advantage. By contrast, those who end up in private isolated institutions have to bear the full cost of their education, which tends to be of much lower quality.

lxxi. Graduate programs have also surged in recent years. Between 1970 and 1976, the number of Masters and Ph.D. programs grew almost six times (from 106 to 569); their enrollment increased over seven times to a total of about 36 thousand in 1976. Not surprisingly, this spectacular growth has not always been accompanied by high quality.

Non-formal Education and Training

lxxii. Diversity among activities officially included under the category of non-formal education (the Brazilian official label is "ensino supletivo," but the term seems misleading) is so great, that just about the only common characteristic element is that they are aimed at the adult population. Governmental responsibilities for these activities are scattered over many agencies. They include four main clusters of programs dealing with, respectively: (i) adult literacy and other basic skills ("literacy" for short); (ii) dropouts from primary and (non-vocational) secondary education who want to obtain "equivalent" instruction or certification ("equivalency"); (iii) instruction through radio, television and correspondence ("distance learning"); and (iv) "vocational" training outside of the formal system ("vocational").

lxxiii. Government programs to "eradicate illiteracy" among the adult population in Brazil have a long tradition. Many such programs preceded the Brazilian Literacy Movement (MOBRAL) which began operations in September 1971; the program has been dominant among other such activities ever since. Many conceptual and statistical problems hamper attempts to provide reliable quantitative assessments of MOBRAL's effectiveness against illiteracy. Nevertheless, it seems clear that its impact has been substantial.

lxxiv. According to MOBRAL data, cumulative enrollment over the 1970-75 period amounted to around one quarter of some 76 million eligible Brazilians. But surely this magnitude greatly exaggerates MOBRAL's impact on literacy. High rate of failure in achieving functional literacy, probably even higher rate of subsequent reversion to illiteracy, and double counting are only some of the sources of exaggeration. Moreover, the program appears to have lost momentum: available data show certifications peaking in 1972 and enrollment peaking 1973. The data also indicate that less than half of participants obtain certificates. For some, the record has been disappointing and several reasons for this have been suggested, including: (a) unsatisfactory training of instructors (they are trained in a course lasting only a few days); (b) the rigid structure of the literacy courses, which does not allow for any regional adjustment, has been blamed for loss of interest by participants after initial enthusiasm; (c) the injection of seemingly political objectives by MOBRAL instructors, provoking a negative reaction among some participants; and, the most important factor of all, (d) failure, in the vast majority of cases, to follow-up through educational or cultural actions after the initial basic literacy course.

lxxv. Despite these shortcomings, MOBRAL undoubtedly has had an impact in spreading literacy. Also significant is the mobilization of community resources for education that has taken place in all of the nearly 4,000 municipalities of Brazil. In creating a precedent for community action, MOBRAL's impact may go beyond the magnitudes associated with enrollments and certifications.

lxxvi. The second cluster of non-formal programs is designed to further educational achievement (mostly adult) through instruction and certification originally intended to be equivalent in substance to that received in primary and secondary formal education programs. Poor as they are, the available data suggest that the equivalency educational program suffers from problems similar to those in the regular track, particularly excessive drop-out and failure rates. In addition, the expansion of the regular track and the perception that this program provides second rate instruction and lesser opportunities for jobs and social mobility have weakened demand for it. Consequently, its strong expansion in the coming years is doubtful.

lxxvii. A related goal in the system of equivalency education has been to experiment with non-conventional technologies (particularly, the use of radio and television and correspondence) for the delivery of instruction. A study on educational radio indicates that the scope of these activities is still quite small in relation to potential users. Nevertheless, based on recent research some experts feel that these technologies hold considerable promise for Brazilian education.

lxxviii. The clients of these programs are persons whose school attainment is above the average and are around the middle of Brazil's socioeconomic structure. While they can lead to higher levels of instruction, the evidence suggests that the probabilities of failure in the university entrance examination, and of dropping out of the university if admitted, are much higher for graduates from the non-formal programs than for others.

Vocational Training

lxxix. Vocational training has a long tradition in Brazil. Its history may be traced back to the 1910s when the first technical schools were set up in Sao Paulo and Guanabara. The National Service for Industrial Apprenticeship (SENAI) and National Service for Commercial Apprenticeship (SENAC) were set up in the 1940s. Others have followed. The Intensive Program for Manpower Training (PIPMO) was added in 1963 to meet additional training needs for industrial service and was later expanded to serve all production sectors. More recently The Brazilian Technical Assistance and Rural Extension Enterprise (EMBRATER) was created to replace a previously existing agency in providing rural training through agricultural extension. SENAI and SENAC have a great deal of financial and operational autonomy, deriving their income from a payroll tax on industrial and commercial firms with 500 or more employees. PIPMO is controlled by the Ministry of Labor.

lxxx. An important feature of current policies is the provision of incentives to enterprises to set up their own training activities. Thus far, the most important incentive is to allow firms to deduct twice their training costs from their taxable income, once such activities are approved by the Ministry of Labor. SENAI carries out its activities in 245 training centers and in "on-the-job" training arrangements. Its organization and management are highly decentralized; its 430,000 certified participants in 1975 ranged from managers to semi-skilled workers. Because of SENAI's wide ranging geographical coverage and decentralization, the courses differ in content, method, duration, and quality standards. However, the quality of SENAI's courses are generally held in high esteem.

Educational Costs and Benefits

lxxxi. Total education expenditures as a proportion of GDP increased from 1.6% in 1960 to 2.8% in 1974. A characteristic of this evolution has been a decentralization of public educational financing: the federal government's share declined from 33% to 22% between 1960 and 1974, while the municipalities increased theirs from 8% to 11%. Partly, this was due to a constitutional provision adopted in 1969 requiring municipalities to allocate 20% of their budgets to education. Despite the growth of municipal education outlays, however, municipalities as a group spend less than the stipulated 20%.

lxxxii. During the last ten years an increasing number of special funds and transfer mechanisms have been set up to finance Brazilian education. In 1977 there were 15 specifically identifiable sources of (earmarked) public funds for this purpose plus "miscellaneous" categories at each of the federal, state and municipal levels of government. These sources include items such as: import duties, income tax, federal lottery, sports lottery, rural

property tax, sales tax. State expenditures per resident grew quite rapidly during the period 1965-73 in all three regions, more than doubling in the Northeast and Southeast and almost quadrupling in the Frontier. By 1973, differences between regions remained great, with the Southeast index four times greater than for the Northeast.

lxxxiii. Comparisons of other educational finance and related indicators between states grouped by total state revenue show that the six wealthiest states made up 83% of all education outlays in 1965, and 79% in 1973 while accounting for only 70% and 65% shares in total enrollment in the respective years. At the other extreme, the poorest states, which in 1965 had 5% of enrollment and 6% in 1973, made up 2% and 3% of education outlays respectively. Federal transfers earmarked for education seem to have been moderately effective in redistributing resources to the poorest states. During the same 1965-73 period they received 24% of all such funds while their share in total enrollment averaged only 6%.

lxxxiv. It has been estimated that student unit costs of state-run primary schools in the Southeast were between 50% to 100% higher than in the Northeast and Frontier in 1960. Similarly, if the Northeast's unit costs had been equivalent to that in the Southeast, the required outlays would have had to be about 3.7 times greater than they were. Reported differences in unit costs are also large between the municipal and the state networks within specific states, as well as between municipal schools in low-income municipalities (usually rural) and high-income (usually urban). Differences as great as 1 to 75 between municipalities have been reported. Information for the period 1965-70 indicates that for Brazil the unit costs of middle-level education (roughly, grades 5 through 12 at that time) were four times those of the primary level, while the unit costs in higher education were, on average, over 40 times higher than the unit costs of primary.

lxxxv. Part of these differences can be attributed to inherent differences in the educational service rendered in each level. For example, university teachers take longer to train and thus their salaries tend to be higher; instruction materials (including laboratories and computers) are naturally far more expensive in university training. All such pedagogically related factors, however, when taken into account, still leave much of the unit cost differences unexplained. This remainder is due to expenses that appear related mainly to consumption demands by students and staff. Consider, for example, that while most rural primary schools must do without piped water and basic sanitation facilities, almost all public universities in Brazil have swimming pools, sports facilities, pleasant cafeterias and other social amenities. Such glaring differences in the physical environment of public universities compared to public primary schools seem difficult to justify on pedagogical or equity grounds.

lxxxvi. Not surprisingly, the compositon of the classroom by the socio-economic background of students changes markedly with grade and level progression. Recent studies indicate that by and large, the parents of first grade students replicate the occupational structure of society, except in backward rural areas where initial enrollment is still far from universal. This corresponds to a proportion of "working class" (unskilled, skilled and supervisory of manual occupation workers) students of about 60-70%. This proportion falls progressively until it reaches about 20% at the end of secondary education. About 10% of university entrants have fathers in these occupational categories. It seems clear that public subsidies to universities are therefore mostly benefitting higher income families.

lxxxvii. Another study shows that families in the two highest categories of income spend over 57 times more on education than families in the two lowest categories in Rio de Janeiro, 55 times more in Recife, 58 times more in Porto Alegre, and 66 times more in Sao Paulo. Income elasticity of educational expenditures, derived from survey data (not adjusted for differences in family size) ranges between 1.3 in Sao Paulo and 1.6 in Rio de Janeiro. Moreover, private educational expenses are tax deductible and thus subsidized. The record of tax deductions appicable to education outlays in the year 1972 shows that the bulk of benefits went to households in the middle to upper income range: 75% of all deductions were given to the groups located between 8 and 44 minimum wages.

lxxxviii. The commonsense and empirical associations between education and income are generally very strong. Few would doubt that the incomes of Brazilians are not only closely correlated with but also caused, at least partially, by corresponding levels in the quantity and quality of the education they had received. To the extent that education may indeed be a strong determinant of an individual's earnings in Brazil, it would seem a powerful policy variable to raise the income of the poor. This, in turn, would enable them to expand their basic consumption. Besides being able to afford more of these basic goods, there is also a presumption that more educated people would be more efficient consumers. To what extent, then, is income affected by education? More importantly, to what extent could certain changes in the provision of public education be relied on to bring about substantial improvement in the income of the poor?

lxxxvii. In his 1973 book, Langoni concluded that education was indeed such a strong determinant of income in Brazil, that the reported concentration of personal income during the 1960s could be largely attributed to increasing inequality in the distribution of education. Although some authors have questioned this rather extreme view, few would deny that education had had an effect on the distribution of income in Brazil. Rate of return calculations on investment in primary and lower secondary education for a cross section of various socioeconomic groups using data collected in 1970 and 1972 shed additional light on this relationship. For Brazil as a whole, the computed social rate of return for primary education ranges from 14% (for rural women) to 31% (for females with low socioeconomic background). For lower secondary education, these rates range from 6% (for males with low socioeconomic background) to 13% (for non-farm males). Subject to many qualifications the reported rates of return do lend support to the view that education has been an important determinant of income among Brazilians.

lxxxviii. A somewhat different question concerning the effect of education on income is addressed in another World Bank publication. 1/ To what extent has income growth since 1960 differed across educational achievement groups? Specifically, to what extent have individuals with little or no formal schooling shared in Brazilian economic growth since 1960? The study's qualified answer is that income growth has lagged for illiterates, although it has not been insignificant. For those among the poor having some primary education, income growth had been faster.

lxxxix. In conclusion, the educational attainment of Brazilians has been an important factor in determining both their income and their income growth in recent years. It seems likely that these relationships will tend to persist during the next couple of decades.

Current Policy Issues

xc. The sharp contrasts that characterize Brazilian socio-economic development are clearly reflected in the realm of education. Geographical disparities in literacy and enrollment rates are wide; with respect to resources devoted to education per student, inequalities are even wider. Important geographical dimensions of these disparities are: (i) regional -- the Northeast and Frontier are far worse off than the Southeast; (ii) rural-urban; and (iii) municipal or district units within any of the preceeding broader categories. Place of residence is a very powerful factor determining the quality of (public) education obtained by students. Many Brazilians feel that such a factor is neither efficient not equitable in allocating educational opportunities.

xci. While socioeconomic status and place of residence of families are not at all independent of each other, socioeconomic status seems to have a strong independent effect on a child's progress through the educational system. The probability of successful progression to the upper levels of the educational system is far smaller for the child from a household of low socioeconomic status than for his well-to-do neighbor. Although this association between socioeconomic background and school performance is virtually universal, some people think that it is somewhat more extreme in Brazil and that efforts to counter the disadvantages of children from poor families should be greatly strengthened.

xcii. A third area of great contrast in Brazilian education concerns the magnitude and equality of resources per student across the different levels of the edcuational system. Representative secondary schools tend to spend much more per student than primary schools. And quality standards bear close relation to expenditures per student. Differences in this and other indicators of relative resource allocation between either of these two levels and universities seem gigantic. These have been characterized as contrasts between squalor and opulence by some Brazilians that feel that such differences can not be justified in terms of either equity or efficiency.

1/ Jean Pierre Jallade, "Basic Education and Income Inequality in Brazil: The Long-Term View," World Bank Staff Working Paper No. 268, June 1977.

xciii. Alongside these inequalities, other regressive forms of public spending on education also exist. Individual municipalities spend more per student on the schools located in the most affluent or urbanized areas within the municipal boundaries. States' transfers to municipalities tend to benefit the most central and prosperous among these. In contrast, the federal government is presently carrying out a neutral to slightly progressive redistribution policy among states. However, because of the great difference in unit costs by level, and the greater participation of students from the top socioeconomic layers in the higher educational levels, the subsidy per capita built into the free public education system clearly benefits the more affluent families. In addition, income tax deductions for education represent a regressive transfer.

xciv. Perhaps the most disappointing feature of Brazilian education is the poor results of basic education. While the proportion of urban children who never attend school is by now fairly small, low attendance in the rural areas is still a big problem. The most pervasive and obvious failure, however, is the high dropout rate in the initial grades. More students abahdon school before reaching the second grade than in any other level. If four or five years of schooling are required for functional literacy, Brazil is faring very poorly in view of the small proportion of students reaching this level.

xcv. There is some consensus on at least two broad reasons for the poor performance of basic education. One is the very low expenditures (and consequent meager resources) per student in most primary schools, particularly outside of the urban Southeast. Another is the high proportion of students from very low socioeconomic backgrounds, who are almost universally difficult to guide through a successful educational experience. However, some Brazilian experts feel that relatively little has been done to compensate such difficulties by means of good quality schools and creative pedagogical strategies. In contract to the attention and imaginative schemes found in higher levels of Brazilian education, basic resources such as school furniture and textbooks are often unavailable in a large proportion of primary schools.

xcvi. If is important to realize that many of the difficulties with Brazilian education have less to do with current management than with past policies and shortcomings. Current growth in overall enrollment is impressive -- and in some cases exaggerated. Enrollment in elementary schools is growing more than twice as fast as population (although, given the data available, it is not possible to say whether enrollment rates in rural areas are improving at a comparable pace, which is a critical issue); secondary education grows five times as fast. University enrollment grows even faster. Whether such a structure of growth rates is appropriate, however, is a matter of debate. In educationally mature countries higher levels grow faster because lower levels achieve nearly universal coverage. This is hardly the case in Brazil, where functional literacy (4 to 5 years of schooling) is not being achieved by roughly two-thirds of the school age population. Moreover, the explosive growth of university enrollment is sucking into the system students who are ill-prepared for higher education. The concurrent decline in average academic standards in universities supports this view. Some observers find that such growth rates are less the result of a definition of social

priorities than a structure of (career) incentives facing decision makers. Indeed, the truly vocal and alert groups pressing the education system aim their demands at the university level. Much political will on the part of the society as a whole will be required to compensate for the very weak incentives to improve the educational levels that need it most.

xcvii. Government strategy to contain pressure for higher education has been to give vocational content to secondary education. There is no clear indication that this has resulted in less pressure for university enrollment. Nevertheless, making secondary education more directly useful to employment opportunities appears sensible in its own right. The implementation of the policy to increase the vocational content of secondary education, however, is sometimes critized. For example, much effort has been devoted to improve the academic and technological levels of industrial technical schools. Paradoxically, such excellent quality education seems to have motivated students to pursue higher education. As a result these schools are enhancing the pressures for even greater expansion of higher education, which is quite the opposite of the original intent. There are other paradoxes. Regular high schools are supposed to add vocational content to their curricula. The best schools do add potentially useful vocational instruction, but their students are uninterested since their goal is the university. The poorer schools, attended by students motivated to pursue vocational training, lack the resources and know-how to provide meaningful programs. While by and large, graduates from secondary schools feel academically overeducated to enter manual occupations, those who would like to take these jobs are underqualified due to insufficient school training. Of course some do benefit from the vocational content of certain secondary school curricula, and it is unlikely that it can do any harm. In sum, it is a very perplexing situation where no final and easy judgments are available. These must await additional evaluations. Moreover, the diversity of situations is likely to require correspondingly diverse solutions.

xcviii. Brazil has long been a leader in non-formal systems for training industrial labor. SENAI, in particular, has developed some of the most successful schemes for training highly skilled workers since its creation some 30 years ago. In sharp contrast with the erratic attempts of the formal system, SENAI has closely monitored labor market demand and responded with creative and sound programs. Without sacrificing quality, the flow of graduates has been increasing over the years, reaching today very impressive numbers.

xcix. Not all non-formal programs have been so successful however; MOBRAL is particularly controversial. While many have undoubtedly benefited from their literacy courses, original expectations have not materialized. Among the main problems, drop out rates seem very high; only a very small proportion of those enrolled and certified are offered anything beyond the basic 200 hours program. And consequently, it is estimated that only about half of the graduates retain their literacy after a couple of years of taking the course. Recent experience from similar programs in other countries, however, suggest that MOBRAL is not alone concerning some of its most negative results. Perhaps there are no shortcuts to a solid basic education program.

Education Simulations

c. Nationwide enrollment and operating cost projections to the year 2000 for basic education (grades 1 to 8; "normative" ages 7 to 14) are described in Appendix D. Based on these projections, plausible ranges of magnitude for enrollment and operating cost in selected future year and comparisons of the projected cost with projected GDP values are discussed here. Unlike other sectoral projections in this report, there is only one set of basic assumptions underlying the detailed projections of future levels of the service in question -- enrollment. This set of assumptions can be described as a continuation with modest improvements of current trends with respect to key projection parameters such as admission, repetition, promotion, and desertion coefficients. As such, they can be regarded as being intermediate in the "pessimistic-optimistic" spectrum. The limiting values of the "plausible ranges" of future enrollment reported have been derived as a 10% interval above and below the values computed by the detailed method described in Appendix D.

ci. Alternative cost-per-student values are also taken from Appendix D. They are assumed to rise significantly over the projection period, almost doubling in the optimistic simulation, to allow for increased quality in basic education. As indicated above, the projections are not geographically disaggregated; they apply only for Brazil as a whole. Since the very wide geographical disparities in enrollment and cost indices are lost in the aggregation, the projections are not at all representative of the evolution of these indices in most geographical areas. Thus, the only purpose of the projections is to suggest possible orders of magnitude for the cost of achieving certain aggregate enrollment goals. Other tools of analysis must be used to take account regional disparities.

cii. According to the projections, total enrollment would grow (from about 18.6 million students in 1974) to between 23 and 28 million in 1980; and to between 34 and 42 million in 2000 (or average annual growth rates of from 2.3% to 3.2% for the 1974-2000 period; this compares with an average of 5.9% during the 1955-74 period). This decline in the growth of gross enrollment rates includes the effect of reducing the number of overage students. But more important, as most of the children aged 7-14 become enrolled, the rate of growth of enrollment tends to the limit set by the rate of growth of the population in this age group. The (midpoint) enrollment projections imply that the proportion of 7-year olds admitted into the system would grow from 87% in 1975 to 100% in 2000. In the urban areas of the Southeast, this proportion is already very close to 100%. Under current trends, it is unlikely that universal coverage of 7-year olds in the rural Northeast would be attained before the 1990s; universal coverage of the 7-year old population might be approached by the end of this century.

ciii. Combining the alternative average operating cost (per student) projections with correspondingly low and high projections of enrollment and GDP, results in GDP shares devoted to the purpose ranging from 0.8% to 0.9% in any one year between 1980 and 2000. Once again, financial resources do not appear to be a serious constraint in achieving universal primary education before the

end of the present century. No additional taxation should be necessary if the explosive growth of higher education can be controlled and better redistribution of funds for basic education to achieve targets in poor areas can be brought about. Much remains to be learned about how to organize and administer federal and state programs in basic education so as to achieve this objective efficiently.

PART I: HEALTH

A. General Health Conditions

1. For health planning to be fully effective, policy-makers should have a detailed and constantly updated set of health indicators at their disposal. Such information not only permits the identification of principal problem areas, but ex-post evaluations of government interventions as well. Unfortunately, this ideal is seldom attained in developing nations owing to the technical difficulties and high costs involved in gathering health-related statistics. Brazil is no exception to this rule -- the expansion of health sector activity observed in recent years has not been paralleled by an equivalent enlargement of the data base.

2. As imperfect as the present data base may be, it is possible to sketch a general picture of health conditions prevailing in contemporary Brazil. This will be accomplished through a review of the vital statistics (e.g., mortality rates and life expectancies) complemented with data on intermediate inputs to the health-care system (e.g., medical facilities and manpower). 1/ Some information will also be presented on the incidence of certain endemic diseases (e.g., malaria, Chagas' Disease, schistosomiasis and tuberculosis), but here the probability of insufficient coverage and underreporting is high.

Mortality and Life Expectancy

3. Mortality rates and life expectancies, though not ideal health indicators (e.g., they do not identify debilitating, but non-fatal afflictions), are the most frequently used because they are generally available and easily comparable. On the basis of estimates presented in the World Bank, World Tables - 1976, it would appear that general health conditions in Brazil are poor as compared to countries at similar per capita GNP levels. Though life expectancy in 1970 as given in this source was slightly higher than the group average (63 years vs. 61.4 years), the infant mortality rate was nearly twice as high (110 vs. 55.6). 2/ However, both indicators have improved considerably in recent decades. The estimates presented in Annex I of this report show that average life expectancy increased by about 12% from 49.6 in the 1950s to 55.7 in the 1960s. The infant mortality rate fell by one-fourth (from 135.6 to 101.4) between 1950-55 and 1965-70. Significant interregional and income class differentials in these indicators still persist.

1/ For a critical review of the available indicators, see L. Jordan, M.F.G. Monteiro and A.W. de Carvalho, "Revisao Analitica dos Indicadores de Saude", in IBGE, Encontro Brasileiro de Estudos Populacionais (Rio de Janeiro: 1977), pp. 638-47.

2/ The Western Hemisphere countries in this group included (1970 infant mortality rate in parentheses): Barbados (45), Chile (79), Costa Rica (60), Jamaica (32), Mexico (61), Nicaragua (45), Panama (41), Peru (75), Trinidad and Tobago (35), Uruguay (43), and Venezuela (49).

As of 1960-70, life expectancy in the Southeast was 15 years longer than in the Northeast; the infant mortality rate in the latter region was two-thirds higher than that prevailing in the former. Special census tabulations, moreover, indicate that life expectancies vary by more than 12 years between the highest and lowest income groups (62 years vs. 49.9 years). 1/

4. Though most observers agree that health conditions in Brazil are generally poor, there is much less agreement as to whether they have been improving in all parts of the country. Here the debate mainly centers around the interpretation of data which show rising infant mortality rates during the 1960s and early 1970s in several state capitals, including Sao Paulo. The Sao Paulo data and estimates are considered to be of considerably better quality though less dramatic than those for Northeastern cities such as Recife. Table 1 gives the infant mortality estimates for both Sao Paulo State and Greater Sao Paulo. If these estimates are accurate, the improving health hypothesis (at least with reference to Greater Sao Paulo) may be seriously questioned. Of particular relevance in this respect are the estimates for Greater Sao Paulo which show an abrupt decline in the infant mortality rate during the 1950s, a steady rise during the 1960s and early 1970s, and a slight decline between 1973 and 1976. The Sao Paulo State Secretariat of Planning estimates that the decline in Greater Sao Paulo continued in 1977, reaching 72.2, 24% below the 1973 level. In an effort to explain this pattern, it has been argued that the observed rise in the Sao Paulo infant mortality rate in the 1960s and early 1970s is more apparent than real. Critics of the data suggest that improvements in the registration of deaths coupled with the "death invasion" phenomenon (i.e., mortality rates being calculated on the basis of place of death, rather than place of residence) are major explanatory factors. Indeed, it can be shown mathematically that improvements in vital statistics, in a situation where age-specific mortality rates do not change, will worsen estimated mortality rates even though births, as well as deaths, are more completely recorded. Another argument (and one less subject to counterarguments), is that recent migrants (especially those from the Northeast) have brought with them the low health and nutritional standards prevailing in their regions of origin. Therefore, the rising infant mortality rates may only reflect the health conditions of children of families arriving in Sao Paulo during the 1960s and 1970s, and not those of children of long-time residents.

5. Among those who accept the reliability of the data, no concensus has yet been reached concerning the reasons behind the rising (and more recently, falling) infant mortality rates. W. Leser (former health secretary of Sao Paulo), for example, has attributed rising infant mortality to falling real wages (as measured by the minimum wage deflated by the cost of living

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1/ See J.A.M. Carvalho and C.H. Wood, "Renda e Concentracao da Mortalidade no Brasil", Estudos Economicos, VII, No. 1 (1977), 127. These estimates clearly differ from those presented in the World Bank publication, World Tables 1976, since Carvalho and Wood estimate the highest income group to have a life expectancy below the average given in World Tables 1976. This matter is discussed in Annex I.

Table 1: SAO PAULO INFANT MORTALITY RATES, 1950-1976

Year	Sao Paulo	
	State	Greater Sao Paulo
1950	122.4	160.5
1955	107.4	157.8
1960	82.0	62.9
1965	73.9	69.4
1966	76.8	73.8
1967	78.9	74.4
1968	72.4	75.1
1969	84.1	83.8
1970	83.3	90.9
1971	89.4	94.6
1972	86.4	93.4
1973	89.0	94.6
1974	82.1	88.6
1975	84.4	87.5
1976	78.5	83.6

Sources: J. Yunes and V. S. C. Ronchazel, "Evolucao da Mortalidade Geral, Infantil e Proporcional no Brasil", Revista de Saude Publica, VIII, Supplement (1974), 34-35; and Governo do Estado de Sao Paulo, Secretaria de Economia e Planejamento, Boletim de Dados Conjunturais (July 1977).

index) and the resultant negative impact on nutritional standards. 1/ Others have traced the phenomenon to the public sector's inability to supply adequate sanitation and medical facilities to the rising number of persons residing in the peripheries of large cities. Conversely, more recent arguments attribute falling mortality rates to a wider dissemination of these facilities. In short, the debate remains open. It seems reasonable to assume, however, that the rising health standards implied by the national indicators have not been shared equally by everyone.

6. Further details on health conditions in Brazil are contained in Table 2, which tabulates regional mortality rates according to age group and principal causes. The most obvious point made by these data is that patterns of mortality (and indirectly, of morbidity) differ markedly from region to region, an aspect also reflected by the interregional variations in infant mortality rates and life expectancies. In this respect, the Northeast and Frontier configurations are remarkably similar, both exhibiting the classical characteristics of underdevelopment, i.e., a high proportion of total deaths occurring in children under five years of age, and high mortality due to infectious and parasitic diseases and perinatal causes. Mortality patterns in the Southeast, in contrast, are more reminiscent of those observed in developed nations, where a relatively large proportion of deaths occur after 55 years of age, and where the leading causes of death are diseases of the circulatory system and neoplasms (tumors). 2/ It should be noted, however, that health conditions in the peripheral areas of major metropolitan areas of the Southeast are closer to those found in Northeastern cities than to regional averages for the Southeast.

7. The regional differences in mortality patterns identified above have some important policy implications. Improvements in basic sanitation, for example, would have a far greater effect on lowering mortality rates (and raising life expectancies) in the Northeast and Frontier than in the Southeast. Conversely, the Southeast might benefit more than the Northeast and Frontier from improved treatment of individuals afflicted with cancer

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1/ See W. Leser, "Relacionamento de Certas Caracteristicas Populacionais com a Mortalidade Infantil no Municipio de Sao Paulo de 1950 a 1970", Problemas Brasileiros, X. No. 109 (1972), 17-30. Other discussions of this issue are: J. Yunes and V.S.C. Ronchezel, "Evolucao da Mortalidade Geral, Infantil e Proporcional no Brasil", Revista de Saude Publica 7: Supplement (1974), 3-48; and J. Yunes, J. Somenesi and V.S.C. Ronchezel, "Tendencia da Mortalidade por Causas no Brasil", in IBGE, Encontro Brasileiro, op, cit., pp. 112-25.

2/ According to the "stage theory" of health, the Southeast has already made the transition to the "Age of Degenerative and Man-made Diseases" while the Northeast and Frontier remain in the "Age of Receding Pandemics". See A.R. Omran, "Changing Patterns of Health and Disease During the Process of National Development" in A.R. Omran, ed., Community Medicine in Developing Countries (New York: Springer Publishing Co., 1974), pp. 259-74.

Table 2: AGE AND CAUSE SPECIFIC PROPORTIONAL MORTALITY RATES, BY REGION, 1970[a/]

(% of total deaths)

Age/Cause	Northeast	Southeast	Frontier	Brazil
Age at Death				
< 5 years	47.3	26.2	44.7	33.1
≥ 55 years	25.7	43.8	21.8	37.5
Cause of Death[b/]				
Infect./parasitic diseases	24.5	11.2	26.6	15.8
Certain perinatal causes	8.2	5.6	11.8	6.7
Ill-defined conditions	16.2	3.0	5.3	6.8
Neoplasms (tumors)	6.0	11.7	6.0	9.8
Diseases of circ. system	15.1	30.4	13.1	25.1
External causes	6.7	9.3	8.2	8.5
Other	23.3	28.2	29.0	27.3

a/ Data from state capitals and federal district.

b/ Grouped according to the International Classification of Diseases, 8th ed., 1965.

Sources: Adapted from A.V.W. de Carvalho and E. de M.Ribeiro, "Estudo da Mortalidade Proporcional, Segundo Grupos de Idade e Causas de Obito, em Algumas Capitais Brasileiras, em 1970", Revista Brasileira de Estatistica, 37:148 (1976), 462-64.

or heart disease, though the lower incidence of these diseases in the less developed regions may in part reflect regional differences in diagnostic capabilities. 1/ The data also suggest that alternative health strategies will have a differential impact according to age group, regardless of the region. This hypothesis follows from the high statistical correlation between infectious and parasitic diseases, and perinatal causes on the one hand, and child mortality on the other. An equally high correlation is observed when deaths from neoplasms, circulatory diseases, and external causes (e.g., accidents, suicides) are regressed on deaths of individuals 55 years of age or older. 2/

8. Additional insights into the issues raised above are made possible by the data in Table 3. Here, proportional mortality rates attributable to infectious and parastic diseases are disaggregated by selected state capitals, and by those diseases reducible through immunizations (e.g., tuberculosis, diptheria, polio, smallpox, measles, whooping cough) and through improved basic sanitation (e.g., typhoid, dysentery, enteritis, plague, malaria). These calculations indicate that about 80% of all deaths from infectious and parasitic diseases may be reduced or prevented via appropriate interventions; a relationship which varies little between the major regions. Furthermore, with few exceptions (generally confined to higher income areas) basic sanitation programs have the potential to reduce mortality to a greater extent than do immunizations. 3/

1/ In a comparative study of Rio de Janeiro and Salvador, J.L. Madeira calculated the effects of eliminating certain causes of death on average life expectancies. The results of this exercise show marked inter-regional differences in the hypothetical response to identical health interventions. The elimination of certain infectious and parasitic diseases through basic sanitation, for example, would increase average life expectancy by 2.9 years in Salvador, but by only .3 years in Rio de Janeiro. On the other hand, the elimination of circulatory diseases would increase longevity by 3.4 years in the former and 3.8 years in the latter. See J.L. Madeira, "Tabuas de Mortalidade do Grande Rio e do Municipio de Salvador e Analise dos Efeitos e Alguns Grupos Escolhidos de Causas de Morte", in IBGE, Encontro Brasileiro, op. cit., pp. 73-98.

1/ A correlation matrix of these variables is presented in A.V.W. de Carvalho and E. de M. Ribeiro, "Estudo da Mortalidade Proporcional, Segundo Grupos de Idade e Causas de Obitos, em Algumas Capitais Brasileiras em 1970", Revista Brasileira de Estatistica, 37:148, (1976), 456-82. It should be pointed out that malnutrition is an important (perhaps the most important) underlying or associated cause of child mortality in Brazil, a fact not revealed by these data. This topic is discussed more fully in the section on nutrition below.

2/ Here, of course, we are ignoring the relative costs of the two interventions. That is, while the standard childhood series of vaccinations (smallpox, DPT, polio, measles, etc.) costs around US$1 per capita, a basic sanitation package may cost US$100 or more per person in rural areas and on the order of US$250 per person in urban areas. More precise estimates of the latter are contained in the Annex IV on housing, water supply and sewerage.

Table 3: DEATHS ATTRIBUTABLE TO INFECTIOUS AND PARASITIC DISEASES AS A PROPORTION OF TOTAL DEATHS, SELECTED STATE CAPITALS, 1970
(percent of deaths from all causes)

Region/City	Deaths from All Infectious and Parasitic Diseases	Deaths from Those Infectious and Parasitic Diseases Reducible: Via immunizations	Via basic sanitation
Northeast	24.5	5.9	14.3
Natal	41.3	6.3	31.9
Joao Pessoa	36.3	3.9	30.8
Recife	26.7	6.9	13.7
Teresina	25.2	6.6	14.8
Salvador	24.8	6.2	13.3
Maceio	24.3	3.7	16.7
Sao Luis	14.6	5.2	3.8
Fortaleza	11.8	5.3	4.5
Southeast	11.2	3.6	5.0
Belo Horizonte	20.2	5.6	10.4
Sao Paulo	11.6	1.9	7.4
Porto Alegre	10.7	4.6	2.9
Niteroi	10.3	3.7	4.6
Rio de Janeiro	8.8	4.6	1.9
Vitoria	8.4	3.7	.9
Curitiba	6.6	3.7	.3
Frontier	26.6	4.9	15.6
Manaus	29.8	8.1	17.5
Brasilia	27.6	4.0	17.7
Goiania	23.9	3.3	10.7
Cuiaba	20.4	3.9	16.0
Brazil	15.7	4.2	8.2

Source: Adapted from A.V.W. de Carvalho and E. de M. Ribeiro, "Estudo da Mortalidade Proporcional, Segundo Grupos de Idade e Causas de Obito, em Algumas Capitais Brasileiras, em 1970", Revista Brasileira de Estatistica, XXXVII, No. 148 (1976), 475.

9. The overall impact of either basic sanitation program or immunizations on the health conditions of a given area depends upon the degree to which infectious and parastic diseases are initially present. According to our mortality estimates disaggregated by region, the incidence of diseases responsive to improvements in basic sanitation varies considerably more in a geographic sense than that of diseases reducible through immunizations. The northeastern city of Natal and the southeastern city of Curitiba may be cited as the two extremes in this respect. In the first case, sanitation programs have the potential of reducing deaths by almost one-third; in the second, this potential declines to less than 1%. The potential effects of an immunization campaign, in contrast, are much closer in both cities. Therefore, decisions concerning the regional pattern of investment in sanitation need to be made more carefully than those pertaining to immunizations.

The Principal Endemic Diseases 1/

10. Relatively little is known about the incidence of various diseases in Brazil, aside from indirect evidence provided by mortality data. Judging from the fragmentary information available, however, morbidity attributable to three vector-borne parasitic diseases--malaria, Chagas' Disease and schistosomiasis--remains high within some (often wide) geographical areas (see Table 4). 2/ Of these three diseases, it would appear that only the first has been successfully contained over the past three decades.

11. According to Ministry of Health sources, the number of reported malaria cases has fallen from 8 million in 1954 (300 cases per 1,000 inhabitants of malarial areas) to less than 90,000 in 1976 (1.7 cases per 1,000 inhabitants of malarial areas). This drastic reduction is no doubt attributable to government anti-malaria campaigns based (since 1947) on housing surveys and the massive use of DDT sprays. While the mosquitoes which transmit malaria are found over 80% of Brazil's territory (containing 40% of the national population), by 1978 less than 9% of the national population was exposed to the risk of malaria. In 1977 94% of reported malaria cases were registered in the Amazon Region where the disease is being contained to a limited number of focal areas. The Ministry of Health foresees complete eradication by 1980 in all but the Amazon Region (accounting for 74% of the potential malarial zone but only 20% of its population). Ridding the Amazon of malaria, however, will be a difficult, if not impossible, task. In addition to providing favorable

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1/ Much of the following discussion is drawn from E.G.F. da Motta, "Situacao Atual do Controle das Grandes Endemias", in Ministerio da Saude, VI Conferencia Nacional de Saude: Brasil 1977 (Rio de Janeiro: FSESP, 1978) 185-198 and Ministerio da Saude, Relatorio de Desempenho - Periodo 1974/1978," Brasilia, December 1978 (mimeo).

2/ Though trachoma is included in Table 4, its eradication has lower official priority than malaria, Chagas' Disease, or schistosomiasis. Other endemic diseases of concern to the Ministry of Health include: tuberculosis, yellow fever, plague, leprosy, leishmaniasis, and filariasis.

Table 4: INCIDENCE OF SELECTED DISEASES, MID-1970s

Disease	Scope of Survey	Sample Size[a]	Incidence (% of sample) Range[b]	Mean
Malaria	National	2,570,156	.4 - 10.4	3.4
Chagas' Disease	11 States[c]	136,062	.09 - 60.5	n.a.
Schistosomiasis	Northeast[d]	880,975	3.8 - 39.2	18.9
Trachoma	National	370,659	.0 - 18.0	3.6

a/ The method by which these samples were chosen is not made clear in the source. Thus, it should not necessarily be inferred they are representative.

b/ Except for malaria and Chagas' Disease, the range refers to interstate variations. In the case of malaria, the high figure applies to the Frontier region and the low to the Northeast/Southeast. The data for Chagas' Disease show variations at the municipio level.

c/ Coastal states (excluding Sergipe and Espirito Santo) plus Minas Gerais and Goias.

d/ Maranhao, Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas and Sergipe.

Sources: For Malaria, Chagas' Disease, and Trachoma adapted from E.G.F. da Motta, "Situacao Atual do Controle das Grandes Endemias", in Ministerio da Saude, VI Conference Nacional de Saude:Brasil 1977 (Rio de Janeiro: FSESP, 1978) 185-198; for Schistosomiasis from Ministerio da Saude, "Relatorio de Desempenho - Periodo 1974/1978," Brasilia, December 1978 (mimeo) p. 45.

conditions for the anopheles mosquito, Amazonia is presently characterized by extensive in-migration. This latter characteristic greatly increases both the communicability of the disease, and the complexity and cost of controlling it. 1/

12. Until recently, Chagas' Disease and schistosomiasis received comparatively little official attention. Hence much less is known about their geographical ranges and infection rates. Preliminary results of surveys initiated in 1975, however, indicate a wide spatial distribution and high rates of infection in some localities. Chagas' Disease, the American form of trypanosomiasis, is a debilitating and often fatal parasitic infection causing anemia, swellings, fever, and heart disease. In Brazil, it has been detected in the Atlantic coastal states (except Espirito Santo, Rio de Janeiro and Santa Catarina) from Maranhao to Rio Grande do Sul, and in Mato Grosso, Goias and Minas Gerais. Health teams have observed rates of infection ranging from .09% to over 60% in the municipios within this area. Goias and Minas Gerais appear to be focal points of the disease, with 30% or more of the population infected in some municipios. Since there is no known cure for Chagas' Disease, government programs have been directed at reducing human exposure to the principal vector (a nocturnally active blood-sucking insect popularly known as the barbeiro which commonly infests houses with straw or palm frond roofs and wattle and daub walls. Effective preventive measures include housing improvements to eliminate the hiding places and spraying of residential structures together with their annexes to kill the barbeiros. Over the period 1975-1978, the Ministry of Health treated 1.5 million houses and 1.8 million related structures, directly protecting 5.7 million people. A parallel program to improve rural housing conducted by the Public Health Services Foundation (Fundacao Servicos de Saude Publica - FSESP), a decentralized agency linked to the Ministry of Health, had resulted in the construction or improvement of less than 3,000 houses by the end of 1978 (see Annex IV). In 1978 an international commission composed of WHO, PAHO and Ministry of Health specialists evaluated the Chagas control program begun in 1975 and concluded that the incorporation of housing improvements was the most important control measure adopted by the program. The Ministry of Health has been unable to fix specific targets for reductions in the incidence of Chagas' disease to be achieved by the control program because the sample survey of the national population through blood tests, which will reliably estimate the current incidence of the disease for the first time, will not be completed until the first half of 1979. Through August 1978 just under 1 million blood samples had been collected in over half of Brazil's municipios.

13. Schistosomiasis, like Chagas' Disease, is a sometimes fatal parasitic infection producing severe liver damage, an enlarged spleen and a bloated abdomen. 2/ Schistosomiasis is endemic to all the seaboard states (with the

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1/ See A.C. de Azevedo, "Commentarios sobre a Realidade Sanitaria da Amazonia" (Brasilia, Ministry of Health, October, 1977) mimeo.

2/ The disease is transmitted through contamination of water with human feces containing eggs of the parasite. During part of its life cycle the parasite must have as its host a freshwater snail, which is the principal vector.

exception to Parana, plus Minas Gerais. An additional similarity is that no system of control has yet been found; at least one proven effective in mass campaigns. 1/ As revealed by the results of some 900,000 stool examinations performed in eight northeastern states in 1976-78, the rate of infection from schistosomiasis reaches extremely high levels in some areas. Overall, 18.9% of the examinations to date have proved positive; in Sergipe the observed rate of infection is 39%. Inadequate statistical data render it impossible to judge whether the incidence of schistosomiasis has been spreading in recent years. Judging from the large migratory flows from the Northeast (and the high probability that many of these migrants are carriers), it is very possible that the disease's range has widened. The control of schistosomiasis is presently high on the Ministry of Health's list of priorities and a special program has been created to this end. The adopted strategy involves improvements in sanitation, elimination of the principal vector, chemotheraphy, education, and epidemiological surveillance. Whether this approach will succeed in breaking the transmission cycle remains problematic.

14. While yellow fever, rabies, and plague have been virtually eliminated from Brazil by human vaccination (yellow fever and rabies), canine vaccination (rabies) and control of the vectors (yellow fever and plague), leprosy, trachoma, and especially tuberculosis continue to be endemic. Tuberculosis is still one of the most important public health problems, and is found throughout the country despite improved measures for its control and cure over the postwar period. The Ministry of Health estimates that mortality in the state capitals fell from 285 per 100,000 inhabitants in 1949 to 23 in 1973. Rough estimates of incidence in 1975 vary from a minimum of 60 cases per 100,000 inhabitants in the three southernmost states to 150 in the Amazon states. Over the period 1974-1978 27.9 million doses of BCG have been applied to the population under 15 years of age.

15. Leprosy is irregularly distributed over the whole country, with an estimated 1.3 cases per 1,000 inhabitants, a rate which has prevailed for the past 20 years. Trachoma is endemic but declining in importance as mass treatment and sanitary education programs, concentrated on hyperendemic areas, have advanced. Tests on 371 thousand school children aged 7-14 in twelve northern and northeastern states showed an incidence ranging from negligible to 6.6%, with an average of 3.6% in 1974-76.

16. Spinal menengitis has always been endemic, but from time to time has assumed epidemic proportions. The most recent epidemic began in 1971. At that time there was no reliable vaccine to protect the population and contain the epidemic. By 1974 the situation had become alarming in major cities like Sao Paulo, where the disease was not restricted to the population living in poverty. The Brazilian government then decided to embark on a mass vaccination campaign using imported vaccine with the goal of vaccinating

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1/ A.M. Kamarck, The Tropics and Economic Development (Baltimore; Johns Hopkins University Press for the World Bank, 1976), p. 63.

80 million Brazilians over a ten-month period. The goal was surpassed both in numbers and time, with 81.7 million vaccinations in nine and a half months, effectively bringing the epidemic to a halt. The Ministry of Health's Oswaldo Cruz Institute has now absorbed the technology of producing the vaccine with the cooperation of a foreign pharmaceutical company. Recently a supplementary mass vaccination campaign was carried out in areas with high endemic rates of spinal menengitis. The experience since 1974 shows that when a relatively cheap technology suitable for mass campaigns is available and political priority is high, Brazil's Ministry of Health is capable of rapid and effective action.

17. In 1973 the Ministry of Health established the National Immunization Program to reduce the risk of sickness and death from contagious diseases preventible by immunization. These include measles, poliomylitis, diphtheria, whooping cough, tetanus, and smallpox. The program is administered by FSESP and executed by the state secretariats of health. Good progress has been made toward immunizing the population less than one year of age over the past four years. But during the first six months of 1978 the highest coverage for any of the subprograms was 46.6% for DPT trivalent vaccine and the lowest was 30.7% for smallpox vaccine. This means that over half of the infant population was still not being reached on a regular basis. The lack of a broad and dense network of basic health facilities, especially in rural areas, is a major obstacle to better coverage, and is discussed at length below.

Health Facilities and Manpower

18. The effectiveness of a given country's health-care system depends greatly upon the availability of qualified medical personnel and associated facilities. The "appropriate" or "feasible" mix of health resources and manpower (i.e., physicians vs. auxiliaries, hospital vs. "health posts", urban vs. rural, curative vs. preventive, etc.) varies considerably between and within nations. Theoretically, scarce health resources should be allocated in accordance with observed health problems (e.g., high infant mortality rates, high incidence of particular diseases, uneven geographical coverage, etc.) in the most cost-effective manners possible. In practice, this rule of thumb may be difficult to follow for a large variety of social, economic, political and historical reasons. In the case of Brazil, relevant factors in this respect would include among others: the political strength and inclinations of private medical organizations, the role of social security institutes in the health delivery system, the historical record of community participation in local decision-making processes.

19. Though the above factors should be taken into account in any evaluation of the Brazilian health sector, the more modest purpose of the present section is to describe and comment upon some quantitative aspects of facilities and manpower. The analytical approach is traditional, i.e., based upon ratios of population to selected physical indicators (physicians, nursing persons, hospital beds, etc.). 1/ National ratios derived in this

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1/ Cost factors, as well as the institutional characteristics of health care, will be discussed in a subsequent section.

Table 5: NUMBER OF PHYSICIANS, NURSING PERSONS, AND HOSPITAL BEDS BY REGION, 1970

Category/Region	Number	Population per Unit	Population per Unit as % Nat'l Average
PHYSICIANS			
Northeast	6,820	4,122	199
Southeast	35,493	1,588	77
Frontier[a/]	2,671	3,249 (4,109)	157 (199)
Brazil	44,984	2,070	100
NURSES			
Northeast	900	31,235	185
Southeast	3,950	14,266	85
Frontier[a/]	670	12,951 (18,415)	77 (109)
Brazil	5,520	16,873	100
NURSING AUXILIARIES			
Northeast	27,006	1,004	147
Southeast	99,225	568	83
Frontier[a/]	10,015	866 (1,006)	127 (147)
Brazil	136,246	684	100
HOSPITAL BEDS			
Northeast	53,671	524	214
Southeast	278,263	203	77
Frontier[a/]	22,439	387 (391)	147 (149)
Brazil	354,373	263	100

a/ Data in parentheses exclude the Federal District (Brasilia).

Source: IBGE, Censo Demografico - 1970; IBGE, Anuario Estatistico - 1973.

manner are commonly employed in international comparisons and for measuring progress over time. Their shortcomings need to be stressed at the outset. Perhaps the most important caveat in this respect is that national ratios tell us little or nothing about the quality, utilization, and distribution of health facilities and manpower--variables which may have an important bearing on the overall effectiveness of the health system. While some adjustments can be made to account for these factors, statistical limitations render the final product somewhat less than ideal.

20. Like most other statistics on health, the reliability of data on health facilities and personnel varies widely according to the source. For present purposes, the census results are considered the most accurate and will be cited to the extent possible. Data published by the Ministry of Health provide some important details not included in the censuses but, for reasons explained below, should be interpreted with some degree of caution. The statistical yearbooks of WHO and PAHO, likely sources of information, provide virtually no data on the Brazilian health system.

21. According to the Census, the number of practicing physicians in Brazil totalled 44,984 in 1970, a figure implying a national ratio of 2,167 persons per physician (see Table 5). 1/ This ratio is considerably better than average when viewed in a Third World context. In the developing nations of Africa, South Asia, and East Asia, for example, the population/physician relationships are 16,867:1; 6,602:1, and 4,415:1, respectively. The Brazilian ratio, however, is far less satisfactory than the 728:1 ratio of the industrialized countries and a bit worse than the 1,782:1 adjusted group average for Latin America. 2/ The population/nursing person (i.e., nurses plus nursing auxiliaries) and population/hospital bed ratios prevailing in Brazil also compare favorably with those of most developing countries. In the case of nursing personnel, the ratio in 1970 (657:1) was only 15-30% as high as the African and Asian norms, and about 40% of the Latin American average. To some extent, however, these comparisons are misleading since the averages are affected by a relatively large contingent of nursing auxiliaries of uncertain quality in many developing countries including Brazil. Nursing auxiliaries are defined here as persons performing nursing functions, and holding no formal degree in the field, but with varying degrees of training -- up

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1/ A survey of health manpower published in the journal of the Brazilian Medical Association put the total number of physicians at 73,000 in 1975. If this estimate is accurate, the number of physicians in 1978 should be in the neighborhood of 90,000; or about 1,300 persons per physician nationally.

2/ WHO estimates reprinted in World Bank, World Tables 1976. It should not necessarily be inferred from these data that countries with low population/physician ratios have "better" health-care systems than those with high ones. Obviously, other factors such as the quality, specialization and geographical distribution of doctors, as well as the existence of appropriate facilities and paramedical personnel, bear upon the effacacy of a given system.

to 6 months for auxiliary nurses (about 25% of the total) and considerably less for attendant nurses (the overwhelming majority of the rest). If we recalculate so as to include graduate nurses only, the ratio rises sharply to 16,873:1. Qualitative implications of this suboccupational pattern deserve serious attention by health planners. 1/

22. The population/hospital bed relationship (a usual proxy for health facilities), though only 10-50% of Third World averages, should also be interpreted with some caution. First of all, the notion of "hospital bed" can vary from a place in a modern university hospital to a hammock in a rural health clinic. Hence, cross-country comparisons are to some extent spurious if no qualitative factor can be introduced. Secondly, even if the qualitative aspect can be controlled, a low population/hospital bed ratio does not necessarily mean that health resources are being allocated efficiently. In Brazil, for example, it probably reflects a health system biased toward curative care of the urban population. A third factor which should be considered is the degree to which available hospital beds are utilized. Although Brazilian data do not permit a precise measurement of this aspect, it would appear that the demand for hospital care has grown at a considerably faster pace than its supply in recent years. Between 1971 and 1974, for example, the number of hospital beds grew by 10.4% while the number of hospital cases increased by 40.3%. The proper interpretation of these statistics is unclear in the absence of more qualitative information.

23. Information on the urban-rural distribution of health care is included in Table 6, which tabulates data on the residence of selected health personnel. These data are drawn from a Ministry of Health source and are not strictly comparable to the Census data; the principal methodological difference being that the former measures manpower by the number of jobs while the latter count individuals. The result is that the Ministry of Health totals (due to multiple employment) are somewhat higher (and the population per unit ratios consequently lower) than those implied by the Census. Still, what is important for present purposes is that physicians and other health personnel show a marked locational preference for state capitals as opposed to smaller towns and rural areas. In the cases of physicians and dentists, population per unit is four times higher in the latter geographical areas; for nutritionists, nurses and nursing auxiliaries the differential is on the order of 10 to 1. This skewed urban-rural distribution undoubtedly mirrors the basic dualism of the Brazilian economy

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1/ Despite the relatively large number of nursing auxiliaries, it is estimated that the deficit in this type of health personnel (in terms of targets set at the special meeting of the Ministers of Health of the Americas in 1972) will reach almost 120,000 persons by 1980. In contrast, the supply of physicians will probably exceed the target by about 3,500. See M.A. Sayeg, "Correlacoes Numericas entre Medicos e Outros Profissionais de Nivel Superior", Revista da Administracao Publica, 11:3 (1977), 119.

Table 6: DISTRIBUTION OF HEALTH MANPOWER BETWEEN STATE CAPITALS AND COUNTRYSIDE, 1973

Professional Category	Brazil		State Capitals		Countryside	
	No.	Population per professional	No.	Population per professional	No.	Population per professional
Physicians	85,070	1,192	46,372	492	38,698	2,032
Dentists	9,558	10,612	5,031	4,532	4,527	17,370
Nutritionists	1,330	76,265	985	23,146	345	227,923
Nurses	9,510	10,666	6,940	3,285	2,570	30,597
Nursing Auxiliaries	33,031	3,071	23,151	985	9,880	7,959

Source: Adapted from M.A. Sayeg, "Correlaçoes Numericas entre medicos e Outros Profissionais de Nivel Superior", Revista de Administracao Publica, XI, No. 3 (1977), 120.

and the desire of health personnel to have access to hospitals and diagnostic facilities, as well as good incomes and living conditions. 1/ An important implication, however, is that, in the absence of any incentives to the contrary, a continuation of urban-biased national economic policies could lead to a worsening of the dualism problem. 2/

24. In addition to the urban-rural dichotomy, both health manpower and facilities tend to be concentrated regionally. The health care system is far more developed in the industrial Southeast than in either the Northeast or Frontier. According to the data in Table 5, the former region accounts for 80% of the total supply of physicians, 73% of all nursing persons, and 79% of the hospital beds. Adjusting for population, we find the Northeast and Frontier ratios to be two to three times higher than those attained in the Southeast. As great as these differentials may be, they mask some important interstate and/or intraregional variations. The most extreme cases in this respect are the states of Maranhao and the former state of Guanabara (the city of Rio de Janeiro); the first with a population/physician ratio of 10,882:1 (over five times the Nicaragua average) and the second with a ratio of 462:1 (27% lower than the U.S. average).

1/ From the limited data available, it would appear that an urban bias in health care is common to many developing countries; in some cases, to a much greater degree than observed in Brazil. In Indonesia, for example, the rural population/physician ratio is over 2,000 times higher than the urban one. See Office of Health Economics, London, Medical Care in Developing Countries (London: White Crescent Press, 1972), p. 26.

2/ Over the 1960s, the urban-rural distribution of health personnel at best remained unchanged, and perhaps worsened. According to data cited in an address by the Minister of Health, the number of health-related jobs in state capitals increased from 34.7 to 82.8 per 10,000 inhabitants between 1961 and 1970; in the countryside the analogous ratio increased from 8.7 to only 19.3 during the same period. This trend is no doubt related to the recent pattern of growth in the public health sector which has favored the urban-oriented social security system. See M.M. de Lemos, "Brazil: Health, Population, and Human Productivity", in M.J. Carvajal, ec., Population Growth and Human Productivity (Gainesville: University of Florida Press, 1976), p. 208; and the section of this annex on the public health sector (see below).

25. The above data strongly suggest that lack of access to medical care (in a geographical sense) constitutes a formidable barrier to improved health conditions in Brazil. 1/ This contention is further supported by Table 7 which contains data on the number of municipios without resident physicians, and their respective populations, in 1972. In this year, about 10 million persons (or about 10% of the national population in 1972) were not within close proximity of a doctor, a factor which may have effectively denied them access. This problem seems to have been most serious in the Frontier and Northeast, where the proportions of persons living in municipios without a resident physician were 20.8% and 16.3%, respectively. Though the analogous percentage was much lower in the Southeast, the high absolute number of persons denied easy access to a doctor (3 million) indicates that the problem is not only confined to the poorer regions. It could, of course, be argued that persons residing in areas where there are no permanent doctors have the option of using the medical facilities of adjoining municipios and/or the services of itinerant doctors. For a number of reasons, however, neither option is satisfactory. High transportation costs (and wages foregone owing to prolonged absences from work), for example, may cause poorer persons to rule out the first choice. The use of itinerant doctors, while effective for some purposes (e.g., treatment of injuries and minor surgery) is ineffective in those instances (e.g., major surgical interventions), where hospitalization and/or repeated follow-ups are indicated.

26. Unfortunately, the Census data do not permit calculations of changes in the interregional (and urban-rural) distribution of health manpower over time. Hence, it is difficult to ascertain whether regional standards have converged or diverged in recent decades. On the basis of Ministry of Health data, it would seem that some convergence occurred between 1965 and 1974, a period of accelerated growth in the public health sector. During this period, the number of jobs filled by physicians and nursing persons generally increased at a faster rate in the Northeast and Frontier than in either the Southeast or Brazil as a whole. The same trend was also observed with respect to hospital beds, albeit with considerably less interregional variations. Though these calculations indicate that regional standards have equalized to some extent, some care should be exercised in their interpretation. First of all, the relatively high growth rates attained in the poorer regions are at least partially attributable to the low bases upon which they were calculated. In this respect the same data show that the Southeast accounted for 75% of the absolute number of health-related jobs created between 1965 and 1974; and about

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1/ When considering the question of accessibility in spatial terms, the income variable is assumed to be constant. Although supporting data are scanty, it seems reasonable to assume that an individual's access to health care is directly related to his or her income, especially when the services in question are privately produced. Hence, it is possible that a wealthy inhabitant of the rural Northeast has greater access to health care than a poor inhabitant of the urban Southeast.

Table 7: MUNICIPIOS WITHOUT RESIDENT PHYSICIANS AND THEIR RESPECTIVE POPULATIONS BY REGION, 1972

Region	Municipios			Population		
	Total (No.)	Without Physician (No.)	(%)	Total (millions)	Without Physician (millions)	(%)
Northeast	1,374	473	34.5	29,923	4,866	16.3
Southeast	2,127	476	22.4	60,187	3,015	5.0
Frontier	449	241	53.1	9,427	1,964	20.8
BRAZIL	3,950	1,190	30.1	99,537	9,845	9.9

Source: Adapted from M.A. Sayeg, "Correlacoes Numericas entre Medicos e Outros Profissionais de Nivel Superior", Revista de Administracao Publica, 11:3 (1977), 116.

70% of the increase in hospital beds. 1/ Secondly, even if we disregard the absolute vs. relative growth question, the rapidly declining population/health manpower and hospital bed ratios observed in the Frontier and Northeast do not necessarily indicate that coverage has improved as much as the statistics seem to imply. At least part of the improvement in the regional ratios may represent a "deepening" of the health manpower and facilities available to affluent urban dwellers rather than a "widening" of coverage to the urban poor and to rural inhabitants. 2/

B. The Public Health Sector: Structure and Growth

27. Despite notable progress achieved during World War II, public activity in the health sector was still at a low level during the immediate post-war years. As of 1949, total resources devoted to this end amounted to only slightly more than 1% of the GDP. The Constitution of 1946 (which remained in effect until 1967) was rather vague concerning health matters, though the central government (uniao) was delegated exclusive responsibility for dealing with rural endemic diseases and setting norms for state and municipal health programs. The states, given residual powers by the Constitution, became most active in the prevention and cure of non-endemic diseases. Of course, the quantity and quality of health services provided by given states and municipios varied widely in accordance with regional income and tax base differentials. In this respect, 1949 data indicate that per capita state expenditures on health in the Southeast region were more than three times those observed in either the Northeast or Frontier.

28. Parallel to the national and state municipal health programs were those provided by approximately 35 social insurance institutes and funds (Institutos and Caixas de Aposentadoria e Pensoes, respectively) linked to the Ministry of Labor. 3/ These entities, established during the 1920s and 1930s, were to provide social protection benefits to specific urban occupational groups such as bank employees, industrial workers, maritime and dock

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1/ The Southeast's population increase was 62% of Brazil's total population increase between 1960 and 1970.

2/ Since the Rural Worker Welfare and Social Security Fund (Fundo de Asistencia e Previdencia ao Trabalhador Rural - FUNRURAL) began receiving substantially increased resources in 1971, there has been a significant expansion in coverage of the rural population by the urban-based curative health system. In 1976 FUNRURAL paid for about 13.8 million outpatient consultations and 1.2 million hospitalizations for the rural population of 43.4 million.

3/ Subsequently reduced to six in 1954 and to one (the National Social Security Institute - Instituto Nacional de Previdencia Social - INPS) in 1966.

workers, etc. 1/ Government employees received similar benefits through the Social Security and Welfare Institute for Public Servants (Instituto de Previdencia e Assistencia dos Servidores do Estado - IPASE). Although these programs were originally conceived along traditional social insurance lines (i.e., to provide old-age, disability and related benefits), health services were offered in the belief that such assistance would reduce the demand for disability benefits, and hence be cost-saving in the long run. The supplementary nature of these services is indicated by the fact that, as of mid-1940s, less than 10% of the social protection plans' total expenditure was devoted to health.

29. Over the past 25 years, public expenditures on health have grown fifteen-fold in real terms and in 1976 equaled about 2.5% of the GDP. Though the organizational structure described above remained essentially intact during this period, its two principal components, i.e., (i) the "collective-preventive" subsystem comprised of the Ministry of Health and the states and (ii) the "individual-curative" subsystem comprised of the social security institutes, now under the Ministry of Social Security and Welfare (Ministerio de Previdencia e Asistencia Social - MPAS), grew at widely divergent rates. 2/ This phenomenon has had such an important impact on the nature of health care in Brazil that a brief discussion of its causes and effects is clearly required.

30. Since World War II, the "collective-preventive" subsystem has lagged increasingly behind the "individual-curative" subsystem. As shown in Table 8, the former's share of total public health expenditure has declined from 87.1% in 1949 to about 30% in 1975. 3/ A notable feature within this

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1/ For further historical background, see J. M. Malloy, "Social Security Policy and the Working Class in Twentieth Century Brazil", Journal of Latin-American Studies and World Affairs, 19:1 (1977), 35-60.

2/ A good case can be made for including expenditures on water supply and sanitation in the public health sector. Adding all investment expenditures on water supply and sewerage under the National Sanitation Plan (Plano Nacional de Saneamento - PLANASA) would raise the share of the "collective-preventive" subsystem in total health expenditures to about 39%. Adding recurrent expenditures by all levels of government on water supply and sanitation and investments outside PLANASA would increase the percentage further. Over 77% of PLANASA investments in water supply and sewerage were financed by loans, which must be serviced, rather than by budgetary funds. For more details, see Annex IV, which deals with housing, water supply, and sewerage.

3/ The municipios also have health programs, part of which may be classified as "collective-preventive." However, data on expenditures by municipios are so incomplete and inconsistent that they cannot be used in this analysis. In any case, inclusion of municipal health expenditures would not affect the major trends identified.

Table 8: EXPENDITURES OF THE CONSOLIDATED PUBLIC HEALTH SECTOR, 1949-1975
(Cr.$10^6 at 1976 prices)[a/]

Program \ Year	1949	1965	1969	1975
INDIVIDUAL-CURATIVE				
INPS[b/]	174.9	2,182.9	6,884.8	19,095.6
	(8.8)	(31.6)	(54.2)	(60.8)
FUNRURAL[c/]	-	-	308.8	2,041.6
	(-)	(-)	(2.4)	(6.5)
IPASE[d/]	81.9	292.7	331.8	898.8
	(4.1)	(4.2)	(2.6)	(2.9)
Sub-Total	256.8	2,475.6	7,525.4	22,036.0
	(12.9)	(35.8)	(59.2)	(70.2)
COLLECTIVE-PREVENTIVE				
Ministry of Health	701.3[e/]	1,792.7	1,645.2	1,706.9
	(35.3)	(25.9)	(13.0)	(5.4)
States	1,029.3	2,634.1	3,525.3	7,639.2
	(51.8)	(38.2)	(27.8)	(24.3)
Sub-Total	1,730.6	4,426.8	5,170.5	9,346.1
	(87.1)	(64.1)	(40.8)	(29.7)
Total	1,987.4	6,902.4	12,695.9	31,382.1
	(100.0)	(100.0)	(100.0)	(100.0)

a/ Data in parentheses are percentages of total.
b/ National Social Security Institute (Instituto Nacional de Previdencia Social).
c/ Rural Worker Welfare and Social Security Fund (Fundo de Assistencia e Previdencia do Trabalhador Rural).
d/ Social Security and Welfare Institute for Public Servants (Instituto de Previdencia e Assistencia dos Servidores do Estado).
e/ Estimated.

Sources: F. A. Rezende and D. Mahar, Saude e Previdencia Social, Uma Analise Economica (Rio de Janeiro: IPEA/INPES, 1974), p. 201, Ministry of Health and Ministry of Social Security and Welfare.

overall trend has been the progressive marginalization of the Ministry of Health, whose budgetary allocation was lower in real terms in 1970 and 1975 than it was in 1965. One plausible explanation of this latter occurrence is the generally low priority awarded to preventive health care (especially in rural areas) observed in most post-war planning documents and budgets. Another possible explanation is that policy-makers consider only the total amount of resources devoted to health (including those handled by the social security institutes and the National Housing Bank) in arriving at decisions concerning the intersectoral allocation of budgetary funds. If this is the case, the rapid growth of the "individual-curative" subsystem observed since the 1940s could have been used as an argument against expanding the Ministry of Health budget. Whatever the reason, the stagnation of budgetary funds has been accompanied by a relative decline in the policy-making influence of the Ministry of Health, a factor which has further hindered its aspirations for a larger share of the federal budget. In combination, these factors have made it difficult for the Ministry to implement a coordinated national health plan, a role assigned to it in the Constitution of 1967. 1/

31. In 1976 the Ministry of Health began implementation of two major new programs, the first to provide a system of rural health posts in rural Northeast staffed by locally-recruited paramedical personnel and the second to control schistosomiasis. These two programs alone might double real Ministry of Health expenditures over the four year period 1976-79; implementation capacity rather than funding may now be the effective constraint on expansion of the "collective-preventive" subsystem. 2/ Their significance for a possible reversal of the trend toward a decline in the "collective-preventive" side of the Brazilian health care delivery system is discussed further below.

32. The vacuum left by the decline of the Ministry of Health has been progressively filled by the social security institutes, i.e., INPS, IPASE, and FUNRURAL. During the past three decades, their combined expenditures

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1/ Four national health plans were elaborated between 1948 and 1968: (i) the SALTE Plan - 1948, (ii) the Plan of Medical Assistance to the Municipios - 1956, (iii) the Plan of Demographic Expansion of Physicians - 1965, and (iv) the National Health Plan - 1968. All had as one of their major objectives the "interiorization" of the Brazilian health system. Unfortunately, owing to problems of implementation (e.g., unrealistic goals in comparison to available resources, lack of interagency coordination) and of conception as well, none of these plans was particularly successful. Problems of the latter type derived from the misconception that the country's urban oriented health system could be readily transferred to rural areas, and a failure to recognize the socioeconomic origins of poor health. See C. Gentile de Mello, "Planejamento de Saude e Desenvolvimento Economico", Revista de Administracao Publica, 12:3 (1977), 84-86.

2/ The Ministry of Health estimates its 1978 expenditures at 54% above the 1975 level in real terms.

on medical assistance (at 1976 prices) have risen at an average annual rate of nearly 19%--from Cr$257 million to more than Cr$22 billion. 1/ This rapid rate of growth has, in turn, caused the share of the "individual-curative" subsystem in the overall public health sector to increase from less than 15% to more than 70% (see Table 8) 2/. The factors explaining this phenomenon are both varied and complex. However, one may consider them according to three broad categories: (i) financial, (ii) demographic, and (iii) philosophical-administrative.

33. Regarding the first category it should be pointed out that, in contrast to the Ministry of Health and states (which must fund their programs through general revenues), INPS and IPASE are funded through earmarked payroll taxes. This has provided the "individual-curative" subsystem with a guaranteed and highly elastic revenue base, which has effectively shielded it from the vagaries of legislative review. The basic demographics of the postwar era have also favored the expansion of INPS and IPASE since their clientele (i.e., the urban labor force) has increased at a considerably faster rate than the population as a whole (4.4% vs. 2.9% during the 1950-1975 period).

34. Two causes of the philosophical-administrative nature may also be cited. First of all, the reorganization and unification of the social security system in 1966 extended the potential coverage of the system from occupationally-defined groups to the urban population as a whole. In addition, various social benefits (including medical care) became available to the rural population with the creation of FUNRURAL in 1963. Starting in the 1970s, the goal of universal coverage assumed even greater importance as new elements of the urban labor force (e.g., domestic servants) have been made eligible for social insurance benefits. As shown in Table 9, the coverage of urban social insurance has risen from 43% of the urban population in 1960 to 79% in 1975; estimates for 1977 are about 90%. A second philosophical-administrative factor has been the changing role of medical care vis-a-vis the other social insurance benefits available through INPS-IPASE. In this respect, expenditure data indicate that health services have expanded to a far greater extent than originally planned in the 1930s and 40s. Health care is no longer a supplementary function of INPS-IPASE, but a major program in itself. While in 1947 health-related programs accounted for only 6.5% of total INPS expenditures, 30 years later they account for about one-third. It is open to question, however, whether this trend is primarily due to basic philosophical modifications. More likely it reflects the large unsatisfied demand for medical services among poorer segments of the urban population coupled with a passive response on the part of INPS.

1/ The social security system has developed strong ties with the private health sector. Data for 1977 indicate that over 90% of the total INPS health expenditures are made via contractual arrangements with private institutions and medical personnel.

2/ The establishment of a separate Ministry of Social Security and Welfare in 1974 further attests to the growing power and prestige of this subsystem.

Table 9: COVERAGE OF URBAN SOCIAL INSURANCE, 1960 - 1975

Year	Insured Population[a/] (Thousands)	Urban Population (Thousands)	Coverage (%)
1960	13,710	32,005	42.8
1970	28,449	52,085	54.6
1975	50,572	64,091[b/]	78.9

a/ Includes dependents.
b/ IBGE estimate.

Source: IBGE, Anuario Estatistico, 1976 for urban population; Ministry of Social Security and Welfare for insured population.

35. For present purposes, the consequences of the growth pattern described above are perhaps more relevant than its causes. Though this topic cannot be completely explored within the bounds of this report, some of the more important allocational and distributional effects may be commented upon. With respect to the allocation of resources, it is clear that the disproportionate growth of the INPS-IPASE subsystem has given rise to a health sector increasingly biased toward high-cost, curative care 1/. As of the mid-1970s, approximately 80-90% of the funds channelled through the "traditional" health sector (i.e., that depicted in Table 9) were devoted to this end. Moreover, owing to the nature of its clientele, medical facilities of INPS-IPASE tend to be concentrated in major urban areas. A consequence of this organizational structure is that some segments of the population may actually be overtreated (e.g., via excessive periods of hospitalization) while others (mainly rural) receive inadequate or no medical care. As mentioned previously, this urban-biased pattern is common to the health sectors of many developing countries and even of the United States, and not confined only to Brazil. However, a major World Bank policy statement on health has deplored it as "not only inefficient but also inequitable". 2/

36. Another problem of allocation concerns the fragmentation of health resources among numerous administrative entities. According to a recent statement of the Ministry of Health, over 70 such entities operate at the federal level alone. This fact has given rise to an institutional setting characterized by overlapping jurisdictions and interagency conflicts. 3/ This fragmentation of the public health sector has also constituted an important barrier to the formulation of a national health policy. The rise of the "individual-curative" subsystem has been a crucial factor is this respect, since its elastic earmarked revenue base (and the financial autonomy this implies) has interfered with attempts to bring it within the national planning apparatus.

37. On the surface, it appears that a public health system dominated by social insurance schemes would produce a favorable distributional impact. That is, while every individual covered by INPS-IPASE contributes according to his income, each theoretically has an equal right to the medical services it provides. Moreover, the interpersonal redistribution of income implied by this basic cost-benefit relationship is reinforced to the extent that the incidence of illness is relatively greater among lower-income groups, and that middle and upper-income groups make relatively greater use of private medical services and facilities. 4/ Against this favorable

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1/ The urban-oriented individual-curative subsystem cost about US$44 per capita served in 1976. In contrast, the estimated per capita cost of a proposed simplified rural health care system is roughly half that much. See the section on simulations below for a description of the proposed rural health care system.

2/ World Bank, Health: Sector Policy Paper (March 1975), p. 33.

3/ A.C. de Azevedo, "Politica Nacional de Saude", Paper prepared for the Sixth National Health Conference, Brasilia, 3 August 1977 (mimeo), p. 1.

4/ For more details on these and related issues, see J. M. Malloy, "Social Insurance Policy in Brazil: A Study in the Politics of Inequality", Inter-American Economic Affairs, 30:3(1977), 41-67; and F.A. Rezende and D. Mahar, Saude e Previdencia Social: Uma Analise Economica (Rio de Janeiro: IPEA/INPES, 1974), ch. IV.

situation, however, one must further consider the question of who really pays for the social security system. Though the literature on the incidence of payroll taxes remains ambiguous, it is safe to assume that at least a part of the employers' share (which accounted for 54% of total INPS income in 1975) is shifted to consumers through higher product prices. As a result, some elements of the population (mainly rural and the poorest urban) help contribute to the system without receiving any of its benefits. The regressive nature of the payroll tax further reduces the redistributional potential of the "individual-curative" subsystem. In sum, the overall distributional effect of INPS-IPASE health programs is unclear. However, it would probably be erroneous to assume that they promote any major transfers of income from rich to poor.

38. The redistributive potential of FUNRURAL is theoretically greater than that of INPS-IPASE because of differences in the way it is financed. That is, instead of relying upon employer-employee contributions, FUNRURAL gets the bulk of its revenues from a 2.5% tax on rural products and a like tax on urban payrolls. Though the burden of these taxes falls partially upon the rural population itself (embodied in the prices of goods), a significant portion is undoubtedly borne by urban residents. To the degree that this occurs (in light of relatively higher average incomes in urban areas), the system is redistributional. Two mitigating factors, however, should be mentioned. First of all, despite recent progress in this area, the coverage of FUNRURAL remains quite limited, at least when compared with the INPS-IPASE systems. This point is illustrated by the data in Table 8, which, together with the urban rural/urban population distribution, imply that the per capita health expenditures of INPS-IPASE in 1975 were almost seven times larger than those of FUNRURAL (Cr$47 in 1976 prices). Secondly, the taxes which finance FUNRURAL are regressive and hence burden the poor relatively more than the rich. This factor, while perhaps not eliminating the positive distributional effects of the urban-rural income transfers, certainly reduces them.

C. Emerging Policy Issues

39. Though public expenditures on health have grown rapidly and now absorb about 2.5% of GDP, the Brazilian health sector is still fraught with serious problems. Among the most important identified in the present report are: (i) a lack of coordination between government agencies responsible for health matters, (ii) a bias towards high-cost, curative care, (iii) an urban and regional concentration of facilities and manpower, and (iv) a lack of success in reducing the incidence of certain endemic diseases. 1/ Recent government documents and pronouncements show that officials are aware of these problems. The central policy issues of the late 1970s concern the appropriate manners in which to deal with them.

1/ The lack of reliable health indicators could be added to this list.

40. One of the most difficult problems to solve will be that of coordinating public activity in the health sector. As a first step in this direction, federal legislation (Law 6229 of July 17, 1975) has formally established a national health system. The major contribution of this new legislation is that it clearly enumerates functional responsibilities among the administrative components of the system, i.e., the Ministry of Health, Ministry of Welfare and Social Security, Ministry of Education, Ministry of Interior, states and municipios. 1/ In a sense, however, the "new" allocation of responsibilities merely legitimizes that which has evolved informally over past decades, i.e., the Ministry of Health is responsible for collective actions; the Ministry of Welfare and Social Security for individual care; 2/ the Ministry of Education for the training of medical and paramedical personnel; the Ministry of the Interior (through the National Housing Bank - BNH) for water supply and sanitation; and the states and municipios for articulating national health policies at the local levels. 3/ What is presumably to be gained from a formalization of these relationships is a reduction in overlapping jurisdictions, and insurance against future encroachments by one agency upon the functional territory of another.

41. At the present juncture, it is difficult to ascertain whether the new health system will solve the coordination problem and thus permit the formulation of a coherent national health plan. Even if it is successful, questions will still arise as to the nature and direction of future growth in the system. Although a number of patterns are possible, two broad options appear to be open: (i) a continuation of past trends, with the urban-biased "individual-curative" subsystem increasingly dominating the "collective-preventive" subsystem; or (ii) a new strategy giving more emphasis to primary health care for rural inhabitants and/or poorer regions.

1/ The overall coordination of the health network is the responsibility of the Social Development Council (Conselho de Desenvolvimento Social - CDS) established in 1974 (through Law 6118 of 9 October) and comprised of the Ministries of Education, Labor, Health, Interior, Welfare and Social Security and the Planning Secretariat.

2/ For reasons of expected efficiency gains, the MPAS has recently undergone a major reorganization. Most importantly, the health activities of INPS, IPASE, FUNRURAL and the Brazilian Assistance Legion (Legiao Brasileira de Assistencia - LBA) have been administratively separated from their traditional social insurance functions (e.g., old-age and disability benefits), and consolidated into an entity known as the National Institute for Medical Assistance of Social Security (Instituto Nacional de Assistencia Medica Previdencia Social - INAMPS). The method of financing these programs, however, has remained essentially unchanged. Thus, while the creation of INAMPS may result in increased allocational efficiency, a concomitant improvement in the distributional area is by no means assured.

3/ An abridged version of this legislation is reproduced in A.C. Azevedo, "Politica Nacional de Saude," op. cit., pp. 13-21.

As might be expected, considerable pressure in favor of maintaining the present system comes from elements of the private health sector seeking to preserve and/or enhance their income and employment ties with the social security system. Some pressure in this direction also may come from old-line "sanitaristas" who could feel threatened by any change in the status quo. Despite this resistance, it would appear that there is some official willingness to experiment with the second option.

42. Sentiments of the latter type undoubtedly explain the creation of the Program for Grass Roots Health and Sanitation Actions in the Northeast (Programa de Interiorizacao das Acoes de Saude e Saneamento no Nordeste - PIASS) in 1976. This program, coordinated by the Ministry of Health, is funded at Cr$4 billion (at 1976 prices) for the period 1976-1979. The guiding principles of PIASS are that a large variety of health problems may be successfully prevented and/or treated at the community level, without recourse to expensive hospitalization in major urban areas, and that preventive and simple curative services should be integrated with more complex curative services through well-defined institutional channels. A related premise is that traditional health services alone tend to have a limited impact on community health standards, and should be integrated with water supply, sewerage, garbage disposal, vaccination and nutrition and other preventive and promotional programs. In order to act upon this latter premise, the PIASS is directed by an interministerial committee comprised of representatives from Health, Welfare and Social Security, Interior, Agriculture, and Planning.

43. At the operational level, the state Secretariats of Health implement PIASS through a hierarchy of medical facilities of increasing complexity, starting with very simple facilities staffed by paramedical personnel and linking with the urban medical system at the top. To the extent possible, existing infrastructure (i.e., Ministry of Health, INPS, FUNRURAL, state, municipal, etc.) is to be used. The elementary level of the system, established in communities of 500-2,000 inhabitants, is based around the "rural health post". 1/ This facility is staffed by locally-recruited auxiliaries and stresses the prevention of infectious diseases and the early detection of more complex health problems. It also serves as the local agent of the National Nutrition Program (Programa Nacional de Nutricao - PRONAN) 2/ and the focal point for basic sanitation programs. Substantial local community participation in planning and administering the health posts and their activities is being sought.

44. As originally conceived, the intermediate level of the PIASS would be directed at towns with populations of 2,000-5,000. These towns would have second level health centers similar to the rural health posts, but with a somewhat greater degree of specialization, e.g., the availability of simple

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1/ Before implementation of PIASS began, similar facilities called "miniposts," existed in a few localities in the Northeast.

2/ See paragraphs 157-173 of this annex for a discussion of PRONAN.

diagnostic facilities and regular visits by itinerant doctors, who would be the titular heads of these health centers. At this intermediate level, supervision would be provided for the rural health posts. At the top of the PIASS hierarchy would be the support (third) level, implanted in communities of 5,000-20,000 inhabitants. Facilities at this level would include health centers staffed by full-time physicians, dentists and trained auxiliary nurses and, in some cases, small hospitals. These facilities would offer services to the surrounding population as well as logistical support to the health posts and second level health centers. Additional functions performed at the support level would be the training of auxiliary personnel, the distribution of food supplements (PRONAN), housing improvements in areas where Chagas' Disease is endemic, and the provision of water supply to populations not attended by the National Sanitation Plan (PLANASA) which is administered by state Sanitation Companies linked to the National Housing Bank (see Annex IV on Housing, Water Supply and Sewerage).

45. In practice, the PIASS program appears to be evolving along somewhat different lines, with two rather than three levels in most areas (health posts and health centers). The health centers apparently vary considerably in degree of sophistication and staffing, and often serve as the entry point to the FUNRURAL "individual curative" system. In most cases the centers are located in the county seats (sedes de municipio) with health posts being established in smaller towns (sedes de distrito) subordinated to the county seats. The health centers are sometimes staffed at least part time by a doctor who visits the health posts. The most elaborate health centers tend to be in the larger county seats. In fact, while formally outside the PIASS system, the FUNRURAL facilities serve many of the functions originally planned for the third level of PIASS.

46. In December 1978 the PIASS technical secretariat estimated the average number of people covered by the PIASS system (which includes part of Minas Gerais as well as the nine Northeastern states) was 6.4 million or 25% of the target population, with a total of 642 health centers and 1,258 health posts in operation, though not always offering all the services they are eventually supposed to provide. Of these, 258 health centers and 888 health posts covering 3.3 million people were constructed under the PIASS program. Thus the density of the network of health posts and health centers constructed as of 1978 was still considerably short of goals. Even the health posts which were constructed since the PIASS program began cover an average of over 3,700 people each. If health posts already in existence before the PIASS program started are included, the population covered by each post is about 5,100. In the case of health centers the average population covered per center constructed and operating under the PIASS program was about 12,900 whereas if previously existing centers are included the figure is about 9,900.

47. When the PIASS system described is fully implemented, the coverage of the public health system should be appreciably increased and its bias towards high cost curative care reduced (at least in the Northeast). A further benefit of the PIASS is that it should improve the efficiency of the "individual-curative" subsystem since the specialized hospital network will be utilized only for treating the most complex cases referred from below. It is highly unlikely that PIASS will be fully and effectively implemented by 1979 as planned. The key problems which have been encountered involve training

of medical and paramedical personnel and management. In the case of training, the objectives, methods (including teaching materials), and duration of training have not been standardized, and hence there is wide variability in practice. Administrative problems include poor staff organization in the state Secretariats of Health and inadequate recruitment, training, and supervision of medical and paramedical personnel. Shortages of disbursable funds, bureaucratic problems in the acquisition of land for and construction of PIASS health facilities, inadequate distribution systems for supplies, ineffective equipment maintenance systems, and insufficient administrative decentralization have also plagued PIASS. All of these problems are in principle resolvable, but this will require first time and second greater political priority for PIASS at all levels to ensure better quality management personnel.

48. Another serious problem is interagency coordination. For some years FUNRURAL has been financing hospital and outpatient services via contracts with state and municipal hospitals, charitable institutions, and rural labor unions. It has also been equipping small hospitals administered by non-profit institutions, municipal governments, or (especially in Pernambuco) state Secretariats of Health. These hospitals receive a monthly operating subsidy from FUNRURAL. These facilities can be linked to the PIASS, serving as the third (support) level. This is now being done in some states, but to be effective requires careful coordination between the state Secretariats of Health and FUNRURAL. Coordination problems also arise with regard to basic sanitation (water supply and excreta disposal) provided by the state sanitation companies, FSESP (which operates in parts of the Northeast, especially irrigated areas), the nutrition program (PRONAN), and the integrated rural development program for the Northeast (Programa de Desenvolvimento em Areas Integrados do Nordeste - POLONORDESTE).

49. Defining more precisely responsibilities for building, staffing, operating, and controlling the different parts of the PIASS system is necessary if the PIASS goals are to be achieved. The training and management problems mentioned are a more serious constraint on the expansion of the PIASS system than funding, even of recurrent costs. Funding of the latter now appears assured under an agreement between MPAS and the Ministry of Health signed in December 1977. This agreement provides that the social security system will finance recurrent costs of PIASS. Implementation of the agreement began in Minas Gerais in 1978 and is expected to be extended to the nine Northeastern states in 1979. This is a highly significant step and if implementation is successful, it may pave the way for a national rural health program in the 1980s.

50. Though health problems are generally most serious in the rural Northeast, the PIASS approach could be applied to the rural areas of other regions and to urban areas as well. As the previous discussion indicated, lack of access to medical care is a problem for a considerable number of persons even in the relatively prosperous Southeast. Whether the PIASS approach can be applied nationally, however, is highly dependent upon its reception by the private medical profession. If physicians feel sufficiently threatened by community involvement and the use of auxiliaries, and if they can muster sufficient support, the future of PIASS-type programs outside the rural Northeast may be quite limited.

51. An alternative institutional and philosophical approach to rural health care delivery is that of FSESP. The basic differences in the FSESP approach compared with PIASS are that FSESP (a) makes greater use of itinerant physicians in health posts, (b) contracts all its personnel on a full-time, exclusive dedication basis; (c) has highly effective training programs; and (d) has per capita investment and operational costs at least three times those of PIASS. Given the administrative problems which have plagued PIASS, the relatively well-managed and high quality FSESP program may well be more cost-effective than PIASS. In fact the two programs often overlap in the Northeast (FSESP also operates in part of the Frontier region). An informal division of territory has been worked out with PIASS to avoid institutional conflict. Before a national rural health care delivery system is implemented the lessons from the PIASS and FSESP experience should be evaluated. In principle the PIASS approach offers an adequate basic rural health care delivery system, but in practice this depends on improving management in the state Secretariats of Health.

52. The appropriate manner in which to deal with the continued high incidence of certain endemic diseases has also emerged as an important policy issue of the late 1970s. In this area, the number one priority of the Ministry of Health is the containment and eventual eradication of schistosomiasis. To achieve this goal, a Special Program for the Control of Schistosomiasis (Programa Especial de Controle da Esquistossomose - PECE) was inaugurated in 1976. It will initially run until 1979 with a total budget of Cr$1.75 billion. The strategy adopted by the PECE involves: (i) epidemiological surveillance, (ii) chemotherapy, (iii) vector control, (iv) improvements in water supply and sanitation, (v) sanitary education, and (vi) research. The first three components of the program are the responsibility of the Superintendency of Public Health Campaigns (Superintendencia de Campanhas de Saude Publica - SUCAM); the last two are to be carried out by FSESP.

53. As a starting point, the PECE has been activitated in seven northeastern states: Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas and Sergipe. Data for mid-1977 indicate that substantial work has already been completed in terms of stool examinations and water supply. By the same date, 50,000 doses of oxamniquine had been administered in two municipios of Rio Grande do Norte, reportedly with a high cure rate and few side-effects. Some doctors interviewed, however, indicated that this drug has many counter-indications and substantial side effects, especially if used repeatedly. According to Planning Secretariat sources, significant headway has also been made by FSESP, including the installation of 48 water supply systems connected to 10,000 homes, and the construction of 51,000 latrines and 40,000 clothes-washing facilities. The eventual success of the PECE hinges upon its ability to treat a proportion of the infested population large enough (probably above 80%) to control transmission. This is likely to be an extremely difficult task. Furthermore, while effective, the drug oxamniquine does not prevent reinfestation of people who have already been cured. Hence, the key to effective schistosomiasis control is the construction of adequate sanitation facilities and their use by the affected population. The latter is facilitated by a high degree of community participation, assuming adequate technical

supervision is available. The former is likely to require more resources than are now available through PECE. 1/

54. In the case of water supply, it should be pointed out that the role of FSESP as an operater of water supply systems may conflict with the expansion of the state sanitation companies into ever smaller communities under PLANASA (see Annex IV on Housing, Water Supply and Sewerage). While there is yet no real problem, it appears likely that FSESP will eventually be responsible only for controlling water quality, building some water supply systems, and the construction of latrines. Operation of water supply systems will probably be consolidated under the state sanitation companies which provide channels through which subsidization of operating costs in low-income rural communities can be carried out.

D. Simulations

55. The purpose of this section is to determine likely upper (optimistic) and lower (pessimistic) limits of the extent to which the Brazilian population's needs for basic health care would be met at different points in time through the end of this century and to estimate in broad orders of magnitude the costs which would be incurred by the public sector in providing basic health care under these two alternative scenarios. The two simulations should not be considered as forecasts, but rather as upper and lower bounds of what may reasonably be expected assuming no radical changes in Brazilian development strategy are forthcoming. The actual outcome is likely to lie somewhere between the optimistic and pessimistic simulations.

56. The basic assumptions underlying the optimistic simulation are: (i) that GDP growth averages 7% per year over the period 1980-2000; (ii) that a strong effort is made to extend to the entire rural population of Brazil a rural health care delivery system similar to that originaly envisaged under the PIASS program; and (iii) that the coverage of the urban population is completed through a restructured urban health care system. The pessimistic simulation assumes that GDP growth averages 4% per year over the period 1980-2000 and that the effort to extend both the urban and PIASS-type rural health care delivery systems will be less intense. In both simulations it is assumed that GDP growth in 1978 and 1979 is 6%. The 4% and 7% rates for the period 1980-2000 are plausible upper and lower limits for GDP growth over the long term. The average annual rate of growth of GDP over the period 1921-1947 was 4.4%; 2/ for the period 1948-1976 it was 7.4%. 3/ These GDP growth rates

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1/ See Annex IV, Part III for estimated capital costs of implementing a rural sanitation package including safe water and excreta disposal.

2/ M.H. Simonsen, Brazil 2002 (Rio de Janeiro: Apec, 1977).

3/ Annex II, Table 9, p. 17.

are not used in any formal sense in projecting coverage rates, but rather are assumed to condition financial and human resource availability and real cost levels and hence the relative ease of extending the public basic health care system.

57. Regression analysis was not used in making the health simulations as in the case of housing, water supply, and sewerage (see Annex IV) principally because (a) the coverage of the lowest level of the rural system (the health post) is still so low that meaningful cross-section analyses with other variables are not possible, (b) data for the second and third levels of the rural system are not available on a sufficiently disaggregated basis for this kind of analysis, and (c) the coverage of the urban system is already so high that small differences in coverage estimates over the period 1975-2000 which might be obtained by more sophisticated simulation techniques would not significantly alter cumulative cost estimates over five- or ten-year subperiods.

58. The simulations of both rural and urban basic health care costs are made in four steps. First, the type of service considered as meeting basic needs is defined. Second, the percentage of the population in each of the three regions used in this report to be covered (the "coverage ratio") is stipulated for each year from 1976 through 2000 for each simulation. Third, unit costs for each component of the health care delivery systems are estimated by region and year in 1976 US dollars. The final step is to multiply the per capita cost estimates for each year by the covered population using the "baseline" demographic projections described in Annex I to simulate total basic health care delivery system costs. 1/ The derivation of these cost estimates for attaining certain projected coverage ratios involves making numerical assumptions that are inherently arbitrary within a very broad range of plausibility and then performing a series of arithmetic operations to arrive at results. Consequently, any such results are vulnerable to the criticism of being predetermined by the assumptions--it is too easy to construct desired results by simple manipulation of stipulated values. Since the criticism is fundamentally valid, the magnitudes of required public sector outlays derived from such exercises are interesting to the extent that they turn out to be "large" ("small") in spite of underlying assumptions at, or beyond, the boundaries of plausibility leading to downward (upward) biased estimates of the required outlays. In the case of the urban population, only total costs are considered. For the rural health system, which is described in greater detail, both current and investment costs (including training of personnel) are simulated to determine total costs.

The Urban Health Care System

59. The "individual-curative" health care system covered about 85% of the urban population in 1976 at a cost of US$43.76 per capita served. This is a national average across all regions. No effort was made to disaggregate the

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1/ Use of alternative demographic projections given in Annex I would not significantly affect total basic health care costs.

urban health cost data by region or to separate current and capital costs. Though this type of service may be rather unequally distributed over the urban population, expenditures at this per capita level could provide adequate basic health care if the urban services were restructured so as to include the urban equivalent of the PIASS health posts, thus providing a greater preventive component and treating simple health problems at the lowest level of the system. The problem in urban areas, in synthesis, is neither coverage (which can be expanded fairly rapidly to fully cover the urban population), nor financial resources (which are already being mobilized), but rather restructuring so as to place less emphasis on doctors and hospitals (i.e., the most expensive part of the system) and more on paramedical personnel, preventive medicine, and outpatient care (which are not only cheaper, but more efficient at delivering many services to persons who most need them). The cost per capita of covered population should, if anything, be less in the restructured system than the present one, hence the cost estimate for basic urban health care is likely to be at the high end of the plausible range, as is appropriate for estimating whether "money is the problem" in extending coverage.

60. The percentage of the urban population covered by this system is projected to reach 100% by 1980 under the optimistic simulation and 93% under the pessimistic simulation. In the latter, coverage subsequently increases at a rate which would provide full coverage by 1990. Beyond this date, both simulations assume that the urban population is 100% covered through the year 2000 (see Table 10). Real per capita costs of the urban health care system are assumed to increase at a 2% annual rate under the optimistic simulation and at 1% under the pessimistic simulation. These assumptions reflect the frequently observed tendency of real medical costs to rise over time. In the U.S., for example, the difference between the medical care price index and the overall cost of living index averaged about 1.2% per annum between 1960 and 1976.

Table 10: PERCENTAGE OF URBAN POPULATION COVERED BY THE URBAN HEALTH CARE SYSTEM BY REGION AND TYPE OF SIMULATION, 1975-2000

Year	Alternative Simulations	
	Pessimistic	Optimistic
1975	79.0	79.0
1980	92.8	100.0
1985	96.4	100.0
1990	100.0	100.0
2000	100.0	100.0

The Rural Health Care System

61. The greatest opportunities for increasing coverage and hence the principal differences between optimistic and pessimistic simulations for the health sectors, are found in the rural sector. Here the approach used was to assume that a PIASS-type system as originally conceived will be progressively implemented in all regions, starting in the Northeast where the effort effort began in 1976, and spreading to other regions beginning in 1981. While in practice PIASS has developed only the first two levels of the system with slightly different staffing and coverage for health posts and health centers now planned, FUNRURAL hospitals in larger towns in fact provide a third level and the costs of the system projected here should not differ much from an upgraded PIASS/FUNRURAL system.

62. While for the purpose of investigating whether "money is the problem" in attaining coverage targets that are ambitious by historical standards, unit cost assumptions tending to overstate the required amounts for a given service are appropriate, a deliberate choice has been made to define basic rural health care as a "no frills" PIASS-type system rather than the much more expensive FSESP system. That choice having been made, the cost (both current and capital) data used here, which are based on World Bank experience in Northeast rural development projects, are augmented by a generous 30% administrative overhead charge to allow for better management of the system and substantial regional cost differentials are assumed in the case of the Southeast and Frontier regions so that the cost estimates should be at the high end of the plausible range for the type of service considered basic.

63. The rate of implementation is essentially a function of per capita GDP growth and development strategy. As explained above, the novelty in the PIASS system is the introduction of health posts staffed by paramedical personnel. The health posts constitute the first level of a three-level system similar to the original PIASS conception. Each post serves an average of 1,500 people and is staffed by a rural health attendant chosen by the local community to receive specialized training. 1/ In addition, a traditional midwife is trained to work at each health post, but is not paid a salary. The staffing patterns used for health posts and the other elements of the rural health care system are based on World Bank experience in Northeast rural development projects. It is assumed that during a year each health post provides 1,500 consultations (an average of one per person served). These in turn generate 500 consultations at the second level of the system and 500 referrals directly to the third level for more serious cases and those requiring hospitalization or immediate attention by a doctor. In addition all dental work is handled at the third level. The health post staff is responsible for conducting inoculation campaigns, basic health education, and simple first aid. Basic medicines, inoculants, and other supplies are included in the operating costs of the health post. Salaries and training costs in 1976 dollars are assumed to increase over time in proportion to per capita GDP, while construction costs are assumed to stay constant in real terms.

1/ In practice to date doctors visit some health posts.

64. Technical and cost coefficients for the health posts as well as components of the second and third levels of the rural system are shown in Table 11. It is assumed that all costs are 32% greater in the Southeast than in the Northeast (roughly the differential in the population-weighted average minimum wage, with the minimum wage in the state capitals used for each state, for the two regions in 1976) in all scenarios even though construction costs in 1976 (as measured by the National Housing Bank) were about the same in all regions. If anything, this is likely to overestimate costs in the Southeast. The Frontier is assumed to have costs 7% above the Northeast, the differential in the regional weighted average minimum wage obtained in the same way as for the Southeast.

65. The second level of the system is a health center somewhat larger than the health post and staffed by a nursing attendant and a sanitation auxiliary. It is visited one day per week by a doctor who is based in a regional health center (the third level of the system). Each second level health center serves on the average 3 health posts (4,500 people). Its main functions are (a) to serve as a point to which cases not requiring immediate attention but needing diagnosis and/or treatment by a doctor can be referred and (b) to serve as the base for the sanitary auxiliary who has an important role conducting sanitary education campaigns, inspecting local water supply systems, and supervising the construction of latrines in his territory. In addition, the nursing attendant can provide medical attention not requiring the services of a doctor.

66. The third level of the system consists of a larger health center attached to a hospital also serving the urban population where it is located. These health centers each serve an average of 4 second-level health centers and 12 health posts--18,000 rural dwellers. Staffing of the third-level health centers/hospitals includes 3 doctors (one of whom travels daily to the second-level centers on a rotating basis), a nurse (with functions in the health center and hospital as well as helping with supervision of the health post and second-level health center personnel), 2 dentists, 5 auxiliary nurses, 9 attendant nurses, 3 administrative auxiliaries, and one driver. 18 beds in the hospital are assumed to be paid for and staffed by the rural health system. It is assumed that a total of 6,000 outpatient consultations per year requiring immediate attention are referred directly from the 12 health posts served by the third-level center, and an additional total of 280 per year are referred by the 4 second-level centers. The two dentists should provide an average of one consultation per year per person in the population served by the third-level health center when supported by an auxiliary nurse with the appropriate training. A total of 1,000 hospitalizations averaging 5 days each per year are generated, which assumes a bed occupancy rate of 76%. This amounts to one hospitalization per year for every 18 members of the rural population. In addition to medical supplies, the operating costs of the third-level health centers and hospitals include operating costs and depreciation on a vehicle used for doctor and nurse visits to second-level centers and health posts (nurse only) as well as per diems for the driver, nurse, and doctor. Investment costs include the construction of 18 beds ($12,000 per bed in the Northeast and Frontier, $15,840 per bed in the Southeast and $12,840 in the

Table 11: TECHNICAL AND COST COEFFICIENTS FOR THE RURAL HEALTH CARE SYSTEM AT FULL BY COMPONENT, REGION AND TYPE OF SIMULATION, 1975 - 2000

Health System Component, System Level, and Population Served	Year	Service Life (years)	Unit Construction or Training Cost (Thousands of 1976 US$)					
			Northeast		Southeast		Frontier	
			P a/	O b/	P a/	O b/	P a/	O b/
Health Posts, Level 1, one per 1500 rural population	1975	30.0	4.80	4.80	6.34	6.34	5.14	5.14
	1980	30.0	4.80	4.80	6.34	6.34	5.14	5.14
	1985	30.0	4.80	4.80	6.34	6.34	5.14	5.14
	1990	30.0	4.80	4.80	6.34	6.34	5.14	5.14
	2000	30.0	4.80	4.80	6.34	6.34	5.14	5.14
Rural Health Attendants and Traditional Midwives, a/ Level 1, one each per 1500 rural population	1975	5.0	.52	.52	.69	.69	.56	.56
	1980	5.0	.61	.63	.81	.83	.65	.67
	1985	5.0	.66	.79	.87	1.04	.71	.85
	1990	5.0	.70	. 6	.92	1.27	.75	1.03
	2000	5.0	.83	1.49	1.10	1.97	.89	1.59
Health Centers, Level 2, one per 4500 rural population	1975	30.0	13.20	13.20	17.42	17.42	14.12	14.12
	1980	30.0	13.20	13.20	17.42	17.42	14.12	14.12
	1985	30.0	13.20	13.20	17.42	17.42	14.12	14.12
	1990	30.0	13.20	13.20	17.42	17.42	14.12	14.12
	2000	30.0	13.20	13.20	17.42	17.42	14.12	14.12
Nursing Attendants and Sanitary Auxiliaries, Level 2, one each per 4500 rural population	1975	10.0	.75	.75	2.31	2.31	.80	.80
	1980	10.0	.88	.91	1.16	1.20	.94	.97
	1985	10.0	.95	1.15	1.25	1.52	1.02	1.23
	1990	10.0	1.02	1.39	1.35	1.83	1.09	1.49
	2000	10.0	1.20	2.12	1.58	2.80	1.28	2.27
Health Centers and Hospitals, Level 3, one center and 18 beds per 18,000 rural population	1975	50.0	256.00	256.00	337.92	337.92	273.92	273.92
	1980	50.0	256.00	256.00	337.92	337.92	273.92	273.92
	1985	50.0	256.00	256.00	337.92	337.92	273.92	273.92
	1990	50.0	256.00	256.00	337.92	337.92	273.92	273.92
	2000	50.0	256.00	256.00	337.92	337.92	273.92	273.92
Doctors, Level 3, three per 18,000 rural population	1975	30.0	112.80	112.80	148.90	148.90	120.70	120.70
	1980	30.0	132.60	136.44	175.03	180.10	141.88	145.99
	1985	30.0	142.71	172.44	188.38	227.62	152.70	184.51
	1990	30.0	152.81	208.44	201.71	275.14	163.51	223.03
	2000	30.0	180.47	326.21	238.22	430.60	193.10	349.04
Nurses, Level 3, one per 18,000 rural population	1975	20.0	9.40	9.40	12.41	12.41	10.06	10.06
	1980	20.0	11.05	11.37	14.59	15.01	11.82	12.17
	1985	20.0	11.89	14.37	15.69	18.97	12.72	15.38
	1990	20.0	12.73	17.37	16.80	22.93	13.62	18.59
	2000	20.0	15.04	27.18	19.85	35.88	16.09	29.08
Dentists, Level 3, two per 18,000 rural population	1975	30.0	47.00	47.00	62.04	62.04	50.29	50.29
	1980	30.0	55.25	56.85	72.93	75.04	59.12	60.83
	1985	30.0	59.46	71.85	78.49	94.84	63.62	76.88
	1990	30.0	63.67	86.85	84.04	114.64	68.13	92.33
	2000	30.0	68.83	133.98	90.86	176.85	73.65	143.36
Auxiliary Personnel, Level 3, four auxiliary nurses, one laboratory technician, three administrative auxiliaries, and one driver per 18,000 rural population	1975	15.0	6.77	6.77	8.94	8.94	7.24	7.24
	1980	15.0	7.96	8.19	10.51	10.81	8.52	8.76
	1985	15.0	8.57	10.35	11.31	13.66	9.17	11.07
	1990	15.0	9.17	12.51	12.10	16.51	9.81	13.39
	2000	15.0	10.83	19.57	14.30	25.83	11.59	20.94
Attendant nurses, Level 3, nine per 18,000 rural population	1975	12.5	3.38	3.38	4.46	4.46	3.62	3.62
	1980	12.5	3.98	4.09	5.25	5.40	4.26	4.38
	1985	12.5	4.28	5.17	5.65	6.82	4.58	5.23
	1990	12.5	4.58	6.25	6.05	8.25	4.90	6.69
	2000	12.5	5.41	9.79	7.14	10.89	5.79	10.48

a/ Pessimistic simulation
b/ Optimistic simulation

Frontier) in a larger hospital also serving the urban population and training for personnel at all levels (including full university training for doctors). Administrative costs at the state and national level are assumed to add 30% to total rural health program costs.

67. The second and third levels of the rural health system can build on the structures and personnel already in place in 1976 and financed by FUNRURAL and the state Secretariats of Health. Judging by the number of consultations and hospitalizations provided under FUNRURAL in 1976, and expanding to take account of an estimate of additional capacity provided by the state secretariats, the level of coverage for the second and third levels of the system is estimated at 50% of the basic standard for the Northeast, 65% for the Southeast, and 40% for the Frontier in 1975.

68. The initial coverage rates for the second and third levels are assumed to increase over time roughly in proportion with per capita GDP in the pessimistic simulation. For the optimistic simulation it is assumed that full coverage is reached in all regions by 1990, with coverage increasing in each region at a rate sufficient to reach this ambitious, but somewhat arbitrary target. In both simulations, once 100% coverage is reached, it is assumed to be maintained, i.e., the system expands at the rate of population growth. In the case of health posts and their staff, it is assumed that they are established only in the Northeast in the years 1976-1980. The coverage at the first level of the rural health system is therefore given as zero in both 1975 and 1980 in the Southeast and Frontier regions despite the fact that some facilities similar to health posts exist. This is done because there are no data easily available concerning these facilities and in order to lean in the direction of overestimating rather than underestimating costs of implementing both the rural and urban health systems. Given the lags being experienced in implementing the PIASS, 1980 coverage is projected at only 15% of the Northeast's rural population in the pessimistic simulation and 30% in the optimistic projection. Over the period 1981-2000, the rates of coverage with health posts in the two simulations are estimates based on discussions with knowledgeable Brazilians, and World Bank experience in integrated rural development projects involving health components. They both reflect the serious management problems discussed earlier. In the optimistic simulation it is assumed that a greater effort is made to resolve these problems. The coverage rates for all levels of the system (as a percentage of full coverage of the population in each year at the basic service level described above) are given in Table 12.

Rural, Urban and Total Health System Costs

69. Given the technical and cost coefficients given in Table 11 and the coverage rates given in Table 12 it is possible to simulate total rural health system costs with the Long Run Planning Model (LRPM) health projection module using any of the demographic projections described in Annex I. As mentioned above, the "baseline" population projections are used here. Table 13 presents the two regionalized cost simulations for the years 1976-80, 1981-85, 1986-90, and 1991-2000 expressed in 1976 US dollars. Rural, urban,

Table 12: PERCENTAGE OF THE RURAL POPULATION COVERED BY THE RURAL HEALTH CARE SYSTEM BY REGION AND TYPE OF SIMULATION, 1975-2000

Level of system and year		Northeast		Southeast		Frontier	
		Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Health Posts and Staff (Level 1)	1975	0	0	0	0	0	0
	1980	15	30	0	0	0	0
	1985	30	65	45	50	10	50
	1990	45	85	90	100	30	75
	2000	70	100	100	100	50	100
Health Centers (Level 2) and Health Centers/Hospitals (Level 3)							
	1975	50	50	65	65	40	40
	1980	60	60	75	80	45	45
	1985	65	80	80	90	50	70
	1990	70	100	90	100	55	100
	2000	80	100	100	100	65	100

Table 13: COSTS OF SIMULATED URBAN, RURAL, AND TOTAL HEALTH CARE SYSTEM BY REGION AND TYPE OF SIMULATION, 1976-2000

Region and Location	1976-1980		1981-1985		1986-1990		1991-2000	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
				Billions of 1976 US$				
Basic Health Care Costs over Period								
Northeast								
Urban	3.16	3.40	4.21	4.77	5.35	6.12	14.68	17.87
Rural	.96	1.00	1.18	1.63	1.75	2.49	3.88	7.22
Total	4.12	4.40	5.39	6.40	7.10	8.61	18.56	25.09
Southeast								
Urban	10.23	10.99	13.98	15.81	17.84	20.41	48.17	58.65
Rural	1.62	1.76	2.14	2.55	3.17	3.54	6.93	10.16
Total	11.85	12.75	16.12	18.36	21.01	23.95	55.10	68.81
Frontier								
Urban	1.25	1.34	1.79	2.02	2.40	2.75	7.01	8.54
Rural	.24	.27	.34	.57	.46	1.00	1.34	3.14
Total	1.49	1.61	2.13	2.59	2.86	3.75	8.35	11.68
Brazil								
Urban	14.64	15.73	19.98	22.60	25.59	29.28	69.86	85.06
Rural	2.82	3.03	3.66	4.75	5.38	7.03	12.15	20.52
Total	17.46	18.76	23.64	27.35	30.97	36.31	82.01	105.58
GDP over Period	806.14	811.27	1000.85	1124.84	1217.69	1577.64	3283.99	5316.19
				Percentages of GDP				
Basic Health Care Costs for Brazil over Period as % of GDP Over Period								
Urban	1.82	1.94	2.00	2.01	2.10	1.86	2.13	1.60
Rural	.35	.37	.37	.42	.44	.45	.37	.39
Total	2.17	2.31	2.36	2.43	2.54	2.30	2.50	1.99

and total health system costs aggregated for Brazil as a whole are also shown as percentages of GDP generated during the same periods for each simulation. It should be noted that these costs are for basic health care coverage as defined above -- it is obviously possible to spend considerably more on health if this is desired, and indeed it is quite likely that this will in fact occur since there is likely to be considerable pressure to provide more than the basic health care coverage through the public system for at least some segments of the population.

70. Urban health care costs are estimated to range from a low of 1.6% of GDP in the optimistic simulation for the period 1991-2000 to a high of 2.1% of GDP for the pessimistic simulation over the same period. In the 1981-85 period they are estimated at 2.0% of GDP for both simulations. After 1985 the percentage falls for the optimistic simulation and rises for the pessimistic simulation. Since coverage is virtually identical in both after 1985, the lower effort required (measured by percentage of GDP) is largely due to the faster growth of GDP in the optimistic simulation. Rural health care system costs come to about 0.4% of GDP in all periods for both simulations, but there are substantial differences in coverage in the two simulations (see Table 12).

71. For total basic health care costs the highest effort required in either simulation in any period is 2.54% in the pessimistic simulation for public health care system, money does not appear to be the problem in extending the basic health care system at the rates indicated in the two simulations. Indeed, given the deliberate upward bias in the cost estimates, it is quite likely that the percentage of GDP required would at no time before the turn of the century exceed that actually realized in 1976. Thus, if the public health care system grew at the rates indicated in Tables 10 and 12, assuming unitary income elasticity of the taxes which now finance public health care, there could be a dividend left over for further acceleration of coverage increases and/or average quality improvements without any increase in taxation rates. Given the relatively low cost of the rural system, total health care costs are relatively insensitive to large percentage increases in rural health care costs which might result if the rural system were upgraded in quality beyond the level defined here as basic.

72. The real challenge in improving the health care system in Brazil is organizational rather than financial. Increasing access to the system by the poor, especially in rural areas, and strengthening the "collective-preventive" components of the system so as to raise overall efficiency are the major measures required. They are not costless, but the costs are likely to be offset at least in part by efficiency improvements. Once full coverage is reached, the real financial effort required to provide basic health care, expressed as a percentage of GDP, should fall.

PART II: NUTRITION

A. The Extent of Malnutrition

73. While there have been many studies concerning malnutrition in Brazil, 1/ before the 1974/75 National Household Expenditure Study (Estudo Nacional da Despesa Familiar - ENDEF) there were only two national estimates of food consumption: The Brazilian Ministry of Agriculture/FAO food balance sheets prepared for various years starting in the 1940s and the Getulio Vargas Foundation/U.S. Department of Agriculture family budget surveys of the early 1960s. The ENDEF is by far the most complete and carefully executed survey, and most of the analysis in this section will be based upon its early publications. However, as background it is useful to review the earlier national estimates. Throughout this report relatively little attention is paid to protein malnutrition because numerous surveys, including the ENDEF, have shown that if calorie intake is adequate, protein requirements are almost always met given the foods normally consumed by Brazilians. Indeed, inadequate calorie consumption may impede the utilization of proteins contained in traditional Brazilian diets, since when calorie consumption is deficient, proteins are diverted from their normal functions to provide energy 2/.

National Estimates Prior to 1974

74. In the 1940s, 1950s, and 1960s, the Brazilian Ministry of Agriculture and the FAO prepared several food balance sheets. These showed that estimated per capita food consumption rose over 25 years from 2,250 calories per day to over 2,600 calories. After the first few years, the estimated level of daily

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1/ See Sebastiao Ferreira Soares, Notas Estatisticas sobre a Producao Agricola e Carestia dos Generos Alimenticios no Imperio do Brasil (Rio de Janeiro: IPEA, 1977) reprint of the original edition dated 1860; F. Pompeo do Amaral, O Problema da Alimentacao: Aspectos Medico-Higenico-Sociais (Rio de Janeiro: Livraria Jose Olympio Editora, 1963) 2 vols; Gilberto Freyre, Casa Grande e Senzala (Rio de Janeiro: Maia e Schimidt, 1933); Gilberto Freyre, Homen, Cultura e Tropico (Recife: University of Recife Press, 1952); Gilberto Freyre, Tropico e Colonizacao, Nutricao, Homen, Religiao, Desenvolvimento, Educacao e Cultura, Trabalho e Lazer, Culinaria, Populacao (Recife: Universidade Federal de Pernambuco, 1969) 2 vols; Josue de Castro, Geografia da Fome (Rio de Janeiro: Empresa Grafica, 1948), Heli de Almeida Campos and Eunice de Souza Campos, "Alimentacao e Nutricao dos Escolares," Anais do Primeiro Congresso Nacional de Saude Escolar (Sao Paulo, 1942); Herminio Ferreira Netto, A Fome e Nossa ou Milhoes Precisam de Comer (Sao Paulo: n.p. 1964); and Interdepartmental Committee on Nutrition for National Defense, Brazil: Nutrition Survey (Washington: U.S. Government Printing Office, 1965).

2/ For a review of the literature on this subject see Joao Bosco Salomon and Jose Garrofe Dorrea, "Perfil da Alimentacao Brasileira: Relacao entre Calorias e Proteinas," Revista ABIA/SAPRO (Sao Paulo) 33 (November 1977) cited in Bertoldo Kruse Grande de Arruda, "Alimentacao, Nutricao e Saude" Lecture at the University of Brasilia Meeting on Health in Brazil, Brasilia, December 13, 1978 (mimeo).

consumption was above the FAO estimates for daily requirements. The balance sheets tended to reinforce the widespread belief that there was generally enough food production in Brazil (though some groups might be in deficit) but were often criticized for relying on notoriously weak national agricultural production estimates.

75. The Getulio Vargas Foundation (Fundacao Getulio Vargas - FGV) and the U.S. Department of Agriculture (USDA) carried out a set of urban and rural family budget studies between 1961 and 1963. 1/ These studies showed that the adequate national averages of the food balance sheets (the FGV/USDA study used the same national production data as the balance sheets to get its global estimates of production and the family surveys to show the distribution of consumption) conceal substantial regional and income class differentials. Over 27 million people were estimated to have substandard diets (below 2,450 calories per person per day). The malnourished were 39% of the whole Brazilian population, 75% of that in the Northeast, 38% in the East, and 29% in the South.

76. There were some serious problems in the FGV studies. In most analyses based on these studies no attempt has been made to allow for differences in family size, sex and age composition, regional climatic differences, differences in occupation, or ethnic groups. This means that all families were assumed to be identical in their daily needs. 2/ Inflation was extremely high during the survey period (252%), and while some adjustment was made within regions, the national estimates were not set to the same base. Another problem comes from the fact that the food consumption estimates were based on food expenditures and consumption was estimated by applying regional prices to these expenditures. This method assumes that the poor and the better-off groups buy identical foods. Evidence from other surveys which obtained both quantity and expenditure data shows that for most food categories, poor families generally obtained more calories per unit of expenditure than did better off families 3/. This may be because the poor trade quantity for quality and/or because they buy where prices are lower for any given quality. Largely because of the bias introduced by this method, some of the poorest Brazilians were supposed to be surviving on only 700-900 calories a day while some of the richest were consuming over 4,500 calories each day. The first would have been well below starvation levels and the latter group well above the levels of any but the quite obese or exceptionally active. On this ground the FGV estimates of the extent of malnutrition may be on the high side.

77. There has been at least one attempt to reestimate malnutrition in Brazil using the FGV studies, which sought to avoid some of the

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1/ Getulio Vargas Foundation, Food Consumption in Brazil: Family Budget Surveys in the Early 1960s (Jerusalem: Israel Program for Scientific Translation, 1970).

2/ The requirements for each family were set at the national average which was based on the national distribution by age and sex.

3/ A comparison of the prices paid by families at the 20th percentile of the ENDEF subregional family expenditure distributions and families just meeting their calorie requirements (generally above the median of the family expenditure distributions) supports this statement. See also E.L.G. Alves and J.L.T.M. Viera, "Evolucao do Padrao do Consumo Alimentar da Populacao da Cidade de Sao Paulo", Pesquisa e Planejamento Economico 8:3 (December 1978) 727-756.

problems of the first publication. F. Morris 1/ used multivariate analysis to allow for demographic differences between families and estimated that 42% of the population was malnourished in the early sixties. He also used the 1970 income distribution estimates, and regressions of calorie consumption on income based on the FGV studies, to estimate that malnutrition fell to 38% of the population in 1970 (with no change in the Northeast and moderate but clear improvements in the rest of the country). Morris estimated the total food deficit of the poor was equal to only 7% of national consumption.

The National Family Expenditure Study (ENDEF)

78. The most recent national estimates of food consumption come from the ENDEF, which was designed, executed, and tabulated by the Brazilian Institute of Geography and Statistics Foundation (Fundacao Instituto Brasileiro de Geografia e Estatistica - IBGE). They are based on a more careful method than any of the earlier national estimates. The national household survey sampling frame was used to select the 55,000 families that were interviewed. Estimates will eventually be available for all major regions and for their urban and rural areas (except for the rural Frontier region) and for nine metropolitan areas. Quantities of food consumed were measured for each family for all meals consumed at home over a period averaging between six and seven days. Detailed expenditure data were also collected and all expenditures were deflated to August of 1974 using price indexes derived from the survey data. The ENDEF did not, however, collect any data on intra-family distribution of consumption or expenditure, so the basic unit of observation is the family.

Average Calorie Consumption and Requirements

79. ENDEF consumption data are based on meals consumed in the home and adjusted to a normalized per capita basis (called per comensal dia) which corrects for meals consumed outside the home 2/. Table 14 shows the ENDEF estimates of average daily per capita consumption for urban and rural areas in the three major regions distinguished in this report as well as for the country as a whole. These estimates were obtained by aggregating the estimates for 22 ENDEF subregions plus the rural Frontier using 1975 population weights.

80. Table 14 also compares the ENDEF consumption data with three separate sets of estimates of average daily per capita calorie requirements. The first set of estimates, labeled ENDEF in the table, shows the ingestion requirements given in the early ENDEF publications, adjusted upwards slightly so as to bring them to the same level in the food chain leading from production to effective assimilation by the human body as the ENDEF consumption data which, unlike the ingestion data, are also available by food type and family expenditure level.

1/ F. Morris, U.S. Food Policy in Latin America, Northeast Brazil: A Case Study (Washington: Library of Congress, Congressional Research Service, 1975).

2/ The implicit assumption underlying the ENDEF per comensal dia calculations is that for any given eating rhythm (the habitual number and relative importance of meals consumed by each person in terms of calories consumed) the number of calories which would be consumed in a meal eaten outside the home would be identical to the number of calories consumed when the meal is eaten at home. To the extent that meals eaten outside the home contain less (more) calories than those consumed inside the home, the ENDEF consumption per comensal dia data will overestimate (underestimate) actual per capita consumption. See Appendix A, Section 4 for more details.

Table 14: AVERAGE PER CAPITA DAILY CALORIE CONSUMPTION AND ALTERNATIVE ESTIMATES OF REQUIREMENTS AND DEFICITS BY REGION AND URBAN/RURAL LOCATION, 1974/1975

	Brazil			Northeast			Southeast			Frontier		
	Urban	Rural[e]	Total[e]	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural[e]	Total[e]
Consumption[a]	2,051	2,208	2,123	1,813	2,017	1,931	2,143	2,452	2,251	1,935	1,926	1,930
Requirements												
A. ENDEF[b]	2,007	2,057	2,030	1,807	1,888	1,854	2,086	2,250	2,142	1,906	1,901	1,904
B. FAO/WHO High[c]	2,336	2,300	2,321	2,273	2,260	2,266	2,359	2,341	2,353	2,305	2,283	2,294
C. FAO/WHO Low[d]	2,261	2,215	2,242	2,150	2,145	2,148	2,299	2,273	2,291	2,232	2,226	2,229
Consumption as % of Requirements												
A. ENDEF	102.2	107.3	104.6	100.3	106.8	104.2	102.7	109.0	105.1	101.5	101.3	101.4
B. FAO/WHO High	87.8	96.0	91.5	79.8	89.2	85.2	90.8	104.7	95.7	83.9	84.4	84.1
C. FAO/WHO Low	90.7	99.7	94.7	84.3	94.0	89.9	93.2	107.9	98.3	86.7	86.5	86.6
Average Deficit (Surplus)												
A. ENDEF	(44)	(151)	(93)	(6)	(129)	(77)	(57)	(202)	(109)	(29)	(25)	(26)
B. FAO/WHO High	285	92	198	460	243	335	216	(111)	102	370	357	364
C. FAO/WHO Low	210	7	119	337	128	217	156	(179)	40	297	300	299

a/ Calculated from consumption per comensal dia data for 22 ENDEF subregions (includes 1-3% wastage depending on the subregion) and aggregated using IBGE 1975 population estimates for each subregion.

b/ Calculated from ENDEF ingestion requirements for 22 subregions adjusted to include 1-3% wastage depending on subregion and aggregated using IBGE 1975 population estimates for each subregion.

c/ Based on FAO/WHO energy requirements guidelines by age and sex weighted by "baseline" estimates of population distribution (see Annex I) and adjusted for wastage based on ENDEF data (see text and Appendix A for details).

d/ Based on FAO/WHO energy requirements guidelines by age and sex using the weight of healthy adults based on ENDEF findings (a trimmed median of 20-29 year olds) and adjusted for wastage based on ENDEF data (see text and Appendix A for details).

e/ Consumption for the Frontier rural region was estimated at the rates of the Frontier urban areas excluding Brasilia and Belem.

The ENDEF consumption data are expressed in calories contained in food in the form served at the table, that is wastage in food preparation is taken into account. ENDEF data show that from 1% to 3% of these calories are not ingested, hence the published ENDEF requirements for ingestion have been adjusted upwards by the average ratio between consumption and ingestion for each subregion, and then aggregated to conform to the regions used in this report. 1/

81. The ENDEF ingestion requirements are "minimum requirements" calculated for each of the persons actually surveyed, based on their age, sex, height and weight and the activity level of those in the labor force at the time surveyed. The ENDEF publications on consumption warn that these minimum requirements do not take into consideration additional needs resulting from pathologic processes, such as infectious diseases which interfere with the absorption of nutrients by the body. Thus, "the simple fact that energy consumption equals requirements does not assure the absence of malnutrition." 2/ This, however, is true of most estimates of calorie requirements including the alternative estimates presented in Table 14.

82. While the ENDEF requirements for children take into account energy needs for growth, they may be biased downward compared to requirements for a healthy population by the fact that the actual weights and heights of the population surveyed (which are affected by malnutrition at the time of the survey and before) were used to calculate "ideal" weights by age and sex for each of the seven ENDEF regions, these "ideal" weights then being used to calculate requirements. The downward bias is also likely to present for adults who were suffering from malnutrition, since even though their height would not be subject to modification by improved diet, they would probably be at less than normal weight for height. Furthermore, the ENDEF estimates of calorie requirements needed to maintain body weight of adults were corrected for activity level in a way which may introduce an additional downward bias. Indeed, the preliminary ENDEF consumption publications warn that the minimum requirements published "are not optimal levels for promotion of a better nutritional state and much less for nutritional recovery." 3/ IBGE has not yet published the details of the complex method used to estimate requirements, and in any case the extent of the possible biases cannot be estimated without access to the raw ENDEF data. IBGE researchers have plans to prepare several alternative estimates of requirements which may be more appropriate for some purposes than those presented in the preliminary publications.

1/ The ENDEF did not cover the rural Frontier region. For these and other calculations it has been assumed that the ENDEF data for the urban regions of Rondonia, Acre, Amazonas, Roraima, Para (excluding the metropolitan area of Belem) and Amapa are representative of the rural areas of these states and territories and the urban areas of Mato Grosso and Goias are representative of the rural areas of these states.

2/ IBGE, Estudo Nacional da Despesa Familiar: Consumo Alimentar, Antropometria; Dados Preliminares 4 vols. (Rio de Janeiro, 1977 and 1978) sections on definitions and concepts.

3/ Ibid.

83. Since in this report requirements are needed which are suitable for projecting the needs of a healthy population, two other sets of requirements were prepared using FAO/WHO guidelines. 1/ These guidelines set standard weights and calorie requirements for children through age 12 that do not differ by ethnic group or race. Calorie requirements above age 12 are a function of age and standard weights for "reference" adults by sex. The guidelines recommend setting national standards for adult weights where such can be estimated. FAO and WHO studies, such as the FAO food balance sheets, have used the international standard adult weights (65 kg for males and 55 kg for females) assuming there is no reason that Brazilian adults would weigh less than the international standard. These international standard adult weights were used together with the 1975 "baseline" population distribution by age and sex (See Annex I) in estimating the set of requirements labeled FAO/WHO High in Table 14. The third set of estimates, labeled FAO/WHO Low in Table 14 because it is somewhat lower than the set based on international standard weights, takes advantage of the fact that the ENDEF survey recorded the height and weight of all the children and adults surveyed. Based on the published ENDEF anthropometric data, estimates of the average weight of healthy adults in each ENDEF subregion were prepared and these were aggregated to conform to the regions used in this report using 1975 population weights. 2/ Then the 1975 "baseline" population distribution by age and sex was used to estimate the FAO/WHO Low requirements by region and urban/rural location. 3/ The same technique used in estimating the FAO/WHO High requirements was applied, the only difference being the lower adult weights adopted. Both the FAO/WHO high and FAO/WHO Low requirements were adjusted upward to make them compatible with the ENDEF consumption data, that is an allowance was added for food prepared, but not eaten.

84. Table 14 shows that when average per capita daily calorie consumption is compared with the ENDEF requirements, there is a slight surplus in all regions and locations. For Brazil as a whole, consumption was 93 calories or 4.6% above requirements, which were estimated at 2030 calories. Using the two alternative sets of requirements as the standard, however, results in deficits in all regions except the rural Southeast. The average deficit for all Brazil was 198 calories (8.5% below requirements) using the FAO/WHO High requirements, estimated at 2321 calories, and 119 (5.3% below requirements) using the FAO/WHO Low requirements, estimated at 2242 calories.

1/ FAO/WHO, Energy and Protein Requirements: Report of a Joint Ad Hoc Expert Committee, FAO Nutrition Meeting Report Series No. 52/WHO Technical Report Series No. 522 (Rome: 1973). See Section (1) of Appendix A to this Annex for details of the method used to prepare the estimates.

2/ The average weight of a healthy adult was estimated for each subregion by a "trimmed" median estimate of adults in their twenties. The height/weight distributions for this group showed that there was a small amount of obesity and a fair percentage of people who were quite lean for their height. So the top 3% of the original distributions as well as a bottom group that was equal to the percentage of 15-17 year olds who were suffering from second or third degree malnutrition for each sex and region were eliminated from the original distributions before estimating the medians.

3/ See Annex I for details of how the demographic data were derived.

85. All three sets of estimates show that average consumption as a percentage of requirements in rural areas is higher than in urban areas. This is notable given the generally lower income levels in rural areas. All three sets of estimates also show that of the three major regions, average consumption as a percentage of requirements is highest in the Southeast and lowest in the Frontier, with the Northeast in an intermediate position, closer to the Southeast in the ENDEF estimates, closer to the Frontier in the alternative estimates. The differences between the Frontier and the Northeast on one hand and the Southeast on the other are much greater for the alternative estimates than for the ENDEF estimates, probably reflecting the impact of existing malnutrition on observed body weights in the ENDEF survey.

86. It must be stressed that the estimates presented in Table 14 are only averages. Since calorie consumption is strongly affected by income, even if average consumption is above requirements it is likely that the poorer groups will nevertheless be in deficit. This question is explored further below.

Population with Adequate Diets and Three Levels of Calorie Deficits

87. Using unpublished tabulations of normalized daily per capita consumption for 22 ENDEF subregions and nine classes of global family expenditure (monetary and non-monetary), estimates of the number of people obtaining adequate diets (defined here as diets satisfying FAO/WHO Low calorie requirements), those with calorie deficits up to 200 calories per day, those with deficits in the 200 - 400 calorie per day range, and those with deficits above 400 calorie per day were prepared. The FAO/WHO Low requirements were selected since the estimates presented here are used later to estimate the probable order of magnitude of costs for large-scale nutrition programs in Brazil through the year 2000. Therefore requirements which would take into account the needs of a well-nourished Brazilian population seemed more appropriate than the ENDEF requirements (which may be on the low side for this purpose) or the FAO/WHO High requirements (which do not take into account the fact that Brazilian adults, even after a rough adjustment to eliminate those estimated to have been suffering from severe malnutrition, appear to be slightly below the FAO/WHO standard weights). While the weight of Brazilians might increase over time with better nutritional conditions, for estimates based on the ENDEF data and projections up to the year 2000 the FAO/WHO Low requirements seem most appropriate. In estimating the FAO/WHO Low requirements for each expenditure class in all ENDEF subregions, adjustments were made to take into account average family size and composition for each group. 1/

88. Table 15 shows the estimates of the population in 1975 with adequate diets and three levels of calorie deficits for the major regions used in this report, with separate estimates for urban and rural areas. Table 15 also gives estimates of the size of the deficits on a per capita and absolute basis.

1/ Detailed demographic data for the ENDEF population were not available at the time these estimates were made, so the adjustments were based on published demographic data for the same regions taken from the 1976 PNAD. See Section 4 of the Appendix A of this annex for more details on the method used.

Table 15: ESTIMATED POPULATION WITH ADEQUATE DIETS, DEFICITS UP TO 200 CALORIES PER PERSON PER DAY, DEFICITS OF 200-400 CALORIES PER PERSON PER DAY, AND DEFICITS ABOVE 400 CALORIES PER PERSON PER DAY, TOTAL CALORIE DEFICITS: AND AVERAGE CALORIE DEFICITS ABOVE 400 CALORIES PER DAY, BY REGION AND URBAN/RURAL LOCATION, 1975

	Total Population (Thousands)	Population with adequate diet (Thousands)	(% of Total[a/])	Deficits up to 200 Calories: Population (Thousands)	Population (% of Total[a/])	Deficits of 200-400 Calories: Population (Thousands)	Population (% of Total[a/])	Total Deficits up to 400 Calories (Million calories per day)	Deficits above 400 Calories: Population (Thousands)	Population (% of Total[a/])	Average deficit (Calories per person per day)	Total deficit (Million calories per day)	Total of all Deficits (Million calories per day)
Northeast													
Rural	17,739.8	5,361.2	30.2	3,775.9	21.3	6,173.8	34.8	1,958.4	2,428.9	13.7	540	1,310.4	3,268.8
Urban	14,291.7	1,217.6	8.5	1,460.6	10.2	4,660.8	32.6	1,473.0	6,952.6	48.7	529	3,678.4	5,151.3
Total[b/]	32,031.5	6,578.8	20.5	5,236.5	16.4	10,834.6	33.8	3,431.4	9,381.5	29.3	532	4,988.8	8,420.0
Southeast													
Rural	20,046.2	14,010.9	69.9	2,408.2	12.0	3,305.3	16.5	943.1	321.7	1.6	476	153.3	1,096.3
Urban	44,524.8	13,195.1	29.6	10,255.5	23.0	15,603.0	35.1	4,709.9	5,471.1	12.3	527	2,882.6	7,592.5
Total[b/]	64,571.0	27,206.1	42.1	12,663.7	19.6	18,908.3	29.3	5,653.0	5,792.8	9.0	524	3,035.9	8,688.8
Frontier													
Rural	5,268.7	678.9	12.9	975.7	18.5	1,850.7	35.1	656.0	1,763.4	33.5	593	1,087.2	1,717.3
Urban	5,274.0	649.8	12.3	1,042.6	19.8	1,948.1	36.9	630.0	1,633.4	31.0	617	968.2	1,624.2
Total[b/]	10,542.7	1,328.7	12.6	2,018.3	19.2	3,798.8	36.0	1,286.0	3,396.8	32.2	605	2,055.4	3,341.4
Brazil													
Rural	43,054.7	20,051.0	46.6	7,226.7	16.8	11,427.2	26.1	3,531.5	4,514.0	10.5	565	2,550.8	6,082.3
Urban	64,090.5	15,062.6	23.5	12,691.8	19.8	22,114.5	34.8	6,858.5	14,057.1	21.9	536	7,529.1	14,367.6
Total[b/]	107,145.2	35,113.6	32.8	19,918.5	18.6	33,541.7	31.3	10,370.2	18,571.1	17.3	543	10,079.8	20,450.0

a/ Population in previous column as percentage of population in first column.
b/ Totals may not equal sums of components due to rounding.
Source: Total population by region and urban/rural location; from IBGE, Anuario Estatistico do Brasil, 1976 (Rio de Janeiro: IBGE, 1977). All other estimates derived from unpublished ENDEF data (see text and Appendix A for methodology).

89. In all Brazil, only 32.8% of the population is estimated to have met their full FAO/WHO Low calorie requirements in 1975. This average hides strong (but not unexpected) regional and urban/rural differences -- the low is 8.5% in the urban Northeast and the high 69.9% in the rural Southeast. 19% of all Brazilians are estimated to have small deficits of up to 200 calories, another 31% had moderate deficits in the 200-400 calorie range, while 17.3% had deficits above 400 calories which averaged 543 calories. Concerning the deficits up to 200 calories very little can be said with any assurance. First, there is considerable debate among the experts concerning the proper way to estimate requirements. In particular, it may be argued that for the population aged 13 and above already irreversibly stunted in height by previous malnutrition, even the FAO/WHO Low requirements may be excessive. Also, while the FAO and WHO no longer recommend an adjustment for temperature, the previously recommended adjustment would decrease requirements in the Northeast and Frontier by on the order of 200 calories, about 150 calories in the Southeast. Second, there may be errors in the measurement of consumption, though there is no reason to believe a priori that there would be any systematic underestimation. Here the key uncertainties concern the effect of the measurement process itself on consumption (did the families eat better or worse than normal because they were being observed?) the appropriateness of the implicit assumption that calorie consumption in meals eaten outside the home is the same as the corresponding calorie consumption for meals eaten at home, and the use of fixed proportions to allocate calorie consumption by individuals between different meals independent of expenditure level, age, sex or location. 1/ The significance of the moderate deficits is far less debatable, however. As for the deficits over 400 calories, they are unmistakable evidence of serious nutritional problems, since they average 2.7 times a margin of error of 200 calories in deficit estimation. 29.3% of the population in the Northeast (13.7% in rural areas and 48.7% in urban areas), 9.0% in the Southeast (1.6% in rural areas and 12.3% in urban areas), and 32.2% in the Frontier (30.8% in rural areas and 33.7% in urban areas) are estimated to suffer from these serious deficits which total 10.1 billion calories per day.

Using the Weights of Children to Measure Malnutrition

90. Nutritionists have long used the weights of children to evaluate the health of a population. As Eveleth and Tanner have stated, "It is widely accepted that nutrition is crucial in the first years of life and that a child's growth rate reflects, better than any other single index, his state of health and nutrition; and often his psychological situation also. Similarly, the average values of children's heights and weights reflect accurately the state of a nation's public health and the average nutritional status of its citizens, when appropriate allowance is made for differences, if any, in genetic potential." 2/

1/ See Section (4) of Appendix A to this annex for details.

2/ See P.B. Eveleth and J.M. Tanner, Worldwide Variations in Human Growth, (Cambridge: Cambridge University Press, 1976), p. 1.

91. During the last 25 years, the Gomez malnutrition indexes have been widely used for analyzing Latin American and other data on the weights of children. 1/ The Gomez classifications are:

(1) First degree malnutrition, 76-90% of normal weight for age;

(2) Second degree malnutrition, 61-75% of normal weight; and

(3) Third degree malnutrition, 60% or less of normal weight.

Gomez and almost all other analysts of Latin American anthropometric data have used the same set of desired or normal weights by age and sex as did the FAO and WHO when they set calorie requirements for children (the FAO and WHO use energy needed per unit of weight and for growth to determine calorie requirements). 1/ However, this widely used standard is based on studies of U.S. children and a brief discussion of the appropriateness of using it for Brazilian children is necessary at this point.

92. When the standard was first used by the FAO thirty years ago, there were very few well-documented alternative studies that tried to measure the size of only healthy children. While it is well known that North American and European children have leveled off in the long-term trend towards growth in adult height, and it is generally accepted that the growth in the height of the average person was due to improvements in diet, it is not known how large non-Europeans would be if they were well-nourished throughout their childhood. Many people believe that they would be smaller than Europeans even under optimal diet conditions because of genetic differences. This is clearly an area of dispute among the experts.

93. There is some recent evidence on how substantial genetic differences might be. From 1964 to 1974, the human adaptability section of the International Biological Programme carried out a large number of studies in 58 countries. The 340 projects of the human adaptability section covered such topics as the genetic constitution of selected populations, their physical fitness, nutritional status, climatic tolerances, physique and body composition, and growth and development. 2/ There was an effort to make these studies the most comprehensive ever made of diverse ethnic groups and environmental conditions around the world. There was also a strong effort made to standardize methodologies, where appropriate.

94. Eveleth and Tanner have reported and analysed all of these studies, as well as some other serious studies of child growth, in all parts of the world for the period 1960-1974 (and a few important earlier ones). 3/ Data from thirty studies have been assembled in Tables A5 and A6 of the appendix

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1/ See F. Gomez, et. al., "Malnutrition in Infancy and Childhood with Special Reference to Kwashiorkor" in S. Levine (ed.), Advances in Pediatrics, (New York: Yearbook Publisher, 1955), Vol. 6, pp. 131-169.

2/ The normal weights are in fact medians of the standard distributions of weight by age.

3/ See K.J. Collins and J.S. Weiner, Human Adaptability, (London: Taylor and Francis Ltd., 1977).

4/ P.B. Eveleth and J.M. Tanner, Progress in Growth and Physique Studies, (London: International Biological Programme Central Office, 1971), and Eveleth and Tanner, op. cit.

to this annex. Most of these studies are of middle or upper class children from developing countries. It is thought that children from families where food consumption is not limited by income would have adequate access to food and that their weights might be more representative of differences in genetic potential than would those of the poor majority. Differences, if any, caused by climate and culture (such as preferences or aversions to certain specific foods) would still be present. The thirty studies include children from the developing countries of European, African, Asian, and Indo-Mediterranean ancestry and a few studies of relatively disadvantaged groups in North America. The standard weights used by the FAO, the WHO, Gomez, and this report are also shown in Tables A5 and A6. These tables show that most of the well-off children have mean weights for their age that are quite close to the widely used standard weights for healthy children until the age of puberty, regardless of race or region of the world. However, there is a wider dispersion of weights after puberty and Asians tend to be noticeably smaller than the three other groups who differ very little from one another.

95. While, from infancy to adulthood, the weights of children from well-off families in the developing countries rather closely follow the pattern of the standard growth curves used by the FAO and WHO to set food or energy requirements, the average weights of Brazilian children in the ENDEF studies do not, because these averages include both the well-off and the poor, including many malnourished children. To show this better, three graphs have been prepared. 1/ The first two, Figure 1 for girls and Figure 2 for boys, make a comparison between the standard normal growth curve and those of children from well-off groups of European descent (living in Latin American and the Caribbean) and of African descent (living in Africa and the Americas). Most Brazilians are of European, African, or mixed European-African descent. The graphs show what statisticians call "cumulative sum" curves and require a short technical introduction. This kind of curve is useful when it is more advantageous to show a series of numbers as deviations from an expected pattern rather than just the absolute values. A cumulative sum graph will demonstrate how a series of numbers diverges from another--whether the deviations are random or systematic, if there are turning points and different trends during different parts of the series.

96. The pattern to be expected from a cumulative sum curve of weights of healthy children mapped against the standard is known. The weight distributions used by the FAO/WHO are available by centiles across age groups and similar weight distribution patterns are available for many Western European countries. 2/ For example, when cumulative sum curves are prepared for both

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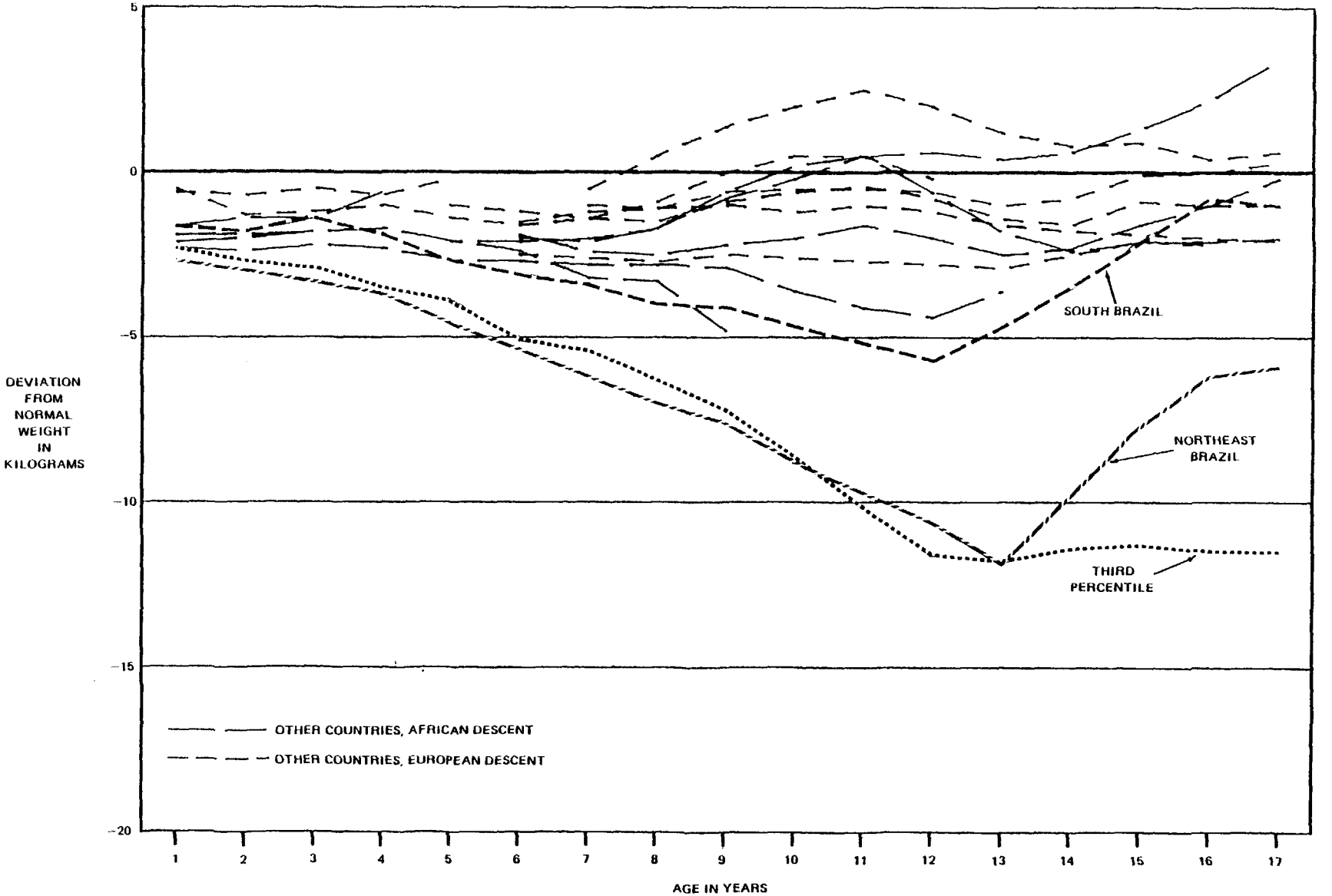
1/ In preparing the graphs, the raw mean weights by age data for various surveys (including the ENDEF) reported in Tables A5 and A6 in the appendix have been "smoothed" and "roughed" in an iterative process using an accepted statistical technique designed to leave the trend lines essentially unchanged but clearer by ironing out the sawtooth aspect caused by variation due to small sample size in each time series. For details on this technique, see J.W. Tukey, Exploratory Data Analysis (Reading, Mass.: Addison-Wesley, 1977) 523-542.

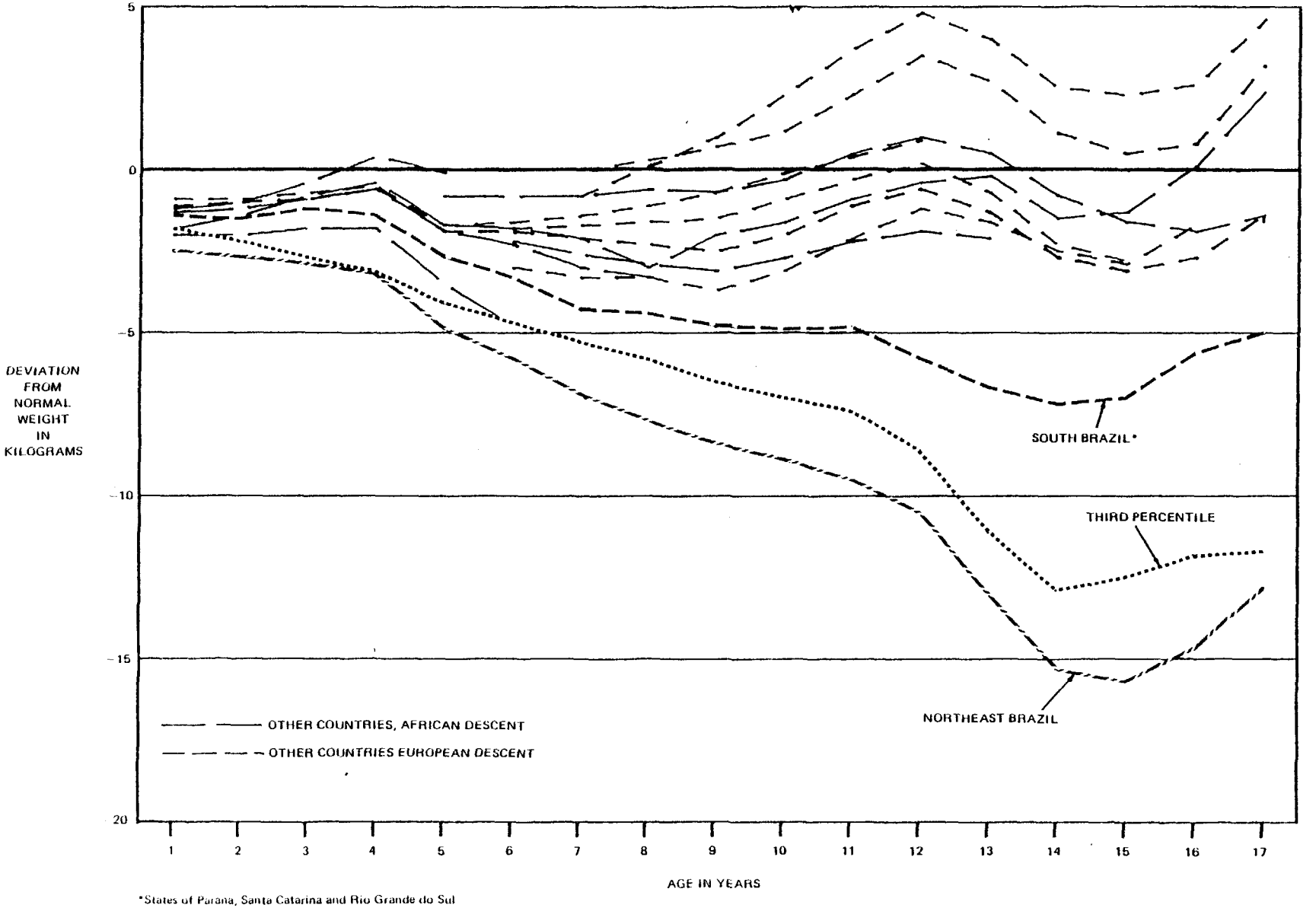
2/ See Nelson, et. al., Textbook of Pediatrics (Philadelphia: Saunders, 1969); Eveleth and Tanner, Progress in Growth and Physique Studies; and Eveleth and Tanner, Worldwide Variations in Human Growth.

FIGURE 1
DEVIATIONS FROM FAO/WHO NORMAL WEIGHTS: COMPARISON OF BRAZILIAN GIRLS, GIRLS FROM PREDOMINANTLY MIDDLE CLASS BACKGROUNDS IN SEVERAL COUNTRIES AND THIRD PERCENTILE OF THE FAO/WHO STANDARD WEIGHT DISTRIBUTION BY AGE FOR GIRLS



World Bank – 19474

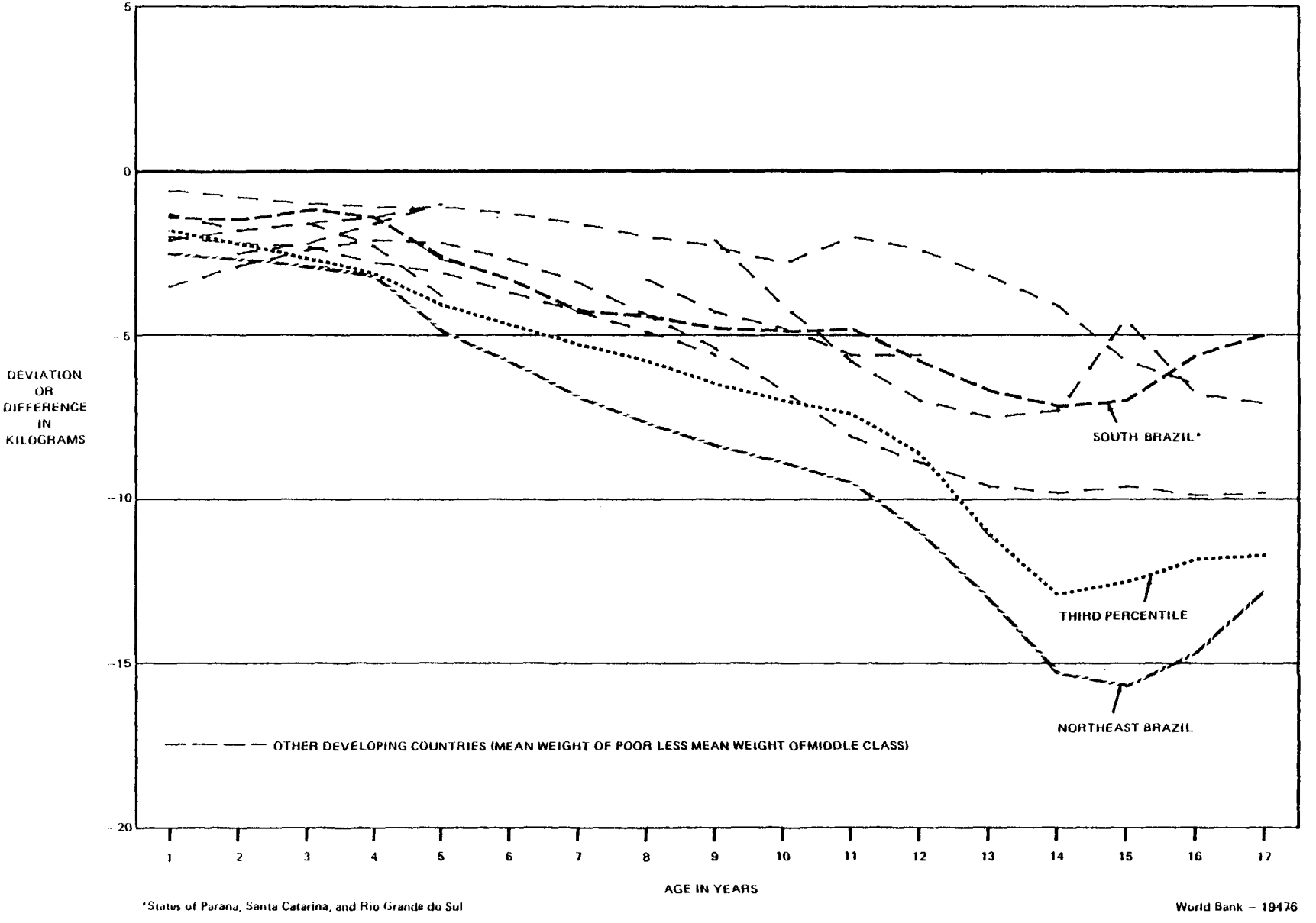
FIGURE 2
DEVIATIONS FROM FAO/WHO NORMAL WEIGHTS: COMPARISON OF BRAZILIAN BOYS, BOYS FROM PREDOMINANTLY MIDDLE CLASS BACKGROUNDS IN SEVERAL COUNTRIES AND THIRD PERCENTILE OF THE FAO/WHO STANDARD WEIGHT DISTRIBUTION BY AGE FOR BOYS



*States of Parana, Santa Catarina and Rio Grande do Sul

World Bank -- 19475

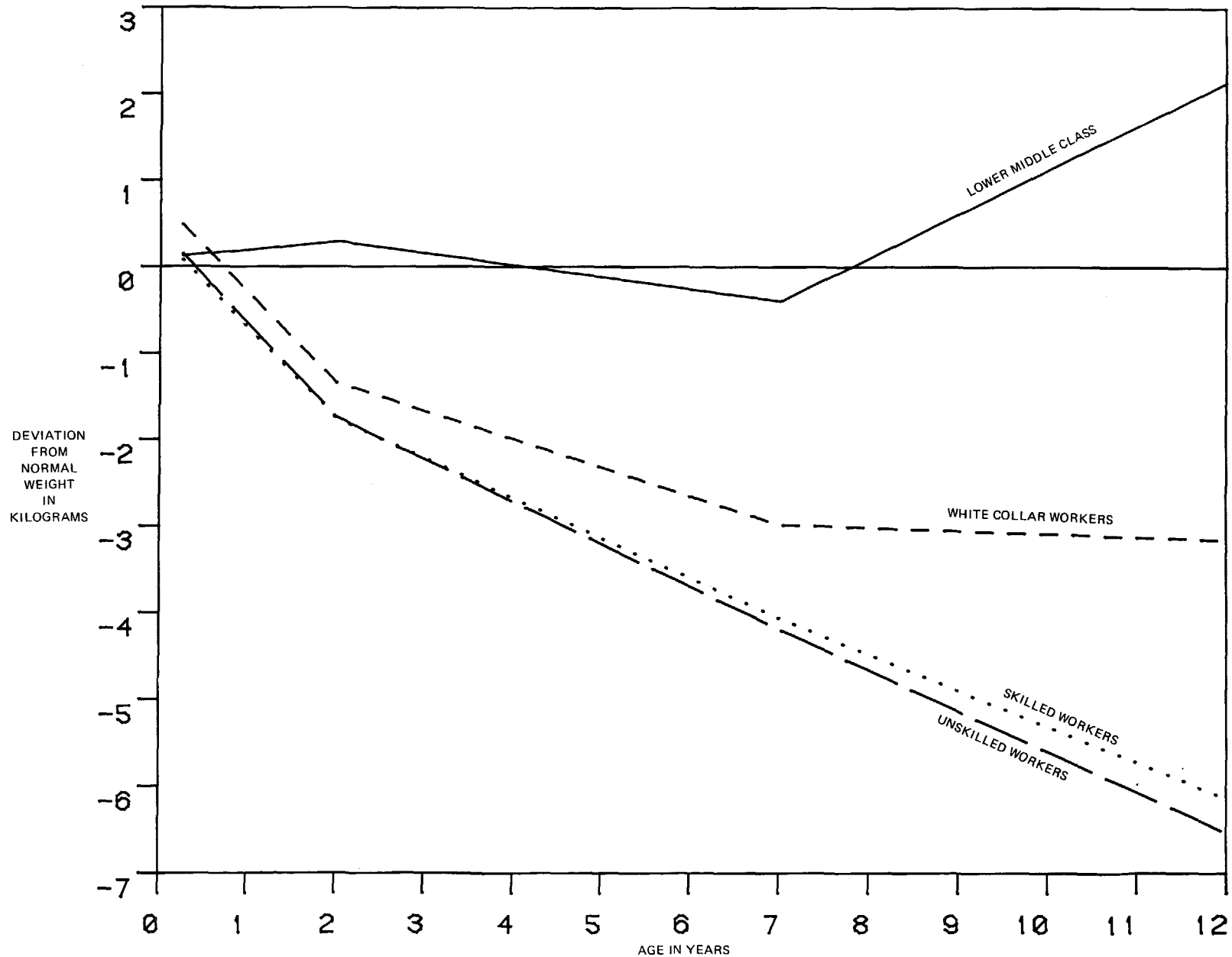
FIGURE 3
COMPARISON OF DEVIATIONS FROM FAO/WHO NORMAL WEIGHT FOR BOYS (BRAZILIAN BOYS AND THIRD PERCENTILE OF FAO/WHO STANDARD WEIGHT DISTRIBUTION BY AGE FOR BOYS) AND DIFFERENCE BETWEEN WEIGHT OF MIDDLE CLASS AND POOR BOYS IN SEVERAL DEVELOPING COUNTRIES



*States of Parana, Santa Catarina, and Rio Grande do Sul

World Bank – 19476

FIGURE 4
COMPARISON OF DEVIATIONS FROM FAO/WHO NORMAL
WEIGHT FOR SAO PAULO BOYS BY SOCIAL CLASS (MARCONDES STUDY)



a small English child (healthy but at the 40th percentile throughout childhood) and a large child (healthy but at the 80th percentile) as deviations from the standard scale which is based on U.S. children, we get two curves--one below the zero line (that would represent no deviations from the standard) but rather flat and almost parallel to it, and another which follows the same pattern above the zero line. The fact that curves are rather flat and parallel means that the corresponding growth velocity curves (based on the second derivative of the growth curves) are also almost equal. It is realistic to use a specific centile in making comparisons since healthy children tend to stay within the same centile throughout childhood. They do leave it at puberty (which arrives at slightly different ages and varies in intensity and the duration of the growth spurt from healthy child to child) but after puberty usually return to the same centile. Medical textbooks about growth in childhood advise doctors to follow a child's growth pattern over time to see how closely he or she stays to a centile path and to treat moderate deviations from such a path as evidence that a nutrition deficiency or other clinical problem may be occurring.

97. Figures 1 and 2 show that children from well-off groups of African and European descent have the expected patterns for healthy children--small deviations from the standard (about one to three kilograms) and a tendency for individual countries to stay about the same distance away from the standard (flat curves). However, the three other curves shown in Figures 1 and 2 demonstrate abnormal paths. The first curve is that for the third percentile of the standard distribution (this is often used instead of Gomez second degree malnutrition to judge whether a child is severely malnourished). U.S. clinical textbooks recommend that children at this weight for their age be immediately treated for severe malnutrition. The treatment could include hospitalization followed by special diets and close supervision by a physician. The mean weight curve for all boys in the Northeast lies consistently below the third percentile curve. The curve for Northeast girls lies below the third percentile curve for girls until ten years of age and shows significant improvement after 13 years. Also shown are the curves for children from the ENDEF South region (Parana, Rio Grande do Sul, and Santa Catarina), the best nourished ENDEF region in Brazil. While these children are substantially closer to the standard (particularly in the critical first two years of life) than the Northeasterners, the South curves still show pronounced abnormal patterns.

98. Figure 3 also shows cumulative sum curves, and in effect juxtaposes two different sets of data. The first set makes a comparison between boys from poor or low income groups and well-off boys in the same developing countries (the data is taken from the studies and countries in Annex A). That is, the curves show the difference in weight between poor and well-off children for each survey of children living in developing countries for which separate mean weight data by age are available. As might be expected, these curves show a tendency towards pronounced and increasing differences between the poor and the well-off children over time. That is why the curves drift downward with increasing age while those of well-off boys compared to the standard used in Figure 2 showed no clear time trends. The other set of cumulative sum curves are the Brazilian boys and the third percentile repeated from Figure 2. These are, of course, measured as deviations from the standard

curve and the Brazilian deviations may be somewhat exaggerated in size from what they would be if a Brazilian standard were available. However, the figure is not meant to show absolute amounts but to demonstrate how the Brazilian children's growth curves follow the patterns expected of malnourished populations.

99. More recent European and U.S. studies could serve as alternatives to the standard the FAO, WHO and Gomez used. However, they differ very little from the old standard in the mean weights shown as normal for a sex and age and not at all in the general shape of the growth curves for children, i.e., in how rapidly a child should be growing at different ages: the first year of life, ages two to five, during puberty, etc. The known studies of healthy children from well-off groups in the developing countries do not meet the following two criteria for a standard. First, it should be based only on children who are healthy (it should not include any who would be classified as malnourished by clinical tests). Second, the sample should be large enough to permit the estimation of centiles, since the health of a child is best evaluated from a growth chart by seeing whether or not he or she stays within the same centile from infancy to puberty. These criteria mean that an adequate survey should generally include about 25,000 children with the ages of most rapid relative growth having larger weighted subsamples. All of the existing samples of healthy children in developing countries are too small to meet these criteria and most of the large samples from these countries include many malnourished children.

100. The studies of well-off children from all over the world collected in the appendix do suggest that the FAO/WHO standard is broadly representative of those children who have adequate diets, whatever their racial group. There are at least twenty studies of Brazilian children besides ENDEF but none of them, even the well designed Marcondes study of working and lower middle class children in Sao Paulo, 1/ come close to meeting the criteria for a standard. Nevertheless, as shown in Figure 4, data taken from the Marcondes study showed that all social groups surveyed were very close to the FAO/WHO normal weight at age 3 months. The highest social group surveyed (largely lower middle class shopkeepers in a working class zone of Sao Paulo) tended to remain close to standard weights (indeed rose to over 2 kg above by age 12), with low-paid white collar workers falling steadily to over 3 kg below the standard by age 12 and manual workers falling steadily to over 6 kg below at age 12. A Porto Alegre study shows that height and weight of pre-school children from the best-off groups are above the FAO/WHO standard. 2/

101. The FAO/WHO standard is the best available against which to measure Brazilian children though it may be slightly on the high side (perhaps an average of 1 to 2 kilograms for most ages). Therefore, the

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1/ E. Marcondes et al., "Estudo antropometrico de criancas brasileiras de zero a doze anos de idade," Anais Nestle 84, 200 pp.

2/ R.M.B. Costa, et al., Levantamento do estado nutricional de criancas em idade preescolar (Porto Alegre: Servico de Nutricao Escolar, 1970).

FAO/WHO standard is used here, with the caveat that it may result in slight overestimates of the extent of malnutrition among Brazilian children. 1/

The Extent of Malnutrition Among Brazilian Children

102. The ENDEF studies included data on the height and weight of all the members of the 55,000 sample families. Tables 16, 17, 18, and 19 show estimates of how the distributions from the ENDEF surveys may be classified according to the Gomez indexes, using the FAO/WHO normal weights for each sex and age as standard against which the average weights of Brazilian children as recorded in the ENDEF survey are measured. Separate estimates for the two sexes were aggregated for the three main regions and the whole country. The age groups shown in the tables were chosen to show the critical periods of childhood: the first six months, the second six months, puberty (usually between 10 and 14 years), and three less critical periods, 2 to 4 years, 5 to 9 years, and 15 to 17 years (which shows what happens after puberty).

103. Table 16 shows how many children were adequately nourished, defined here as weighing above 90% of the median of the standard weight distribution for their age. In the first six months of life, about three quarters of the children in the Southeast and almost two thirds of the children in the Northeast were adequately nourished according to this definition. In the second six months of life, there is a 10% fall in the percentage of adequately nourished children in the Northeast and Frontier regions but only a 2% fall in the Southeast. After the first year, the percentages of adequately nourished children falls until only 31% of the 5 to 9 year olds in all Brazil, 21% of the Northeast children, 37% of the Southeast and 23% of the Frontier children meet this criterion of adequate nutrition. There is a very perceptible improvement in the numbers of children exceeding 90% of normal weight for age during the years when puberty occurs and some improvement after puberty and after the critical years of childhood. Overall from birth to seventeen years of age, only 42% of the Brazilian children in 1975 met this criterion of adequate nutrition. The corresponding figures are about 32% in the Northeast, 48% in the Southeast, and 37% in the Frontier region.

104. Table 17 shows the extent of first degree malnutrition, that is 76-90% of the median standard weight for the age. It is low near birth, only 17% for the whole country. However, by two years of age, almost 40% of the children are affected. During and after puberty, there is some improvement among many children which is not that visible in Table 17 because some children moving from first degree malnutrition to normal weights are being replaced by other children moving from second degree malnutrition to first degree malnutrition. The regional differences are not pronounced, varying from 36% in the Southeast to 38% in the Northeast and 39% in the Frontier. Nutritionists

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1/ The primary ENDEF data might be used to identify families where nutritional needs are met. The anthropometric data for children from these families might then be used to estimate standard weights for Brazil, though it is not clear that such a sample would meet the demanding criteria set forth above.

Table 16: ADEQUATELY NOURISHED CHILDREN, BY REGION AND AGE GROUP, 1975[a/]

Age Group	Thousands of Children				Percent of Age Group			
	Brazil	Northeast	Southeast	Frontier	Brazil	Northeast	Southeast	Frontier
Birth - 5.99 months	1,477	473	817	187	71.3	63.6	76.0	73.9
6.00 - 11.99 months	1,349	400	791	158	65.2	53.8	73.6	62.6
1.00 - 1.99 years	1,899	507	1,177	215	56.1	43.4	64.9	53.2
2.00 - 4.99 years	4,533	1,200	2,874	459	47.0	36.5	54.6	41.5
5.00 - 9.99 years	4,325	864	3,081	380	30.7	21.3	36.6	23.3
10.00 - 14.99 years	4,583	968	3,202	413	34.1	22.5	41.1	30.5
15.00 - 17.99 years	3,556	818	2,434	304	48.6	36.4	56.0	41.9
Total[b/]	21,723	5,231	14,376	2,116	41.7	31.6	48.3	37.0

a/ Adequately nourished is defined here as weighing above 90% of the median of the FAO/WHO standard distribution of weight by age.

b/ Totals may not equal sum of components due to rounding.

Source: IBGE, ENDEF: Consumo Alimentar; Antropometria, Dados Preliminares, 4 volumes (Rio de Janeiro: IBGE, 1977 and 1978) for body weight of Brazilian children; FAO/WHO, (1973) Energy and Protein Requirements: Report of a Joint FAO-WHO Ad Hoc Expert Committee, FAO Nutrition Meeting Report Series No. 52/WHO Technical Report Series No. 522 for the normal age-weight destribution; 1975 Population by age groups from "baseline" demographic projections contained in Annex I of this report.

Table 17: CHILDREN WITH FIRST DEGREE MALNUTRITION, BY REGION AND AGE GROUP, 1975

Age Group	Thousands of Children				Percent of Age Group			
	Brazil[a/]	Northeast	Southeast	Frontier	Brazil	Northeast	Southeast	Frontier
Birth - 5.99 months	360	152	173	35	17.4	20.4	16.1	13.7
6.00 - 11.99 months	463	196	210	57	22.3	26.4	19.6	22.4
1.00 - 1.99 years	1,091	414	542	134	32.2	35.5	30.0	33.0
2.00 - 4.99 years	3,679	1,340	1,882	458	38.1	40.7	35.8	41.5
5.00 - 9.99 years	6,087	1,731	3,615	742	43.1	42.6	43.0	45.5
10.00 - 14.99 years	4,951	1,569	2,883	499	36.8	36.5	37.0	36.9
15.00 - 17.99 years	2,717	931	1,476	310	37.1	41.5	34.0	42.7
Total[a/]	19,349	6,332	10,783	2,234	37.2	38.2	36.2	39.0

a/ May not equal sum of components due to rounding.

Source: IBGE, ENDEF; Consumo Alimentar, Antropometria, Dados Preliminares, 4 volumes (Rio de Janeiro: IBGE, 1977 and 1978) for body weight of Brazilian children; FAO/WHO, (1973) Energy and Protein Requirements: Report of a Joint FAO-WHO Ad Hoc Expert Committee, FAO Nutrition Meeting Report Series No. 52/WHO Technical Report Series No. 522 for the normal age-weight distribution; 1975 Population by age groups from "baseline" demographic projections contained in Annex I of this report.

differ on the amount of harm caused by mild malnutrition. 1/ Certainly many persons who fall in the upper ranges of first degree malnutrition show no signs of clinical malnutrition and score well on intelligence and physical tests. However, many individuals in this weight range do show lower than normal mean intelligence and physical skills and those clinical symptoms that are often associated with more severe forms of malnutrition.

105. Table 18 shows the extent of second degree malnutrition, i.e., 61 to 75% of normal weight. In the first six months of life, it affects only about 9% of the children in Brazil. The Northeast rate, 12%, is almost double that of the Southeast. The number of Northeast children afflicted rises very fast with age until almost 37% of the 10 to 14 year olds are suffering from second degree malnutrition. The Southeast shows a better picture, with only about 6% of the infants to 2 year olds being affected. It is not until the period 5 to 9 years that second degree malnutrition reaches 20% of the children. The Frontier shows a pattern similar to, but lower than, that of the Northeast. Nutritionists differ on the amount of harm to a child caused by mild malnutrition but there is little debate concerning prolonged second degree malnutrition (as opposed to short bouts). It stunts growth, and the growth deficit will become permanent if not made up before adolescence. Many nutrition experts also suspect that brain growth may also be impaired with lasting effects on mental capacity, but this position is not supported by incontrovertible statistical evidence.

106. Table 19 shows that a small number of children in the published distribution from the ENDEF surveys were suffering from third degree malnutrition. This may be an underestimate since the publications indicate that persons obviously abnormal or ill were omitted from the final tabulations. Nonetheless, there are still almost 500 thousand children shown at weights below 60% of the median standard weights for their age. Third degree malnutrition is often a sign of kwashiorkor, marasmus, and other often fatal nutritional disorders. The mortality rate among third degree malnourished children is extremely high.

107. Summarizing the data presented in Tables 16-19, of all Brazilian children below 18 years of age in 1975, only 42% or 22 million could be considered adequately nourished, 37% or 19 million had first degree malnutrition, 20% or almost 11 million suffered from second degree malnutrition, and at least 1% were crippled by third degree malnutrition. 2/

1/ See Alan Berg, The Nutrition Factor: Its Role in National Development (Washington: The Brookings Institution, 1975) 9-50.

2/ The estimates of first and second degree malnutrition appear relatively insensitive to a small downward change in standard weights. For example reducing standard weights by 1.5 kg for all ages results in an unweighted average increase of only 5 percentage points in the ratio of the weight of Northeastern children to the standard. This would result in shifting some third degree to second degree and some second degree to first degree malnutrition. The number of "normal" children would increase and those with third degree malnutrition decrease more significantly.

Table 18: CHILDREN WITH SECOND DEGREE MALNUTRITION, BY REGION AND AGE GROUP, 1975

Age Group	Thousands of Children				Percent of Age Group			
	Brazil[a/]	Northeast	Southeast	Frontier	Brazil	Northeast	Southeast	Frontier
Birth - 5.99 months	185	92	71	22	8.9	12.3	6.6	8.6
6.00 - 11.99 months	229	126	71	32	11.0	17.0	6.6	12.7
1.00 - 1.99 years	374	229	92	54	11.1	19.6	5.1	13.2
2.00 - 4.99 years	1,427	748	505	175	14.8	22.7	9.6	15.8
5.00 - 9.99 years	3,647	1,430	1,717	501	25.9	35.2	20.4	30.7
10.00 - 14.99 years	3,700	1,568	1,695	437	27.5	36.5	21.7	32.3
15.00 - 17.99 years	979	437	430	112	13.4	19.5	9.9	15.4
Total[a/]	10,543	4,630	4,581	1,131	20.2	28.0	15.4	23.3

a/ May not equal sum of components due to rounding

Source: IBGE, ENDEF: Consumo Alimentar, Antropometria, Dados Preliminares, 4 volumes (Rio de Janeiro: IBGE, 1977 and 1978) for body weight of Brazilian children; FAO/WHO, (1973) Energy and Protein Requirements: Report of a Joint FAO-WHO Ad Hoc Expert Committee, FAO Nutrition Meeting Report Series No. 52/WHO Technical Report Series No. 522 for the normal age-weight distribution; 1975 Population by age groups from "baseline" demographic projections contained in Annex I of this report.

Table 19: CHILDREN WITH THIRD DEGREE OF MALNUTRITION, BY REGION AND AGE GROUP, 1975[a/]

Age Group	Thousands of Children				Percent of Age Group			
	Brazil[b/]	Northeast	Southeast	Frontier	Brazil	Northeast	Southeast	Frontier
Birth - 5.99 months	51	28	15	9	2.5	3.7	1.4	3.6
6.00 - 11.99 months	30	21	3	6	1.4	2.9	0.3	2.4
1.00 - 1.99 years	21	18	1	2	0.6	1.5	c/	0.6
2.00 - 4.99 years	15	2	-	13	0.2	c/	-	1.2
5.00 - 9.99 years	51	40	3	8	0.4	1.0	c/	0.5
10.00 - 14.99 years	214	192	17	4	1.6	4.5	0.2	0.3
15.00 - 17.99 years	66	60	5	d/	0.9	2.7	0.1	c/
Total[b/]	447	361	44	42	0.9	2.2	0.2	0.7

a/ Third degree malnutrition may be underestimated because some children who were obviously far below normal weights were dropped before the final tabulations.
b/ May not equal sum of components due to rounding.
c/ Less than 0.1 percent.
d/ Less than 500

Source: IBGE, ENDEF: Consumo Alimentar; Antropometria, Dados Preliminares, 4 volumes (Rio de Janeiro: IBGE, 1977 and 1978) for body weight of Brazilian children; . FAO/WHO, (1973) Energy and Protein Requirements: Report of a Joint FAO-WHO Ad Hoc Expert Committee, FAO Nutrition Meeting Report Series No. 52/WHO Technical Report Series No. 522 for the normal age-weight distribution: 1975 Population by age groups from "baseline" demographic projections contained in Annex I of this report.

Costs of Calorie Adequate Diets

108. Using the published ENDEF data on family expenditures 1/ together with as yet unpublished ENDEF data, the average annual cost of a calorie per day was calculated for each of 10 food categories for each ENDEF subregion and for families at two points in the subregional total family expenditure distributions -- the 20th percentile, and the point where families just meet their FAO/WHO Low calorie requirements. Essentially, the procedure used was to derive the cost data from expenditure data and calorie consumption data, both by expenditure class. 2/

109. The unit cost data for families just meeting their FAO/WHO Low calorie requirements was then used to calculate the annual cost of a diet composed of the mix of foods actually consumed by families meeting the FAO/WHO Low requirements in each of 22 ENDEF subregions. These diets were labeled "Type 1" adequate diets. Two alternative definitions of adequate diets were also derived from these data and costed out. "Type 2" adequate diets were defined as being composed of foods in the proportions consumed and at the prices paid by families at the 20th percentile of the ENDEF subregional family expenditure distributions. Since these quite poor families were in calorie deficit, the cost of the diet actually consumed was inflated by the ratio of the FAO/WHO Low requirements to estimated calorie consumption. Finally, "Type 3" adequate diets were defined as meeting FAO/WHO Low calorie requirements and being composed entirely of cereals the same proportion and at the same prices paid the average subregional families. For each of the three types of diet, the annual cost of 100 calories per day derived from the same mix of foods at the same prices was calculated. This information can be used to get an idea of the cost of diet supplements of different kinds which might be provided by nutrition programs. For any desired size of diet supplement, the annual cost for 100 calories per day can be multiplied by the relevant factor. Type 3 diets and supplements would probably be unacceptable except under famine conditions. Nevertheless, their cost should provide a rough lower limit for survival costs.

110. Table 20 presents the costs of the three types of diets and diet supplements for each of the 22 ENDEF subregions. To facilitate comparisons, the annual cost of all diets is for 2,242 calories per day, the national average FAO/WHO Low requirements. In the case of the diets, the costs are

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1/ IBGE, Estudo Nacional da Despesa Familiar: Despesas das Familias; Dados Preliminares, 4 Vols. (Rio de Janeiro: 1978).

2/ The actual procedure required was somewhat more complex because the ENDEF expenditure data is for families, whereas the calorie consumption data is available on a normalized per capita basis (per comensal dia). Several adjustments, involving additional unpublished ENDEF data, are necessary to estimate the annual cost of a calorie per day at the desired points in the family expenditure distribution. See section 4 of Appendix A to this annex for details on the procedure used.

Table 20: COSTS OF DIETS MEETING NATIONAL AVERAGE FAO/WHO LOW PER CAPITA CALORIE REQUIREMENTS (2242 Calories) AND COSTS OF 100 CALORIE SUPPLEMENTS FOR 22 ENDEF SUBREGIONS (Cr$ of August 1974, % of 12 Rio de Janeiro Monthly Minimum Wages of August 1974, and US$ of August 1974)

	COST PER PERSON PER YEAR FOR A 2242 CALORIE DIET[a]									Cost Per Person Per Year of a 100 Calorie Diet Supplement		
	TYPE 1[b]			TYPE 2[c]			TYPE 3[d]			TYPE 1[b]	TYPE 2[c]	TYPE 3[d]
	(Cr$)	(% of Rio de Janeiro minimum wage)	(US$)	(Cr$)	(% of Rio de Janeiro minimum wage)	(US$)	(Cr$)	(% of Rio de Janeiro minimum wage)	(US$)	(Cr$)	(Cr$)	(Cr$)
Northeast												
Metropolitan Salvador	2,038	45	295	1,614	36	234	1,055	23	153	91	72	47
Metropolitan Recife	1,928	43	279	1,260	28	183	876	19	127	86	56	39
Metropolitan Fortaleza	1,772	39	257	1,067	24	155	802	18	116	79	48	36
Other urban areas	1,670	37	242	975	22	141	836	18	121	74	43	37
Rural areas[e]	896	20	130	879	19	127	619	13	90	40	39	27
Rio de Janeiro State												
Metropolitan Rio de Janeiro	2,080	46	301	1,586	35	230	954	21	138	93	71	43
Other urban areas	1,652	37	239	1,257	28	182	877	19	127	74	56	29
Rural areas[e]	1,201	27	174	917	20	133	637	21	92	54	41	38
Sao Paulo State												
Metropolitan Sao Paulo	2,408	53	349	1,710	38	248	1,076	24	156	107	76	48
Other urban areas	2,208	49	320	1,290	29	187	911	20	132	90	58	41
Rural areas[e]	1,170	26	169	1,126	25	163	784	17	114	52	50	35
South[f]												
Metropolitan Porto Alegre	1,697	38	246	1,623	36	235	846	19	123	76	72	38
Metropolitan Curitiba	2,026	45	293	1,256	28	182	904	20	131	90	56	40
Other urban areas	1,423	31	206	1,208	27	175	766	17	111	63	54	34
Rural areas[e]	988	22	143	955	21	138	643	14	93	44	43	29
Minas Gerais/Espirito Santo												
Metropolitan Belo Horizonte	2,007	44	291	1,293	29	187	863	19	125	90	58	38
Other urban areas	1,602	35	232	979	22	142	797	18	115	71	44	36
Rural areas[e]	901	20	131	858	19	124	620	14	90	40	38	28
Frontier												
Brasília	2,209	49	320	1,642	36	238	874	19	127	99	73	39
Metropolitan Belem	1,784	39	258	662	15	96	827	18	120	80	30	37
Urban West[g]	1,248	28	181	916	20	133	877	19	127	56	41	39
Urban Amazon[h]	2,987	66	433	870	19	126	1,021	23	148	133	39	46

a/ See text and appendix for an explanation of how the FAO/WHO Low calorie requirements were estimated.
b/ Type 1 adequate diets are those typical of families in each subregion which just met their FAO/WHO Low calorie requirements. Type 1 supplements provide 100 calories with the same proportional composition by type of food as Type 1 adequate diets. See text and Appendix A for details.
c/ Type 2 adequate diets are composed of foods in the proportions contained in the diets of families in the 20th percentile of the family expenditure distribution (monetary and non-monetary) in each subregion. Since these families were in deficit, the cost of the diet is inflated by the ratio of requirements to actual calorie consumption. Type 2 supplements provide 100 calories of foods in the same proportion as Type 2 adequate diets. See text and Appendix A for details.
d/ Type 3 adequate diets and supplements are composed entirely of cereals with the same proportion of different cereals as in the "average" diet for each subregion. See text and Appendix for details.
e/ Outside metropolitan areas.
f/ Parana, Santa Catarina and Rio Grande do Sul.
g/ Mato Grosso and Goias.
h/ Rondonia, Acre, Amazonas, Roraima, Para, and Amapa.

given in cruzeiros of August 1974, as a percent of 12 Rio de Janeiro monthly minimum wages (i.e., an annualized Rio de Janeiro minimum wage), and in US dollars at the average exchange rate prevailing in August 1974. The costs of the supplements are given only in cruzeiros of August 1974. In general, the cost of diets of each type is highest in the metropolitan areas and Brasilia and considerably lower in the rural areas, with other urban areas falling in between. As would be expected, Type 1 diets are generally the most expensive, Type 3 diets the cheapest, and Type 2 diets fall in between (they average 69% of the Type 1 diet cost in the metropolitan areas, 59% in other urban areas, and 92% in rural areas).

111. These features are shown in the following table, which presents the costs in August 1974 US dollars. The figures are unweighted means for the corresponding ENDEF subregions, and conceal considerable variation in some cases as may be verified by examining Table 20. Nevertheless, certain other aspects in addition to those mentioned above are noteworthy. First, the average metropolitan/rural cost ratio is far higher for Type 1 diets (1.94) than for Type 2 diets (1.45) or Type 3 diets (1.42). This appears to reflect not only the lower average prices prevailing in rural areas, but also the fact that FAO/WHO calorie requirements are generally met at much higher percentiles in the family expenditure distribution in metropolitan as opposed to rural areas (see Table 21). In any case the significant diet cost differences found between subregions even for Type 2 diets suggest that at least as far as the food component of family expenditure is concerned, using national average income, wage, or expenditure data to identify the absolute or relative poor may be quite misleading, tending to underestimate the number of poor in high food cost areas and overestimate them in low food cost areas.

	Type 1	Type 2	Type 3
9 Metropolitan Areas and Brasilia	289	199	132
7 Other Urban Subregions	264	155	126
5 Rural Subregions	149	137	96

112. The meaning of these adequate diet costs in the context of a poor family's budget is better grasped if they are expressed in terms of the cost for feeding a Type 2 diet to a family of five measured in annualized Rio de Janeiro minimum wages (the minimum wage in Rio de Janeiro is the highest in Brazil). Only in the rural areas outside of Sao Paulo and the South (Parana, Santa Catarina, and Rio Grande do Sul) would this adequate "poor family's diet" cost less than one minimum wage. In fact, it is closer to two minimum wages in Rio de Janeiro, Sao Paulo, Porto Alegre, and Brasilia.

Family Expenditure, Calorie Consumption, and Durable Goods Ownership Patterns

113. Table 21, summarizes some of the most striking aspects of the ENDEF data on family expenditure, calorie consumption and consumer durables ownership patterns at four points in the 22 subregional distributions of global family expenditure (monetary and non-monetary). The figures presented in

Table 21: AVERAGE TOTAL EXPENDITURE AND PATTERNS OF FOOD EXPENDITURE, CALORIE CONSUMPTION, AND DURABLE GOODS OWNERSHIP FOR FAMILIES AT SELECTED POINTS IN THE ENDEF SUBREGIONAL FAMILY EXPENDITURE DISTRIBUTIONS BY METROPOLITAN AREAS, OTHER URBAN AREAS, AND RURAL AREAS, 1974/1975

Family Characteristics	PANEL A: Families at Lower 20th Percentile of Subregional Family Expenditure Distribution			PANEL B: Families with Expenditures Twice the Cost of a Type 2 Diet[b]			PANEL C: Families with Per Capita Calorie Consumption 200 Calories below Requirements[c]			PANEL D: Families with Per Capita Calorie Consumption Equal to Requirements[c]		
	Metropolitan Areas[d]	Other Urban Areas[e]	Rural Areas[f]	Metropolitan Areas[d]	Other Urban Areas[e]	Rural Areas[f]	Metropolitan Areas[d]	Other Urban Areas[e]	Rural Areas[f]	Metropolitan Areas[d]	Other Urban Areas[e]	Rural Areas[f]
Annual Family Expenditure (Cr$ of August 1974)[a]	8,840	6,711	4,400	13,829	11,459	11,154	26,817	17,939	6,412	46,278	32,125	9,593
Average Percentile in Subregional Global Family Expenditure Distribution	20.0	20.0	20.0	36.3	41.5	67.9	60.5	55.5	38.6	79.6	77.6	56.9
Food Expenditure as a Percent of Total Expenditure	45.3	53.3	63.3	41.9	48.9	58.0	33.3	43.0	62.3	24.4	32.4	59.5
Percent of Food Expenditure Spent on Meat and Fish	24.5	22.3	16.2	26.6	25.0	20.4	29.2	26.1	18.4	30.8	28.8	20.1
Percent of Families Owning												
Automobile	1.1	0.7	0.3	1.9	1.3	1.6	12.3	5.4	0.5	54.0	33.3	7.8
Television	35.7	15.9	2.8	48.3	22.4	6.7	76.8	42.0	2.2	93.5	72.2	23.0
Refrigerator	22.2	11.3	1.0	33.7	16.5	4.7	67.0	38.1	1.4	92.6	75.5	12.2
Blender	22.0	9.9	1.1	32.9	13.1	2.7	61.8	32.0	1.2	87.0	64.1	8.6
Per Capita Calorie Consumption	1,760	1,820	1,966	1,927	1,954	2.373	2,034	2,042	2,071	2,235	2,240	2,269
Calorie Deficit (Adjusted for Size of Family)	492	447	328	309	301	-130	200	200	200	-	-	-
Calorie Elasticity[g]	.29	.20	.41	.29	.21	.27	.14	.15	.20	.07	.10	.23

a/ Global monetary and non-monetary expenditure.
b/ A Type 2 diet is composed of 2242 calories (national average FAO/WHO Low requirements) obtained from foods in the proportions consumed and at the prices paid by the (lower) 20th percentile families in each of the 22 ENDEF subregions.
c/ FAO/WHO Low requirements. See text and Appendix A for details.
d/ Unweighted mean for Brasília and 9 metropolitan areas (Fortaleza, Recife, Salvador, Rio de Janeiro, Sao Paulo, Curitiba, Porto Alegre, Belo Horizonte, and Belem).
e/ Unweighted mean for the 7 ENDEF non-metropolitan urban subregions excluding Brasília.
f/ Unweighted mean for the five ENDEF rural subregions.
g/ Arc elasticity of normalized per capita (per comensal dia) calorie consumption with respect to normalized (per comensal dia) per capita annual family expenditure around the expenditure class containing the family in question.

Source: Appendix B, Tables B.1 - B.4

Table 21 are unweighted means for the 9 metropolitan areas and Brasilia, the 7 other urban subregions, and the 5 rural subregions found in the ENDEF data set. Despite some differences within these groupings of subregions by degree of urbanization, the similarities of patterns found seems sufficiently great to justify not separating regions in this summary table. The subregional data for all 22 subregions from which these means have been calculated may be found in Tables B.1-B.4 of Appendix B to this annex. It must be stressed that the ENDEF data base is extraordinarily rich and the findings presented here represent only the most salient points emerging from preliminary exploration of the data.

114. Panel A presents data for the families at the (lower) 20th percentile of the family expenditure distribution in each subregion, that is those families at the upper limit of the poorest fifth of the families in each subregion. In 21 of the 22 subregions, the average calorie deficit (adjusted for family size at the 20th percentile) shown in Panel A exceeds 200 calories per person per day. The average deficits are 492 calories in metropolitan areas, 447 in other urban areas, and 328 in the rural areas. Panel B presents data for families in each subregion with expenditures equal to twice the cost of a Type 2 diet, that is families who could have satisfied the national average FAO/WHO Low calorie requirements if they consumed foods in the proportion and at the prices paid by the 20th percentile families and still devote half of their total expenditure to other uses. With one exception, these families have higher total expenditures than the 20th percentile families, which means that this is a less restrictive definition of a "poverty line."

115. Panel C gives corresponding information for families who fall short of meeting their FAO/WHO Low calorie requirements by exactly 200 calories per person per day, that is by the margin of error in deficit estimation accepted as a working basis in estimating the severity of calorie deficits. Except in the rural subregions and one urban subregion which may in fact contain many rural families (urban areas in Goias and Mato Grosso), these families are considerably higher in the expenditure distribution than the Panel B families. Finally, Panel D presents the data for the families who just met their FAO/WHO Low calorie requirements -- families well above the median of the subregional expenditure distributions except in the rural South (Parana, Santa Catarina and Rio Grande do Sul) and rural Sao Paulo.

116. The first striking feature highlighted in Table 21 is the relatively low proportion of total family expenditures devoted to food purchases in metropolitan and other urban areas. Only in the case of the 20th percentile families in the non-metropolitan urban areas does it average more than 50%, whereas in all four panels for rural areas it approaches or exceeds 60%. Systematically across all four panels the percentage of family expenditures devoted to food is lowest in the metropolitan areas and highest in the rural areas, with other urban areas falling in between. In part the low levels of food expenditure are accounted for by the fact that the expenditure data includes non-monetary expenditure, which is particularly important for food in the rural areas and imputed rents of owner-occupied residences and home improvements in both urban and rural areas (though rent and housing costs in general are much higher in urban areas). But it also appears to reflect the greater needs and opportunities for non-food expenditure in urban areas.

117. Not only do rural families spend more on food, those on the poverty line as defined in panels A and B have lower average calorie deficits than do the corresponding urban families. In fact, rural families with expenditures twice the cost of a Type 2 diet (Panel B) on average have calorie surpluses averaging 130 calories in the rural subregions (the only rural subregion with a deficit was Rio de Janeiro State, where it averaged only 114 calories). But despite food price differentials in favor of the rural poor, the proportion of rural families with global expenditures less than twice the cost of a Type 2 diet is much higher, 67.9% for the rural subregions as opposed to 41.5% for the non-metropolitan urban areas and 36.3% for the metropolitan areas. Thus the appropriate generalization is that after deflating by food costs, the rural poor are poorer than the urban poor, but better fed.

118. Another significant fact is that even families with large calorie deficits, such as the 20th percentile families in Panel A, spend a relatively high proportion of their food budget on meat and fish--24.5% in metropolitan areas, 22.3% in other urban areas, and 16.2% in rural areas. The price of calories obtained from meat and fish is on the order of five to seven times that of calories obtained from cereals and cereal derivatives for the 20th percentile families. More surprisingly, the percentage is highest in the metropolitan areas and lowest in the rural areas in all four panels, despite the greater opportunities for raising animals in rural areas. There are undoubtedly strong cultural factors underlying this phenomenon, and of course meat and fish are important sources of proteins and other nutrients as well as calories. But when calorie deficits are large, the ingestion of protein from meat and fish appears economically wasteful since most of the protetin will be converted into energy rather than body tissue. It is unlikely that the Brazilian poor with calorie deficits are generally aware of this fact. On the other hand, the desire for variety and tastefulness may simply be stronger than the perceived need for energy intake.

119. The penetration of durable consumer goods such as television sets, refrigerators, blenders, and even automobiles is significant even for the 20th percentile families, especially in the metropolitan areas. It is uniformly less in other urban areas, and very low in rural areas. For example, at the 20th percentile the unweighted mean possession of television sets in the metropolitan areas is 35.7%, compared with 15.9% in other urban areas and 2.8% in rural areas. For families with expenditures twice the cost of a Type 2 diet, the corresponding figures are 48.3%, 22.4% and 6.7%.

120. Thus for large numbers of poor and indeed many not so poor families the ENDEF data suggest that possession of consumer durables may be preferred to meeting FAO/WHO Low calorie requirements. As suggested above, it may be that even the FAO/WHO Low requirements are too high for the present Brazilian population. But even allowing a margin of error of 200 calories in estimating requirements, there appear to be families with refrigerators, but insufficient food to put in them. While research is clearly needed on this phenomenon, it is likely that some families have obtained used consumer durables as gifts or purchased them in the second hand market at costs well below the cost of new goods. Another partial explanation may be that the incomes of the poor fluctuate greatly, especially in real terms due to inflation, and that the purchases are made on consumer credit the real burden of which increases when

when real incomes fall, resulting in decreased food purchases in order to avoid repossession of the consumer durable. For example, it is common for down payments to be made at the Christmas season when the "13th salary" bonus is paid and commercial pressure is high, but installment payments then burden family budgets over the succeeding months when there is no extraordinary income available, and the family may even undergo a period during which the principal income earner is unemployed.

121. Perhaps the most significant conclusion which emerges from Table 21 is that unless consumption habits change, reliance upon increases in income alone to improve the nutritional status of the poor in Brazil will involve either massive transfers of income or allowing serious malnutrition to persist well into the 21st century except under very optimistic assumptions regarding income growth and distribution. This matter is further explored in the simulations reported in Section E below. It also suggests that investments in nutrition education should accompany any other forms of nutrition intervention designed to reduce malnutrition.

122. Two characteristics of the consumption patterns summarized in Table 21 underlie the relative slowness with which income increases alone will reduce malnutrition. First, the percentage of total family expenditures devoted to food does not exceed 60% except in rural areas, even at the 20th percentile of the subregional distributions, and in metropolitan and other urban areas of the Southeast never exceeds 50% at the 20th percentile. In general the percentage falls as one moves up the expenditure distributions. And the percentage of the population living in rural areas will continue to fall over the remainder of the century (see Annex I). Second, the elasticity per capita calorie consumption to per capita total expenditure 1/ is generally very low -- it does not average much over 0.4 even in rural areas in any of the panels of Table 21, and is generally on the order of 0.2 to 0.4 for panels A-C.

123. One might expect the elasticities to be highest for those families in greatest calorie deficit, falling somewhat as requirements are approached, and then falling more sharply once requirements are met. While the elasticities do indeed fall for most groups once requirements are met (though relatively much less in rural areas, which suggests that requirements may have been set too low for the activity levels involved in agriculture), they do not appear to be uniformly higher for families with greater deficits, even controlling for metropolitan/other urban/rural location. The only clear patterns emerging even after a more detailed look at arc elasticities between expenditure classes in the 22 ENDEF subregions (see Appendix B, Table B.5) are the generally low calorie elasticities, and significantly higher calorie elasticities in rural subregions compared with the metropolitan areas or other urban subregions.

124. Together the likelihood that on the average well over half of any increases in family incomes will be devoted to non-food expenditure (the principal exceptions being the poorest urban families and most residents of rural areas) and that per capita calorie consumption will increase only on

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1/ More formally, the elasticity of calorie consumption per comensal dia with respect to global family expenditure per comensal dia around the expenditure class containing the family in question.

the order of 20% to 40% as fast as per capita total expenditure must lead to pessimism with regard to the efficacy of a laissez faire policy if rapid reduction in malnutrition is sought in Brazil.

Summary of Findings Based on Preliminary Review of ENDEF Data

125. The comparisons of the ENDEF food consumption data with requirements for a healthy Brazilian population, the growth patterns of Brazilian children with those of healthy children of similar ethnic background in other countries, and the ENDEF age/weight data with the normal standard using the Gomez classification, together with the estimates of the number of Brazilians with moderate and severe calorie deficits all suggest that malnutrition in Brazil is more widespread and severe than earlier analyses based on food balance sheets or the family budget studies of the early 1960s had indicated. The cost of calorie adequate diets for a family of five containing foods in the same proportions and at the same prices paid by the (lower) 20th percentile families in each ENDEF subregion, when measured in terms of the highest minimum wage prevailing in Brazil in August 1974 is such that except in some rural areas, at least one full minimum wage would have been required simply to feed the family -- in a number of urban areas the cost would have been closer to two minimum wages. But the patterns of family expenditure, calorie consumption, and durable goods ownership revealed by the ENDEF data suggest that reliance on plausible increases in income alone will not allow rapid progress in reducing malnutrition.

Other Recent Survey Research on Nutrition

126. Other surveys conducted in recent years also suggest that malnutrition is a serious social problem of contemporary Brazil, even in relatively prosperous cities like Sao Paulo and Rio de Janeiro. Information on nutritional standards prevailing in the former city may be gleaned from research conducted by the Institute of Economic Research (Fundacao Instituto de Pesquisas Economicas - FIPE) of the University of Sao Paulo in 1971 and 1972. 1/ A principal finding of this survey was that almost 16% of the families selected for interviews consumed inadequate diets. 2/ Through extrapolation, this

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1/ Some basic tabulations of this survey are available in E.L.G. Alves, "Nivel Alimentar, Renda e Educacao," Internal Discussion Paper No. 06/77 (Sao Paulo: USP/FIPE, 1977), mimeo. Another investigation of nutritional standards in Sao Paulo (with similar findings) is Departamento Intersindical de Estatistica e Estudos Socio-Economicos (DIEESE), "Nivel Alimentar da Populacao Trabalhadora da Cidade de Sao Paulo," Estudos Socio-Economicos, I (July 1973).

2/ In this survey, families were classified according to a two dimensional protein-caloric scale of adequacy. The recommended standard was drawn up from tables supplied by the U.S. National Research Council, and each family's intake was compared with the (age and sex-adjusted) standard.

percentage implied that about 970,000 inhabitants of the municipio of Sao Paulo were subject to malnutrition. As in the earlier FGV surveys, nutritional adequacy was closely related to income. In this respect, the data showed 71% of the families in the lowest per capita income bracket (up to .25 minimum wages) to be inadequately nourished, versus less than 2% in the highest bracket (5 or more minimum wages). A closely related finding was that, in general, the nutritional deficiencies of the sample group were more owing to a lack of calories than of proteins. This contention was supported by data which showed protein adequacy being reached by families with total monthly incomes of only 1.7-2.4 minimum wages; shortfalls in calorie consumption, on the other hand, persisted up to the 5.6-8.4 minimum wages bracket. It was only in the most inadequately nourished families where protein deficiencies were observed to be a more serious problem than calorie shortages.

127. Nutritional patterns similar to those revealed in the FIPE survey were found in a family budget survey sponsored by the Getulio Vargas Foundation in 1973. The sample for the latter survey was drawn from families residing in popular housing in the city of Rio de Janeiro. 1/ Overall, between 20% and 30% of these families did not consume recommended minimum amounts of calories. As in the Sao Paulo survey, such shortfalls were highly correlated with income. In some types of housing, for example, over 40% of the families in the lowest bracket (up to one minimum wage) reported inadequate calorie intakes, while less than 5% of those in the highest bracket (5.25-7.99 minimum wages) suffered from the same problem. Another similarity with the FIPE survey was that average protein intakes were found to be more than satisfactory at all income levels except the very lowest.

128. Both the FIPE and FGV surveys noted a strong association between nutritional status and family-size. Tabulations of the Sao Paulo data, for example, indicated that the two variables were inversely related, with inadequately nourished families being composed, on the average, of one more person than those adequately nourished. This general relationship applied regardless of a given family's income level. The Rio de Janeiro data, as well, demonstrated that the risk of incurring dietary deficiencies increased with family-size. In fact, only in those families composed of three members or less were combined protein-calorie intakes observed to be satisfactory.

1/ This study used FAO standards (adjusted for age, sex and mean temperature) in determining whether a family consumed adequate amounts of calories, protein, vitamins and minerals. The reference tables are reproduced in volume II of the published results. See Fundacao Getulio Vargas, Pesquisa sobre Consumo Alimentar, 3 vols. (Rio de Janeiro: FGV, 1975).

Findings of this nature suggest that while steps to improve nutritional standards may reduce fertility rates, the converse may also hold true. 1/

129. Contrary to expectations, the education variable had relatively little power in "explaining" (in a statistical sense) the nutritional status of families in either the FIPE or FGV samples. The educational attainments of mothers and fathers did tend to be higher in adequately nourished families than in those inadequately nourished, but this was mostly a reflection of education's positive association with income. For the Sao Paulo sample, FIPE economists found that the education of the mother in low-income families (up to one minimum wage) had a favorable association with nutritional status only when the attainment level was high school (ginasio) or above. 2/ These authors concluded that educational attainment became important only after the point where family incomes permitted the purchase of a quantity of foods sufficient to satisfy minimum nutritional requirements.

B. The Relationship Between Nutrition, Other Basic Needs, and Economic Development

130. The nutritional status of a population is closely related to both demographic factors and the satisfaction of other basic needs. Indeed, the interrelationships between nutrition, family size, health, sanitation, shelter and education are multiple. For example, poor sanitation is a major cause of gastrointestinal disturbances which can diminish the body's ability to assimilate what food is ingested. A child's mental capacity and energy, and hence capacity to learn, are affected by serious malnutrition. And with any given family income, the larger the family the greater is the probability of malnutrition. Overcrowding of dwelling space and inadequate quality of the same contributes to sanitary and health problems, which in turn may have nutritional consequences. Unraveling and quantifying these complex interrelationships in any precise way is not an easy task. 3/

1/ The same inverse relationship between dietary adequacy and family size appeared in a study of nutritional standards prevailing in rural Ceara. The authors suggest that this tendency could explain part of the traditional emigration from the Northeast. See J.O. Ward and A.T. de Almeida, "Nutricao, Renda e Tamanho da Familia: Um Exame de Situacao Nutricional em Caninde, Ceara," Revista Economica do Nordeste, VIII, No. 1 (1977), 77-94.

2/ See A.C. Campino, E.L.G. Alves and J.L.T.M. Vieira, "Factores Socio-Economicos Associados a Nutricao no Municipio de Sao Paulo," Estudos Economicos, V, No. 1 (1975).

3/ Paragraphs 131-136 are adapted from the appraisal report for the Nutrition Research and Development Project being carried out by the National Nutrition Institute.

Internationally Accepted Findings

131. The effectiveness of improved nutrition as a means of reducing mortality and the severity of childhood infections has been clearly established for some time and is, of itself, sufficient justification for investment in better nutrition. Although the case for and investment in better nutrition on economic grounds has only recently been advanced and is as yet less easy to quantify, the benefits would appear to be substantial.

132. Improvement in diet increases work output. 1/ Malnourished workers have been shown to lose 30% of their muscle strength and 15% of their precision of movement. Pace of work, coordination and behaviorial characteristics are altered. Desires to take advantage of opportunities for innovation are foregone. Nutrition status is also related to the extent of absenteeism from the labor force in that the length and severity of illness and the length of time required for recovery of infections, and surgery are heavily influenced by the nutritional condition. Because malnutrition is an important associated cause of early death rates among adults, their potential working life span is cut short and the potential return to the investment during childhood reduced.

133. Investment in the education system becomes more effective when students are adequately nourished. People who are better educated are more likely to achieve higher skills and become more productive. Malnutrition interferes with the child's motivation and his ability to concentrate and learn. A malnourished student is listless, lacking in curiosity and unresponsive to stimulation. Because of frequent bouts of nutrition-related illnesses, the malnourished youngster is frequently absent as much as a third of the school-days in a year. Improved nutrition reduces the high rate of drop-outs and increases the absorptive capacity of those who do pass on to advanced grades.

1/ This conclusion is supported by a substantial body of literature including, inter alia, S. Basta and A. Churchill, "Iron Deficiency and the Productivity of Adult Males in Indonesia," IBRD Staff Paper No. 175 (1974); Maurice E. Shils, "Food and Nutrition Relating to Work and Environmental Stress," in Michael Gershon Wohl and R.S. Goodhard (eds.), Modern Nutrition in Health and Disease (4th ed., Lea, 1968, pp. 1014-44); W.D. Keller and H.A. Kraut, "Work and Nutrition," in Geoffrey H. Bourne, World Review of Nutrition and Dietetics (Hafner, 1962), Vol. 3, pp. 69-81; Nutrition and Physical Activity: Symposium of the Swedish Nutrition Foundation (Uppsala, Sweden: Swedish Nutrition Foundation, 1967); H. Kraut and others, in Arbeitsphysiologie, Vol. 14, (1950), p. 147; F.W. Lowenstein, Nutrition and Working Efficiency, Special Paper No. 3 (FAO, WHO, and Organization of African Unity, Scientific, Technical and Research Comission, May 1968); W.H. Forbes, "The Effects of Hard Work upon Nutritional Requirements," Milbank Memorial Fund Quarterly, January 1945, pp. 89-96; Bhavani Belvady, "Nutrition and Efficiency in Agricultural Labourers," Indian Journal of Medical Research, October 1966, pp. 971-76; N.H. Areskog, Ruth Selinus, and B. Vahlquist, "Physical Work Capacity and Nutritional Status in Ethiopian Male Children and Young Adults," American Journal of Clinical Nutrition, April 1969, pp. 471-79.

134. Because malnutrition during the fetal period and in early childhood impairs physical and mental development (80% of eventual brain weight is reached by the first 24 months of life), investment to prevent malnutrition during this period is the most critical in terms of subsequent performance. Even if a child's diet is fully adequate only in utero and during the first critical years, he will be brought closer to his growth potential. Even if during adulthood nutrition levels fall short of the desirable norm, his productivity will already have been ratcheted to a higher level--more relevant to a modern economy--than would otherwise be achieved. Investment to prevent malnutrition during this early period will make it possible for children to respond to outside stimuli, better cope with the school situation and subsequently as part of the labor force perform with more alertness, dexterity, incentive and have greater comprehension and retention of things taught. Inasmuch as investments in increased agricultural production and other development activities consist largely of new technologies, such characteristics in the labor force grow in importance.

135. Investment in nutrition improvement of pregnant and lactating women is linked to productivity in that the nutrition status of the child at birth and during infancy is heavily influenced by the nutritional condition of the mother. Lethargy induced by malnutrition severely limits maternal stimulation for the child, a recognized ingredient in an infant's mental development. Also, women whose activities are not measured in a market economy improve performance on a number of economically important functions around the home, including care of food gardens and the quality of care for the rest of the family.

136. Other economic benefits accruing from improved nutrition are the reduced cost of medical care (or increased effectiveness of the current health care system since demand will be lessened); savings resulting from the lower incidence of communicable disease, reducing the exposure of these diseases to others; savings on the cost of caring for those malnourished who become a social burden (e.g., the blind); and increased future productivity of the well-nourished worker's dependents because of his higher income and the resulting improvement in living conditions. Nutrition programs also provide a direct means of income redistribution. The nature of nutrition activities benefits the poor directly in ways that boost both their health and real income.

Brazilian Research Results

137. Research on the consequences of malnutrition in Brazil is considerably less developed than that aimed at measuring its nature and magnitude. This situation is largely explained by the lack of an appropriate data base (though when all the ENDEF results are available this constraint will be greatly eased), but also by the methodological difficulties generally encountered in studies of the former type. Nevertheless, there is a strong indication that malnutrition is an important cause of child mortality and an impediment to full mental and physical development (and hence educational attainment).

138. Detailed evidence on the contribution of nutritional deficiencies to child mortality is available in a study published by the Pan American Health Organization (PAHO). 1/ Table 22 which summarizes some findings of this report, shows between 60% and 70% of all deaths of children under five years of age to be nutrition-related. In all survey areas, deaths related to nutritional deficiencies were relatively more important than those attributable to immaturity (defined as a birth weight of 2,500 grams or less); the latter condition being closely related to the nutritional status of the mother during pregnancy. Deaths from nutrition-related causes were found to be especially prevalent in the under one year age group, with the infant mortality rate (attributable to such causes) in Recife reaching 35.5 per 1,000 live births. 2/ This was the second highest observed in the Americas (marginally above that of rural El Salvador) and well above the infant mortality rate from all causes registered in many countries. Another important finding of the PAHO study was the high degree of interaction between malnutrition and infection. For the Brazilian sample as a whole, between 60% and 75% of all deaths from infective and parasitic diseases had nutritional deficiency as an associated cause.

Table 22: CHILD MORTALITY FROM NUTRITIONAL DEFICIENCY AND IMMATURITY AS UNDERLYING OR ASSOCIATED CAUSE, SELECTED CITIES AND COMMUNITIES, 1968-1970 /a

(% of total deaths)

Location	Nutritional Deficiency	Immaturity /b	Both
Recife (urban)	46.2	20.2	66.4
Ribeirao Preto, SP (urban)	34.5	35.3	69.8
Franca, SP (urban)	36.4	27.6	64.1
Five Communities, SP (suburb-rural)	38.2	28.5	66.7
Sao Paulo (urban)	30.4	28.4	58.8

/a Children under five years of age.
/b Birth weight of 2,500 grams or less.

Source: R.R. Puffer and C.V. Serrano, Patterns of Mortality in Childhood (Washington, D.C.: Pan American Health Organization, 1973), p. 165.

1/ R.R. Puffer and C.V. Serrano, Patterns of Mortality in Childhood (Washington, D.C.: Pan American Health Organization, 1973).

2/ Judging from the overall infant mortality rate in Recife during 1968-70 (about 175), this estimate would appear to be a gross understatement.

139. In urban areas, problems of inadequate food intake are exacerbated by infections derived from unsanitary conditions and inadequate personal hygiene. In the low-income Encruzilhada section of Recife, where sanitary conditions are highly inadequate, infant mortality (91 per 1,000 live births) and the death rate of children under 5 years of age (29 per 1,000 population) are the highest reported in the PAHO study for an urban area in the Western Hemisphere.

140. Breastfeeding is declining in Brazil, as in many countries in the world. A common urban practice in Northeast Brazil is for mothers to wean their children at five or six weeks and substitute manioc gruel (which contains almost no protein) for breast milk. Mothers are reluctant to feed children fruits or vegetables; meat and eggs are considered noxious. Heavily promoted commercial milk-based baby formulas are often used, but because of income limitations, the product is frequently over-diluted, and served unhygienically. Infant diarrhea often results, leading to malabsorption, malnutrition and increased severity of otherwise minor childhood infections--all factors contributing to the high infant mortality rate. In Recife, 73% of the children who died during their first year had been breast fed less than one month. At the age of about one year, children are fed the adult diet without any added precaution such as pureeing the foods. Among the poor, there apparently is little understanding about the types of foods and the amounts to be fed or basic practices of hygiene in child feeding.

141. Additional evidence indicates that malnourished children surviving their first few years of life are likely to score lower on instruments testing various aspects of learning ability. A study of preschool-aged children in Sao Paulo and Brasilia, for example, found significant differences between the performances of well nourished and malnourished children in the areas of psychoneurological functions, knowledge of basic concepts, and language. These differences were especially pronounced with respect to children who had suffered from early malnutrition. 1/ Almost identical tendencies were observed in a study of preschool-aged children in Aracaju, Sergipe. 2/ Both studies show that malnutrition is much more likely to impede the cognitive development of children coming from lower socioeconomic environments (as measured by the occupation of the father, family income, and educational attainments of parents) as compared to those from higher socioeconomic levels. Overall, this limited research seems to imply that in Brazil, as elsewhere,

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1/ See A.C.C. Campino, "Nutricao e Retorno Social da Educacao," Fundacao Carlos Chagas, Cadernos de Pesquisa, No. 24 (1977), 18.

2/ E.N. Macedo, "Efeitos da Desnutricao no Processo de Desenvolvimento Cognitivo de Pre-Escolar de Aracaju" (Rio de Janeiro, 1977), Mimeo.

nutritional adequacy is a necessary, though not sufficient, condition for normal mental development. 1/

C. Evolution of Policies Affecting the Nutritional Status of the Population

142. Almost any government policy may have some direct or indirect effect on the nutritional status of the population. But the most important policies are those which directly seek to affect some link in the chain from food production to effective assimilation of food by the human population. To order the subsequent discussion, Table 23 breaks this chain into three major stages: production, marketing, and consumption. For each stage several broad policy categories are distinguished, their principal immediate and ultimate objectives specified, and some of the major problems or constraints affecting implementation listed. The table is meant to be illustrative and to provide a general framework for the discussion which follows rather than to be exhaustive and analytic. To the extent that specific policy types have been important in Brazil, especially those at the consumption end of the chain, the discussion of the constraints and implementation problems is more detailed. For policy categories which have had little or no importance in Brazil since the World War II, such as land reform, there is little or no discussion in the text of this section.

143. Assuring an adequate supply of food at reasonable prices has been an ongoing concern of policy-makers in postwar Brazil. Until very recently, however, the nutrition problem was viewed almost entirely in terms of production and marketing considerations. As a consequence, the important cause and effect relationships between nutritional status and poverty were afforded scant attention, at least explicitly. This posture has changed markedly during the present administration. Though a preoccupation with supply (abastecimento) still persists, policies of the mid-1970s explicitly recognize that malnutrition is most severe among the poor and that direct interventions designed to increase food consumption of the poor are justified. The

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1/ The relative importance of malnutrition and social environment on the mental development of children is still being debated in the literature. N. Christiansen and associates, for example, conclude (based on data from Colombia) that malnutrition and intellectual functions are related even when social and health factors are controlled. S.L. Manocha, citing evidence from India, verifies the malnutrition-mental development connection but gives much greater emphasis to environmental factors. For greater details, see N. Christiansen, et al, "Social Environment as It Relates to Malnutrition and Mental Development" in J. Cravioto, L. Hambraeus and B. Vahlquist, Early Malnutrition and Mental Development (Uppsala: Swedish Nutrition Foundation, 1974), pp. 186-99; and S.L. Manocha, Malnutriton and Retarded Human Development (Springfield, Ill.: Charles C. Thomas Publisher, 1972), Ch. 4.

Table : NUTRITION RELATED POLICIES, OBJECTIVES, PROBLEMS AND CONSTRAINTS

Stage in Food Production to Consumption Chain	Type of Policy	Immediate Objectives	Ultimate Objectives	Likely Problems and Constraints
Production	Tax land	Stimulate efficient land use	Increase food production	Administratively difficult. May increase costs and decrease product if land already used efficiently.
	Give fiscal incentives (reductions in taxes on agriculture income and products)	Decrease effective production costs, increase profitability	Increase food production	Reduces government revenues. May distort factor prices in favor of land and capital and against labor, reducing employment creation.
	Expand agricultural credit	Increase use of purchased inputs (including capital goods)	Increase food production	May not reach food producers. May be diverted to non-agriculture uses.
	Subsidize agriculture credit	Decrease production costs	Increase food production	May be diverted to non-food producing uses. May encourage inappropriate choice of technology.
	Support food prices	Decrease downward price fluctuations, increase profitability	Increase food production	Requires government purchase and storage. May have significant budgetary costs.
	Colonize new lands	Bring new lands into production control tenure structure in new lands	Increase food production	Requires efficient management. May have high short-term budgetary costs compared with spontaneous colonization.
	Reform land tenure and production organization	Alter existing structure of land ownership and exploitation	Increase food production, increase agricultural employment, improve income distribution	Requires strong administrative capability. May disrupt production in short- to medium-term.
	Expand research	Develop better varieties, improve production technology, decrease production costs	Increase food production	Research may not be relevant to needs of food producers. Research and extension may ignore special needs of small producers.
Marketing	Improve transportation system	Decrease transportation costs	Increase food production. Decrease prices to consumer	Producers, consumers, and intermediaries may be the beneficiaries, in what proportions not always clear ex ante.
	Improve storage system	Decrease physical loss in storage, decrease price fluctuations	Increase consumable food production	Producers, consumers, and intermediaries may be the beneficiaries, in what proportions not always clear ex ante.
	Institute buffer stocks	Decrease price fluctuations	Increase food production assure supply to consumers in bad years.	May result in excessive storage and physical loss. May have high budgetary costs. Storage capacity required.
	Develop marketing centers	Decrease marketing margins, stimulate competition	Increase food production and consumption	Distribution of benefits between consumers, producers, and intermediaries not always clear ex ante.
	Separate producer and consumer prices	Decrease prices to consumers increase prices to producers	Increase food production, increase consumption	Administratively difficult especially for commodities not requiring centralized processing. May have high budgetary costs.
	Control prices	Hold-down price to consumer	Increase food consumption	May decrease production. Difficult to implement effectively without full control of at least one stage in chain closer to production.
	Increase imports or decrease exports	Hold-down consumer prices and assure domestic supply	Increase food consumption	Unless producer prices are separated from consumer prices production may be discouraged.
	Increase food technology research and development	Develop low cost nutritious foods and food processing technology	Increase food consumption and stimulate food production	If food processing technology has large returns to scale, processors may develop local monopsony and monopoly power, thus appropriating some or all of the benefits.
Consumption	Increase employment	Increase disposable income of previously unemployed or underemployed	Increase food consumption	Some fiscal and credit policies may work against this objective by altering relative prices in favor of capital. Not all income will be spent on food, or spent efficiently in terms of reducing malnutrition.
	Transfer income to target groups	Increase disposable income of the poor	Increase food consumption	Requires identification of the poor. Not all income will be spent on food or spent efficiently in terms of reducing malnutrition. High budgetary costs and administration may present problem.
	Subsidize food for target groups	Decrease effective price of food to target groups	Increase food consumption	Requires identification of target groups and individuals qualifying. Administratively difficult. Food purchased with the subsidy may replace food which would have been purchased anyway (the substitution problem) or not be consumed by the intended beneficiaries (the dilution problem).
	Distribute free food directly to target groups	Increase supply of food to those most needing it	Increase food consumption of malnourished	Requires identification of target groups and individuals qualifying. Administratively difficult. Food distributed may replace food which would have been purchased anyway (the substitution problem) or not be consumed by the intended beneficiaries (the dilution problem).
	Change food consumption habits	Increase awareness of nutrition problems and feasible solutions, including choice of foods, improved hygiene in food preparation, and better intra-family distribution	Increase effective food consumption of malnourished	Requires strong administrative capability. Undesireable dietary habits may be resistant to change.

clearest manifestation of this new thrust is the National Food and Nutrition Program (Programa Nacional de Alimentacao e Nutricao - PRONAN), established through Decree 77,116 of February 6, 1976. While the present discussion centers on this latter phase, it is instructive to briefly review its antecedents.

Agricultural and Food Supply Policies

144. Brazilian nutrition-related policies of the 1950s and early 1960s were almost exclusively concerned with adequately supplying a rapidly growing, and increasingly affluent urban population. During this era of import-substitution, industry generally received the highest priority, except when periodic urban food supply crises threatened to interfere with the rate of industrial growth. When such crises occurred, the usual reaction was to increase public investments in agricultural marketing facilities (i.e., warehouses, silos, highways), to institute controls over retail food prices, and to a limited extent to call for an increase in food production prices.

145. The first postwar food supply crisis occurred in the first half of the 1950s. Food prices during this period increased at an average annual rate almost twice that of the general price index. The generally accepted diagnosis of this phenomenon was not that Brazil was producing too little food or that too little food was imported, but that 25-40% of the output was being lost through inadequate storage and transportation facilities. In addition, it was alleged that unscrupulous middlemen were exploiting both consumers and producers, thus simultaneously causing high consumer prices and depressed farm incomes.

146. To meet these challenges, the Brazilian government created the Federal Supply and Price Commission (Comissao Federal de Abastecimento e Precos - COFAP) in 1951. Although this agency was to exercise overall jurisdiction in the food supply area, its most important function was the imposition and enforcement of price controls. At the same time, a system of agricultural support prices was established under the aegis of the Production Finance Commission (Comissao de Financiamento da Producao - CFP). Price support levels, however, were set consistently lower than market prices so as not to exert upward pressure on urban cost-of-living indices. 1/

147. The formal government plans of the 1950s also reflected a concern with the national food supply. Almost 14% of the SALTE Plan (1949-53) budget,

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1/ Several agencies and programs more directly related to nutrition also functioned during the 1950s. Included among these were the National Food Commission (Comissao Nacional de Alimentacao - CNA), Social Security Food Service (Servico de Alimentacao da Previdencia Social - SAPS), and National School Food Campaign (Campanha Nacional de Alimentacao Escolar - CNAE). In general, however, these programs were limited in scope, with no explicit distributional content.

for example, was allocated to projects in the food sector. 1/ Owing to subsequent administrative and budgetary deficiencies, however, not one of the 27 projects was successfully completed, and 16 were abandoned completely. Despite this record of failure, the Kubitschek government continued to stress the need for greater food production and improved marketing facilities in its Target Program (Programa de Metas) of 1957-61. While the Target Program was generally biased towards industrialization, the attention paid to agriculture is probably traceable to a series of reports that appeared in the mid-1950s which identified an inadequate food supply as a potentially serious problem in urban areas. 2/ The accomplishments of the Target Program were far more positive than those of the SALTE Plan. In particular, significant gains were realized in the production of fertilizers, agricultural mechanization, and the construction of warehouses and silos. 3/

148. As impressive as these advances may have been, they did not prevent a second food supply crisis from occurring in 1962-63. 4/ The official reaction to this crisis was similar to that observed in the 1950s, that is, emphasis was placed on improving agricultural marketing infrastructure and on price controls. To these ends, a series of laws passed in 1963 established a federal supply system composed of the National Supply Superintendency (Superintendencia Nacional de Abastecimento - SUNAB), Brazilian Storage Company (Companhia Brasileira de Armazenamento - CIBRAZEM) and the Brazilian Food Company (Companhia Brasileira de Alimentacao - COBAL). However, in contrast to policies of the early 1950s, more attention was paid to increasing agricultural output. This latter goal was to be implemented largely through the expansion of subsidized credit and a revitalization of the price support program. 5/

149. The institutional framework and instruments adopted in the early 1960s have persisted more or less intact to the present day and have constituted a major part of Brazilian agricultural-food policy. Since the early 1970s, however, the agricultural sector has been increasingly viewed in terms of its potential contribution to the national balance of payments. While this goal was considered important by the writers of the Second National Development Plan (II Plano Nacional de Desenvolvimento - II PND) of 1975-79, it has since

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1/ SALTE is an acronym of the Portuguese words for health (saude), food (alimentacao), transportation (transporte) and energy (energia).

2/ See, for example, Comissao de Desenvolvimento Industrial, O Problema da Alimentacao no Brazil (Rio de Janeiro, 1954); and Joint Brazil-United States Economic Development Commission, The Economic Development of Brazil (Washington, D.C.: Institute of Inter-American Affairs, 1953), p. 24.

3/ See J.G. da Costa, Planejamento Economico Governamental: A Experiencia Brasileira (Rio de Janeiro: Fundacao Getulio Vargas, 1971), p. 175.

4/ A more detailed discussion of this crisis may be found in G.W. Smith, "Brazilian Agricultural Policy, 1950-1967," in H.S. Ellis (ed.), The Economy of Brazil (Berkeley: University of California Press, 1969), pp. 243-45.

5/ Of greatest importance in these areas was the establishment of a national rural credit system in 1965, and the adoption of pre-announced minimum prices (previously, the CFP had set support levels after crops were already planted).

been accorded even greater priority owing to rising petroleum prices, an uncertain demand for Brazilian manufactured exports, and a buoyant international market for products such as soybeans, cocoa and fruit juices. In order to prevent conflicts between policies to increase exchange earnings via agricultural exports and those aimed at assuring an adequate, and reasonably priced domestic food supply, the Brazilian government has generally adopted an "exportable surplus" strategy. That is, exports of agricultural products are prohibited (through export quotas) whenever it appears that the internal supply of a given food item might not be adequate (as in the case of rice in 1975) to satisfy the demand. This strategy has been complemented by a continuation of price controls on "first necessity" items (e.g., milk, bread, sugar, beef) and periodic recourse to foreign imports. Clearly these policies are intended to hold down food prices to consumers rather than foment production.

150. Whether the policies mentioned above have averted a trade-off between export promotion and nutrition is now being debated among Brazilian agriculture and nutrition specialists, and no real consensus has yet been reached. However, there is evidence to show that, despite price controls, internal food prices have been rising at a faster rate than the general index. Furthermore, the per capita supply and yields of some important food products have been stagnant or falling in recent years. Price and output data, by themselves, do not prove that official agriculture and food supply policies have been the principal cause of this unfavorable behavior. The data do strongly suggest, however, that some major components of the internal food supply (imports notwithstanding) are subject to inelasticities, and that the price increases provoked by these inelasticities may have had a negative nutritional impact.

151. The behavior of wholesale food prices relative to the general index is illustrated in Table 24. Here it may be noted that the former have increased, on the average, 3% faster per year than the latter during the 1970s. In fact, food prices have fallen relative to the overall inflation rate in only two years since 1969 (1974 and 1975). Over the whole 1969-77 period, real food prices have risen by about 20%.

152. To explore the possible consequences of these real price increases on the nutritional status of poverty groups, the price behavior of certain items important in the diets of poor persons was compared to average wages paid to unskilled construction workers (serventes). Reasoning that food price/wage relationships might differ between regions, calculations were made for both Sao Paulo (the largest urban center in the South) and Recife (the largest urban center in the Northeast). The products included were rice, beans, beef (second quality), and cassava flour since they (along with bread and sugar) form the basis of the low-income Brazilian diet. In both Sao Paulo and Recife, these four items accounted for about 40% of the calories and between 45-50% of the protein consumed by poor families as of the early 1970s. 1/ The results of this exercise are presented in Table 25.

1/ These percentages are based on the consumption patterns of families with incomes in the 1-2 minimum salaries range. The estimates for Sao Paulo are based on the 1971-72 FIPE survey as reported in J.L.T. Marques Vieira, "O Impacto da Renda no Estado Nutricional das Familias Paulistanas" (Sao Paulo: FIPE, 1976), mimeo. The Recife estimates are from a 1973 survey carried out by the Superintendency for the Development of the Northeast (SUDENE) and the University of Pernambuco (U.F.Pe): SUDENE/U.F.Pe, Abastecimento Alimentar no Nordeste Urbano: Grande Recife (Recife, 1975).

Table 24: WHOLESALE PRICES - GENERAL AND FOODSTUFFS, 1969-1977[a] (1969=100)

Years	(1) General	(2) Foods	(3)= (2)÷(1)
1969	100	100	1.00
1970	119	124	1.04
1971	145	159	1.10
1972	171	191	1.12
1973	197	220	1.12
1974	255	282	1.11
1975	325	346	1.06
1976	456	534	1.17
1977	641	767	1.20

a/ Yearly averages; products for domestic use.

Source: Conjuntura Economica (various issues),

Table 25: SAO PAULO AND RECIFE: NUMBER OF WORK HOURS NECESSARY TO PURCHASE ONE KILOGRAM OF RICE, BEANS, BEEF, AND CASSAVA FLOUR; 1969-1976[a/]

Year	Rice		Beans		Beef[b/]		Cassava Flour	
	Sao Paulo	Recife	Sao Paulo	Recife	Sao Paulo	Recife	Sao Paulo	Recife
1969	1.52	2.06	1.75	2.04	3.15	4.11	.66	1.26
1970	1.36	1.89	2.40	2.88	3.70	4.59	.71	1.66
1971	1.70	1.97	2.05	2.35	4.48	5.25	.97	1.80
1972	1.84	1.97	1.79	1.65	4.43	4.82	1.08	1.00
1973	1.68	1.84	2.98	3.35	5.26	6.03	.98	.89
1974	1.75	2.27	2.31	2.70	4.00	6.80	.87	1.15
1975	1.88	2.88	1.68	2.08	4.10	6.28	1.02	1.77
1976	1.30	2.28	1.93	2.80	3.95	5.00	1.46	1.98
1969/71-1974/76 (% change)	+7.2	+25.9	-4.8	+4.5	+6.3	+29.7	+43.6	+4.5

a/ Based on hourly wage of unskilled construction worker (servente).
b/ Second quality.

Sources: IBGE, Anuario Estatistico (various years) and Central Bank of Brazil for hourly wage rates; IBGE, Inquerito Nacional de Precos; Generos Alimenticios (various years) for retail food prices.

153. Several observations may be made on the basis of this table. First of all, it is clear that an unskilled construction worker in Sao Paulo is far better off than his counterpart in Recife in terms of the food he can purchase with his hourly wage. Secondly, it is also clear that there is considerable interregional variation in the behavior of food prices. Finally, and most importantly, it may be noted that the real prices of all four basic food items (with the exception of beans in Sao Paulo) rose between 1969-71 and 1974-76; in some cases by a substantial margin (e.g., rice and beef in Recife, cassava flour in Sao Paulo). This latter finding suggests that the nutritional status of urban unskilled laborers and their families may have deteriorated during the 1970s. It could, of course, be argued that poor families have the option of substituting products whose real prices are falling for those whose real prices are rising. While this may have occurred in some instances, the available data indicate that the dietary habits of the poor are quite rigid and have not changed appreciably over the past two decades. According to the early FGV study, poor urban families (with annual incomes in the one minimum wage range) in Sao Paulo and Pernambuco received almost exactly the same percentage of their total calorie and protein intakes from rice, beans, beef and cassava flour in 1960 as they did in the early 1970s. 1/ Of course, while the diets of the poor appear resistent to change, the poor at one point of time do not necessarily remain poor. The evidence suggests that dietary habits do change as incomes rise, though even the rich consume these four basic products.

154. Additional data indicate that the recent increases in the real prices of these food items are related to inadequate gains in production and productivity. 2/ With the major exception of wheat and to a much lesser extent powdered milk, recourse to imports of staple products to supplement the domestic food supply has been only sporadic. Imports of food (including wheat) averaged US$280 million or 3.1% of total goods imports over the period 1971-77. Though it is generally agreed that Brazilian agricultural statistics are deficient, the calculations presented in Table 26 are nonetheless suggestive. Despite

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1/ See FGV, Food Consumption in Brazil, op. cit.

2/ These examples are not meant to imply that stagnating output is a general characteristic of Brazilian agriculture. On the contrary, increases in the production of some crops have been extraordinary during the 1970s. Per capita outputs of wheat and soybeans (unadjusted for foreign trade), for example, rose by 24% and 512%, respectively, between 1969-71 and 1974-76. These crops are related to balance-of-payments considerations and thus qualify for a host of official price (in the case of wheat only--international prices for soybeans have been attractive to Brazilian producers), credit and fiscal incentives. Their remarkable performances in recent years attest to the ability of Brazilian agriculture to react quickly to favorable economic stimuli. Policies for wheat and soybeans (which generally are planted on the same land at different times of the year) are more fully discussed in R.M. Paiva et al, Brazil's Agricultural Sector (Sao Paulo, 1973), pp. 174-82.

Table 26: PER CAPITA PRODUCTION[a/] AND AVERAGE YIELDS OF RICE, BEANS, BEEF, AND CASSAVA; 1969-76

Year	Rice		Beans		Beef		Cassava	
	Prod. (kg.p.c.)	Yield (kg./ha.)	Prod. (kg.p.c.)	Yield (kg./ha.)	Prod. (kg.p.c.)	Yield[b/] (kg./an.)	Prod. (kg.p.c.)	Yield (kg./ha.)
1969	69.0	1,384	25.2	600	20.2	192	331.9	14,800
1970	70.4	1,517	24.7	635	19.8	192	316.5	14,553
1971	54.7	1,410	25.8	668	19.1	192	315.2	14,762
1972	62.2	1,491	28.3	659	20.5	193	302.2	14,762
1973	65.2	1,495	23.2	584	19.7	193	261.9	12,580
1974	61.7	1,557	22.4	521	20.3	200	237.2	12,309
1975	70.8	1,428	22.1	548	20.1	200	241.0	12,300
1976	86.1	1,451	18.3	483	20.2	200	240.2	12,698
1969/71-1974/76 (% change)	+12.7	+2.9	-20.4	-18.5	+2.5	+4.2	-25.4	-15.4

a/ Rice and bean production includes net imports; an accurate adjustment could not be made for beef owing to the noncomparability of production and foreign trade data; cassava is not generally imported or exported.

b/ Average carcass weight; 1969-71 data are 1961-65 average.

Sources: United Nations, Food and Agriculture Organization, FAO Production Yearbook (various years) for basic data on production and yields; population data are IBGE estimates.

annual fluctuations, the production (rice excepted) and yields of all four staple crops have tended to stagnate or decline since 1969-71. 1/ The reasons behind this behavior have not yet been adequately explained, but some preliminary studies by Brazilians argue that insufficient agricultural research and price controls have been important contributing factors.

155. J. Pastore (of FIPE), for example, argues that Brazilian research efforts have been overwhelmingly biased toward key export crops (using coffee, sugar and cotton as case studies) because (i) production is concentrated in only a few geographical areas (thus facilitating the formation of strong common-interest groups and close interaction between farmers and researchers); (ii) production is industrialized (thus requiring standards, periodicity and scale which demand technological improvements in the agricultural production process); (iii) technology transfer is possible. 2/ In the cases of several basic food crops (Pastore cites rice, beans and maize as examples) one or more of these factors is absent and thus research has generally been underdeveloped. 3/ With respect to rice and beans, Pastore cites evidence showing that average yields of the 1970s are actually lower than those of the 1930s. 4/ In another recent article, P. Rabello de Castro (Coordinator of Agricultural Information at the FGV) blames price controls for the recent unsatisfactory output performance of some food crops (citing

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1/ Though increases in the real price of cassava flour have probably caused some hardship to persons who rely upon this product for a large proportion of their total caloric intake (particularly the Northeastern poor), most surveys have shown cassava to be an "inferior good" (i.e., demand falls as income rises). Thus as per capita incomes rise in the future, stagnating production may not be associated with rising prices.

2/ J. Pastore, "Brazilian Agricultural Research: Export vs. Nutrition," Food Policy (August 1977), 217-27.

3/ Official recognition of this problem has resulted in the formulation of a national program (Diretriz Nacional para o Feijao) to increase the production and productivity of bean cultivations. This program will provide technical assistance and improved seeds to farmers, as well as credit, warehousing, and aid in selling the product. For greater details, see "Feijao tem Diretrizes para Plantio e Comercializacao," Planejamento and Desenvolvimento, 5:58 (1978), 18-31.

4/ According to FAO data, current rice yields in Brazil (1974-76) are 81% of the South American average (1,823 kg/ha) and 29% of the U.S. average (5,110 kg/ha). However, varying proportions of irrigated rice production (irrigated rice productivity is normally at least twice that of upland rice) in different countries make rice international productivity comparisons more than normally hazardous. More than two thirds of Brazilian rice production is upland rice.

beef, milk and beans. 1/ With respect to beef and milk, he argues that periods of price controls followed by periods of decontrol have increased the uncertainty of investments in the livestock sector, thus retarding the introduction of modern technology (e.g., genetic and nutritional improvements). In the case of beans, Rabello de Castro argues that the detrimental impacts of price controls are aggravated by the rudimentary nature of the production process, i.e., beans tend to be grown on small plots (often in association with another crop); and are not readily subject to mechanization. Thus, when price controls are instituted (as in 1976), small farmers have little chance to compensate for declines in their incomes via recourse to subsidized credit, either because they lack sufficient collateral or because the available credit is not sufficient to offset the risks inherent in any attempt to modernize the production process.

156. In sum, the recent Brazilian research reviewed here does suggest that government efforts to promote agricultural exports, as well as price controls, may to some extent have conflicted with efforts to assure an adequate domestic food supply. The issues remain controversial, however, and considerably more research is needed before firm conclusions can be reached. In any case, the survey data reviewed above indicate that even relatively poor people often spend less than half their income on food, and even the relatively well off do not always eat the foods they need to meet recommended nutritional standards. To the extent this remains the case, a better supply would not necessarily produce better nutrition.

The National Nutrition Program (PRONAN)

157. In contrast to general food production and marketing policies, specific nutrition programs of the mid-1970s reflect a growing concern with the distributional aspects of development. They also acknowledge the shortcomings of national agriculture policies which give preference to landholders producing crops for export, and the limited success so far achieved in establishing cooperatives and agricultural colonies. As mentioned previously, the principal new program in the nutrition area is PRONAN, first established in 1973, but restructured and upgraded in 1976. This program, administered by the National Food and Nutrition Institute (Instituto Nacional de Alimentacao e Nutricao - INAN) is to be in effect for the 1976-79 period with a budget of Cr$1.5 billion at 1975 prices. The World Bank is helping support PRONAN through INAN's Nutrition Research and Development Project (Loan 1302-BR signed in October 1976) which is discussed further in the next section of this annex. The two major stated objectives of PRONAN are to: (i) promote the direct purchase of foodstuffs utilized in the food supplement subprogram from small and medium producers in depressed regions, and (ii) promote real increments in the income of the whole population through lower food prices (the expected result of a greater food supply and lower intermediation costs). 2/

1/ P. Rabello de Castro, "Agropecuaria: Exame de Algumas Politicas de Producao e de Abastecimento," in D. Dias Carneiro (ed.), Brasil: Dilemas de Politica Economica (Rio de Janeiro: Editora Campus Ltda, 1977), pp. 153-76.

2/ E. de M. Kertesz, "Acao Interinstitucional e Intersetorial do PRONAN," Paper prepared for the VI National Health Conference, Brasilia, 3 August 1977 (mimeo), pp. 6-7.

158. But in practice, PRONAN combines the "shortcut" approach to alleviating malnutrition through provision of food supplements directly to "biologically vulnerable" target groups (i.e., pregnant and lactating women and preschool-aged children from low-income families) with a longer term approach aimed at improving the viability of small scale food production oriented agriculture in poorer regions. Official documents make it clear that the food supplement subprogram is only temporary and that the long-term social content of PRONAN lies in its attempt to redirect agricultural policy. This basic philosophy is further attested to by the program's emphasis on the distribution of food supplements in natura. 1/ Owing to its newness, it is probably premature to make an assessment of PRONAN. It is useful, however, to briefly describe its main subprograms and their interim accomplishments, and to discuss some of the factors likely to affect their eventual outcomes.

159. With reference to food supplements, that is direct interventions aimed at increasing food consumption among the nutritionally disadvantaged, the principal subprograms are the Nutrition in Health Program (Programa de Nutricao em Saude - PNS), the Nutrition in Metropolitan Areas Program (Programa de Nutricao em Areas Metropolitanas), the Worker's Food Program (Programa de Alimentacao do Trabalhador) and the School Nutrition Program (Programa de Nutricao Escolar). The latter two programs have been in effect (albeit in somewhat modified forms) for a number of years and do not appear to have received the same emphasis as the former two under PRONAN. Hence, they will not be discussed further here. 2/ 3/

160. As its name suggests, PNS integrates nutrition with maternal-infant health care programs: to qualify for food supplements beneficiaries must participate in the full range of health services (e.g., pre and postnatal examinations, immunizations, and health and hygiene education) offered by state governments. During 1976, over one million persons were assisted by the PNS; the majority residents of the Northeast. In the process, over 40,000 tons of food (powdered milk, sugar, corn meal, beans and starches) were distributed.

161. Roughly speaking, the supplements contain the following proportions of beneficiaries' recommended protein and energy requirements: pregnant

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1/ According to its proponents (principally the Ministry of Health, INAN and IPEA/IPLAN), the "natural foods approach" is more in tune with the nature of malnutrition (i.e., its quantitative origins) and more acceptable to target groups, provides greater direct benefits to small and medium rural producers, and is less costly than an approach based on the distribution of processed foods.

2/ For more details, see B.K.G. de Arruda, "Acao Interinstitucional e Intersetorial do PRONAN: Mecanismos de Aperfeicoamento" Paper prepared for the VI National Health Conference, Brasilia, August 3, 1977 (mimeo), pp. 18-19; 20-21.

3/ Most of paragraphs 159-164 and 168-171 are based on a study on social welfare programs in Brazil prepared by John Wells.

mothers: 45% and 33%, respectively; lactating mothers: 40% and 30%; children (6-11 months): 57% and 36%; and children (1-6 years): 46% and 33% (see Table 27). Because of intra-family redistribution, it is expected that these supplements actually make a smaller contribution to target group diets: in the case of pregnant (17% and 17%) and lactating (21% and 21%) mothers, the supplement corresponds only to the additional energy and protein requirements arising out of pregnancy and breast-feeding; in the case of pre-school children (26% and 25%), the supplement corresponds only to energy and protein requirements which arise from growth. The actual content of the supplement has changed somewhat: for example, beans could not be introduced in 1976 because of local supply difficulties and rising prices, and powdered milk has been withdrawn from mothers during 1978 for similar reasons.

Table 27: DAILY PER CAPITA QUANTITIES OF FOOD DISTRIBUTED THROUGH THE NUTRITION IN HEALTH PROGRAM IN 1976 AND 1978
(grams)

1976	Milk	Sugar	Corn	Beans	Corn Grits (Fecula de Milho)	Protein g	Protein % of Requirements	Calories Cal.	Calories % of Requirements /a
Pregnant Mothers	17	67	67	67	-	27	45	792	33
Lactating Mothers	17	67	67	67	-	27	40	792	30
Children									
6-11 Months	34	34	-	-	17	12	57	308	36
1-6 Years	17	67	34	17	-	13	46	498	33

1978 (Northeast)	Milk	Sugar	Corn	Beans	Rice	Manioc Flour
Pregnant Mothers	-	34	34	67	67	67
Lactating Mothers	-	34	34	67	67	67
Children						
6-11 Months	34	67	-	-	-	-
1-3 Years	17	34	34	34	67	-
4-6 Years	-	34	34	34	67	-

/a As defined by PNS.

Source: INAN

162. The final distribution system of the PNS is based on state government networks of health posts and on infrastructure provided by philanthropic organizations, etc. COBAL is reponsible for purchases and transportation and CIBRAZEM for storage. So far as possible, food is acquired locally (in line with the longer run aims of the program), though this has apparently not always been so, and it is admitted that coordination between the various agencies has not been perfect. While INAN has made some transfers to state governments to finance infrastructural costs (these have represented about 10% of the total program costs, the rapid growth of the delivery system has been achieved mainly through the more intensive utilization of existing (human and equipment) resources. Thus, it is doubtful whether the number of beneficiaries can continue to expand without a discontinuous increase in fixed costs.

163. The coverage of the program has increased extremely rapidly since its introduction in 1975 (see Tables 28 and 29). By the end of 1977, there were 1.8 million individual beneficiaries, principally concentrated in the urban and rural Northeast, and this is expected to increase to 2.6 million by the end of 1978. So far, there are no data evaluating the impact of the program, though it is understood these are being carried out.

Table 28: NUMBER OF NUTRTITION IN HEALTH PROGRAM BENEFICIARIES AT END OF YEAR, 1975-1977 ACTUAL, 1978 PROJECTED

	Pregnant Women	Lactating Women	Babies 6 Months-1 Year	Children 1-6 Years	Total
1975	n.a.	n.a.	n.a.	n.a.	252,062
1976	219,114	71,893	71,892	703,819	1,066,718
1977	373,636	128,549	130,796	1,172,019	1,805,000
1978	511,114	243,400	243,400	1,582,100	2,580,014

Source: INAN

Table 29: VOLUME OF FOOD DISTRIBUTED UNDER THE NUTRITION IN HEALTH PROGRAM, 1975-1977 ACTUAL, 1978 PROJECTED
(Metric tons)

	Manioc Flour	Milk	Sugar	Corn Flour	Corn Grits (Fecula de Milho)	Rice	Beans
1975	-	3,200	1,590	310	210	-	-
1976	-	3,950	14,100	9,200	181	6,484	-
1977	1,100	5,982	16,000	14,600	-	30,100	6,400
1978	7,092	6,372	23,856	21,480	-	44,040	23,076

Source: INAN

Table 30: EXPENDITURE OF NUTRITION IN HEALTH PROGRAM 1975-1977, BUDGETED 1978
(Current prices)

	Food Costs (Including Transportation)	Administrative Costs	Total	Cost Per Beneficiary Per Day (Cr$)
	(Cr$ Million)			
1975	79.0	12.0	91.0	1.35
1976	181.0	21.0	202.0	0.64
1977	523.0	31.0	554.0	
1978	-	-	832.0	

Source: INAN

164. PNS is a relatively low cost program; its budget for 1978 (see Table 30) is Cr$832 million (US$50 million) and yet it is designed to provide food supplements for more than 2 million people. The average cost per capita per day was about Cr$1.20 (or about US$.07) in mid 1978. The program, through its provision of low-cost calories, is addressed to the principal source of dietary inadequacy (namely insufficient calories). But some of the food distributed may not reach the persons for whom it was intended, even within the target family, (dilution) or replace food which would have been purchased anyway (substitution). Dilution may in fact be a positive phenomenon if the food reaches even more needy beneficiaries than the intended recipients. Likewise substitution may be considered beneficial if it allows a more balanced diet than provided by a limited number of foods provided in a supplement. Such phenomena affect all food supplement programs. In the absence of any

data on program evaluation for PNS as a whole, it is difficult to assess the significance of either for PNS. It is reported that PNS suffers from management problems, particularly in the delivery system to the health posts and the lack of an effective evaluation system. When food fails to arrive at the health posts in sufficient quantity or quality, this may cause participants to drop out of the program. As a preliminary evaluation, it can be said: (i) that the program is a step forward; (ii) that the increase in coverage has been remarkably rapid; and (iii) that any extension of the program is likely to require greatly increased funding to meet the infrastructure needs of an expanded delivery system as well as the recurring costs of the supplements themselves.

165. While there has been no overall evaluation of the PNS program to date, under the INAN/IBRD Nutrition Research and Development Project 2,500 urban families from poor districts of Recife and 2,500 families from a rural area in the sugar zone of Pernambuco enrolled in the PNS program serve as control groups for an experiment (called The Integrated Program for Nutrition and Health) 1/ designed to test alternative levels of subsidization of basic food purchases (rice, cornmeal, beans, and dried milk) by an additional 10,000 families in Recife. Subsidies equivalent to 30%, 45%, and 60% of the market price are being tested. One of the 45% subsidy groups has compulsory participation in health services similar to that of the PNS. Clinical and anthropometric data for the target population are being collected and food consumption surveys conducted. Evaluation will seek to determine changes in nutritional status of children in free versus different degrees of subsidized food distribution, voluntary versus compulsory participation in health services, and the relationship between the costs and benefits of alternative nutrition intervention models.

166. The two PNS groups have been in operation only since late 1978 and subsidized purchase groups for only about one year more. Therefore, only a few partial results are available for the subsidized purchase groups only. From the limited baseline data it is clear that both infant mortality and cases of severe malnutrition are highest in those groups with poor access to water and sewerage facilities. Problems which are purported to be decreasing participation throughout the projects are the distance to the COBAL markets and buying habits of the beneficiaries in the subsidized purchase programs. The food must be bought in three specific supermarkets once every two weeks. Most low income people prefer to buy more often in smaller amounts (thus paying less at one time) at small markets where they can receive credit when they lack cash. The highest participation rates as of September 1978 were, not unexpectedly, for the 60% subsidy (86% of the families enrolled), followed, more surprisingly, by the 45% subsidy without compulsory health care (60%), the 30% subsidy (56%) and the 45% subsidy with compulsory health care (50%). This suggests that the population may question the value of benefits received from the health care compared to its costs in time and transportation to the health centers. But more families participate on a discontinuous basis than

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1/ Programa Integrado de Nutricao e Saude - PINS.

at any given point in time -- in part due to problems of cash flow and time availability.

167. An initial survey of a sample of 300 families participating in the 60% subsidy and the two 45% subsidy programs after they had been in operation six months showed that almost half had increased their purchase of other food items not previously consumed prior to receiving the subsidy. Of the four subsidized items, the most popular by far was dried milk, with 83% of those mentioning a specific product saying they have increased their consumption of this item the most. The least popular by far was cornmeal, with only 4%. 92% of the full 300 families said that family food intake had improved because of the program. 26% of the full sample said the subsidy program helped them to purchase non-food items, and of the 23% mentioning specific items, 42% mentioned purchases of clothing, 22% household furnishings including appliances, and 16% health expenditures. Hence some substitution is apparently taking place. Between 2% and 3% of the 300 families interviewed mentioned giving part of their purchases of one or more of the subsidized products to neighbors or relatives they considered even less fortunate than themselves, thus some dilution to outside the target families, apparently of a positive sort, has been taking place. Less than 1% said they resold the subsidized food. Of 244 families mentioning other food items which they would like to see subsidized, 84% mentioned sugar, 55% coffee, 57% fresh or dried meat, and 36% flour. 1/

168. The Nutrition in Metropolitan Areas Program is the joint responsibility of INAN and the Ministry of Welfare and Social Security. In mid 1978 213,000 residents of Belem, Recife and Salvador were receiving food supplements through a PNS-type delivery system. However, misgivings about the "natural foods approach" within the MPAS have resulted in the establishment of a somewhat different program in the cities of Rio de Janeiro, Belo Horizonte and Brasilia. In these locations, the MPAS (through the Brazilian Assistance Legion - Legiao Brasileira de Assistencia - LBA) is distributing special instant foods developed at the University of Campinas. This program was initiated in October 1977 in Rio de Janeiro (Baixada Fluminense) and was expected to reach 450,000 pregnant and lactating women and children three years of age and under within a year. But in Rio de Janeiro alone there were already over 500,000 beneficiaries after only six months of operation.

169. Under the LBA program pregnant and lactating mothers receive a fortified soup powder, consisting principally of dextrose, dried milk, corn flour, dried eggs, soya, minerals, and vitamins. The soup is designed to provide 445 calories a day (about 18% of requirements). Young babies (3-12

1/ All of these results on participant's evaluation of the subsidy program are taken from Constance Clark, "Avaliacao do PINS pela Populacao Beneficiada, Depois de um Semestre do Programa" in Clovis Cavalcanti et al, "Avaliacao Socio-Economica do Projeto Integrado de Nutricao e Saude e do Programa de Nutricao e Saude em Pernambuco: I Relatorio Parcial (Recife: INJPS-FESP-INAN, December 1978).

months) receive a dried milk mixture, fortified by soya, rice flour, dextrose, and saccharin. This preparation is to be made up in a bottle and provides 445 calories per day (about 50% of requirements). Mothers are also encouraged to continue breast feeding. Finally, young children (12-36 months) receive a strawberry flavored milkshake drink in powdered form. It consists principally of powdered milk, dextrose, soya, powdered rice, vitamins, and minerals, and contains 424 calories (about 30% of requirements). Critics of the MPAS/LBA approach assert that the cost of these processed instant foods, distributed in individual waterproof packets, are much higher per calorie of energy and gram of protein than the natural food supplements provided by INAN.

170. An initial evaluation of the LBA program was underway in mid 1978. Preliminary data suggest that no more than 10% of the initial recipients fail to present themselves to receive food suplements on a regular basis. Critics of the natural foods approach charge that natural food supplements are particularly subject to dilution and substitution problems. But preliminary evidence from the LBA program suggests that it too has been subject to dilution, though (as in the case of PNS) supervisors thought family incomes of target groups were too low to make substitution a problem. The cost effectiveness and acceptability by target groups of processed instant foods as compared with natural foods remains to be established.

171. On the production side, the most important subprogram of PRONAN is the Food Production in the Northeast Program (Programa de Producao de Alimentos no Nordeste) which is administered by the Brazilian Technical Assistance and Rural Extension Enterprise (Empresa Brasileira de Assistencia Tecnica e Extensao Rural - EMBRATER) and funded by INAN. The principal objective of this subprogram is to assist small farmers to: (i) increase productivity; (ii) expand the area under cultivation; and (iii) improve the marketing system. Health and nutrition assistance is another aspect of this subprogram. During 1976, 3,900 families, from eight northeastern states, were selected to participate. By 1978 31,000 farmers cultivating 90,000 hectares were participating in the program. While the Food Production in the Northeast Program has only recently entered the operational stage, its preliminary results are encouraging. In the state of Alagoas, for example, participating farmers report increases in the outputs of corn and beans of 30% over 1974 levels (1975 was a drought year with abnormally low agricultural production). Significant declines in the incidence of second and third degree malnutrition among preschool-aged children of assisted farm families are also reported.

172. A similar program is being implemented in 12 municipios of Sergipe as part of the INAN/IBRD Nutrition Research and Development Project. This program is being administered by EMBRATER (and its counterpart at the state level, EMATER-SE) and, as of mid-1978, had enrolled 4,900 farm families organized in 322 farmer groups. Accomplishments to date include training courses for farmers and health aides, distribution of improved seeds, construction of 30 health posts involving substantial community self-help, and the concession of some US$3.7 million of agricultural credit. Over 3,000 producers benefited from the credit in 1978. An important feature of the Sergipe project is its use of the Anticipated Production Purchase (Compra Antecipada

da Producao - CAP) which assures financing of 60% of a given farmer's estimated production. In contrast to usual rural credit lines, the CAP requires no collateral other than potential output (as determined by EMATER-SE) and is thus available to those holding no title to their land (e.g., tenants, sharecroppers, squatters). During 1977, in those municipios where the CAP was utilized, the area cultivated doubled as compared to the two previous years.

173. Large fluctuations in weather conditions in the two years since the project became effective prevent drawing any definitive conclusions concerning its success in improving crop yields and the nutritional status of the intended beneficiaries despite the existence of a sophisticated evaluation component. Evaluators have noted that supervision and supply of the health posts by the state and federal health systems is deficient, confirming the experience reported for the PIASS program. Insufficient inter-agency coordination of the health, agriculture (including extension, credit, and marketing), and education components of the project has also been noted.

D. Current Policy Issues and Research Possibilities

174. In the previous section a number of nutrition or nutrition-related policy issues were touched upon and some policy-relevant research was reviewed. In this section the objective is to define more explicitly some important policy issues and research fields. Particular attention is given to the research possibilities opened up by PRONAN (including the IBRD/INAN Nutrition Research and Development Project) and the impressive data base being established by ENDEF. Both policy issues and research possibilities are reviewed within the framework set forth in Table 23--that is, food production, marketing, and consumption are discussed sequentially despite the numerous interactions between these links in the food chain.

Production and Marketing

175. Three major areas for policy related research are discussed briefly below: the costs and benefits and the distribution of these among socio-economic groups of present agricultural production and marketing policies, the costs and benefits of promoting agricultural development in the Northeast compared to stimulating out-migration from this region to the Frontier, and land reform. These subjects will not be treated in depth here, since the principal focus of this report is on consumption. But before moving on to specific issues, some general comments on agricultural policies and their effects on nutrition are in order. 1/

1/ Paragraphs 176-182 draw on a draft paper by Schlomo Reutlinger entitled "Agricultural Policies and Their Effect on Nutrition" (Xerox, September 22, 1978).

176. Agricultural policy can affect the nutritional status of the population in several major ways: it can affect the supply price of food consumed by the malnourished population, it can affect the fiscal burden to a government that is subsidizing the price of food to consumers, and it can affect the income of large numbers of people in the undernourished population. Any determination of the nutritional impact of agricultural policies should ultimately take into consideration all of these possible effects.

177. The link between changes in agricultural production in general, and of food production in particular, and the prevalence of calorie deficient diets in a country's population is far from straightforward. All too often, a positive nutrition effect of expansion in food production is simply taken for granted. The danger in governments adopting this view is severalfold. It delays any positive response to the problem until present constraints on food production can be effectively removed. It diverts attention from non-production oriented remedies. And most importantly, it prevents proper discrimination between the kind of agricultural policies which have nutritional benefits and those which have little or even negative nutritional consequences.

178. The first condition for analyzing the nutritional consequences of agricultural production policies is to achieve an understanding of which people in the general population of a country are undernourished, of what they eat, and how their consumption patterns change when food prices, incomes, and perhaps other key elements in their environment change. Only then is it possible to understand how changes in agricultural production patterns through their effect on the incomes of relevant groups and on the supply of relevant foods influences the achievement of national nutritional goals. These questions are discussed further below in the section on consumption.

179. The most cost-effective way for promoting calorie-adequate diets may be to decrease the price of selected basic foods accounting for a large share of poor people's expenditures. The ENDEF data provide a detailed nationwide view of expenditure patterns by expenditure levels. Once the publication of these data has been completed, a broad range of research can be accomplished even without access to the raw data. Some preliminary findings based on the data from three of the seven ENDEF regions were reported in the section on the extent of malnutrition. Table 31 shows how families in the same expenditure brackets as the 20th percentile families spend their food budgets on 16 of the 52 items for which data have been published in each of 12 ENDEF subregions. 1/ These 16 categories include from 63% to 75% of total food expenditure. With the exception of wheat-based products (bread and pasta which are much more important in urban than in rural areas), virtually the entire supply of such basic foods is obtained from domestic production. One such food, for instance, is cassava flour. In the rural Northeast and

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1/ Monetary and non-monetary current expenditure. Capital expenditure is only about 1 to 2% of total expenditure in families at this level of expenditure. The detailed food expenditure data are not available together with total expenditures, but only total current expenditure. The data are from Table 11 of the ENDEF expenditure volumes.

Table 31. AVERAGE ANNUAL EXPENDITURES ON 16 BASIC FOODS BY FAMILIES IN THE ENDEF CURRENT EXPENDITURE BRACKETS CONTAINING THE 20TH PERCENTILE FOR 12 ENDEF SUBREGIONS, 1974/75[a]
(Cr$ of August 1974 and percentages of total food expenditure)

	Northeast										Rio de Janeiro State						South[b]							
	Metropolitan Salvador		Metropolitan Recife		Metropolitan Fortaleza		Other urban		Rural		Metropolitan Rio de Janeiro		Other urban		Rural		Metropolitan Porto Alegre		Metropolitan Curitiba		Other urban		Rural	
Percentiles included in bracket	19-28		19-29		11-25		19-37		9-21		10-31		17-44		13-47		7-27		11-35		16-40		6-32	
	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%	Cr$	%
Total food expenditure	4,668	100.0	3,945	100.0	3,250	100.0	3,313	100.0	1,957	100.0	5,291	100.0	5,594	100.0	4,121	100.0	5,197	100.0	5,148	100.0	5,648	100.0	4,201	100.0
Type of food																								
Rice	129	2.8	104	2.6	168	5.2	241	7.3	122	6.2	569	10.8	663	11.9	478	11.6	465	8.9	606	11.8	571	10.1	592	14.1
Bread and biscuits	541	11.6	525	13.3	275	8.5	250	7.5	47	2.4	341	17.4	353	6.3	119	2.9	332	6.4	299	5.8	321	5.7	89	2.1
Pasta (spaghetti etc.)	34	0.7	84	2.1	45	1.4	24	0.7	3	0.2	104	5.3	150	2.7	124	3.0	97	1.9	145	2.8	151	2.7	74	1.8
Maize	23	0.5	68	1.7	28	0.9	62	1.9	122	6.2	35	1.8	66	1.2	144	3.5	21	0.4	70	1.4	54	1.0	158	3.8
White potatoes	19	0.4	14	0.4	3	0.1	4	0.1	-	-	93	4.8	94	1.7	47	1.1	127	2.4	171	3.3	153	2.7	110	2.6
Cassava flour	211	4.5	216	5.5	165	5.1	237	7.2	265	13.5	29	1.5	60	0.1	126	3.1	4	0.3	4	0.1	22	0.4	35	0.8
Sugar[c]	129	2.8	148	3.8	151	4.6	130	3.9	86	4.4	142	7.3	240	4.3	244	5.9	174	3.3	158	3.1	231	4.1	201	4.8
Dried beans	235	5.0	217	5.5	318	9.8	273	8.2	309	15.8	319	16.3	357	6.4	383	9.3	244	4.7	307	6.0	328	5.8	435	10.4
Beef	1,025	22.0	608	15.4	251	7.7	410	12.4	162	8.3	670	34.2	476	8.5	285	6.9	754	14.5	547	10.6	611	10.8	166	4.0
Chicken	149	3.2	242	6.1	104	3.2	87	2.6	47	2.4	213	10.9	209	3.7	122	3.0	246	4.7	265	5.1	262	4.6	168	4.0
Pork	72	1.5	46	1.2	87	2.7	161	4.9	97	5.0	102	5.2	185	3.3	126	3.1	41	0.1	102	2.0	138	2.4	156	3.7
Eggs	84	1.8	80	2.0	76	2.3	55	1.7	20	1.0	118	6.0	144	2.6	88	2.1	130	2.5	122	2.4	125	2.2	94	2.2
Milk[d]	178	3.8	186	4.7	194	6.0	134	4.0	69	3.5	206	10.5	211	3.8	169	4.1	298	5.7	205	4.0	257	4.6	149	3.5
Cooking oils	92	2.0	57	1.4	81	2.5	55	1.7	20	1.0	192	9.8	163	2.9	84	2.0	211	4.1	201	3.9	216	3.8	105	2.5
Pork lard	6	0.1	1	-	10	0.3	18	0.5	8	0.4	93	4.8	194	3.5	318	7.7	113	2.2	131	2.5	183	3.2	367	8.7
Coffee, mate, tea, etc.	216	4.6	203	5.1	104	3.2	181	5.5	124	6.3	212	10.8	277	5.0	268	6.5	266	5.1	291	5.7	280	5.0	239	5.7
Subtotal	3,143	67.3	2,799	71.0	2,060	63.4	2,322	70.1	1,501	76.7	3,438	65.0	3,842	68.7	3,125	75.8	3,523	67.8	3,624	70.4	3,903	69.1	3,138	74.7
Rice, Maize, cassava flour and beans	598	12.8	605	15.3	679	20.9	813	24.5	818	41.8	952	48.6	1,146	20.5	1,131	27.4	734	14.1	1,141	22.0	975	17.3	1,220	29.0

a/ Monetary and non-monetary current expenditure.
b/ States of Parana, Santa Catarina, and Rio Grande do Sul.
c/ Crystal and refined sugar.
d/ Fresh, pasteurized, and processed.

Source: IBGE, Estudo Nacional da Despesa Familiar: Despesas das Familias; Dados Preliminares, volumes for Regions I, III, and V (Rio de Janeiro: IBGE, 1978), Table 11.

metropolitan Recife, respectively, cassava flour accounts for about 35% and 16% of calories consumed by families in the ENDEF expenditure brackets including the 20th percentiles of the family total expenditure distribution 1/ and on the order of 14% and 6% of total food expenditures (monetary and non-monetary) of these same families. While even a large decrease in the price of such foods may not lead to much of an increase in their consumption, the savings realized by the poor household could lead to significantly higher consumption levels of other foods.

180. A strategy consisting of a series of interventions leading to a reduction in the cost of producing and processing only four staples of the Brazilian diet--rice, cassava, beans and maize--which are grown by almost all small farmers (and these are themselves usually among the poor) would affect foods which account for roughly 1/3 of expenditures for food in rural areas and 1/5 in urban areas for families at about the 20th percentile in the expenditure distribution, according to published ENDEF data (see Table 31). But the proportion of the calories consumed by these same families which are derived from these four commodities is at least twice as high. Such a strategy could trigger an agricultural development process with significant nutritional benefits. In addition to providing for increases in the supply of these foods, demand would also be generated for other foods with higher income elasticities. Such a strategy could trigger an agricultural development process with significant nutritional benefits. In addition to providing for increases in the supply of these foods, demand would also be generated for other foods with higher income elasticities. Such a strategy is implicit in several PRONAN subprograms dealing with production, marketing, food processing technology, and food distribution. Hence, careful monitoring and evaluation of the PRONAN experience should be most helpful in planning future Brazilian nutrition programs.

181. Whatever means are used to reduce the price of "target" foods to consumers, care must be taken to assure supplies adequate to meet the demand for these foods at the reduced price. That is, it must be assured that production is profitable for farmers. One way to accomplish this is for the government to procure the entire crop at a price high enough to secure the supply and resell it to consumers at a reduced price. Separation of producer and consumer prices is current practice in Brazil for wheat (where the domestic producer price is set well above the price of imports, while the price to mills is set near or below the import price) and sugar (which is also an export product--the domestic price is set sometimes above and sometimes below the import price). Aside from the difficult fiscal burden which may be involved (this is clearly the case for wheat), it may be difficult to administer such a scheme on a national scale, especially for products which do not require centralized and relatively easily monitored processing facilities, such as wheat and sugar. Cassava and beans, both basic foods, fit in this category. Rice, also a basic food, might be a counterexample.

1/ These are rough estimates based on average prices paid for roots and tubers in these subregions. About 93% and 59% of the total expenditures in this category were for cassava flour and cassava in the rural Northeast and Recife respectively according to the ENDEF data.

182. In many cases, the only feasible way for implementing a cheap food policy may be to reduce the cost of producing these foods to farmers. Obviously, every effort should be made to develop and extend improved production techniques. Again, PRONAN is clearly working in this direction. Subsidized inputs and credit for the production of basic foods may help attack the problem if satisfactory assurance can be obtained that these are used in the production of the designated foods. The pitfalls of subsidized credit, which has been used extensively in Brazil (more often for agricultural products other than basic foods) and which has in the past benefited mostly large commercial farms, are well known. There is a tendency for such credit to be diverted to non-agricultural uses either directly or by replacing other sources of operating and investment capital available to large farmers. An alternative approach is to pay direct compensation to farmers for each hectare planted to the designated foods. None of these instruments are problem free. But if the provision of one or several particular foods at a price much below its cost of production proves to be extremely effective in making the diets of all groups in the population nutritionally adequate, the benefits may far exceed the costs of even imperfectly administered policy instruments.

183. An area in which economic research is badly needed is in examining the costs and benefits, and the distribution of these costs and benefits among different socio-economic groups, of the present agricultural production and marketing policies. All of the major categories shown in the first two sections of Table 23 warrant study, but particular emphasis should be given to research on the expansion and subsidization of agricultural credit that has taken place, the granting of fiscal incentives, the separation of producer and consumer prices for some products, and the expansion of the research and extension system. These are the policies which have had the greatest budgetary (fiscal and monetary) costs or possibly involve significant amounts of foregone government revenue and can clearly be linked to agricultural production and marketing (unlike transportation system improvements, for example). In view of the present debate in Brazil on export-oriented agriculture and its effects on the nutritional status of the population, the studies should give attention to specific agricultural products. The following groups could be distinguished:

Basic Foods Produced Primarily for the Domestic Market	Food and Beverage Crops Important in Brazil's Foreign Trade but Also in Brazilian Diets	Industrial Crops or Crops Not Important in the Brazilian Diets
Rice	Soybeans	Cocoa
Cassava	Wheat	Citrus
Beans	Sugar	Cotton
Maize	Coffee	Rubber
Beef		
Pork		
Poultry		
Eggs		
Milk		

184. Soybeans are important in Brazilian diets as a source of cooking oil and a component in feeds for livestock (especially poultry for meat and eggs) rather than for direct human consumption, but the potential exists. Experiments are being conducted in fortifying processed foods with soybean derivatives as in the case of the Nutrition in Metropolitan Areas program administered by the MPAS and LBA mentioned above, and "soy-milk", which is widely used in the United States, also offers possibilities. Wheat is an import substitute involving large amounts of subsidized credit, producer prices well above the price of imports, and subsidized prices to consumers. Wheat products are also an important expenditure item and source of calories for the urban poor (see Table 31), perhaps substituting for other sources of calories more easily produced in Brazil. Coffee consumption is a well-ingrained habit even among the poor and accounts for about 5% of food expenditures of families at about the 20th percentile of the expenditure distributions in 12 subregions for which detailed ENDEF data is available. Sugar is generally the cheapest source of calories for these same families and typically accounts for 3 to 5% of their food expenditures. Thus, while these products are important in international trade, they also play critical roles in the diets of the poor in Brazil.

185. A second area which needs study is the relative costs and benefits and their distribution among socioeconomic groups of expanding agricultural production within the rural Northeast (as is done in parts of PRONAN and the POLONORDESTE integrated rural development projects) on one hand and promoting out-migration to the Frontier to open up new lands on the other. The costs and benefits of varying degrees of direction for the migration and settlement process (spontaneous, guided, fully planned, etc.) should be part of this research.

186. Finally, the nutritional implications of land reform, particularly in the Northeast, should be examined with the help of data accumulated by PRONAN, the ENDEF studies, and the sophisticated model of agricultural production in the Northeast developed by researchers from the World Bank and SUDENE. But study of the nutritional implications of land reform should also include studies of alternative strategies for financing and implementing the reform, including the forms of organizing production (smallholders, production cooperatives, etc.).

Consumption

187. The major issues which should be resolved before a comprehensive attempt to meet the basic nutrition needs of the Brazilian population is made are essentially two: first, how should basic needs be defined, and second, what kinds of programs would be most effective in achieving this objective.

188. First, there is the physiological question--how should basic needs be defined if "normal" human development is the objective? Since, in general, Brazilian data shows that needs for proteins are almost always met if calorie requirements are satisfied, and missing vitamins and minerals may be provided very cheaply as supplements, the problem may be simplified by discussing calories alone.

189. As was discussed above (paragraphs 79-82), in the preliminary food consumption volumes of the ENDEF requirements are defined in a way which may bias them downward compared to requirements for a healthy population. In this

report two alternative definitions of requirements were provided using the FAO/WHO estimation technique. The FAO/WHO Low and High requirements differ only with regard to the weights assumed for the "reference" adults and consequently the entire population aged 13 and above since fixed coefficients are used to convert requirements for the reference adults into those for teenagers and older adults. The FAO/WHO Low requirements were based on the median observed weights of adults in their twenties in Brazil after trimming an estimate of the severely underweight and the obese from the distributions, 1/ and the latter assume that healthy young Brazilian adults would weigh the same as the FAO/WHO international standard "reference" adults. For estimating long term needs for the simulations (section E below) and in order to estimate requirements in a way which if anything overstates needs today slightly, the FAO/WHO Low standards have been used in this report to calculate the magnitude of calorie deficits and the size of the population groups which have deficits. In estimating the number of children who suffer from varying degrees of malnutrition, the assumption has been that well-nourished Brazilians would have an age/weight distribution like that of the FAO/WHO standard, which is based on healthy U.S. children in the 1930s. The discussion has indicated in all cases that these standards may be slightly on the high side, though probably not by much.

190. The ENDEF data show that only 42% of Brazilian children under age 18 have weights above 90% of the median of the FAO/WHO standard weight for their age and sex, and that only about 33% of the entire population meets their full FAO/WHO Low calorie requirements. These estimates appear consistent, since the calorie adequacy measure for the entire population is based on full requirements for estimated Brazilian standard weights while weight for "adequately nourished" children was defined as only 90% of the standard. The dietary habits revealed by the ENDEF data suggest that many low and even moderate income Brazilians do not consider meeting calorie requirements as important as consuming various kinds of meat (especially beef); drinking coffee, beer, and soft drinks; smoking; and purchasing consumer durables. But this evidence is based on averages rather than an analysis of individual observations which is in principle possible if the full ENDEF data set were utilized. In order to establish the facts more firmly, it would be helpful to (a) base the analysis of the extent to which calorie requirements are met on both physical consumption and expenditure data at the finest possible breakdown of food categories and either using smaller expenditure brackets or treating expenditure as a continuous independent variable in multivariate analysis and (b) determine whether those families which do not meet their requirements using the reestimated calorie consumption data are also families which devote significant proportions of their expenditure to meat, coffee, soft drinks, beer, tobacco products, consumer durables, etc.

191. Assuming that this analysis still shows that large numbers of Brazilian families prefer to consume relatively expensive foods, beverages, tobacco, and even consumer durables rather than meet their calorie requirements, at least two important issues must be faced. The first is whether even the FAO/WHO Low requirements may be too high for the current Brazilian population, particularly in the warmer Northeast and Frontier regions, since the current FAO/WHO guidelines recommend that no adjustment be made for temperature. The whole issue of calorie requirements is controversial and could benefit from

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1/ See footnote 2, page 48 and Section (1) of Appendix A of this annex.

further study, including alternative definitions of requirements based on the ENDEF primary data. The second issue is whether an effort should be made to try to change these consumption habits. There is no doubt that any kind of program to reduce or eliminate malnutrition will be cheaper the more the population is willing to increase their calorie intake before satisfying other tastes. The issue, then, is one of tastes and preferences. How much public intervention in the formation of dietary habits is acceptable is clearly a political question, but it may have important economic consequences. Even without any other nutrition intervention or any further growth in incomes, both of which are clearly needed, the nutritional status of the Brazilian population might be significantly improved (assuming supply is not the problem) by modifying the way Brazilian families spend their incomes, even if the amount spent on food is not increased.

192. For example, unpublished ENDEF data shows that the families at the 20th percentile of the ENDEF total family expenditure distribution in Recife in 1974/75 spent 29.1% of its food budget on meats and fish and 7.3% on beverages other than milk (mostly coffee) consumed at home. The per capita calorie consumption may be estimated at only 1,571 calories per capita (598 calories below the FAO/WHO Low calorie requirements). With a deficit this severe, it is likely that much protein consumed in the form of meat and fish will be transformed into energy rather than building body tissue. If instead of meat, fish, and beverages other than milk, the same amount of money which was spent on these foods had been spent on the average mix of cereals and cereal derivatives consumed in Recife by the same 20th percentile families (mostly rice, and bread) family calorie consumption would rise by 27.3%. If it were spent on roots and tubers (mostly cassava flour), calorie consumption would rise by 48.6%. The latter substitution would bring per capita consumption to 162 calories above the FAO/WHO Low requirements for these families. The former would bring per capita calorie consumption to 173 calories below the FAC/WHO Low requirements. These examples are purely illustrative and are not intended to suggest recommended diets. They merely illustrate that there are very significant differences in the price of calories from different sources and that consumer preferences must be very strong to overcome these price differentials. Certainly, variety and tastefulness are valued by the poor as well as the rich, and even if the nutritional consequences of not meeting calorie requirements are known by the poor, they may prefer to allocate a significant proportion of their expenditures to tasteful and expensive as opposed to calorie-intensive and cheap foods. The issue is an important one and should be faced by the Government, which through PRONAN has shown that it is determined to try to improve the nutritional status of the Brazilian population.

193. Whatever effects nutrition education might have in the long run, for the near to medium term the dietary habits of the population must be considered relatively fixed. Even with rapid per capita income growth the calorie deficit population is still likely to be on the order of 20% of the total by the year 2000 if the relative income distribution and consumption habits do not change over this period (see section E below for simulation results). There is clearly a need for research on the full body of ENDEF data, once it is available, to specify more precisely the relationships between income and nutrition and allow a more accurate quantification of Brazil's "nutrition gap." But the key operational problems center on designing nutrition interventions which are both socially acceptable and cost effective.

194. At the consumption end of the food chain there are three basic types of nutrition interventions other than those designed to change consumption habits. They are income transfers to target groups (which appear not to be efficient in the Brazilian context for reasons given above and are not being tried by PRONAN), subsidization of food purchases by target groups (through food stamps or a similar mechanism), and free distribution of food to target groups.

195. One administrative problem is common to all three: the target groups must be defined operationally and their members identified in a way which keeps errors of exclusion or inclusion at a low level and has acceptable costs. There is obviously some trade off between the first and second objectives. After a certain point, the expense of reducing errors may exceed the cost of tolerating them. The ENDEF data base should be helpful in "mapping" the malnourished. Analysis of the full range of socioeconomic and nutritional data it contains should permit predicting with a high probability of success whether a person is malnourished if other key socioeconomic and demographic data is known. Establishing which independent variables best predict malnutrition may help in the practical identification of target groups for nutrition interventions. In making this analysis, the cost of obtaining different types of socioeconomic data on a regular basis (and thus maintaining an up-to-date record of the target population) should be taken into consideration. For example, in some poor urban regions the malnourished population may be such a percentage of the total population that it would be cheaper and politically easier to define the target population by area of residence alone than try to use more sophisticated criteria to exclude a low percentage of residents.

196. Both targeted food subsidies and direct distribution programs are being experimented with by PRONAN. The IBRD/INAN Nutrition Research and Development Project includes careful evaluation of both. Varying levels of subsidies and different kinds of distribution systems for direct distribution (including both natural and processed foods) are being tried. As was indicated above, it is too early to report any definitive results, but the research and data being generated by this project is likely to prove critical in designing effective large scale nutrition programs in Brazil. Repetition of the 1974/75 ENDEF survey in the near future as is now planned by IBGE will also be most helpful in gaining a better view of how the nutrition status of the population is changing over time, and allow still better planning of nutrition programs. An area where more research is needed is intra-family distribution -- it is clearly possible that average consumption within a family is at or above requirements, but that one or more members of the family are in deficit. Very little is known about the extent of this phenomenon. In both subsidy and direct distribution programs education is likely to prove valuable for increasing the nutritional motivation and awareness of the target groups.

E. Simulations

197. Given that defining basic nutritional needs in the Brazilian context and designing socially acceptable, cost-efficient nutrition programs are issues which should probably receive more attention before a truly massive national effort to eliminate or reduce malnutrition is made, projecting the

costs of programs with these objectives is an even more hazardous endeavor than in the case of extending basic health services to the urban and rural populations. The simulations which follow must therefore be considered highly tentative and designed simply to explore the orders of magnitude of costs which meeting certain goals (which themselves are tentative) might imply. A deliberate effort was made to state costs at the high end of the plausible range.

198. Two major assumptions underlie these simulations. The first is that Type 1 and Type 2 adequate diets described in the previous section will also guarantee sufficient proteins, vitamins and minerals. That is, in the Brazilian context, adequate calorie consumption is the binding constraint on achieving satisfactory nutrition. This assumption appears to be justified by the ENDEF data published to date and by previous less comprehensive surveys. If some vitamins or minerals are in deficit, the cost of providing them as supplements is minimal compared with that of obtaining sufficient calories and can safely be ignored for the purpose of simulations. Therefore, basic nutritional needs will be defined here as meeting the FAO/WHO Low calorie requirements by adequate Type 1 or Type 2 diets. As stated before, this should, if anything err on the high side in defining requirements, particularly for adults who, because malnutrition in the past has irreversibly limited their height, will never need as many calories to maintain a normal weight for their stunted height as they would have required had they been better nourished as children and youths. Over time, with better nutrition of children and the death of older adults, this possible source of upward bias in the estimation of requirements would tend to disappear. Another source of upward bias may well be the failure to adjust the requirements for the warm climates prevailing in much of Brazil, though as explained in Appendix A, current FAO/WHO guidelines assert that there is no quantifiable basis for correcting calorie requirements according to the climate, and therefore this has not been done.

199. The second assumption is that unless there are massive changes in the relative income distribution which is implicit in the ENDEF expenditure distributions or significant changes in dietary habits, income growth alone will not be sufficient to wipe out malnutrition, defined here as consumption below the FAO/WHO Low calorie requirements. That this assumption is reasonable can be demonstrated by "baseline" simulations where income and population are the only two factors which change. For this purpose it is assumed that no large scale nutrition programs are undertaken over the last quarter of the century. Two simulations are reported in Table 34. The first, labeled pessimistic, assumes 4% per year GDP growth over the period 1980-2000 and the second, labeled optimistic, assumes 7% per year GDP growth. These two growth rates bracket the range within which actual average GDP growth is likely to lie. 1/ In both simulations GDP is assumed to grow at 6% per year in 1978 and 1979. The "baseline" population projections (see Annex I) are used for both

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1/ See paragraph 56 for a justification of this statement.

these simulations and the others reported below. "Neutral" income distribution (no change in relative shares) is assumed in each of the three major regions used in this report. The base distribution is that taken from the ENDEF family expenditure distributions for the 22 ENDEF subregions. Simulated consumption behavior as incomes rise is based on estimates of per capita calorie consumption for different levels of global family expenditure for the same 22 ENDEF subregions. As mentioned previously, the elasticity of per capita calorie consumption with respect to per capita family expenditure is rather low, particularly in urban areas. 1/

200. On these assumptions, Table 32 shows the total population, population with deficits up to 400 calories per person per day, and population with deficits above 400 calories per person per day under the pessimistic and optimistic GDP growth assumptions. Comparing Table 32 with Table 15, which shows comparable estimates for 1975, it is clear that by the year 2000 under the pessimistic growth assumption there would be some reduction in the proportion of Brazilians with small calorie deficits (42.2% of the total population in the year 2000 compared with 49.9% in 1975). But the population with large deficits would have fallen to 4.3% compared with 17.3% in 1975. The absolute number of Brazilians with small deficits would have increased by 60.5% due to population growth and the effect of income in turning large deficits into smaller ones. The population with large deficits would fall to 46.7% of its absolute level in 1975. Under the optimistic GDP growth assumption the outlook is much brighter, with 22.2% of the population having small deficits and only 0.5% having deficits over 400 calories by the year 2000. The regional and rural/urban distribution of the adequately nourished and calorie deficient population is also shown in Table 32. This suggests that even if the goal is only to eliminate the deficits over 400 calories by the end of the century, some kind of intervention will be necessary.

201. Tables 33 and 34 show the results of four additional simulations which use the baseline simulations as their starting point to estimate the cost of eliminating calorie deficits through direct distribution of diet supplements during the period 1980-2000. In each table two simulations are presented. In the first (labeled pessimistic) it is assumed that supplements sufficient to eliminate all calorie deficits are distributed and that the annual GDP growth rate is 4%. In the second (labeled optimistic) it is assumed that supplements sufficient to eliminate all calorie deficits are distributed and the GDP growth rate is 7%. The only difference between the tables is that in Table 33 Type 1 diet supplements (the food assortment consumed at the prices paid by families just meeting their FAO/WHO Low calorie requirements in 1974/75 in each ENDEF subregion) are used, and in Table 34 Type 2 diet supplements (the food assortment consumed at prices paid, for each ENDEF subregion, by families at the 20th percentile of the total family expenditure distribution in 1974/75) are used. Therefore, the costs in Table 33 are higher than those in Table 34.

1/ See Appendix B, Table B.5 for the arc elasticities between 9 expenditure classes for the 22 ENDEF subregions.

Table 32: ESTIMATED POPULATION WITH ADEQUATE DIETS, DEFICITS OF UP TO 400 CALORIES PER PERSON, PER DAY, AND DEFICITS OVER 400 CALORIES PER PERSON PER DAY IN THE YEAR 2000 BY REGION, URBAN/RURAL LOCATION AND TYPE OF SIMULATION[a/]

	Total Population[b/] (Thousands)	Population with Adequate Diet				Population with Deficits up to 400 Calories				Population with Deficits over 400 Calories			
		Pessimistic		Optimistic		Pessimistic		Optimistic		Pessimistic		Optimistic	
		Thousands	% of Total[c/]	Thousands	% of Total[c/]	Thousands	% of Total[c/]	Thousands	% of Total[c/]	Thousands	% of Total[c/]	Thousands	% of Total[c/]
Northeast													
Rural	24,891.8	21,670.9	87.1	24,891.8	100.0	3,220.9	12.9	-	-	-	-	-	-
Urban	31,634.8	6,495.3	20.5	15,679.6	49.6	20,419.5	64.5	15,799.2	49.9	4,720.0	14.9	156.0	0.5
Total	56,526.6	28,166.2	49.8	40,571.4	71.8	23,640.4	41.8	15,799.2	28.0	4,720.0	8.4	156.0	0.3
Southeast													
Rural	25,165.9	24,566.4	97.6	25,165.9	100.0	599.5	2.4	-	-	-	-	-	-
Urban	96,365.9	49,810.1	51.7	79,678.8	82.7	45,891.3	47.6	16,687.1	17.3	664.5	0.7	-	-
Total	121,531.8	74,376.5	61.2	104,844.7	86.3	46,490.8	38.3	16,687.1	13.7	664.5	0.5	-	-
Frontier													
Rural	10,061.4	1,508.0	15.0	4,472.9	44.5	7,030.6	69.9	5,135.1	51.0	1,522.8	15.1	453.4	4.5
Urban	15,100.5	4,672.3	30.9	7,177.0	47.5	8,666.9	57.4	7,506.6	49.7	1,761.3	11.7	416.9	2.8
Total	25,161.9	6,180.3	24.6	11,649.9	46.3	15,697.5	62.4	12,641.7	50.2	3,284.1	13.1	870.3	3.4
Brazil													
Rural	60,119.1	47,745.3	79.4	54,530.6	90.7	10,851.0	18.0	5,135.1	8.5	1,522.8	2.5	453.4	0.8
Urban	143,101.2	60,977.7	42.6	102,535.4	71.7	74,977.7	52.4	39,992.9	27.9	7,145.8	5.0	572.9	0.4
Total	203,220.3	108.723.0	53.5	157,066.0	77.3	85,828.7	42.2	45,128.0	22.2	8,668.6	4.3	1,026.3	0.5

a/ Pessimistic simulation assumes 4% per year GDP growth 1980-2000, optimistic simulation assumes 7% per year.
b/ "Baseline" population projection (see Annex I).
c/ Population in previous column as % of population in first column.

Table 33: COSTS OF SIMULATED TYPE 1 DIET SUPPLEMENT PROGRAMS BY REGION, URBAN/RURAL LOCATION, AND TYPE OF SIMULATION, 1980 - 2000

Region and Location	1980		1981-1985		1986-1990		1991-2000	
	Pessimistic[a]	Optimistic[b]	Pessimistic[a]	Optimistic[b]	Pessimistic[a]	Optimistic[b]	Pessimistic[a]	Optimistic[b]
Costs Over Period (Millions of 1976 US$)								
Northeast								
Rural	258.1	246.1	1,139.6	1,043.3	890.5	733.4	1,044.8	547.4
Urban	1,073.1	937.8	5,544.5	4,475.3	5,812.9	4,107.4	12,268.0	7,049.2
Total	1,331.2	1,183.9	6,684.1	5,518.6	6,703.4	4,840.8	13,312.8	7,596.6
Southeast								
Rural	104.5	102.2	462.5	443.4	356.2	324.1	360.2	252.9
Urban	1,565.6	1,336.9	8,030.2	6,179.6	8,395.7	5,337.1	18,043.1	8,140.9
Total	1,670.1	1,439.1	8,492.7	6,623.0	8,751.9	5,661.2	18,403.3	8,393.8
Frontier								
Rural	198.2	174.9	1.030.0	847.3	1,093.1	804.1	2,363.3	1,490.5
Urban	416.2	370.6	2,205.5	1,848.9	2,404.5	1,845.3	5,359.1	3,697.2
Total	614.4	545.5	3,235.5	2,696.2	3,497.6	2,649.4	7,722.4	5,187.7
Brazil								
Rural	560.8	523.2	2,632.1	2,334.0	2,339.8	1,861.6	3,768.3	2,290.8
Urban	3,054.9	2,645.3	15,780.2	12,503.8	16,613.1	11,289.8	35,670.2	18,887.3
Total	3,615.7	3,168.5	18,412.3	14,837.8	18,952.9	13,151.4	39,438.5	21,178.1
GDP Over Period (Billions of 1976 US$)	167.46	172.29	1,000.85	1,124.84	1,217.69	1,577.64	3,283.99	5,316.19
Diet Supplement Costs for Brazil Over Period as % of GDP Over Period				PERCENTAGES OF GDP				
Rural	.33	.30	.26	.21	.19	.12	.11	.04
Urban	1.82	1.54	1.58	1.11	1.36	.72	1.09	.36
Total	2.16	1.84	1.84	1.32	1.56	.83	1.20	.40

a/ Neutral income distribution, "baseline" population projections (see Annex I), 4% annual GDP growth, and supplements sufficient to eliminate all calorie deficits.

b/ Neutral income distribution, "baseline" population projections (see Annex I), 7% annual GDP growth, and supplements sufficient to eliminate all calorie deficits.

Table 34: COSTS OF SIMULATED TYPE 2 DIET SUPPLEMENT PROGRAMS BY REGION, URBAN/RURAL LOCATION, AND TYPE OF SIMULATION, 1980 - 2000

Region and Location	1980		1981-1985		1986-1990		1991-2000	
	Pessimistic[a]	Optimistic[b]	Pessimistic[a]	Optimistic[b]	Pessimistic[a]	Optimistic[b]	Pessimistic[a]	Optimistic[b]
Costs Over Period (Millions of 1976 US$)								
Northeast								
Rural	253.4	241.6	1,119.0	1,024.6	874.4	720.2	1,026.3	537.6
Urban	712.1	622.3	3,679.3	2,970.6	3,857.4	2,725.7	8,140.9	4,677.6
Total	965.5	863.9	4,798.3	3,995.2	4,731.8	3,445.9	9,167.2	5,215.2
Southeast								
Rural	94.5	92.5	418.3	401.2	322.3	293.3	325.6	228.8
Urban	1,129.0	964.1	5,790.8	4,456.3	6,054.4	3,848.6	13,011.2	5,870.5
Total	1,223.5	1,056.6	6,209.1	4,857.5	6,376.7	4,141.9	13,336.8	6,099.3
Frontier								
Rural	134.2	118.5	697.6	573.7	740.3	544.6	1,600.4	1,009.5
Urban	206.9	184.2	1,096.1	919.0	1,195.1	917.1	2,663.6	1,837.5
Total	341.1	302.7	1,793.70	1,492.7	1,935.4	1,461.7	4,264.0	2,847.0
Brazil								
Rural	482.1	452.6	2,234.9	1,999.5	1,937.0	1,558.1	2,952.3	1,775.9
Urban	2,048.0	1,770.6	10,566.2	8,345.9	11,106.9	7,491.4	23,815.7	12,385.6
Total	2,530.1	2,223.2	12,801.1	10,345.4	13,043.9	9,049.5	26,768.0	14,161.5
GDP Over Period (Billions of 1976 US$)	167.46	172.29	1,000.85	1,124.84	1,217.69	1,577.64	3,283.99	5,316.19
Diet Supplement Costs For Brazil Over Period As % of GDP Over Period				PERCENTAGES OF GDP				
Rural	.29	.26	.22	.18	.16	.10	.09	.03
Urban	1.22	1.03	1.06	.74	.91	.47	.73	.23
Total	1.51	1.29	1.28	.92	1.07	.57	.82	.27

a/ Neutral income distribution, "baseline" population projections (see Annex I), 4% annual GDP growth, and supplements sufficient to eliminate all calorie deficits.

b/ Neutral income distribution, "baseline" population projections (see Annex I), 7% annual GDP growth, and supplements sufficient to eliminate all calorie deficits.

202. In these simulations no dilution or substitution is assumed to occur, but on the other hand the price of the supplement is set at 50% above the estimated price in 1976 U.S. dollars. To obtain these prices the costs of diet supplements in August 1974 cruzeiros (see Table 20) were inflated by 70% (the average increase in food costs in the available regional price indices for the year 1976 compared with the month of August 1974) and then converted to US$ at the average selling rate for 1976. The additional 50% price increase is to cover the costs of administering the program (though retail food prices were recorded in ENDEF, thus the cost of commercial distribution was already included), any real increases in food prices which might occur, and a strong nutrition education component. By assuming free distribution rather than selective subsidies (such as a food stamp program) the costs are automatically at a maximum. If nutrition consciousness were higher in the population, still cheaper supplements might be used. It should be emphasized that the choice of direct distribution programs rather than food stamps or some other type of intervention is made only for illustrative purposes and to get an idea of the plausible upper bounds on the costs of large scale nutrition programs. It is not meant in any way to prejudge the decision on what type of program would be socially acceptable and cost-effective in Brazil.

203 A look at Tables 33 and 34 will show that the costs of supplements in rural areas are strikingly lower than in urban areas. There are two basic explanations for this phenomenon. First, food prices are notably less in rural than in urban areas (see Table 20). Second, dietary habits in rural areas are generally more cost-efficient than in urban areas, so that requirements are met faster as incomes rise, even after correcting for price differentials.

204. Of course, it is not realistic to assume that programs of this nature could be implemented at full coverage the year they begin. But presenting the costs of full coverage is useful for showing how the costs, expressed as a percentage of GDP, would decline over time as incomes rise and target populations fall as a percentage of the population. A more realistic assumption would be gradual implementation of the programs over the period 1980-1990. This would allow for developing the necessary distribution system and the expansion of agricultural output which would be required so as to avoid unnecessary price increases. For illustrative purposes, gradual implementation will be defined as spending 10% of full coverage costs in 1980, 40% of full coverage costs over the period 1981-1985, 80% of full coverage costs over the period 1986-1990, and then 100% of full coverage costs over the period 1991-2000. The following table summarizes the information contained in Tables 33 and 34 and shows the costs of gradual implementation for each of the four simulations. Here all costs are expressed as percentages of GDP generated over the corresponding period.

	1980		1981-1985		1986-1990		1991-2000	
	Pes.	Opt.	Pes.	Opt.	Pes.	Opt.	Pes.	Opt.
Type 1 Supplements								
Full Implementation	2.2	1.8	1.8	1.3	1.6	0.8	1.2	0.4
Gradual Implementation	0.2	0.2	0.7	0.5	1.2	0.7	1.2	0.4
Type 2 Supplements								
Full Implementation	1.5	1.3	1.3	0.9	1.1	0.6	0.8	0.3
Gradual Implementation	0.2	0.1	0.5	0.4	0.9	0.5	0.8	0.3

205. Assuming gradual implementation, the greatest effort would be required under the pessimistic simulations over the period 1986-2000, when about 1.2% of GDP would be required with Type 1 diet supplements and 0.9% with Type 2 supplements. Again, costs have been deliberately and consistently stated on the high side to avoid underestimation. First, the measure of requirements may be slightly high for the adult Brazilian population. Second, relatively cost-inefficient foods were included in the supplements, in accord with Brazilian dietary habits. Finally, a full 50% was added to the commercial retail prices observed in each subregion. If the relative income distribution improved (greater per capita income growth for the calorie deficit population than for the population with adequate diets), the costs would be reduced. On the other hand, deterioration in the relative income distribution could increase costs. Finally, direct distribution of food supplements is more expensive than food stamp programs and other forms of partial subsidy.

206. It may be concluded that the costs of massive nutrition programs with the objective of totally eliminating calorie deficits by 1990 would not require inordinate expenditure even if totally free distribution were used, assuming that GDP grows at least 4% per year for the remainder of this century. But much remains to be learned about how to organize and administer such programs so as to achieve their objectives efficiently.

PART III: EDUCATION

A. Overview of the System

207. Many of the themes and issues concerning Brazilian education today have been in discussion since colonial times. The division of responsibilities between federal, state and municipal governments; the nature of entrance examinations and certifications; the function and orientation of secondary education; the degree of official support for private education; and the social consequences of educational distribution--among others--have been widely debated and legislated upon in the course of the last 100 years.

208. The legal principles of modern Brazilian education are contained in the Constitution of 1934. Prior to that, a Ministry of Education and Health was set up in 1930 to "administer Brazilian education..." Among other provisions, the 1934 constitution reaffirmed the principles of free and compulsory education established originally in the Constitution of 1824, provided for the writing of a National Education Plan "to coordinate and supervise all levels," regulated the financing of public schools through fixed quotas for the federal Government, states, and municipalities and mandated the formation of mechanisms for administration. 1/

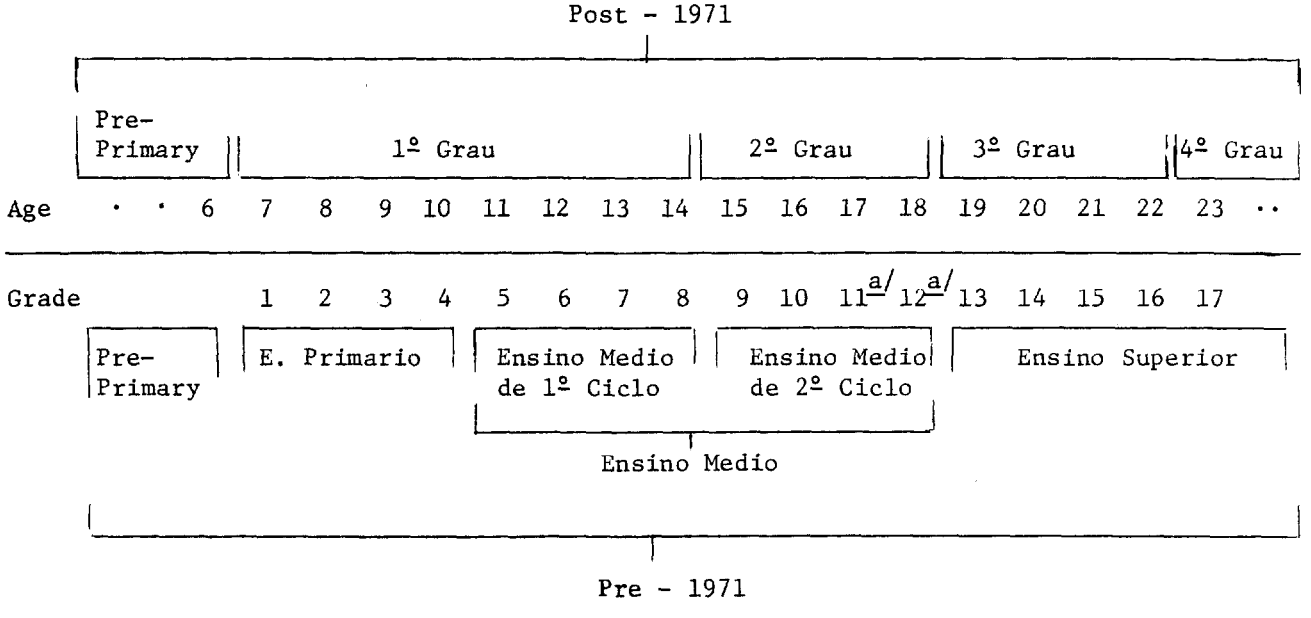
209. Education became a matter of heated national political debate when the 1946 constitution gave the federal government the power to legislate the directives and norms of education, while granting the state governments the responsibility to organize their systems of formal education. The law regulating Brazilian education was not passed until 1962 because of serious political and ideological differences. In essence, the law set up parallel federal, state and municipal school systems within each state. Formal education was structured into a primary level, consisting of four grades (1 to 4), a secondary level consisting of seven or eight grades (5 to 11 or 12) and the university (Figure 5). The law prescribed entrance examinations to enter into the secondary and university levels. Provisions regarding work-oriented instruction in the middle level are yet to be fully realized. They reinforce earlier ideas of making this level a self-contained unit not necessarily leading to higher education.

210. Limitations of the 1962 law, rapidly growing social demands for higher education and the recognized need to accelerate the development of human resources brought another substantial reform of the educational system. In 1968 the Reform of Higher Education Law (No. 5540) was passed to allow the expansion of this level and to improve its management and organization. Basic and middle level education were reformed in 1971 by the Lei de Diretrizes e Bases de Ensino de Primeiro e Segundo Graus (No. 5692). Both laws have since been amended reflecting continuing concern and debates regarding the education sector. 2/

1/ Barbara Freitag, Estado e Sociedade (Sao Paulo: Edart., n.d.).

2/ Iale Renan and Ricamar P. de Brito Fernandes, "Sistema Educacional Brasileiro: Legislacao e Estrutura", Faculdades Integrades Estacio de Sa (Rio de Janeiro: August 1977).

Figure 5: FORMAL EDUCATION (EDUCACAO REGULAR) CATEGORIES BEFORE AND AFTER THE REFORM OF 1971: AND THEIR NATIONAL CORRESPONDENCE WITH AGE AND GRADE SEQUENCES



a/ Ensino medio de 2° ciclo could end either at grades 11 or 12.

211. From a purely legal and administrative point of view, these laws define a unified formal education system in a national framework. This system is structured into four levels: basic (first eight grades), middle (the next three or four grades), higher and post-graduate. 1/ The structure and current orientations of the system represent a significant refinement and departure from the earlier initiatives embodied in the 1962 law. Basic education has been extended from four to eight years and the examination to enter middle level is no longer required; the work-oriented character of middle level education has been strengthened by setting up what is called ensino profissionalizante which is to offer a broad array of work-related specializations; finally the development of higher education, including post-graduate education, has become a matter of first priority.

212. An important feature of current educational legislation and policies is the attention being paid to non-traditional modes of education. The education sector comprises a number of programs and activities known as supletivo (supplementary) education and extra-escolar (non-formal) education. 2/ The global control of supletivo is to be held by the Ministry of Education but some of its most important components are either semi-independent, as in the case of the Brazilian Literacy Movement (Movimento Brasileiro de Alfabetizacao--MOBRAL), or entirely autonomous, like the National Service of Industrial Training (Servicio Nacional de Aprendizagem Industrial--SENAI) and the National Service of Commercial Training (Servicio Nacional de Aprendizagem Comercial--SENAC).

213. Other non-formal activities are sponsored by a number of ministries (the most prominent ones being Health, Labor, Agriculture and Armed Forces) and executed by either the ministries themselves, by the Ministry of Education, or by other specialized government agencies. Many of the non-formal programs are the product of local initiatives prompted by specific needs. 3/

214. Some of the major tools, in sum, are designed as follows:

(a) MOBRAL, is intended to eradicate illiteracy.

(b) The basic education level (ensino de primeiro grau), linking the old primario and ginasio, is expected to provide a functionally useful education to the bulk of the population.

1/ In Brazilian terminology, basic education is denominated Ensino de Primeiro Grau; middle level is Ensino de Segundo Grau; higher education includes Terceiro and Quarto Graus.

2/ The following functions are ascribed to ensino supletivo: apprenticeship training for industrial or service occupations; on-the-job training; basic education which consists largely of literacy and adult education; and upgrading or grade-equivalency instruction.

3/ An inventory of such activities carried out in the state of Sao Paulo revealed the existence of at least 800 independent projects and programs. (Information provided by Prof. Osmar Favero of Getulio Vargas Foundation -- Fundacao Getulio Vargas -- FGV.)

(c) Middle-level work-oriented education (ensino profissionalizante de segundo grau) is supposed to prepare graduates for labor markets.

(d) Non-formal education and training activities (supletivo) are expected to provide instructional flexibility at low costs.

(e) Universities are expected to generate high level manpower to cope with an increasingly specialized and technologically complex economy. This has led to a substantial expansion of enrollment in scientific areas as well as improvements in their faculty and physical facilities.

Compared with achievements to date, these policy objectives indicate that much remains to be done.

B. Trends in Educational Indicators

215. During the period 1940-1970 the share of the population aged 10 and over classified as "literate" grew from 43.0% to 66.6%. 1/ Progress was quite uneven between the three decades in this period and was substantially faster for women (Table 35). Relative to the group average of 26 other countries in Brazil's per capita income class (70.3%), Brazil's adult literacy rate in

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1/ "Literacy" and "literacy rates" refer here to the official census definition of literacy, which is a positive response to the question of whether the respondent can read or write a short paragraph in any language. Different definitions of "literacy" may also be found in official Brazilian data sources. In addition to the stated census definition, MOBRAL considers individuals to be "literate" if they can pass a MOBRAL administered "literacy test"; however, there is no standard test. The evaluation reflects the instructor's judgment. The 1973 PNAD, in term, considers as "literate" anyone who has passed first grade. The recently published 1976 PNAD, on the other hand, uses the previously stated census definition. The (unwarranted) comparison between the 1973 and 1976 PNADS shows an increase in the number of "illiterates", which has led to much idle speculation and debate. None of these criteria is ideal. A common convention is to judge as functionally literate those who have completed more than four grades of primary schooling.

1970 was slightly lower. 1/ While this group average literacy rate increased by 18.9 percentage points between 1960 and 1970, Brazil increased its rate during the same period by only 6 percentage points--less than one third of the group average increment. In absolute numbers, the 1960-70 net increase in Brazil's literate population among persons 10 years of age and older amounted to over 14 million. The total population in this age group, however, grew by an even larger amount. Thus, the number of illiterates increased by almost 2.5 million. 2/

Table 35: LITERACY RATE OF POPULATION OF TEN YEARS OF AGE AND OLDER, BY SEX; CERTAIN YEARS, 1940-1970

	1940	1950	1960	1970	1940 -50	1950 -60	1960 -70
	Percentage				Percentage Points Gained in Period		
Men	48.2	52.6	64.0	68.9	4.4	11.4	4.9
Women	38.0	44.2	57.3	64.4	6.2	13.1	7.1
Total	43.0	48.4	60.6	66.6	5.4	12.2	6.0

Source: IBGE, Indicadores Sociais (Rio de Janeiro: 1977), Table 1 and 1a, p. 209.

1/ World Bank, World Table 1976 (Washington: 1976), Table 5, p. 523. The percentage reported for Brazil in this source is 68.0%, instead of the 66.6% given in the IBGE publication cited above. The reference group includes all countries for which data is available having GNP per capita incomes between US$376 and 1000 in 1970.

2/ IBGE, Indicadores Sociais, (Rio de Janeiro: 1977), Table 1, p. 209.

216. The evolution of educational opportunities is reflected in the age distribution of literacy. In 1970, the literacy rate for the population aged 10 to 14 was 70.4% and for the 15 to 19 age group it was 75.7%. The age-group rates decline gradually for older cohorts, to a low of 43.0% for the population aged 70 and above. The overall literacy rate in urban areas was 73% while the rural rate was 40% (Table 36).

217. The extent of literacy varied widely across regions and between urban and rural areas in 1970. The most dismal literacy levels are consistently in rural areas of the Northeast, where state-level rural literacy rates ranged from a high of 27% in Paraiba and Bahia to a low of 19% in Alagoas. Urban areas of the Southeast show the highest state-levels: from a maximum of 82% in Rio Grande to Sul to a low of 73% in Minas Gerais.

Table 36: LITERACY RATES BY REGION, 1970

(percentage)

	Urban	Rural
Brazil	73	40
Region a/		
Northeast		
max-min	64-55	27-19
mean	58	24
Southeast		
max-min	82-73	68-33
mean	79	54
Frontier		
max-min	75-66	44-23
mean	71	37

a/ Percentages are the maximum, minimum and unweighted mean among the states included in each region--for urban and rural areas.

b/ Excludes Federal District, which is 76 in urban and 40 in rural areas.

Source: Y. Tencalla, "Brazil, Education Sector Memorandum", Draft (World Bank, August 1978).

218. Table 37 shows that by 1970, of the total population aged 15 and over, 22% of the men and 21% of the women had attained more than four years of schooling, the conventional measure of achievement of functional literacy. In the urban areas, the corresponding figures were 36% and 32% respectively. For rural areas they were about 5% for both sexes. 1/ In comparison, literacy rates (according to the standard definition) 2/ for the same age group are about three times as high as the functional rates -- a further reason why census literacy rates may be highly inflated. Aagain there are major differences between urban and rural areas.

Table 37: LITERACY ACCORDING TO TWO DEFINITIONS AMONG POPULATION AGED 15 AND OVER; 1970
(Percent)

	Total		Urban		Rural	
	Men	Women	Men	Women	Men	Women
1. Literacy Rate (standard definition) a/	69.1	62.8	83.8	75.7	49.5	42.5
2. "Functional" Literacy Rate b/	22.5	21.1	35.9	31.6	4.7	4.5
Functional Literates as Percentage of Self-Declared Literates	32.5	33.6	42.9	41.7	9.4	10.7

Notes: a/ Percentage of population aged 15 and over declaring that they could read and write.

b/ Percentage of population aged 15 and over declaring that they had studied 5 years or more.

Source: IBGE, Censo Demografico, 1970.

1/ It is unusual in developing countries for educational attainment indices such as this to show values for women as close to those for men for a comparably defined population, particularly in rural areas.

2/ I.e., percentage of population aged 15 and over declaring that they could read and write.

219. Increases in literacy have been accompanied by measurable but slow improvements in the educational profile of the adult population. Table 38, which provides information on the highest attainment by categories of schooling, shows that in 1940, in the group aged 20 and over, only 12% of the literate population had completed elementary schooling, while 4% had completed either first or second cycle middle level schooling and less than 1.5% had completed higher education. 1/ By 1970, 32% had completed elementary, 13% had completed middle, and almost 2% had completed higher education. Judging the evolution of human resource development by the latter two among these ideas of the "quality" of the working age population, no significant gain in momentum appears to have occurred in the more recent decades 1950-70 compared to the 1940s. A very crude, but straightforward measure of the rates of progress in the per capita accumulation of "human capital" implied by the percentages in Table 4 is the average annual (percentage) point gain in the percentage of middle plus higher level graduates. Between 1940 and 1950 this average was 0.32 per year; between 1950 and 1970, it was virtually unchanged at 0.33 per year. A continuation of the latter yearly rate, would enable Brazil to increase its proportion of middle and higher education potential workers from about 15% in 1970 to around 25% by the end of this century. The historical trends are thus clearly too slow if the objectives of a predominantly skilled work force are to be achieved within the next hundred years or so.

Table 38: HIGHEST SCHOOLING ATTAINMENT OF THE LITERATE POPULATION AGED 20 AND OVER, 1940 - 1970 (Percentage) a/

Year	At least first 5 grades	Elementary b/	Middle c/	Higher d/
1940	17.2	12.1	3.8	1.3
1950	40.0	31.7	7.0	1.3
1970 e/	47.1	32.2	13.0	1.9

a/ Figures are percentages of the (literate) population aged 20 and over having attained the corresponding schooling category as highest attainment.

b/ First 5 grades.

c/ Grades 6-12.

d/ Grades 13-17, and beyond.

e/ No information available for 1960 according to this breakdown.

Source: IBGE, Indicadores Sociais, Table 6a, p. 216.

1/ There was a jump between 1940 and 1950 in elementary schooling attainment from 12 to 31% which casts doubt on the statistics.

C. Formal Education

220. Developing educational systems are characterized by concentration of participation in the first grades of primary with steep declines of participation in each succeeding grade. While there is no agreement about the optimum shape of a country's educational pyramid, an over-extended base of the pyramid, accompanied by a thin middle and an almost imperceptible upper section, is a manifestation of complex problems such as limited educational opportunities and perverse interactive effects of poor quality schools and the virtually universal difficulties that children from low socio-economic households have in adjusting and succeeding in the formal education process.

221. During the period 1960-73, the student population increased from 8.7 million to 18.9 million; the proportion of students in the first eight grades decreased from 96 to 86 percent (Table 39). There are significant differences among regions - particularly between the Northeast and the Southeast. 1/ Although the average annual rate of enrollment growth in the Northeast was high (6.8 percent), it was concentrated in the basic level to a greater extent than in the Southeast. In the latter, the proportion of total enrollment in basic education declined from 95 to 84 percent, while in the Northeast this decline was from 96 to 91 percent. Conversely, the proportion in higher education increased from one to two percent in the Northeast, while it went up from one to six percent in the Southeast. The clear advantage of the Southeast over the Northeast and Frontier regions by the year 1973 in the shape of their educational pyramids is apparent from Table 40.

Table 39: FORMAL EDUCATION ENROLLMENT BY LEVEL, SELECTED YEARS, 1960-1973: RELATIVE DISTRIBUTION AND RATE OF CHANGE, BRAZIL

	Percentage Distribution (%)			Av. Annual Change Rate a/ (% per year)	
Levels	1960	1970	1973	1960 -70	1970 -73
A. All Levels	100	100	100	7.1	0.9
B. Grades 1-8	96	92	86	6.6	0.8
C. Grades 9-12	3	6	9	14.2	18.8
D. Higher Ed.	1	2	5	16.6	30.2

a/ This rate of change refers to the underlying absolute number of students in each corresponding category. Annually compounded.

Source: Appendix Table C.1.

1/ The three regions used in this annex are the same as those used elsewhere in this report. The Northeast is defined as usual; the Southeast includes the South and Southeast regions as defined by the IBGE, and the Frontier includes the Center West and North regions as defined by IBGE.

Table 40: FORMAL EDUCATION BY LEVEL AND REGION, 1973: RELATIVE DISTRIBUTION (Percentage)

Region	All Levels	Grades		Higher Ed.
		1-8th	9-12th	
Brazil	100	86	9	5
Northeast	100	91	7	2
Southeast	100	84	10	6
Frontier	100	90	7	3

Source: Appendix Table C.1.

Basic Education

222. Progress in basic education coverage since the early 1950s has been apparent in all regions (Table 41). This is particularly striking in the Southeast, where virtually universal coverage exists. The Northeast has lagged behind all other regions but there, again, the enrollment rate increased from 34% in 1955 to 67% in 1974, while absolute enrollment went up from 1.3 million to 4.5 million (an average annual growth rate of 6.7%). For Brazil as a whole, the enrollment rate went up from 54% to 85% while enrollment increased from 6.2 million to 18.3 million during the same 1955-74 period (an average annual growth rate of 5.9%). These accomplishments should be gauged considering the accompanying growth of the population base, which grew at a rate of 3.4% per year from 11.5 million in 1955 to 21.7 million in 1974.

223. Despite this effort, educational opportunities still remain limited and are related to the social and economic status of the client population. Rural education lags behind urban to a very substantial degree. Enrollment rates for grades 1-8 in rural areas in the year 1974 were about half the level in urban areas (Table 42).

224. The grade distribution of enrollment by region and location for 1974 shown in Table 43, is consistent with historical trends. Enrollment in first grade in the rural locations of the Northeast and Frontier account for at least 60% of their respective totals. In the rural Southeast, this share is very much lower (44%). This profile indicates substantially higher retention than in either of the two other regions. The schooling experience of rural children in the Northeast or Frontier is largely limited to one grade (69% and 60% of enrollment) or the first two grades (87% and 81% of enrollment). In the urban areas, however, the enrollment profile is similar in all three regions.

Table 41: ENROLLMENT IN GRADES 1-8 AS PERCENTAGE OF POPULATION IN AGES 7-14, BY REGION, SELECTED YEARS, 1955-1974

(percentage)

A. Region	1955	1962	1968	1970	1974
Brazil	54	63	77	80	85
Northeast	34	42	53	62	67
Southeast	67	76	89	90	97
Frontier	46	58	72	77	78

Average Annual Percentage Point Change

B. Region	1955-62	1962-68	1968-70	1970-74
Brazil	1.3	2.3	1.5	1.2
Northeast	1.1	1.8	4.5	1.2
Southeast	1.3	2.2	0.5	1.8
Frontier	1.7	2.3	2.5	0.2

Source: Appendix Table C.2.

Table 42: ENROLLMENT IN GRADES 1-8 AS PERCENTAGE OF POPULATION IN AGES 7-14 BY REGION AND LOCATION, 1974

(percentage) a/

	All Locations	Urban	Rural
Brazil	85	110	55
Northeast	67	94	46
Southeast	97	116	64
Frontier	78	105	50

a/ Percentages exceeding 100 indicate the inclusion of "over-age" pupils in the numerator.

Source: Appendix Tables C.3 and C.4.

Table 43: PERCENTAGE DISTRIBUTION OF ENROLLMENT IN GRADES 1-8 BY GRADE, REGION AND LOCATION, 1974

(percentage)

Grade	Northeast		Southeast		Frontier	
	Urban	Rural	Urban	Rural	Urban	Rural
1st	25	69	20	44	25	60
2nd	16	18	15	23	16	21
3rd	14	8	13	17	13	11
4th	13	4	12	12	11	6
5th	12	a/	13	2	13	1
6th	8	a/	11	1	9	a/
7th	7	a/	9	a/	8	a/
8th	5	a/	7	a/	5	a/
All Grades:	100	100	100	100	100	100

a/ Less than 1%.

Source: Appendix Table C.3.

225. The analysis of student flows is useful in assessing the performance and, indirectly, the equity of the educational system. According to the principle of universal and compulsory coverage in basic education, the Brazilian educational system is constitutionally bound to provide instruction to the school age population of the country in grades one to eight. This mandate is still far from fullfilled. Not all eligible participants are offered entry grade vacancies and the distribution of opportunities in subsequent grades is highly unequal among regions and locations. Furthermore, in functional terms, the attainment of given grade levels may be viewed as a proxy for the acquisition of knowledge and skills. While no unique definition of an "educated" person exists, there is some agreement that there is a minimum threshold of educational exposure below which the basic knowledge and skills required to function as an "educated" person are not acquired.

226. The extraordinary diversity of Brazilian urban society is displayed in the first grade since close to 90% of the primary school age population residing in urban areas attends school. Their learning progress is no less diverse. In order to cope with this heterogeneity, schools have devised numerous strategies that are not contemplated in legislation. Indeed, they are sometimes directed at circumventing legal rigidities. As a result, a variety of de facto tracking systems exist. In some cases, for example, the first grade contains an internal sequence of grades: weaker students taking two to three years to reach the official 2nd grade. In other cases to enter the first grade may require taking one "pre-1st grade" year. From a statistical point of view, such procedures are regarded as repetition. These complexities weaken the aggregate statistics on repetition.

227. Considering these caveats, the "flow experience" of cohorts entering in three periods, the first one beginning in 1951, is shown in Table 44. While showing some improvement over each successive period, progression was still very inadequate for the cohort finishing in 1971. According to this table, only 24% of all entrants into first grade in 1964 had made it to the fourth grade by their fourth year in school. For the majority of students, the schooling experience is probably too short to fulfill the most elementary educational objectives. 1/

Table 44: STANDARDIZED COHORT FLOW PROFILES IN BASIC EDUCATION BY REGION, 1951-1958, 1958-1965 and 1964-1971,

	Entries First Grade (Year t)	Second Grade (t+1)	Fourth Grade (t+3)	Fifth Grade (t+4)	Eighth Grade (t+7)	Finishers
	(1)	(2)	(3)	(4)	(5)	(6)
1951-1958						
Northeast	100	24	8	7	3	2
Southeast	100	46	21	11	5	4
Frontier	100	26	9	6	3	2
Brazil	100	38	16	10	4	4
1958-1965						
Northeast	100	25	10	11	4	3
Southeast	100	51	26	18	8	7
Frontier	100	28	12	11	4	3
Brazil	100	42	20	16	7	6
1964-1971						
Northeast	100	23	12	16	6	6
Southeast	100	50	31	34	13	12
Frontier	100	36	21	26	10	8
Brazil	100	41	24	28	11	10

Source: Jurandir Santiago, Modelo de Analise do Sistema Educacional, Convenio Ministerio da Educacao e Cultura-Fundacao Universidade da Brasilia (n.d.). Computed from table in pages 50-76.

1/ It is revealing to note that in a sample of MOBRAL students taken in 1974, 59% of the participants declared that they had attended school previously. Cf. C.M. Castro, et. al. "Aspectos da Economia de Educacao e a Assistencia ao Estudante" draft version, mimeo.

228. While the research evidence leaves no doubt that individual traits and socio-economic characteristics of students play a major role in determining schooling and learning achievement, it is also clear that the quantity and quality of educational services play an essential role. 1/ The supply of education is largely the result of policy. In terms of supply, the realities of Brazilian formal education in the rural areas are bleak. A stylized description of the typical rural school might read as follows: The school is typically a one-room house where groups of students (officially in different grades) sit and stare (but do not actively participate). The instructor, herself unlikely to have advanced beyond basic level education, is paid less than the minimum wage. She has been assigned to teach the entire program of studies in all grades, but her knowledge of the subjects is, at best, a product of sheer repetition. The room is overcrowded; it may be hot, or cold; there may not be enough benches for all the students to sit on. There are no textbooks: some volumes were produced but have not yet been distributed to all outlets; they are expensive at any rate. The ability to repeat unquestioningly what the teacher says is equated with learning. When this is achieved, the reward is moving to the intermediate or back benches in the classroom (a sign of grade promotion). The price of failure is to stay in the same row or drop out.

229. In addition to these typical problems of rural education described above, there are others which may not be quite as pervasive, but are all too common nevertheless. For example, in some rural areas, local schools may offer only the first 3 or 4 grades. In these cases, a high "drop-out" rate is virtually guaranteed, since even successful students cannot complete the primary cycle. Also, in sparsely populated rural areas, long distances to school discourage continued attendance over the years. Such problems are not easy to correct in any educational system. Unless these problems are overcome, the basic education needs of these children will not be met. Even more so, the distribution of educational opportunities will remain very unequal.

230. The magnitude of the problem is large. Seven out of ten of the 165,000 school buildings in Brazil in 1972 were one-room, one-teacher school houses. These were the schools attended by nine out of ten rural students. In these schools about 12% of the students drop out during the school year, an even greater proportion drop out between grades 2/ and an additional 25% fail the course at the end of the year. Only 50% of students in the first grade are promoted at the end of the year. Since not all those who are promoted enter the second grade in the following year, the loss exceeds 50%. Such magnitudes of current wastage imply that improvements in the quality of the primary education system are likely to lead to possibly very large reductions in drop out. The consequent additional bulging in the number of students in first and second grade would impose additional strains on the system's capacity and thus, in turn, militate against the original quality improvement. This feedback effect, however, would be partially offset by similarly expected reductions in repetitions in the first and second grades.

1/ Cf. Claudio M. Castro, op. cit.; also Caludio M. Cartro and Jorge A. Sanguinetty, "Informe Final de las Investigaciones Acerca de Costos y Determinantes de la Educacion en la America Latina" ECIEL Program, Rio, March 1977; and Alberto de Mello e Souza, "Os Gastos Publicos e Privados com a Educacao Formal no Brasil" (preliminary draft, March 1976).

2/ Official statistics do not explicitly show the number of dropouts between grades, but they do allow rough estimates.

Secondary Education

231. Prior to the 1971 education reform law, secondary or middle-level ("ensino medio") education in Brazil corresponded to a sequence of 7 to 8 grades, beginning with grade 5 (officially associated with age 11) and ending with grade 12 (similarly associated with age 18). This sequence was split into two parts, or cycles: the first ("ensino medio de primero ciclo" or "ginasio") running from grades 5 to 8 (ages 11 to 14); the second ("ensino medio de segundo ciclo" or "colegial") running from grades 9 to 11, or 12 (ages 15 to 17, or 18). Secondary education's orientation at that time is usually characterized as being "purely general" and "academic," except for the industrial-technical and the commercial schools.

232. The 1971 reform law prescribed substantial changes in both the length and content of secondary education. Its first cycle (grades 5 to 8) was officially shifted into basic (sometimes still referred to as "primary") education, thus leaving a sequence containing a maximum of 4 grades (9 to 12; corresponding to ages 15/16 to 18/19). In practice secondary education often is only 2 to 3 years in duration. Since the reform, the educational system has been gradually phasing out the pure general education stream in favor of either a vocational curriculum in federal technical schools leading to a certificate at sub-professional level (teacher training, agriculture, industry and commerce) or to a general curriculum with pre-vocational or labor market-oriented practical activities in a so-called family of skills (habilitacoes basicas). This new structure is still in a process of adoption by the various states so that all kinds of intermediate and transitional structures are to be found.

233. It should be clear from the preceeding attempt to define secondary education in Brazil that quantitative indicators of its coverage call for guarded interpretation. There may be fewer differences in quality of instruction than in the case of primary education, but differences in the content and orientation of the instruction are greater. It should be generally true, however, that the bulk of individuals who have made it to secondary education (grade 9 or above) can be regarded as being functionally literate and potentially capable of productive work using modern technology.

234. From 267 thousand in the year 1960, total enrollment in grades 9-12 grew at an average rate of 13.4% per year in Brazil to just over 2 million students in the year 1976 (Appendix Table C.5). These 2 million students, however, were less than 17% of the estimated number of persons aged 15-19 in that year 1976 (Table 45). In 1960 the comparable percentage was less than 4%. Regional differences in this indicator ranged from 2.6 times in 1960 to 2.0 times in 1976. In both years the maximum value was for the Southeast and the minimum for the Northeast.

235. Table 46 suggests that recent educational policy has had some effect in expanding the range and scope of middle-level vocational and technical instruction. Historically the academic track has dominated enrollment, followed by the commercial track (dominated by accounting) and teacher training. With the passing of the 1971 reform law, the industrial and paramedical tracks expanded while enrollment shares in the academic and teacher-training tracks declined considerably.

Table 45: ENROLLMENT IN GRADES 9-12 AS PERCENTAGE OF POPULATION IN AGES 15-19, BY REGION, SELECTED YEARS, 1960-1976 (percentage)

Regions	1960	1965	1970	1975	1976
Brazil	3.7	6.0	9.8	15.6	16.6
Northeast	1.9	3.2	6.0	9.5	10.1
Southeast	5.0	7.8	12.0	19.4	20.7
Frontier	2.0	3.7	7.4	12.6	13.4

Note: Enrollments for 1960, 1965 and 1970 correspond to the category "Ensino Medio de 2º Ciclo" in the data source; for 1975 and 1976, they correspond to the category "2º Grau" and are preliminary.

Sources: Appendix Tables C.5 and C.6.

Table 46: PERCENTAGE DISTRIBUTION OF SECONDARY ENROLLMENT BY CERTAIN TRACKS, SELECTED YEARS, 1960-74 (percentage)

Track	1960	1970	1974
"Academic"	43	46	37
Teacher Training	24	26	16
Commercial	30	22	28
Industrial	2	5	10
Agricultural	1	1	1
Paramedical	0	0	7
Other "non-academic"	0	..	..
Sub-total: "non-academic"	57	54	63
Total: All tracks	100	100	100

Note: Enrollments for 1960 and 1970 correspond to the category "Ensino Medio de 2º Ciclo" in the data source for 1974, they correspond to the category "2º Grau"

.. less than 1%.

Source: Appendix Table C.7.

236. Great care, however, is required in interpreting these statistics. By law secondary schools are required to add "useful" subjects to their curricula, but they receive little or no guidance from specialized agencies on implementing this directive. Enforcement of this very controversial act has been varied. Some schools did not comply, being too poor to afford the added costs. The very best schools set up higher quality programs, but most of their students took no interest in the vocational content of the program, the university entrance being their only goal. In between, some schools offer useful programs while others merely simulate vocational content or offer programs of doubtful "usefulness". It is hard to know how these very different situations are reflected in the statistics. Moreover, the extent to which such skills are used after schooling is uncertain. Nevertheless, these statistical problems should not obscure the fact that considerable change is taking place in the direction of a larger proportion of vocationally oriented enrollment, even though the latter's efficacy has not been sufficiently demonstrated. 1/

237. In its initial conception, the 1971 Educational Reform Law intended to turn the middle level into one large sector of technical education preparing students in specific occupational areas, and requiring, in addition, that all students should pursue some type of professional specialization. It envisaged providing some 130 subjects in various technical tracks through a wide range of specific training schemes.

238. This was an extreme position which largely disregarded the past experience and frustrations of setting up large scale schemes of vocational education. 2/ It also disregarded the financial and managerial constraints impeding such changes in Brazilian education. Moreover, the policy assumed that schools can provide adequate training for the quantity and quality of services demanded by labor markets, and this position puts a great deal of faith on the accuracy of manpower forecasting.

239. Since 1974 this extreme position has changed perceptibly. After the law was passed it was recognized that the existing physical facilities could not handle all the prescribed specializations, either in terms of space, materials or equipment; besides, trained teachers were not available in sufficient numbers in the majority of these areas. These constraints prevented significant implementation. Instead of providing training for specific occupations, the current orientation is to organize instruction around occupational clusters and to focus on basic skills which are expected to be complemented with on-the-job training.

1/ Vocational training tends to be somewhat more expensive than "academic" programs. In a public high school with about 1000 students, the additional cost associated with vocational training increases total cost by about 20%. (Communication from Claudio Castro.)

2/ See for instance P.J. Foster, "The Vocational School Fallacy in Development Planning," in M. Blaug, Readings in the Economics of Education, (London: Penguin 1971).

240. Many unanswered questions remain about how far to go in orienting education to specialized labor markets or what might be a resonable timetable for implementing any such strategy. While a definitive assessment of this strategy is not yet possible, it may be anticipated that progress in developing a strong function-oriented middle-level educational program in the coming years is likely to be hampered by strong competition from the attractions of a rapidly expanding higher educational system. The preferences, aspirations and actual power of students to make educational and career decisions is bound to be a very important factor in the resolution of these issues. Most of the fields offered are associated with an occupational status lower than the white collar jobs traditionally available to high school graduates. Moreover, salary levels are positively related to these status differences. 1/

Higher Education

241. The most conspicuous feature of Brazilian higher education in recent years has been the explosive growth in enrollment which went from 93 thousand in 1960 to almost 1 million in 1975 (Table 47). Prior to 1938 the growth of enrollment had been gradual; public universities had the highest enrollment, although an increasing proportion of students were being enrolled in the so-called isolated institutions, which offer only a small number of areas of specialization. Around the beginning of the 1940s enrollment in isolated institutions began to grow very rapidly; between 1960 and 1975 it increased more than 15 times. In 1974, there were 835 institutions of higher education in Brazil. Of these, only 57 were full-fledged universities: 36 public (30 supported directly by the federal government) and 21 private. The rest were isolated institutions, including 607 that were private (Table 48).

Table 47: ENROLLMENT IN HIGHER EDUCATION BY TYPE OF INSTITUTION SELECTED YEARS, 1960-75

Type of Institution	(thousands of students)				Average Annual Change Rate (percent per year)	
	1960	1966	1970	1975	1960 -70	1970 -75
All Institutions	93.2	180.1	425.5	951.2	16.4	17.4
. Public Universities	45.0	86.4	167.9	422.6	14.1	13.1
. Private Universities	14.2	24.4	60.7		15.6	
. Isolated Institutions	34.0	69.3	196.9	528.7	19.2	21.8

Source: MEC/SEEC, Anuario Estatistico da Educacao, for years 1960-70; MEC/DAU, for 1975.

1/ Claudio M. Castro, "Secundario Profissionalizante: Premio de Consolacao?" Cuadernos de Pesquisa (June 1976).

Table 48: HIGHER EDUCATION ENROLLMENT BY TYPE OF INSTITUTION, SOURCE OF SUPPORT, AND REGION, 1974
(Figures in parentheses are number of institutions)

	Brazil	Northeast	Southeast	Frontier
A. Universities				
Federal	193,292 (30)	65,657 (10)	100,074 (14)	27,567 (6)
State	51,025 (6)	-	49,004 (5)	2,021 (1)
Private	164,831 (21)	17,849 (4)	141,460 (16)	5,522 (1)
B. Isolated Institutions				
Federal	12,274 (18)	254 (1)	11,237 (15)	783 (2)
State	39,563 (73	6,112 (14)	32,080 (54)	1,371 (5)
Municipal	44,877 (77)	4,982 (18)	39,461 (58)	434 (1)
Private	431,729 (607)	20,806 (46)	392,194 (546)	18,729 (15)

Source: MEC/SEEC Estatisticas do Ensino Superior, 1974

242. Particularly since the enactment in 1968 of a law reforming higher education, Brazil's education policymakers have been faced with multiple and conflicting pressures which, for simplicity, can be characterized as pressures for expanding the availability of higher education on one hand, and improving its quality on the other. The 1968 law envisaged a process for meeting both objectives. In the event, the surge in demand for higher education was way beyond the highest estimates made when that law was decreed. This has overwhelmed the tradeoff between quantity and quality to the detriment of the quality objective. Prior to 1968 institutions of higher education were

subject to little regulation and supervision from federal agencies. The law sought to establish a system of higher education based on universities defined as "institutions ruled by central administrative mechanisms offering a comprehensive range of professional, scientific, and humanistic disciplines, combining teaching and research, and organized into departmental units." Additional provisions included the division of higher education into basic and professional cycles, the substitution of isolated (and lifetime) "chairs" by a departmental structure, the progressive incorporation of full-time teaching and development of common facilities (e.g. computing services) in integrated campuses. 1/

243. In varying degrees, these reforms have been met in the public universities, and some of these have attained -- and, in certain cases, sustained -- a high degree of academic excellence. By and large, however, Brazilian higher education has polarized into at least two distinct groups: the (full fledged) universities and the "isolated institutions". This latter group has grown fastest since 1962 and has been absorbing the major portion of incremental enrollment since 1967/68. Its share in total enrollment has risen from 36% in 1960 to 55% in 1975 (Table 47). Isolated institutions are characteristically small (ranging in enrollment from 200 to 1000), and offer comparably few disciplines dominated by the social sciences, administration, and law. Most are private institutions, whose academic standards are often lax.

244. There are wide differences in the perceived value of higher education certificates depending on the type of institution granting them as well as on the prestige of the individual school. Graduates from the best universities are treated as elites, while most graduates of isolated institutions are regarded as being barely above secondary school graduates. This difference in treatment is subject to criticism on the grounds that most of those admitted to public universities are in the higher socio-economic strata. Then they receive the best education available at a highly subsidized private cost, which naturally exacerbates their original social and economic advantage. By contrast, those who end up in private isolated institutions have to bear the full cost of their education which, moreover, tends to be of much lower quality.

245. Owing to this institutional split and the virtually unlimited and forceful demand for placement in universities, there has been a marked deterioration of quality standards. An analysis of results of the entrance examinations (exame vestibular) for several years, found that the scores of some successful candidates approached the probabilistic floor obtained by the random choice of answers to the multiple choice questions in the tests. 2/ This situation largely reflects a policy of trying to accomodate the explosive demand for higher education.

1/ Cf. Esther de Figueiredo Ferraz, Alternativas da Educacao, (Rio de Janeiro: J. Olimpo, 1976).

2/ Cf. cited by C.M. Castro, op. cit.

246. Graduate programs ("pos-graduacao" or "4º grau" in Brazilian terminology) have also surged in recent years. Between the years 1970 and 1976, the number of Masters and Ph.D. programs grew almost six times (from 106 to 569); their enrollment increased over seven times to a total of about 36 thousand in 1976. Forceful and effective government support has permitted notable improvements in most programs: better trained faculty and expanded opportunity for serious research. Not surprisingly, this spectacular growth has not always been accompanied by high quality. 1/

D. Non-Formal Education and Training

247. Diversity among activities officially included under the category of non-formal education (the Brazilian official label is "ensino supletivo" 2/) is so great, that just about the only common characteristic element is that they are aimed at the adult population. Governmental responsibilities for these activities are scattered over many agencies.

248. The domain of non-formal education and training ("NFET") contains four main clusters of programs dealing with, respectively: i) adult literacy and other basic skills ("literacy" for short); ii) dropouts from primary and (non-vocational) secondary education who want to obtain "equivalent" instruction or certification ("equivalency"); iii) instruction through radio, television and correspondence ("distance learning"); and iv) "vocational" training outside of the formal system ("vocational"). Many institutions are engaged in NFET activities. Literacy and equivalency programs are mainly under the responsibility of the Ministry of Education; vocational programs are mainly the responsibility of ministries concerned with the skills in question (e.g., the Ministry of Health being responsible for the training of paramedics), or of semi-autonomous institutions.

249. The technology and resources used in the delivery of the training service are also varied. They include the standard techniques of academic education, mass media technology (e.g., as in the radio education programs of Projeto Minerva), volunteer personnel and community resources (important factors in the MOBRAL programs), and industrial facilities (e.g., as in the Intensive Program for Manpower Training and the National Service for Industrial Apprenticeship which place trainees in private firms to obtain practical training). NFET in Brazil attempts to develop a complex and innovative area of educational services. It is also an outstanding example of how educational opportunities may be expanded beyond the formal system.

1/ IBGE, Indicadores Sociais, op. cit., Table 19, p. 256.

2/ Literally, "supplementary education," but this term seems misleading.

Adult Literacy 1/

250. Government programs to "eradicate illiteracy" among the adult population in Brazil have a long tradition. In the 1940s, it was the Campaign for the Education of Adults and Adolescents; in the 1950s, the National Campaign to Eradicate Illiteracy; in the 1960s, the ABC Crusade. In December 1967, the Brazilian Literacy Movement (Movimento Brasileiro de Alfabetizacao--MOBRAL) came into being. Operations began in September 1971; the program has been dominant among other such activities ever since. It is also the only such program for which some national level quantitative data is available.

251. Like its predecessor programs, MOBRAL has attempted to carry out cultural and basic educational activities that go beyond a narrow interpretation of literacy training. These include instruction in general education subjects, cultural events and sanitation education which are considered essential to prevent loss of the literacy skills after the end of the training period. However, these complementary activities have not always accompanied the basic literacy instruction and, where carried out, their nature and quality have varied greatly. Thus, here again attempts to measure the dimensions of the literacy program using indicators such as enrollment or certifications must be highly qualified.

252. Additional caution is required in any attempt at interpreting the available data on enrollment and certifications in MOBRAL's functional literacy courses ("intermediate variables") in terms of their impact on illiteracy itself (the "outcome variable"). 2/ For example: MOBRAL's data does not include the age of participants; MOBRAL's definition of illiteracy differs substantially from the 1970 census definition; core studies of MOBRAL courses in two municipalities have revealed that a very substantial proportion (39% in the cases in question) of the participants were not "adults" (i.e., were under 15 years of age). 3/ Also, a 1974 MOBRAL survey indicates that perhaps up to one third of participants had enrolled for the second time (many of them already certified as being literate). 4/ The enrollment count also includes individuals who had previously been to school (60% according to another survey), most of whom would have been classified as literate in

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1/ This section draws heavily on IBGE, Indicadores Socias, (Rio de Janeiro, 1977) pp. 277-81.

2/ MOBRAL publications claim that its activities reduced the illiteracy rate in Brazil from 33.6% on September 8, 1970 to 18.7% in September of 1975 (Cfs MEC/MOBRAL, 1975 Cinco Anos de MOBRAL, Rio de Janeiro, 1976; p. 1). Very few analysts outside of MOBRAL's public relations office take this sort of information seriously.

3/ IBGE, Indicadores..., op. cit. pp. 279-80.

4/ MEC/MOBRAL, Relatorio da Subcomissao encarregada de estudar o fenomeno da regressao de ex-alunos de cursos de alfabetizacao do MOBRAL (Rio de Janeiro: MEC/MOBRAL, 1977), p. 23.

in the census returns. Finally, data on cumulative output does not reflect "recidivism", loss of functional literacy skills, which is a well-known occurrence in programs of short duration, such as MOBRAL courses, which usually last less than a semester. 1/ Considerations such as these lead the authors of the IBGE study to conclude that no meaningful assessment of MOBRAL's impact on Brazilian illiteracy is yet possible. Despite these caveats, however, it is undeniable that MOBRAL has been an important experience in Brazilian non-formal education.

253. MOBRAL's data on enrollment and certification for the period 1970-75 (Table 49) show very large numbers particularly when summed over those years and set against the size of the Brazilian population over that interval--around 108 million people of all ages at the end of the interval, of which only about 76 million were above the age of 9. According to those data, cumulative enrollment over the 1970-75 period amounted to around one quarter of those 76 million (minimally) eligible Brazilians.

Table 49: MOBRAL, ENROLLEMENT AND CERTIFICATION IN FUNCTIONAL LITERACY COURSES, BRAZIL, 1970-75

(in millions)

Years	Enrollment (1)	Certification (2)	Percent (2) : (1) (3) a/
1970	0.3	0.2	52
1971	2.3	1.1	46
1972	3.7	2.0	55
1973	4.5	1.8	40
1974	4.1	1.9	47
1975	3.8	1.6	44
Sum: 1970-75	18.8	8.7	46

a/ Percentages computed from unrounded data.

Source: IBGE, Indicadores Sociais (Rio de Janeiro: 1977), p. 282.

1/ "Normal" rates of recidivism to illiteracy are estimated at 50 percent Cf. Ora Grebelsky, From Illiteracy to Literacy, Jerusalem: Adult Education Center, 1970; L. Soria, Alfabetizacion Functional de Adultos, (Mexico: Crefal 1968).

254. The table also shows enrollment peaking in 1973 and certifications peaking one year earlier. Taking the percentage ratio of certifications to enrollment as an index of "internal efficiency", the data yield an average of less than 50% for the period as a whole--and no improvement trend is apparent. Some analysts have found these levels disappointingly low and reasons for them have been suggested. Those include: (a) unsatisfactory training of instructors (they are trained in a course lasting only a few days); (b) the rigid structure of the literacy courses, which does not allow for any regional adjustment, accounting for the loss of interest shown by many participants after an initial enthusiasm; (c) the injection of seemingly political objectives by MOBRAL instructors, provoking a negative reaction among some participants; and, the most important factor of all, (d) failure to follow-up through educational or cultural actions after the initial basic literacy course in the vast majority of cases.

255. Despite these shortcomings, MOBRAL undoubtedly has had an impact in spreading literacy. Also significant is the mobilization of community resources for education that has taken place in all of the nearly 4,000 municipalities of Brazil; and that considerable experience and technical expertise have been gained in carrying out massive instruction to out-of-school individuals. Such mobilization of community resources for education, through the formation of community commissions involving volunteer labor and direct community participation in educational programming are important aspects of educational and social development. MOBRAL's financing is also of some interest (this is treated in a subsequent section). These experiences need not be limited to literacy campaigns, which are temporary by nature. In creating a precedent for community action, MOBRAL's impact may go beyond the magnitudes associated with enrollments and certifications.

Educational "Equivalency"

256. This second cluster of NFET is designed to further educational achievement (mostly adult) through instruction and certification originally intended to be equivalent in substance to that received in primary and secondary formal education programs. The quantity and, particularly, comparability and overall quality of the data available for this type of NFET is very poor. In terms of quantity, data on basic variables (e.g., enrollment) are only available for some years during the period 1965-73, and most of the data are not comparable among most available years. 1/

257. According to these data, enrollment and other basic indices pertaining to "primary equivalency instruction" programs (ensino primario supletivo) show very large variations between years (that would seem comparable) and across regions. In 1971, slightly over 1/2 million persons were enrolled in this program, and almost 90% of these were located in urban areas. The overall pass-rate was 77%. Data for "secondary equivalency instruction" suggests

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1/ This section also draws heavily on IBGE, Indicadores, op. cit., pp. 197-199.

that enrollment in this program was no more than 225 thousand persons in any one year in the 1971-73 period for which some data are available. Poor as they are, the available data suggest that the equivalency educational program suffers from problems similar to those in the regular track (e.g., excessive drop-out and failure rates.) In addition, the expansion of the regular track and the perception that supletivo provides second rate instruction that hampers opportunities for jobs and social mobility have weakened demand for this program. Consequently, its strong expansion in the coming years is doubtful.

258. A related goal in the system of equivalency education has been to experiment with non-conventional technologies for the delivery of instruction and correspondence courses. A study carried out by the Institute for Economic and Social Planning (Instituto de Planejamento Economico e Social - IPEA) on (private) educational radio, indicates, however, that the scope of these activities is quite small in relation to the target population. 1/ In 1971, for all of Brazil, it was estimated that only 36 thousand persons were participating in these "distance learning" programs. That study estimates that over 20 million people could conceivably be served by these educational radio programs. Clearly, radio and TV education is still a very small component of Brazil's overall educational effort. However, on the basis of some recent research some experts feel that these technologies hold considerable promise for Brazilian education. 2/

259. Who are the clients of ensino supletivo? A study by the University of Brasilia for the Ministry of Education combining five regional capitals in 1977 concludes that the secondary education part of this program is often a means to certification for individuals who have left the regular track for financial reasons, but have professional aspirations at the university level. 3/ These are persons whose school attainment is higher than average and are around the middle of Brazil's socio-economic structure. While supletivo can lead to higher levels of instruction, the evidence suggests that the probabilities of failure in the university entrance exam, and (university) dropout rates are much higher for supletivo graduates than for others.

1/ Cf. IPEA/IPLAN, Radio Educativo No Brasil: Um Estudo, (Brasilia 1976). The institutions surveyed were the movement for Basic Education--Movimento de Educacao de Base (MEB), programming for the North, Northeast and Mato Grosso, the Padre Landell de Moura Foundation covering Rio Grande do Sul and Santa Catarina, the Padre Archieta Foundation in Sao Paulo, the Institute of Radio Education in Bahia, and Projeto Minerva in all of Brazil.

2/ See, for example, J.B. Oliveira and F. Orivel, "The Minerva Project in Brazil", in H. Perraton, editor, Alternative Routes to Formal Education: Distance Teaching for School Equivalency. Draft, September, 1978; Forthcoming. Also, E. Arena, D. Jamison, J. Oliveira and F. Orivel, "Analisis Economico de la Television Educativa en Maranhao, Brasil". Revista del Centro de Estudios Educativos (Mexico), Vol. VIII, No. 1, 1978, pp. 121-140.

3/ J.R. Velloso, Exames de Suplencia: Candidatos e Rendimento em Cinco Capitais, (Brasilia 1977).

Vocational Training

260. Vocational training has a long tradition in Brazil. Its history may be traced back to the 1910s when the first technical schools were set up in Sao Paulo and Guanabara. The National Service for Industrial Apprenticeship (Servico Nacional de Aprendizagem Industrial - SENAI) and National Service for Commercial Apprenticeship (Servico Nacional de Aprendizagem Comercial - SENAC) were set up in 1942 and 1946 to meet these needs. To these, the Intensive Program for Manpower Training (Programa Intensivo de Preparacao de Mao de Obra - PIPMO) was added in 1963, to meet additional training needs for industrial service, and was later expanded to serve all production sectors. More recently The Brazilian Technical Assistance and Rural Extension Enterprise (Empresa Brasileira de Asistencia Tecnica e Extensao Rural - EMBRATER) was created, replacing the Brazilian Association for Rural Credit and Assistance (Associacao Brasileira de Credito e Asistencia Rural - ABCAR), to provide rural training through agricultural extension. SENAI and SENAC have a great deal of financial and operational autonomy, deriving their income from a payroll tax on industrial and commercial firms with 500 or more employees. PIPMO is controlled by the Ministry of Labor.

261. An important feature of current policies is the provision of incentives to enterprises to set up their own training activities. Thus far, the most important incentive is to allow firms to deduct twice their training costs from their taxable income, once such activities are approved by the Ministry of Labor. SENAI carries out its activities in 245 training centers and in "on-the-job" training arrangements. Its organization and management are highly decentralized; its 430,000 certified participants in 1975 ranged from managers to semi-skilled workers. Because of SENAI's wide ranging geographical coverage and decentralization, the courses differ in content, method, duration, and quality standards. However, the quality of SENAI's courses are generally held in high esteem.

E. Educational Costs and Benefits

Financing Public Education

262. Brazilian public education is financed through a complex mechanism which assigns specific responsibilities to the different layers of government (federal, state and local) and, at the same time, interlocks the different layers in a number of revenue raising and transfer arrangements. Federal resources made available to education proceed from earmarked funds and from a series of transfer schemes which are designed to support specific programs, and which aim at redistributing income from the wealthy to the poor regions.

263. There has been a long and varied sequence of legal schemes to provide discretionary sources of financing for public education. 1/ These have included government lotteries, stamp taxes, and earmarking specific proportions of federal, state and municipal government expenditures for education.

264. Table 50 provides estimates of some basic magnitudes and sources of funds applied to Brazilian public education during the period 1960-74. Total education expenditures as a proportion of GDP increased from 1.6% in 1960 to 2.8% in 1974. A characteristic of this evolution has been a decentralization of public educational financing: the federal government's share declined from one third to 22% between 1960 and 1974, while the municipalities increased theirs from 8% to 11%. Partly, this was due to a constitutional provision adopted in 1969 requiring municipalities to allocate 20% of their budgets to education. Despite the growth of municipal education outlays, however, municipalities as a group spend less than the stipulated 20%.

265. During the last ten years an increasing number of special funds and transfer mechanisms have been set up to finance Brazilian education. In 1977 there were 15 specifically identifiable sources of (earmarked) public funds for this purpose plus "miscellaneous" categories at each of the federal, state and municipal levels of government. 2/

266. According to region-level aggregations based on state-level estimates, the share of state budgets allocated to education increased somewhat in the Northeast and Southeast during the period 1965-1973 (Table 51). 3/ In the Frontier a slight decline is indicated. Differences in this share across regions were small by the end of the period, ranging from 18% in the Frontier to 20% in the Southeast. Educational state expenditures per capita, however, grew quite rapidly during the period in all three regions, more than doubling in the Northeast and Southeast and almost quadrupling in the Frontier. By 1973, differences between regions remained great, with the Southeast index value four times greater than for the Northeast.

1/ The first education-specific tax was levied in 1768 (Real Mesa Censoria); it financed a literacy program. See A.E. Marques, Financiamento e Despesas com a Educacao no Brasil (MEC, Secretaria Geral: Brasilia, 1977).

2/ These sources include items such as: import duties, income tax, federal lottery, sports lottery, rural property tax, sales tax.

3/ Otavo B. Lima, Jr., "Financiamento da Educacao Publica no Brasil - Determinantes e Desequilibrios Regionais", 1977.

Source: A. Stocker, op. cit. Chart 2.

Table 50: PUBLIC EXPENDITURES ON EDUCATION BY BUDGETARY SOURCE AND ADMINISTRATIVE LEVEL SELECTED YEARS, 1960-1964

(billions of 1974 Cruzeiros; percentage)

Source, Level Budgetary	1960	1965	1970	1974	Percentage of total expenditures (row (8)) 1960	1974
(1) Federal	1.3	2.6	3.1	4.3	33	22
(2) State	2.3	3.8	7.1	12.5	59	63
(3) Municipal	0.3	0.4	1.3	2.1	8	11
(4) (1)+(2)+(3)	3.9	6.9	11.5	18.9	100	95
(5) FNDE a/	-	-	-	0.8		4
(6) MOBRAL	-	-	..	0.1		1
(7) (5)+(6)	-	-	..	0.9	-	5
(8) (4)+(7) (All sources)	3.9	6.9	11.6	19.8	100	100
(9) GDP	240.6	312.2	454.5	719.5	--	--
(10) [(8)/(9)]x100	1.6	2.2	2.6	2.8	--	--

Notes:

a/ Stands for Fundo Nacional de Desenvolvimento da Educacao (National Education Development Fund).

.. indicates less than 0.1 billion.

- indicates zero: programs not yet in operation.

-- indicates not applicable.

Source: Alberto de Mello e Souza, Os Gastos Publicos e Privados com a Educacao Formal no Brasil, IPEA, 1977, except GDP for 1965-1974, Conjuntura Economica 31:7 (July 1977) p. 90.

Table 51: INDICES OF STATE-LEVEL OUTLAYS ON EDUCATION, BY REGIONS, CERTAIN YEARS, 1965-1973

	1965	1969	1973
A. Outlays on education as percentage share of total (state) outlays			
Northeast	15.6	16.7	19.9
Southeast	18.1	18.8	20.2
Frontier	20.6	19.1	17.9
B. Index of state-level education outlays per capita (Northeast, 1965 = 100)			
Northeast	100	167	267
Southeast	467	667	1066
Frontier	107	233	400

Note: State-level indices in source averaged into the region-level indeces in this table using 1973 state-level enrollment as weights.

Source: Otavo B. Lima Jr., "Financiamento da Educacao Publice no Brasil - Determinantes e Desequilibrias Regionais", 1977.

267. Comparisons of other educational finance and related indicators between states grouped by total state revenue are shown in Table 52 for the years 1965 and 1973. The six wealthiest states made up 83% of all education outlays in 1965, and 79% in 1973 while accounting for only 70 and 65% shares in total enrollment in the respective years. At the other extreme, the poorest states, which in 1965 had 5% of enrollment and 6% in 1973, made up 2 and 3% of education outlays respectively.

268. According to the estimates, Federal transfers earmarked for education were moderately effective in redistributing resources to the poorest states which received 24% of all such funds while their share in total enrollment was only 6%.

Unit Costs

269. Calculations based on a study by Mello e Sousa indicate large differences among regionwide averages in the unit costs of state-run primary schools for the year 1960. 1/ Roughly, the averages computed for the Northeast and Frontier regions turned out to be of the same order of magnitude, while for the Southeast it was between 50 to 100 percent higher. 2/ Some additional calculations, based on the same source suggest that if in 1970 the Northeast's primary school coverage had been equivalent to that of the Southeast, this would have required educational outlays in the former region to have been about 2.3 times greater than they were. If, in addition, the quality of educational services, measured by unit costs, had been equivalent to that estimated to have prevailed in the Southeast, the required outlays would have had to be about 3.7 times greater than they were.

270. The same study suggests that school characteristics are closely related to characteristics of their specific location. In the poorer locations in Pernambuco in 1972, the schools were mostly one-room one-teacher school buildings, housing between 25 and 65 students in the municipal network, and between 40 and 200 students in the state network. The reported differences in unit costs are large between the two networks and in one locality in Pernambuco (Santa Terezinha) the municipal school costs imply unit costs of the order of US$2 per student. By contrast municipal schools in Recife are the most affluent in the state of Pernambuco and the numbers imply an average cost of over US$150 per student.

1/ Alberto Mello e Sousa, op. cit.

2/ The many likely sources of error underlying the numbers on which these calculations are based discourage any attempt at greater precision in these comparisons.

Table 52: EDUCATION-RELATED INDICATORS BY STATE GROUP (GROUPED BY PER CAPITA INCOME CLASS) 1965 and 1973

Indicator	Group/Year							
	Richest group 1/		Upper Middle 2/		Lower middle 3/		Poorest group 4/	
	1965	1973	1965	1973	1965	1973	1965	1973
Percentage share of total population	57	56	24	25	9	9	10	10
Percentage share of total enrollment	70	65	16	19	9	10	5	6
Percentage share of federal education transfers received		31		23		21		24
Percentage share of total state-level education outlays	82	79	9	11	5	5	2	3

Notes:

1/ Includes six most affluent states: Sao Paulo, Guanabara, Rio de Janeiro, Rio Grande do Sul, Parana, Minas Gerais.

2/ Includes five upper intermediate states: Santa Catarina, Bahia, Pernambuco, Goias, Espirito Santo.

3/ Includes five lower intermediate states: Ceara, Amazonas, Mato Grosso, Para, Maranhao.

4/ Includes six poorest states: Acre, Paraiba, Alagoas, Piaui, Rio Grande do Norte, Sergipe.

Source: Otavo B. Lima Jr., "Financiamento da Educacao Publice no Brasil - Determinantes e Desequilibrias Regionais", 1977.

271. In the case of Brasilia and its satellite communities, reported differences are also quite marked. The data show that the direct total unit costs incurred by public basic level schools in the satellite communities (where lower income families live) are one third the costs incurred in Brasilia's private schools. These relative orders and magnitude are also apparent in middle level schools (Table 53).

272. Information for the period 1965-70 indicates that at that time, the unit costs of middle level education (roughly, grade 5 through 12) were 4 times those of the primary level, while the unit costs in higher education were, on average, over 40 times higher than the unit costs of primary. 1/

273. As Castro and Frigotto point out, part of these differences can be attributed to inherent differences in the educational service rendered in each level. For example: university teachers take longer to train and thus their salary tends to be higher; instruction materials (including laboratories and computers) are naturally far more expensive in university training. All such pedagogically related factors, however, when taken into account, still leave much of the unit cost differences unexplained. This remainder is due to expenses that appear related mainly to consumption demands by students and staff. Consider, for example, that while many (most?) rural primary schools must do without piped water and basic sanitation facilities, almost all public universities in Brazil have swimming pools, sports facilities, pleasant cafeterias and other social ammenities. Such glaring differences in the physical environment of public universities compared to public primary schools seem difficult to justify on pedagogical or equity grounds.

Effects of Income on Education

274. Evidence discussed thus far supports the view that residential location (by region, state, municipality, urban/rural) is a powerful factor related to the quantity and quality of the education. Undoubtedly, within any such geographical unit, household income can also be expected to be a strong correlate of these key dimensions of education. This section explores the questions of the extent to which family income determines educational services received, and the extent to which public subsidies to education may be benefitting the rich more than the poor. Owing to the broad scope of this report, the treatment accorded to these very important, but very complex questions, is meant to be merely suggestive.

1/ C.M. Castro and C. Frigotto, Aspectos da Economia da Educacao (forthcoming).

Table 53: UNIT COST INDICES FOR TWO EDUCATIONAL LEVELS IN BRASILIA AND IN SURROUNDING ("SATELLITE") COMMUNITIES, 1977

(Direct Total Cost in Satellite Communities, Basic Level = 100)

	Direct Total Cost a/	School Total Cost b/	School Monetary Cost c/	Private User Cost d/
Basic level (1º Grau)				
Brasilia, private	333	207	71	126
Brasilia, public	149	109	77	45
Satell., public	100	68	49	32
Middle level (2º Grau)				
Brasilia, private	481	209	153	271
Brasilia, public	204	130	89	74
Satell., public	155	99	59	56

a/ Direct total costs include the costs of labor, services, capital outlays and private student costs. These constitute social costs on commonly computed save for the exclusion of opportunity costs of the students.

b/ School total costs exclude private user costs (which in this table have been corrected from those reported in the original source due to unexplained discrepancies).

c/ School monetary costs include actual outlays for labor and services.

d/ Private user costs are costs incurred by students by going to school. These include such expenses as transportation, texts and materials, purpose-specific clothing and fees.

Source: C.M. Castro and C. Frigotto, Aspectos da Economia da Educacao (forthcoming).

275. Not surprisingly, the composition of the classroom by the socio-economic background of students changes markedly with grade and level progression. By and large, the parents of first grade students replicate the occupational structure of society, except in backward rural areas where initial enrollment is still far from universal. This corresponds to a proportion of "working class" (unskilled, skilled and supervisory of manual occupation workers) students of about 60-70%. This proportion falls progressively until it reaches about 20% at the end of secondary education. About 10% of university entrants have fathers in these occupational categories. It seems clear that public subsidies to universities are therefore mostly benefitting higher income families.

276. A survey of educational expenses carried out by FGV in three cities in 1967/68 found that at the lower end of the income distribution (families earning one minimum wage or less) educational outlays represented 0.6% of family income in Recife, 2.1% in Porto Alegre, and 1.8% in Rio de Janeiro. At the upper end of the distribution (income of 18 minimum wages or more) the proportions were, respectively, 2.7%, 1.7% and 2.4%. 1/ In a separate survey for Sao Paulo carried out by FIPE in 1971/72 the range went from 2.5% in the lower end to a maximum of 5.9% in the income class of 18-20 minimum salaries. 2/ In terms of total money outlays, families in the two highest categories of income spend over 57 times more on education than families in the two lowest categories in Rio de Janeiro, 55 times more in Recife, 58 times more in Porto Alegre, and 66 times more in Sao Paulo. Income elasticity of educational expenditures, derived from survey data (not adjusted for differences in family size) ranges between 1.3 in Sao Paulo and 1.6 in Rio de Janeiro.

277. Private educational expenses are tax deductible and thus subsidized. The record of tax deductions applicable to education outlays in the year 1972 shows that the bulk of benefits went to households in the middle to upper income range: 75% of all deductions were given to the groups located between 8 and 44 minimum wages. In terms of geographical regions, the states of Sao Paulo and Rio de Janeiro, in that order, were the most favored. In Sao Paulo, average deduction per dependent was Cr$1180, against an average in other regions that ranged betwen Cr$500 and Cr$700. These amounts are large relative to educational unit costs: for those whose yearly income was 15 times the minimum wage, the amount of deductions was equivalent to the unit cost in the primary level in the former state of Guanabara; for those whose earnings were 23 times the minimum wage, the deductions per school dependent were slightly higher than the unit cost of ginasio level instruction.

1/ Unless otherwise noted, empirical information in this section is derived from Mello e Souza, op. cit.

2/ Educational expenses in Sao Paulo are highest owing, at least to a very large measure, to a greater share of private school attendance in that city. Beyond the 18-20 minimum salary range education costs decline as a proportion of family income.

278. Duration of schooling and progress along the educational ladder are important determinants of the cumulative magnitude of education-related subsidies accruing to individuals. Since all public education is almost totally subsidized, and unit costs generally increase over each subsequent cycle from primary to higher education, the longer and the higher the level of the individual's educational experience, the greater the subsidy. Even after adjusting ("netting") the subsidies by the higher taxes paid by the more highly educated individuals, a study by J.P. Jallade based on 1970 and 1972 cross-section data estimates that such net subsidies are substantially and consistently greater for persons having completed lower secondary schooling than for those completing only primary schooling. 1/

279. Jallade's data also show that the income level of parents (and its strong correlate, their education) is a strong determinant of how much schooling the children receive. Children from lower income families are less likely to attain either primary or secondary schooling. Consequently, the expected net subsidy accruing to them is significantly lower than that accruing to the children from higher income families.

Effects of Education on Income

280. The common sense and empirical associations between education and income are generally very strong. Few would doubt that the incomes of Brazilians are not only closely correlated with but also caused, at least partially, by corresponding levels in the quantity and quality of the education they had received. To the extent that education may indeed be a strong determinant of an individual's earnings in Brazil, it would seem a powerful policy variable to raise the income of the poor. This, in turn, would enable them to expand their basic consumption. Besides being able to afford more of these basic goods, there is also a presumption that more educated people would be more efficient consumers. To what extent, then, is income affected by education? More importantly, to what extent could certain changes in the provision of public education be relied on to bring about substantial improvement in the income of the poor?

281. These questions have been central to the debate surrounding Brazilian income distribution and the most important contributions on the subject of income consequences of education are inserted in the broader income distribution context. This debate is reviewed by Jallade in a paper containing his own original contribution on the subject. 2/

282. In his 1973 book, Langoni 3/ concluded that education was indeed such a strong determinant of income in Brazil, that the reported concentration of

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1/ J.P. Jallade, "Basic Education and Income Inequality in Brazil: The Long Term View." World Bank Staff Working Paper, No. 268 (Washington, D.C.: June 1977).

2/ Jean-Pierre Jallade, "op. cit. Unless otherwise noted, the material in the remainder of this section is drawn (sometimes verbatim) from Jallade's paper.

3/ Carlos Langoni, Distribucao da Renda e Desenvolvinmento Economico de Brasil, (Rio de Janeiro: Editora Expressao e Cultura, 1973).

personal income during the 1960s could be largely attributed to increasing inequality in the distribution of education (measured by school attendance) among the Brazilian labor force. This view was later criticized by M. Carnoy 1/ who arrived at an unchanged distribution of investment in education during the period by weighing school attendance with the relative costs of the various levels of schooling.

283. Fishlow 2/ also questions Langoni's view that the principal factor responsible for income inequality is unequal access to education and attempts to reinstate the role of real and financial ownership-of assets in explaining income inequality. In his view, an overemphasis on education leads to disregard other important factors such as land tenure, wage policy and occupation. As far as the role of education in distributing income is concerned, he states that "educational policy should not be made to bear a burden that exceeds its capability. Ease in obtaining consensus for more expenditure on schooling, in contrast to the serious strains posed by outright redistribution of wealth, does not make education the sole or ideal investment for greater equality. But more properly understood, educational investment can at least cease to be a perverse influence and turned to rightful advantage."

284. What Fishlow meant by the last sentence was that, within the confines of educational policy, emphasis upon primary education to the detriment of higher education - rather than the reverse which actually happened - could contribute to reduce inequality. In doing so, he acknowledges that education has some role to play in reducing inequality - even if it is smaller than that attributed by Langoni.

285. In his paper, Jallade reports results of rate of return calculations on investment in primary and lower secondary education for a cross section of various socio-economic groups. The data are from the 1970 census and 1972 PNAD. For Brazil as a whole, the computed social rate of return for primary education ranges from 14% (for rural women) to 31% (for females with low socio-economic background). For lower secondary education, these rates range from 6% (for males with low socio-economic background) to 13% (for non farm males). 3/ It should be emphasized that like all calculations of social rates of return to education based on cross section empirical data, Jallade's results are subject to many qualifications and should be interpreted with great care. This is particularly true concerning their policy implications for decisions affecting outcomes in the future. Nevertheless, the reported rates of return do lend support to the view that education has been an important determinant of income among Brazilians.

1/ M. Carnoy, "Distribuicao da Renda e Desenvolvimento Economico de Brasil: un Comentario". Revista de Administracao de Empresas. According to Carnoy, as the education distribution in terms of school attendance became more unequal during the sixties, there was a counterbalancing trend towards an equalization in the costs of the various levels of schooling.

2/ "Brazilian Income Size Distriubution - Another Look", Albert Fishlow (mimeographed), n.d.

3/ J.P. Jallade, op. cit., Table 1, p.8.

286. A somewhat different question concerning the effect of education on income is addressed in a forthcoming World Bank study by Pfeffermann and Webb: 1/ to what extent has income growth since 1960 differed across educational achievement groups? Specifically, to what extent have individuals with little or nor formal schooling shared in Brazilian economic growth since 1960? Their qualified answer is that income growth has lagged for illiterates, although it has not been insignificant:

> "...it includes modest improvement within the category of illiterates [and] faster income growth for those amongst the poorest who have some primary education.... For the rest of the population, the trend in educational differentials is not clear,...." 2/

287. In conclusion, the educational attainment of Brazilians has been an important factor in determining both their income and their income growth in recent years. It seems likely that these relationships will tend to persist during the next couple of decades.

F. Current Policy Issues

288. The sharp contrasts that characterize Brazilian socio-economic development are clearly reflected in the realm of education. Geographical disparities in literacy and enrollment rates are wide; with respect to resources devoted to education per student, inequalities are even wider. Important geographical dimensions of these disparities are: (i) regional -- the Northeast and Frontier are far worse off than the Southeast; (ii) rural-urban; and (iii) municipal or district units within any of the preceeding broader categories. Place of residence is a very powerful factor determining the quality of (public) education obtained by students. Many Brazilians feel that such a factor is neither efficient not equitable in allocating educational opportunities.

289. While socio-economic status and place of residence of families are not at all independent of each other, socio-economic status seems to have a strong independent effect on a child's progress through the educational system. The probability of successful progression to the upper levels of the educational system is far smaller for the child from a household of low socio-economic status than for his well-to-do neighbor. Although this association between socio-economic background and school performance is virtually universal, some people think that it is somewhat more extreme in Brazil and that efforts to counter the disadvantages of children from poor families should be greatly strengthened.

290. A third area of great contrast in Brazilian education concerns the magnitude and equality of resources per student across the different levels of the educational system. Representative secondary schools tend to spend much more per student than primary schools. And quality standards bear close relation to expenditures per student. Differences in this and other

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1/ Guy Pfeffermann and Richard Webb, "Income Distribution and Poverty in Brazil" (forthcoming, 1979).

2/ Ibid.

indicators of relative resource allocation between either of these two levels and universities seem gigantic. These have been characterized as contrasts between squalor and opulence by some Brazilians that feel that such differences can not be justified in terms of either equity or efficiency.

291. Alongside these inequalities, other regressive forms of public spending on education also exist. Individual municipalities spend more per student on the schools located in the most affluent or urbanized areas within the municipal boundaries. States' transfers to municipalities tend to benefit the most central and prosperous among these. In contrast, the Federal government is presently carrying out a neutral to slightly progressive redistribution policy among states. However, because of the great difference in unit costs by level, and the greater participation of students from the top socio-economic layers in the higher educational levels, the subsidy per capita built into the free public education system clearly benefits the more affluent families. In addition, income tax deductions for education represent a regressive transfer.

292. Perhaps the most disappointing feature of Brazilian education is the poor results of basic education. While the proportion of urban children who never attend school is by now fairly small, low attendance in the rural areas is still a big problem. The most pervasive and obvious failure, however, is the high drop out rate in the initial grades. More students abandon school before reaching the second grade than in any other level. If four or five years of schooling are required for functional literacy, Brazil is faring very poorly in view of the small proportion of students reaching this level.

293. There is some consensus on at least two broad reasons for the poor performance of basic education. One is the very low expenditures (and consequent meager resources) per student in most primary schools, particularly outside of the urban Southeast. Another is the high proportion of students from very low socio-economic backgrounds, who are almost universally difficult to guide through a successful educational experience. However, some Brazilian experts feel that relatively little has been done to compensate such difficulties by means of good quality schools and creative pedagogical strategies. In contrast to the attention and imaginative schemes found in higher levels of Brazilian education basic resources such as school furniture and textbooks are often unavailable in a large proportion of primary schools.

294. It is important to realize that many of the difficulties with Brazilian education have less to do with current management than with past policies and shortcomings. Current growth in enrollment is impressive - and in some cases exaggerated. Enrollment in elementary schools is growing more than twice as fast as population; secondary education grows five times as fast. University enrollment grows even faster. Whether such a structure of growth rates is appropriate, moreover, is a matter of debate. In educationally mature countries higher levels grow faster because lower levels achieved nearly universal coverage. This is hardly the case in

Brazil, where functional literacy (4 to 5 years of schooling) is not being achieved by roughly two thirds of the school age population. Moreover, the explosive growth of university enrollment is sucking into the system students who are ill-prepared for higher education. The concurrent decline in average academic standards in universities supports this view. Some observers find that such growth rates are less the result of a definition of social priorities than a structure of (career) incentives facing decision makers. Indeed, the truly vocal and alert groups pressing the education system aim their demands at the university level. Much political will on the part of the society as a whole will be required to compensate for the very weak incentives to improve the educational levels that need it most.

295. Government strategy to contain pressure for higher education has been to give vocational content to secondary education. There is no clear indication that this has resulted in less pressure for university enrollment. Nevertheless, making secondary education more directly useful to employment opportunities appears sensible in its own right. The implementation of the policy to increase the vocational contnet of secondary education, however, is sometimes critized. For example, much effort has been devoted to improve the academic and technological levels of industrial technical schools. Paradoxically, such excellent quality education seems to have motivated students to pursue higher education. As a result these schools are enhancing the pressures for even greater expansion of higher education, which is quite the opposite of the original intent. There are other paradoxes. Regular high schools are required to provide pre-vocational courses. Many schools lack the resources and know-how to provide meaningful programs. Though, by and large, graduates from secondary schools feel academically overeducated to enter manual occupations, those who would like to take these jobs are underqualified due to insufficient school training. Of course some do benefit from the vocational content of certain secondary school curricula, and it is unlikely that it can do any harm. In sum, it is a very perplexing situation where no final and easy judgments are available. These must await additional evaluations. Moreover, the diversity of situations is likely to require correspondingly diverse solutions.

296. Brazil has long been a leader in non-formal systems for training industrial labor. SENAI, in particular, has developed some of the most successful schemes for training highly skilled workers since its creation some 30 years ago. In sharp contrast with the erratic attempts of the formal system, SENAI has closely monitored labor market demand and responded with creative and sound programs. Without sacrificing quality, the flow of graduates has been increasing over the years, reaching today very impressive numbers.

297. Not all non-formal programs have been so successful however. MOBRAL, is particularly controversial. While many have undoubtedly benefited from their literacy courses, original expectations have not materialized. Among the main problems, drop out rates seem very high; only a very small proportion of those enrolled and certified are offered anything beyond the basic 200 hours program. And consequently, it is estimated that only about half of the graduates retain their literacy after a couple of years of taking the course. Recent experience from similar programs in other

countries, however, suggest that MOBRAL is not along concerning some of its most negative results. Perhaps there are no shortcuts to a solid basic education program.

G. Simulations: Summary Results

298. Nationwide enrollment and operating cost projections to the year 2,000 for primary education (grades 1 to 8; "normative" ages 7 to 14) are described in Appendix D to this annex. Based on these projections, plausible ranges of magnitude for enrollment and operating cost in selected future years are presented in Table 54 below. Comparisons of the projected cost with projected GDP values are also shown in Table 54. Unlike other sectoral projections in this report, there is only one set of basic assumptions underlying the detailed projections of future levels of the service in question -- enrollment. This set of assumptions can be described as a continuation with modest improvements of current trends with respect to key projection parameters such as admission, repetition, promotion and dessertion coefficients. As such, they can be regarded as being intermediate in the "pessimistic-optimistic" spectrum. The limiting values of the "plausible ranges" of future enrollment reported in Table 54 have been derived as a 10% interval above and below the values computed by the detailed method described in Appendix D. Alternative cost-per-student values in Table 54, however, are taken from Appendix D. Average recurrent cost per student (another index of educational quality) is assumed to rise significantly over the projection period, almost doubling in the optimistic simulation.

299. As indicated above, the projections are not geographically disaggregated; they apply only for Brazil as a whole. Since the very wide geographical disparities in enrollment and cost indices are lost in the aggregation, the projections are not at all representative of the evolution of these indices in most geographical areas. Thus the only purpose of the projections is to suggest possible orders of magnitude for the cost of achieving certain aggregate enrollment goals. Other tools of analysis must be used to take into account regional disparities.

300. According to the projections, total enrollment would grow (from about 18.6 million students in 1974) to between 23 and 28 million in 1980; and to between 34 and 42 million in 2000 (or average annual growth rates of from 2.3% to 3.2% for the 1974-2000 period; this compares with an average of 5.2% during the 1955-74 period). This decline in the growth of gross enrollment rates includes the effect of reducing the number of average students. But more important, as most of the children aged 7-14 become enrolled, the rate of growth of enrollment tends to the limit set by the rate of growth of the population in this age group. The (midpoint) enrollment projections imply that the proportion of 7-year olds admitted into the system would grow from 87% in 1975 to 100% in 2000. In the urban areas of the Southeast, this proportion is already very close to 100%. Under current trends, it is unlikely that universal coverage of 7-year olds in the rural Northeast would be attained before the 1990s; universal coverage of the 7-year old population might be approached by the end of this century.

Table 54: GROSS ENROLLMENT AND OPERATING COST IN BASIC EDUCATION; PLAUSIBLE RANGES FOR SELECTED YEARS, 1980-2000, AND COMPARISONS WITH GDP

	1980		1990		2000	
	Min.	Max.	Min.	Max.	Min.	Max.
1. Gross Enrollment[a/]	22.6	27.6	30.2	37.0	34.3	41.9
(as percent of population aged 7-14)[b/]	(90)	(109)	(88)	(108)	(85)	(103)
2. Cost per student[c/]	63.3	64.2	78.7	86.2	92.4	115.9
3. Total Cost (Lines (1) * (2))[d/]	1.4	1.8	2.4	3.2	3.2	4.9
4. GDP[e/]	177.7	182.8	263.0	359.6	389.3	707.4
5. Lines [(3) ÷ (4)] * 100[e/]	0.8	1.0	0.9	0.9	0.8	0.7

a/ Millions of students, including overaged and repeaters.
b/ Obtained from "baseline" population projections (see Annex I).
c/ Constant US$ of 1976.
d/ Billions of constant US$ of 1976.
e/ Note: Accumulated total cost over 10-year periods, divided by accumulated GDP over the same periods would yield (in %):

for the period	Min.	Max.
1981 - 1990	0.86	0.93
1991 - 2000	0.76	0.85

301. Combining the alternative average operating cost (per student) projections with correspondingly low and high projections of enrollment and GDP, results in GDP shares devoted to the purpose ranging from 0.76% to 0.93% in any one year between 1980 and 2000. Once again, financial resources do not appear to be a serious constraint in achieving universal primary education before the end of the present century. No additional taxation should be necessary if the explosive growth of higher education can be controlled and better redistribution of funds for basic education to achieve targets in poor areas can be brought about. Much remains to be learned about how to organize and administer federal and state programs in basic education so as to achieve this objective efficiently.

APPENDIX A

METHODOLOGIES USED IN ESTIMATING THE EXTENT OF MALNUTRITION IN BRAZIL

1. Estimation of Calorie Requirements

1. The FAO has defined the energy or food requirements of persons as that energy intake considered adequate to meet the energy needs of the average healthy person in a specific age/sex category. While some individuals are expected to need more or less than the average energy requirements, the requirements are set at a level where surpluses and deficits cancel each other or at the average expected needs of the group. 1/ The FAO calorie requirements are based on a system developed by Atwater in the nineteenth century: the use of a reference man and woman with other factors such as age, climate, or activity rate used to modify the requirements for the reference person. The FAO standard has been revised several times during the 25 years that it has been used. It is open to criticism on some points where insufficient scientific knowledge is available, but has proven generally acceptable.

2. The reference man and reference woman are hypothetical persons of defined age, body size, and physical activity, used for the purpose of calculating energy needs of populations by means of appropriate corrections based on body weights, patterns of activity, and age structure.

(a) Reference man. He is between 20 and 39 years of age and weighs 65 Kg. (This can be changed to a national standard.) He is healthy, that is, free from disease and physically fit for active work. On each working day he is employed for 8 hours in an occupation that usually involves moderate activity. When not at work he spends 8 hours asleep, 4-6 hours sitting or moving around in only very light activity, and 2 hours in walking, in active recreation, or in household activities.

(b) Reference woman. She is between 20 and 39 years of age, similarly healthy, and weighs 55 kg. (This can also be changed to a national standard.) She may be engaged for 8 hours in general housework, in light industry, or in other moderately active work. Apart from 8 hours asleep, she spends 4-6 hours sitting or moving around in only very light activity, and 2 hours in walking, in active recreation, or in household duties. 2/

1/ See FAO/WHO, Energy and Protein Requirements: Report of a Joint Ad Hoc Expert Committee, FAO Nutrition Meeting Series 52/WHO Technical Report Series 552 (Rome, 1973).

2/ See FAO/WHO, op. cit., p. 12.

3. FAO and WHO experts recommend the following methodology which was also used to prepare the FAO/WHO High and FAO/WHO Low estimates presented in Table 14 in the main text. 1/ The only difference between the two sets of estimates is the lower weights assumed for the reference man and reference woman in the FAO/WHO Low estimates.

(a) Calculate the average energy needs of the reference man (M) and woman (F) with weights W and W′ respectively:

Male $M = 46\ W$

Female $F = 40\ W'$

i.e., 58 kg. Male

$M = (46) \times (58) = 2,668$

(b) Adjust the requirements for age using the following table: 2/

Age Group	Calories per person per day	
	Males	Females
Infants /a	1,120	1,120
1-3	1,367	1,350
4-6	1,867	1,787
7-9	2,260	2,110
10-12	2,600	2,350
13-15	.97M	1.13F
16-19	1.02M	1.05F
20-39	1.00M	1.00F
40-49	.95M	.95F
50-59	.90M	.90F
60-69	.80M	.80F
70+	.70M	.70F

/a Infants include an allowance for pregnant and lactating mothers.

1/ Ibid., page 79.

2/ Ibid., Table 26, page 80 and Table 7, page 34. An informal FAO/WHO expert group has recommended different standards for children 16-19 to allow some catch up growth. This suggestion has not yet been officially adopted, but would not change requirements by more than 1% for the whole population. See "Energy and Protein Requirements: Recommendations by a joint FAO/WHO Informal Gathering of Experts," Food and Nutrition 1:2 (1975), FAO, Rome, p. 11-19.

4. The FAO/WHO guidelines used in this report state that no adjustment for temperature should be made, reversing some recommendations of earlier FAO publications. 1/ If the temperature adjustment were made, requirements in the Northeast and Frontier regions would be on the order of 200 calories lower than estimated in this report, about 150 calories lower in the cooler Southeast. No adjustment was made for activity level since the guidelines state that "it is unlikely that the average activity of the working portion of the population differs markedly from the moderate activity referred to in the definition of the reference adult." 2/ The ingestion requirements calculated as suggested above were adjusted upwards by the average ratio of consumption to ingestion in the corresponding ENDEF subregions (generally on the order of 1 to 3%) so as to permit comparison with the detailed ENDEF consumption data by expenditure class.

5. In order to illustrate the nature of the calculations involved in estimating FAO/WHO High calorie requirements for the Brazilian population in 1975, Table A-1 shows the calories per day needed by the different age/sex groups in the Southeast region. Table A-2 shows the estimated population in the region in 1975. Table A-3 shows the total calories needed each day by age/sex groups (obtained by multiplying the figures in Table A-1 by that in Table A-2). Table A-4 shows that the regional estimate of calorie requirements (total calories divided by population) for the Southeast in 1975 would be 2,353 as shown in the main text in Table 14. The energy requirements calculations for 1975 for each region by the high and low standards are based on "baseline" population projections described in Annex I of this report.

1/ FAO/WHO, op. cit., p. 27.

2/ Ibid., p. 81.

Table A-1:

FAO/WHO HIGH CALORIE REQUIREMENTS FOR THE SOUTHEAST REGION, 1975
(Calories per person per day)*

Age Group (Years)	Males	Females
Infants	1,124	1,121
1-4	1,496	1,470
5-9	2,192	2,060
10-14	2,776	2,467
15-19	3,140	2,412
20-24	3,084	2,262
25-29	3,084	2,262
30-34	3,084	2,262
35-39	3,084	2,262
40-44	2,930	2,149
45-49	2,930	2,149
50-54	2,776	2,036
55-59	2,776	2,036
60-64	2,467	1,809
65+	2,282	1,674

* Includes only 2.8% for waste.

Table A-2: POPULATION OF SOUTHEAST REGION BY AGE GROUPS, SEX, AND URBAN/RURAL LOCATION, 1975
(Thousands)

Age Group (Years)	Urban Males	Rural Males	Urban Females	Rural Females
0-4	2,926.9	1,754.3	2,843.1	1,700.1
5-9	2,754.3	1,507.4	2,703.6	1,451.3
10-14	2,574.2	1,355.5	2,598.6	1,269.8
15-19	2,369.8	1,193.9	2,504.7	1,040.9
20-24	2,172.0	950.9	2,398.8	870.5
25-29	1,876.4	775.4	1,970.3	692.3
30-34	1,486.0	579.2	1,551.6	520.0
35-39	1,306.9	504.4	1,340.7	454.7
40-44	1,200.1	407.5	1,268.0	363.3
45-49	950.6	425.5	992.5	370.9
50-54	803.4	338.2	855.2	278.4
55-59	617.0	248.1	683.0	201.7
60-64	470.6	173.0	541.0	137.0
Over 64	748.0	299.4	940.5	260.5
Total	22,256.3	10,512.7	23,191.7	9,611.2

Total Urban = 45,448.0 Total Males = 32,769.0

Total Rural = 20,123.9 Total Females = 32,802.9

Total Population 65,571.9

Source: "Baseline" demographic projections (see Annex I)

Table A-3:

TOTAL FAO/WHO HIGH CALORIE REQUIREMENTS FOR THE POPULATION OF THE SOUTHEAST REGION BY THE AGE GROUP, SEX, AND URBAN/RURAL LOCATION, 1975
(In millions of calories per day)

Age Group (Years)	Urban Males	Rural Males	Urban Females	Rural Females
Infant	772.1	464.8	735.9	440.1
1-4	3,348.2	2,004.2	3,214.3	1,922.0
5-9	6,037.4	3,304.2	5,353.1	2,989.7
10-14	7,146.0	3,762.9	6,179.1	3,132.6
15-19	7,441.2	3,748.8	5,785.9	2,510.7
20-24	6,698.4	2,932.6	5,426.1	1,969.1
25-29	5,786.8	2,391.3	4,456.8	1,566.0
30-34	4,582.8	1,786.3	3,509.7	1,176.2
35-39	4,030.5	1,555.6	3,032.7	1,028.5
40-44	3,516.3	1,194.0	2,724.9	780.7
45-49	2,785.3	1,246.7	2,132.9	797.1
50-54	2,230.2	938.8	1,741.2	566.8
55-59	1,712.8	688.7	1,390.6	410.7
60-64	1,161.0	426.8	978.7	247.8
Over 64	1,706.9	683.2	1,574.4	436.1
Total	58,955.9	27,128.9	48,236.3	19,974.1

Total Urban = 107,192.2 Total Males = 86,084.8

Total Rural = 47,103.0 Total Females = 68,210.4

Total population = 154,295.2

Source: "Baseline" projections (See Annex I).

Table A-4: AVERAGE FAO/WHO HIGH CALORIE REQUIREMENTS FOR THE SOUTHEAST REGION BY URBAN/RURAL LOCATION, 1975
(Calories per person per day)

Total Population	=	2,353
Urban	=	2,359
Rural	=	2,341

2. Use of FAO/WHO Age/Weight Standards in Measuring Malnutrition

6. To justify the use of the FAO/WHO weight standards in analyzing the ENDEF data on Brazilian children, Tables A5 and A6 show mean weight data by age from 30 recent studies which are predominantly of middle class children from developing countries, though four studies of relatively disadvantaged ethnic groups from the United States and Canada have been included:

(a) European Descent: Argentina, French-Canadians, Chile, Guatemala, Jamaica, and Puerto Rico;

(b) African Descent: Bermuda, Haiti, Jamaica, Nigeria (two regional studies), Uganda, U.S. Blacks, the West Indies, and Zaire;

(c) Asian Descent: Hong Kong, Jamaica, Japan, Taiwan, Thailand, U.S. Eskimos, U.S. Indians, U.S. Japanese; and

(d) Indo-Mediterranean Descent: India (two regional studies), Iraq, Israel, and Turkey.

7. These studies, full references for which are given in the bibliography in this appendix, were chosen because all the 28 groups of children in the 30 studies (two studies have been merged into other series) are believed to have been well nourished since, if food is freely available as is generally the case in middle class families, people tend to eat enough to meet or exceed their individual requirements for energy. The average size of adults in developing countries is considerably smaller than that of North Americans. If these differences are due to climate, genetic, or even cultural factors, the middle class children should show these differences from country to country, assuming that middle class children are genetically and culturally more similar to other children in their own countries than to middle class children in other countries. An examination of Tables A5 and A6 will show that the age/weight curves for most of the groups surveyed lie very close to one another and to the FAO/WHO standard which is based on large surveys of healthy U.S. children done in the 1930s. However, they often fall slightly below the FAO/WHO standard (1 to 3 kg.) and after puberty there are definitely differences between the various groups. Moreover, the Asian children are consistently smaller than those of European, African, or Indo-Mediterranean descent.

Table A5: COMPARISON OF MEAN WEIGHT BY AGE DATA FOR GIRLS IN SURVEYS CONDUCTED IN BRAZIL AND OTHER COUNTRIES WITH FAO/WHO NORMS
(Weight in kilograms)

Age in years	Normal[a/] (FAO/WHO)	Third Percentile (FAO/WHO)	Northeast Brazil (ENDEF)	European descent							African descent						
				Argentina (Lozano)	Bermuda (Gourlay)	Canada-French (Demirjian)	Chile (Barja)	Guatemala (Sabharwal)	Jamaica (Ashcroft) (1)	Puerto Rico (Knott)	Haiti (King)	Jamaica (Ashcroft) (2)	Nigeria (Janes)	Nigeria (Rea)	Uganda (Rutishauser and Burgess)	US-Blacks (Verghese)	West Indies (Luyken)
1	11.1	8.8	8.4	9.6			10.5						9.0	9.5	8.8	9.2	
2	13.4	10.7	10.4	11.9			13.0						11.5	11.7	11.2	11.3	
3	15.4	12.5	12.1	14.8			14.9						13.7	15.3	13.1	14.0	
4	17.5	14.0	13.8	16.7			16.9						16.0	16.1	15.3	15.7	15.3
5	20.0	16.1	15.4	17.9			18.8		19.0				17.8	-	17.4	18.2	17.2
6	22.4	17.3	17.0	21.0	20.9	19.9			21.2		20.5	20.4	19.8		18.6	19.5	19.2
7	25.0	19.6	18.8	22.4	23.6	21.6		24.0	23.3	24.5	22.5	22.1	22.1		22.5	22.8	21.9
8	27.7	21.4	20.7	26.8	26.8	25.5		26.0	26.0	28.0	24.5	24.9	24.8		25.2	25.6	24.1
9	30.4	23.2	22.8	30.3	29.5	27.2		28.9	28.8	32.2	27.5	29.8	26.6		27.5	29.5	26.5
10	33.8	25.2	25.0	34.1	32.3	30.8		32.7	32.5	35.3	32.0	34.0	31.4		30.0	32.8	30.5
11	37.7	27.6	28.0	38.2	37.3	34.5		35.7	38.0	39.4	35.0	38.5			31.5	37.7	35.9
12	42.4	30.8	31.8	42.2	41.4	38.8		40.6	41.5	45.1	41.0	42.9			38.0	43.5	40.2
13	47.0	35.2	36.1		46.6	44.9		46.8	45.5	49.5	45.5	45.0			42.5	48.3	42.4
14	50.4	39.0	40.6		51.1	49.5		50.3	50.0	51.8	48.0	48.1			47.8	51.8	
15	52.3	41.0	44.6		52.7	52.1		52.0	52.5	52.8	52.0	51.4			51.2	54.4	
16	53.6	42.1	47.2		54.3	51.4		50.0	53.5	55.7	53.0	52.5			53.0	55.0	
17	54.2	42.7	48.3		54.5			52.1	53.2	54.8	54.0	52.2			53.7	57.6	
18			49.1									51.5			53.5		

Age in years	Normal[a/] (FAO/WHO)	Asian descent							Indo-Mediterranean descent					
		Hong Kong (Chang)	Jamaica (Ashcroft) (3)	Taiwan (Kimura)	Japan (Tokyo DMCH) (1963/1970)	US-Japanese (Kondo)	US-Eskimos (Jamison)	US-Indians (ICNND)	India (Raghavan)	India (Banik)	Iraq (Shakir)	Israel (Shiloh)	Tunisia Bourtourline-Young)	Turkey (Neyzi)
1	11.1			10.8	9.8			9.0		9.4			9.0	
2	13.4			12.1	11.2			12.0		11.9	12.6		11.5	
3	15.4			14.0	12.5		16.1	14.3		13.7	14.4		13.6	
4	17.5			15.7	14.0		-	16.5		15.9	16.4		15.4	
5	20.0		16.4	17.0	17.3		20.2	18.8		17.2	18.5		17.0	
6	22.4	18.1	17.9	18.4	18.8	19.8	21.4	21.0	20.0			22.1	18.5	
7	25.0	19.5	19.0	20.3	20.7	21.8	24.6	22.6	23.2			23.7	20.5	
8	27.7	21.4	22.0	22.3	23.2	24.7	26.0	25.5	25.5			26.7	22.5	
9	30.4	23.4	24.8	25.0	25.8	27.4	30.3	28.5	28.0			29.0	25.7	28.5
10	33.8	26.0	-	27.0	29.2	32.2	32.3	31.5	31.5			31.5	28.6	34.1
11	37.7	29.4	-	28.2	33.3	35.3	35.9	35.5	35.0			34.7	30.1	40.2
12	42.4	33.8	37.1	36.0	38.2	40.2	45.3	41.0	40.0				34.5	44.1
13	47.0	39.1	41.8	40.4	42.7	45.9	47.0	45.5	43.5				44.0	48.2
14	50.4	42.2	45.4	41.5	46.7	48.5		49.7	45.8				50.0	53.4
15	52.3	44.3	46.6	43.7	49.5	49.2			47.5				49.1	55.0
16	53.6	45.1	47.8	45.2	51.0	49.4			49.0				51.9	52.8
17	54.2	45.8	48.0	44.5	51.8	51.8			49.7					54.6
18		45.3		46.6										

a/ 50th percentile

Source: See Bibliography to this appendix

Table A6: COMPARISON OF MEAN WEIGHT BY AGE DATA FOR BOYS IN SURVEYS CONDUCTED IN BRAZIL AND OTHER COUNTRIES WITH FAO/WHO NORMS
(Weight in kilograms)

Age in years	Normal[a/] (FAO/WHO)	Third Percentile (FAO/WHO)	Northeast Brazil (ENDEF)	European descent							African descent							
				Argentina (Lozano)	Bermuda (Gourlay)	Canada-French (Demirjian)	Chile (Barja)	Guatemala (Mendez)	Jamaica (Ashcroft) (1)	Puerto Rico (Knott)	Haiti (King)	Jamaica (Ashcroft) (2)	Nigeria (Janes)	Nigeria (Rea)	Uganda (Rutishauser)	US-Blacks (Verghese)	West Indies (Luyken)	Zaire (Ghesquire)
1	11.4	9.6	8.9	10.3			10.5						10.1	10.2	9.4	9.6		
2	13.6	11.4	10.9	12.9			13.0						12.5	13.7	11.7	13.3		
3	15.6	12.9	12.7	14.8			14.9						14.8	14.3	13.8	14.4		
4	17.4	14.3	14.2	16.7			16.9						16.7	17.5	16.0	17.0	16.0	
5	20.7	16.6	15.8	18.5			18.8		18.8				18.9	20.6	17.8	19.3	18.4	
6	23.2	18.5	17.4	21.0	21.4	20.2			21.0		21.0	19.9	20.7		18.5	21.0	20.0	
7	25.9	20.6	19.0	24.7	23.6	22.5		25.9	24.0	25.1	22.5	22.8	22.9			23.4	22.3	21.8
8	28.6	22.8	20.9	27.7	26.8	24.8		28.6	26.3	28.4	26.0	25.0	25.4			26.4	24.1	23.8
9	31.3	24.8	22.9	30.6	30.4	27.6		32.2	28.7	31.9	28.0	27.1	28.0			29.1	25.5	26.5
10	33.9	26.9	25.0	32.9	32.3	30.3		34.4	30.8	35.9	30.5	31.2				33.0	28.6	29.3
11	36.7	29.3	27.2	37.2	35.7	33.2		39.4	35.0	41.1	34.0	33.8				34.1	32.3	31.5
12	40.2	31.6	29.6	41.1	40.0	38.6		40.6	40.0	44.0	39.0	36.1				39.7	38.9	35.5
13	45.5	34.4	32.5	-	44.5	44.9		50.5	44.0	49.5	41.0	40.1				43.7	44.1	
14	51.7	38.8	36.4		50.0	47.9		54.2	48.0	54.8	48.0	46.0				50.5	47.0	
15	56.7	44.2	41.0		53.9	55.5		55.8	54.5	58.2	49.0	51.7				56.3		
16	60.3	48.5	45.6		58.6	58.6		60.5	59.5	64.9	52.5	56.1				60.8		
17	62.4	50.7	49.6		64.3	59.3		65.6	61.0	66.8	56.5	59.1				64.5		
18			53.1								61.0	61.0						

Age in years	Normal[a/] (FAO/WHO)	Asian descent								Indo-Mediterranean descent					
		Hong Kong (Chang)	Jamaica (Ashcroft) (3)	Taiwan (Kimura)	Thailand (Khanjanasthiti)	Japan (Tokyo DMCH)	US-Japanese (Kondo)	US-Eskimos (Jamison)	US-Indians (ICNND)	India (Raghavan)	India (Banik)	Iraq (Shakir)	Israel (Shiloh)	Tunisia Bourtourline-Young)	Turkey (Neyzi)
1	11.4			11.1	9.1	9.5			10.0		10.0			9.6	
2	13.6			12.7	11.0	11.8			12.0		12.2	13.6		12.3	
3	15.6			14.7	13.4	13.3			15.0		14.2	15.7		14.4	
4	17.4			16.2	15.1	14.5		18.2	17.5		16.1	17.3		16.4	
5	20.7		17.9	17.0	16.3	17.7		19.6	20.0		18.1	18.5		17.9	
6	23.2	18.5	19.5	18.7	-	19.3	22.0	21.4	21.8	20.8				19.3	
7	25.9	19.5	20.1	20.8		21.3	23.8	24.7	23.2	23.4			24.0	21.6	
8	28.6	21.8	23.0	22.7		23.7	27.2	27.6	26.0	25.5			26.8	24.8	
9	31.3	23.7	28.0	24.7		26.3	28.0	29.1	29.0	28.3			29.0	26.9	28.9
10	33.9	26.4	-	27.8		29.0	32.3	31.4	32.5	31.3			31.5	29.5	34.0
11	36.7	29.3	-	29.6		32.2	36.0	34.8	36.5	34.0			33.8	31.7	37.8
12	40.2	31.6	36.0			35.3	40.0	39.4	38.8	37.2				31.6	43.4
13	45.5	36.8	40.8	39.3		41.0	44.8	40.6	41.5	41.0				38.5	47.8
14	51.7	42.4	47.1	44.4		46.7	51.4	50.4	46.3	46.0				43.9	51.7
15	56.7	47.4	52.2	49.7		51.7	54.3	54.7		50.3				46.9	59.5
16	60.3	49.7	54.8	50.8		55.0	59.9	58.7		54.0				53.5	60.9
17	62.4	52.9	56.8	53.5		57.8				57.2					67.8
18		54.3		55.2											

a/ 50th percentile.

Source: See Bibliography to the appendix.

8. Since most Brazilian children are of European, African, or mixed European and African descent, Figures 1 and 2 in the main text of this annex show how the growth curves of girls and boys of African and European descent differ from the FAO/WHO standard growth curve. Most of the groups are within 1 to 3 kg. of the standard. 1/ The ENDEF mean weight by age data for the Northeast (the worst Brazilian region in terms of nutrition) and the South (the states of Parana, Santa Catarina and Rio Grande do Sul, which show the least malnutrition of any ENDEF region) are also shown in these graphs. The Brazilian data, particularly for the Northeast, show a very clear pattern of increasing deviations from the FAO/WHO normal standard until the start of puberty. Figure 3, also presented in the main text, shows the curves for boys from the Northeast and the South, again as deviations from the FAO/WHO normal standard, along with several curves indicating the differences between mean weights of poor and middle class children in some of the same surveys and countries included in Tables A1 and A2 for which data on poor children were available. The shape of the Brazilian curves is obviously similar to the curves depicting the differences in mean weights of poor and middle class children from other countries.

9. The FAO and WHO have been quite cautious in recommending the use of the standard they use to estimate requirements for developing countries as a standard for anthropometric comparisons, but the results presented here and which for the most part were not available at the last time the FAO/WHO standards were revised in 1971, tend to confirm that the middle class groups from developing countries as well as the relatively disadvantaged ethnic groups from North America approach the FAO/WHO standard. An alternate approach might be to estimate a new normal growth curve against which to measure the extent of malnutrition in Brazil by taking the median of the means 2/ of the available studies on middle class children of European and African descent in developing countries. This would produce slightly lower estimates of the extent of the various degrees of malnutrition in Brazil, but the merging of samples taken from various countries at various times would appear to be a more questionable procedure than using the FAO/WHO standards which they approximate, in any case. The extent of malnutrition would still be very large as should be clear from an examination of Tables A5 and A6 in this appendix and Figures 1, 2, and 3 in the main text of this annex.

1/ The data from Tables A5 and A6 in the appendix have been smoothed for use in Figures 1, 2, and 3 to bring out the trend in growth over time by reducing the distortions caused by small sample size. See J.W. Tukey, Exploratory Data Analysis (Reading, Massachusetts: Addison-Wesley, 1977) 205-236 and 523-542 for an explanation of the techniques used.

2/ It would be preferable statistically to take the median of the medians of the national studies, but the published studies usually give only the mean.

3. Estimation of the Extent of Malnutrition by Gomez Indexes

10. A fair amount of statistical manipulation was needed to use the ENDEF data on the weights of children to estimate the number of children falling in the various Gomez categories of nutritional status.

11. First, it was necessary to make the calculations for seven regions and then aggregate them into the three major regions used in this report. These regions were: (1) the Northeast states (identical with the Northeast in the rest of the report); (2) Rio de Janeiro (Southeast); (3) Sao Paulo (Southeast); (4) Minas Gerais and Espirito Santo (Southeast); (5) Parana, Rio Grande do Sul, and Santa Catarina (Southeast); (6) Brasilia (Frontier); and (7) the Central West and Amazon states (Frontier). For the last region only, data had been collected for just the urban areas. For the purpose of obtaining Brazilian national estimates, the rural areas in ENDEF region (7) were estimated with the same malnutrition rates as the urban areas from that region. This seems reasonable because the state volumes in the 1970 census show that the generous Brazilian definition of large areas as urban often resulted in the inclusion of many farmers and agricultural laborers in the urban statistics for small and medium sized cities, a category which embraces all but a few of the cities and towns in ENDEF region (7).

12. Second, the ENDEF data for each region were only available as percentages of age groups in an unusual 86 way breakdown of ages and sex groups. The data were presented for the following age groups separated for males and females:

Groups of days:	1 to 29, 30-59
Individual months:	2, 3, 4, 5, 6, 7, 8 and 9
Groups of months:	12-14, 15-17, 18-20, 21-23, 24-29, 30-35
Single years of age:	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18 and 19
Five year groups:	20-24, 25-29
Ten year groups:	30-39, 40-29, 50-59, 60-69
Final group:	over 70

This analysis used the first 33 age groups.

13. Third, the FAO/WHO weight standards normally used to estimate food requirements were used to obtain estimates of median weight for each of the ENDEF age/sex groupings. Then Gomez indices for first, second, and third degree malnutrition were estimated from the median standard weights for each age/sex grouping.

14. Fourth, the edited Brazilian data of weight distributions for each age/sex group was available only in the following format (the example here is Northeast boys age 5):

Percentile:	3	10	25	50	75	90	97
Weight (kg.):	12.7	13.0	15.0	16.5	18.3	19.8	21.3

15. Fifth, a curve was fitted to the weight distributions using a computer, and then the Gomez indices for that age, sex and region were calculated from the curve. This gave the cut-off percentiles of the ENDEF distribution for first, second, and third degree malnutrition. The percentage of children with first degree malnutrition was then calculated for each sex and region by subtracting the percentile for second degree from that for first degree, and so on.

16. Sixth, in order to use these percentages the population for each region for each age/sex group had to be estimated. The "baseline" projections described in Annex I of this report provide estimates for 1975 for each of the three macro-regions by five year age-groups. These were broken down into single year age-groups with the LRPM DEMWA submodel. 1/ Where intervals of less than one year were needed, these were obtained from the yearly estimates by simple arithmetic, i.e., one month equals 1/12th of year. Then the three macro-regions were divided into the seven ENDEF regions by using the ratios of population in 1970, that the states of smaller regions had in their larger macro-regions for each five year age group. The census data of single years of age are not used because of substantial age misreporting at this level.

17. Seventh, estimates of malnutrition for each small age-sex group for each region were obtained by multiplying the population estimates by the estimates of the percentage of each group that fell in a given category of malnourishment. Since few children met the criteria for obesity (above the 97th percentile of the FAO/WHO age/weight distribution reference series), all non-malnourished were estimated as normal. The series of data for the 33 age breaks and two sexes and seven regions were then smoothed and roughed (residuals added back in) in an 11 step iterative process to bring out the time trends more clearly. 2/ The smoothing and roughing leaves the trend lines essentially unchanged but clearer, since the saw-tooth aspect caused by variation due to small sample size in each time series is ironed out.

1/ For the methodology for dividing five year age groups into single years of age, see Joseph E. Quinn, et al, LRPM2, Manual B, Methodology, DEMWA; (Washington: U.S. Bureau of the Census, 1977).

2/ See J.W. Tukey, Exploratory Data Analysis, (Reading, Mass.: Addison-Wesley, 1977), pp. 523-542.

18. Eighth, the smaller regions were then summed to get the estimates for the three macro-regions and all of Brazil and the age-groups were summed to get a more condensed set of age breakdowns as shown in Tables 15-18 in the main text of this annex. Nutritionists maintain that three ages are the most critical during childhood: the first year, the second year and puberty. In the tables, the first year of life has been broken into two six-month periods because there were sharp differences in the share of malnourished children between the two intervals (the second six months of life, when many Brazilian babies stop breastfeeding, show very rapid deterioration in the average nutritional status). Then the second year is broken out, the next three (a less critical period), the period 5-9 years, the period 10-14 years (which includes puberty for most but the worst nourished children whose puberty is delayed for some time), and a final post-puberty period up to 17 years to show that many children start putting on weight after the really critical years for physical and mental development.

4. Estimation of Expenditure of Families Meeting Calorie Requirements and Costs of Adequate Diets

19. Several problems were encountered in reconciling the ENDEF consumption data with the family expenditure data and then using the combined information to estimate the cost of calorie adequate diets at different points in the 22 ENDEF subregional family expenditure distributions. The first set of problems arises because the expenditure data was available by families in each of 22 subregions (not all published at the time these calculations were made) by 9 expenditure breaks (the cut-off points for which varied from subregion to subregion). The consumption data, on the other hand, was available in the published volumes as subregional averages per normalized food consumer (per comensal dia -- see definition below) without any breakdown by expenditure classes. IBGE kindly furnished unpublished data sufficient to reconcile the expenditure and consumption data. This included daily consumption per normalized food consumer by annual family expenditure class for all 22 subregions and data on the average number of normalized food consumer days observed during the week of the survey for each expenditure class in each subregion, and finally, the average number of days families were actually surveyed in each subregion and for each expenditure class.

20. The concept of normalized food consumer day (comensal dia) is fundamental in understanding the ENDEF consumption data. Rather than dividing total food consumption in an eating unit (unidade alimentar) by the number of family members to estimate per capita consumption, the ENDEF methodology recognizes that non-family members (explicitly boarders, domestic servants, and guests) share food purchased by a single family unit, but that not all members of the eating unit (a group which has the family at its core but may be larger) regularly eat all their meals at home. Thus each person in each eating unit surveyed was classified as following one of 11 "eating rhythms" each day he was surveyed. The relative calorie consumption weights for each meal for each rhythm were defined from subsamples of the ENDEF families who

shared all their meals together, had no guests present, and shared the same eating rhythm. The families in these subsamples were distributed over all of Brazil. For example, one eating rhythm was breakfast, lunch, afternoon snack, and supper; another was breakfast, afternoon snack, and supper. For each rhythm, weights were assigned to each meal corresponding to the average ratio of calories consumed in that meal to all calories ingested for all members of the appropriate subsample. For example, the weights for the rhythm breakfast, dinner, and supper were 0.18, 0.49, and 0.33, which means that persons with this eating rhythm are assumed to ingest, on average, 18%, 49%, and 33% of their total daily calories at breakfast, dinner, and supper.

21. The "index of presence" of a person was then defined as the sum of the relative weights corresponding to the meals he actually ate in the eating unit during the week of the survey. The total number of normalized food consumer days (comensais dia) of an eating unit is defined as the sum of the indexes of presence of all the persons in that unit during the period surveyed. If the average number of normalized food consumer days for all eating units in a given expenditure class are divided by the average number of days surveyed, a number is obtained which is the average number of normalized food consumers per day. This number may be greater than, equal to, or less than the number of family members.

22. For example, in the third expenditure class in metropolitan Recife, the average number of normalized food consumer days was 28.711, and the average number of days surveyed was 6.87. Dividing through the average number of normalized food consumers per day for this subregion and expenditure class was 4.18, while the average number of family members was larger, 4.73.

23. This method implicitly assumes that all Brazilians (independent of age, sex, expenditure class and region) who share a common eating rhythm in fact ingest calories in the same proportions as the average for the subsamples used to establish the weights for that eating rhythm. If one accepts calorie consumption per normalized food consumer (often called normalized per capita calorie consumption in the text and tables and referred to as consumo per comensal dia in the ENDEF publications) as an estimate of per capita daily calorie consumption as is done in this report, a further assumption is implicit, namely that when a meal is eaten outside the home the same number of calories are consumed as if the meal were consumed inside the home. It is virtually impossible a priori to determine whether any systematic bias is introduced by the use of uniform relative calorie weights by eating rhythm. To the extent meals consumed outside the home contain less (more) calories than those consumed in the home, the estimate of per capita calorie consumption will be an overestimate (underestimate).

24. Once the average number of normalized food consumers per day has been calculated for each of the 9 expenditure classes and 22 subregions, the corresponding average annual family expenditure on food (excluding food consumed outside the home) may be divided by the corresponding average number of normalized food consumers per day to get average annual food expenditures per normalized food consumer (per comensal dia). This exercise may be done for

any finer breakdown of food expenditure if desired. After these adjustments, it is possible to compare the ENDEF calorie consumption data (per comensal dia) with the annual family expenditure data (now adjusted to a comensal dia basis) and obtain the average price of a calorie per day for a year.

25. For example, again taking the average for the third expenditure class from the bottom in metropolitan Recife, total food expenditures were Cr$ 3,916, of which Cr$ 338 were spent on food outside the home, leaving Cr$ 3,578 to be divided by 4.18 normalized food consumers to give Cr$ 855.98 annual food expenditure per normalized food consumer. With calorie consumption of 1,630.31 per normalized food consumer in this class, the average cost of a calorie per day for one year is Cr$ 525. This type of price calculation, for specific points in the subregional expenditure distributions, was used to estimate the cost of calorie-adequate diets in the main text of this annex.

26. But in determining the cost of a calorie adequate diet for a particular expenditure level and subregion, one further adjustment was made to the FAO/WHO Low regional requirements calculated as described in part (1) of this appendix and reported in Table 14 of the main text. The average requirements for a region could differ dramatically from the average requirements for a subset of the population if the two groups differ substantially in age and sex composition. Since no demographic data by age and sex is available for the ENDEF survey, the 1976 PNAD (National Household Sample Survey) publications were used to estimate the average requirements by family size for each subregion. This was done using the FAO/WHO Low requirements for calorie consumption, and age and sex composition data for families in each size classification as given by the 1976 PNAD. Because the 1976 PNAD provided a breakdown by relation to the head of the family rather than by age, the following requirements were used. Heads of families and spouses were assumed to have requirements equal to those of persons of the same sex in the corresponding macro region (Northeast, Southeast, Frontier) and urban/rural location who were over 21 years of age. Similarly, children were assumed to be under 21 years of age (in a few urban subregions it was necessary to weight a few children at the over 21 requirements because the number of children slightly exceeded the number of people under 21 years of age). All other family members and unrelated persons were estimated at the requirements level needed to arrive at the regional (urban or rural) average (i.e., they were treated as a residual category).

27. In this way, the FAO/WHO calorie adjustments were determined for families of different sizes for each subregion in the 1976 PNAD, and then this information (interpolating when necessary) was used to estimate per capita requirements and then deficits (comparing with consumption) for families of the precise size found at different points in the ENDEF subregional distributions of family expenditure (see Table 21 in the main text of this annex and Appendix B, Tables B.1-B.4).

5. Estimation of Population with Adequate Diets and Deficits of Various Sizes

28. The unpublished ENDEF data on calorie consumption per normalized food consumer were used as estimates of per capita calorie consumption and then compared with the subregional per capita FAO/WHO Low calorie requirements for each expenditure class (adjusted for family size). The resulting information, coupled with the IBGE 1975 population estimates for each ENDEF subregion was used to estimate the number of people in each subregion meeting their FAO/WHO Low requirements. Estimates were also made of the population with daily per capita calorie deficits of three sizes: up to 200 calories, 200-400 calories, and over 400 calories.

29. In the case of the rural Frontier region, which was not covered in the ENDEF survey (but accounted for only about 5% of Brazil's total population in 1975), the pattern of calorie consumption in Goias and Mato Grosso was assumed to be equal to that of the urban areas of these states, and in the remainder of the Frontier the same assumption was made (excluding Brasilia and Belem from the urban areas). The urban areas of the Frontier (excluding Brasilia and Belem) include the few large cities, and given the generous definition of urban areas used by IBGE (see Annex I), have many of the characteristics of rural areas. The resulting estimates, aggregated by the major regions distinguished in this report, are presented in Table 15 of the main text of this annex.

30. Two simulations were performed to determine the number of people who would fall in each of three categories (adequate calories, deficits up to 400 calories, and deficits over 400 calories) in various years up to the year 2000 under optimistic (7% per year) and pessimistic (4% per year) assumptions concerning growth of GDP over the period 1980-2000, assuming that the relative income distribution (actually expenditure distribution) obtained from the ENDEF expenditure volumes will remain the same and no nutrition programs not existing in 1974/75 are carried out. For the years 1978 and 1979 6% per year GDP growth was assumed for both simulations. The shares of the population with adequate diets, deficits up to 400 calories, and deficits over 400 calories were estimated from the revised income curves (using the 1974/75 expenditure levels at which families consumed adequate diets or had deficits not greater than 400 calories per person per day) and the "baseline" population projections (see Annex I). The results are shown in Table 32 of the main text of this annex. Implicit in these simulations is the assumption that as incomes increase over time, people who move up in income level will spend their incomes in the same patterns as those having the higher expenditures in 1974/75. Thus, these two simulations provide baseline "pure income effect" holding everything else constant.

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APPENDIX B

FAMILY EXPENDITURE, CALORIE CONSUMPTION, AND DURABLE GOODS OWNERSHIP PATTERNS

This Appendix consists of five tables. Tables B.1-B.4 give the full detail (22 ENDEF subregions) behind the unweighted means for metropolitan areas and Brasilia, other urban areas, and rural areas presented in Table 21 in the main text. Table B.5 gives arc elasticities of normalized per capita daily calorie consumption with respect to normalized per capita annual family expenditure between 9 family expenditure groups for 22 ENDEF subregions.

Table 8.1: TOTAL EXPENDITURE AND PATTERNS OF FOOD EXPENDITURE, CALORIE CONSUMPTION, AND DURABLE GOODS OWNERSHIP FOR FAMILIES AT THE 20th PERCENTILE IN THE ENDEF SUBREGIONAL FAMILY EXPENDITURE DISTRIBUTIONS, 1974/1975

Regions and Subregions	Total Family Expenditure[a] (Cr$)	Food Expenditure as a % of Total Expenditure	Expenditure on Meat and Fish as a % of Food Expenditure	Percent of Families Owning				Normalized Per Capita Calorie Consumption[b]	Per Capita Calorie Deficit[c]	Calorie Elasticity[d]
				Automobile	Television	Refrigerator	Blender			
Northeast										
Metropolitan Salvador	3,937	47.5	33.4	0.4	18.9	14.6	20.4	1,476	687	-.014
Metropolitan Recife	6,151	51.4	29.1	-	11.1	4.0	11.1	1,571	598	.401
Metropolitan Fortaleza	4,771	55.7	21.6	-	2.5	0.9	3.9	1,497	668	.449
Other Urban Areas	3,202	57.6	29.8	0.1	0.6	0.5	1.0	1,553	634	.354
Rural[e]	2,878	67.7	24.5	-	-	-	-	1,671	520	.888
Southeast										
Metropolitan Rio de Janeiro	9,786	42.5	21.3	1.8	56.7	52.0	37.9	1,868	464	.266
Other Urban Areas, Rio de Janeiro	7,859	49.5	17.5	1.3	31.1	21.3	17.2	1,839	470	.232
Rural, Rio de Janeiro[e]	3,781	60.2	16.5	0.4	0.7	2.1	0.9	1,955	375	.475
Metropolitan Sao Paulo	13,420	37.1	23.0	2.4	70.7	44.4	49.4	1,825	487	.312
Other Urban Areas, Sao Paulo	8,232	47.5	18.7	0.9	40.1	29.1	25.4	1,925	393	.160
Rural, Sao Paulo[e]	6,202	59.1	14.2	1.1	9.0	1.6	4.3	2,111	211	-.084
Metropolitan Porto Alegre	11,077	41.0	23.8	2.5	46.0	35.0	24.7	2,113	206	.222
Metropolitan Curitiba	9,130	44.0	19.3	2.0	42.0	22.7	17.0	1,864	442	.294
Other Urban Areas South[f]	8,141	49.2	21.1	1.7	21.0	18.7	11.4	1,943	366	.287
Rural South[e/f]	5,161	61.7	15.0	0.1	0.6	1.0	0.3	2,121	202	.401
Metropolitan Belo Horizonte	9,173	43.4	15.7	1.5	31.5	10.0	21.0	1,852	448	.139
Other Urban Areas, Minas Gerais/Espirito Santo	4,606	55.7	16.2	0.5	10.9	4.2	4.1	1,744	565	.272
Rural, Minas Gerais/Espirito Santo[e]	3,976	67.9	11.1	0.1	0.1	0.1	-	1,973	335	.359
Frontier										
Brasilia (Federal District)	12,151	40.0	21.1	0.7	50.2	14.5	17.8	1,704	541	.675
Metropolitan Belem	8,807	50.4	36.5	0.1	27.8	24.0	16.8	1,830	382	.172
Other Urban Areas, West[g]	8,004	55.9	16.3	0.6	5.8	3.1	3.2	2,040	184	.017
Other Urban Areas, Amazon[h]	6,933	57.8	37.2	-	1.5	1.9	1.4	1,699	518	.059
Unweighted Means										
Metropolitan Areas and Brasilia	8,840	45.3	24.5	1.1	35.7	22.2	22.0	1,760	492	.292
Other Urban Areas	6,711	53.3	22.3	0.7	15.9	11.3	9.9	1,820	447	.197
Rural Areas[e]	4,400	63.3	16.2	0.3	2.8	1.0	1.1	1,966	328	.408

a/ Global annual monetary and non-monetary family expenditure in cruzeiros of August 1974.
b/ Consumption per comensal dia. See Appendix A for details.
c/ Difference between FAO/WHO Low requirements, adjusted for family size, and consumption per comensal dia. See Appendix A for details.
d/ Arc elasticity of normalized per capita calorie consumption with respect to normalized per capita annual family expenditure around the class containing the 20th percentile family.
e/ Outside metropolitan areas.
f/ Parana, Santa Catarina and Rio Grande do Sul.
g/ Goias and Mato Grosso.
h/ Rondonia, Acre, Amazonas, Roraima, Para (excluding Belem) and Amapa.

Sources: Calculated from data in IBGE, Estudo Nacional da Despesa Familiar: Despesas das Familias; Dados Preliminares (Rio de Janeiro: 1978) 4 Vols., Tables 7 and 14, and unpublished ENDEF data.

Table B.2: TOTAL EXPENDITURE AND PATTERNS OF FOOD EXPENDITURE, CALORIE CONSUMPTION, AND DURABLE GOODS OWNERSHIP FOR *FAMILIES WITH ANNUAL EXPENDITURES* TWICE THE COST OF A TYPE 2 DIET IN 22 ENDEF SUBREGIONS, 1974/1975[a/]

Regions and Subregions	Total Family Expenditure[b/] (Cr$)	Percentile in Family Expenditure Distribution	Food Expenditure as a % of Total Expenditure	Expenditure on Meat and Fish as a % of Food Expenditure	Percent of Families Owning				Normalized Per Capita Calorie Consumption[c/]	Per Capita Calorie Deficit[d/]	Calorie Elasticity[e/]
					Automobile	Television	Refrigerator	Blender			
Northeast											
Metropolitan Salvador	19,337	58.3	38.0	34.4	4.1	68.1	66.9	63.6	1,680	465	.233
Metropolitan Recife	14,626	52.6	44.2	30.7	-	49.7	36.2	45.4	1,772	366	.270
Metropolitan Fortaleza	13,524	61.4	48.2	28.5	0.9	42.9	31.6	36.1	1,660	481	.471
Other Urban Areas	11,646	64.7	50.8	32.1	1.3	12.4	16.3	16.4	1,759	386	.403
Rural[f/]	12,959	98.2	57.9	27.2	2.1	2.1	3.1	1.7	2,227	-105	.063
Southeast											
Metropolitan Rio de Janeiro	13,433	30.9	41.3	24.1	2.0	57.5	53.0	38.7	1,988	283	.212
Other Urban Areas, Rio de Janeiro	12,576	39.8	44.9	21.4	2.4	42.7	29.7	21.9	1,932	390	.32
Rural Rio de Janeiro[f/]	10,460	65.9	55.9	21.3	1.9	7.9	7.1	4.5	2,171	114	.272
Metropolitan Sao Paulo	14,395	22.1	36.6	23.4	1.8	62.9	38.0	41.5	2,097	213	.300
Other Urban Areas, Sao Paulo	11,573	29.7	44.7	21.0	0.9	40.2	29.1	25.4	2,015	289	.160
Rural Sao Paulo[f/]	12,441	58.0	57.2	19.3	1.1	18.9	8.3	5.5	2,352	-82	.250
Metropolitan Porto Alegre	12,244	23.1	40.6	24.2	1.6	35.2	27.5	18.3	2,153	163	.222
Metropolitan Curitiba	10,987	26.4	42.4	20.9	2.0	37.2	19.3	14.8	2,121	182	.294
Other Urban Areas South[g/]	11,362	32.0	45.9	23.0	2.0	23.6	20.7	12.9	2,117	180	.287
Rural South[f/g/]	9,641	45.1	57.5	17.7	1.1	3.2	3.2	0.7	2,632	-350	.360
Metropolitan Belo Horizonte	13,289	35.2	40.3	20.4	2.5	48.7	20.3	30.8	1,906	381	.415
Other Urban Areas, Minas Gerais/Espirito Santo	9,831	36.6	48.2	18.7	0.7	19.1	6.9	6.4	1,971	316	.243
Rural Minas Gerais/Espirito Santo[f/]	10,786	72.3	61.4	16.4	1.0	1.5	1.7	1.0	2,484	-227	.418
Frontier											
Brasilia (Federal District)	17,361	33.2	36.9	22.6	2.9	61.4	26.4	26.1	1,921	313	.321
Metropolitan Belem	9,094	20.6	50.4	36.6	0.9	19.3	18.2	13.4	1,969	243	.172
Other Urban Areas, West[h/]	10,956	35.7	58.3	37.0	1.9	9.5	3.3	2.5	2,060	162	.017
Other Urban Areas, Amazon[i/]	12,327	51.8	49.8	21.8	-	9.3	9.8	5.9	1,822	387	.138
Unweighted Means											
Metropolitan Areas and Brasilia	13,829	36.3	41.9	26.6	1.9	48.3	33.7	32.9	1,927	309	.292
Other Urban Areas	11,459	41.5	48.9	25.0	1.3	22.4	16.5	13.1	1,954	301	.211
Rural Areas[f/]	11,154	67.9	58.0	20.4	1.6	6.7	4.7	2.7	2,373	-130	.273

a/ A Type 2 diet is composed of 2242 calories *(national average FAO/WHO Low requirements)* obtained from foods in the proportions consumed and at the prices paid by the (lower) 20th percentile families in each of the 22 ENDEF subregions.
b/ Global annual monetary and non-monetary family expenditure in cruzeiros of August 1974.
c/ Consumption per comensal dia. See Appendix A for details.
d/ Difference between FAO/WHO Low requirements, adjusted for family size, and consumption per comensal dia. See Appendix A for details.
e/ Arc *elasticity of normalized per capita* calorie consumption with respect to normalized per capita annual family expenditure around the class containing the families with expenditures twice the cost of a Type 2 diet.
f/ Outside metropolitan areas.
g/ Parana, Santa Catarina and Rio Grande do Sul.
h/ Goias and Mato Grosso.
i/ Rondonia, Acre, Amazonas, Roraima, Para *(excluding Belem)* and Amapa.

Sources: Calculated from data in IBGE, Estudo Nacional da Despesa Familiar: Despesas das Familias; Dados Preliminares (Rio de Janeiro: 1978) 4 Vols., Tables 7 and 14, and unpublished ENDEF data.

Table B.3: TOTAL EXPENDITURE AND PATTERNS OF FOOD EXPENDITURE, CALORIE CONSUMPTION, AND DURABLE GOODS OWNERSHIP FOR FAMILIES WITH PER CAPITA CALORIE CONSUMPTION 200 CALORIES BELOW REQUIREMENTS IN 22 ENDEF SUBREGIONS, 1974/1975[a]

Regions and Subregions	Total Family Expenditure[b] (Cr$)	Percentile in Family Expenditure Distribution	Food Expenditure as a % of Total Expenditure	Expenditure on Meat and Fish as a % of Food Expenditure	Percent of Families Owning				Normalized Per Capita Calorie Consumption[c]	Calorie Elasticity[d]
					Automobile	Television	Refrigerator	Blender		
Northeast										
Metropolitan Salvador	39,745	72.9	24.7	36.6	17.9	85.1	85.0	80.0	1,943	.036
Metropolitan Recife	23,296	72.6	37.5	32.4	5.4	80.2	65.8	74.2	1,933	.236
Metropolitan Fortaleza	34,516	85.8	27.9	32.3	21.3	83.0	80.7	79.1	1,941	.027
Other Urban Areas	21,452	86.3	41.5	33.8	8.9	39.4	43.0	44.5	1,938	.175
Rural[e]	6,032	59.9	66.6	26.8	-	-	-	-	1,947	.376
Southeast										
Metropolitan Rio de Janeiro	24,265	57.4	35.8	26.5	8.8	85.9	83.5	66.9	2,089	.144
Other Urban Areas, Rio de Janeiro	25,669	73.8	33.6	26.7	14.0	78.6	72.1	58.9	2,061	.076
Rural Rio de Janeiro[e]	8,108	52.6	58.4	20.3	1.1	3.5	4.7	2.6	2,091	.272
Metropolitan Sao Paulo	30,127	56.2	29.0	26.1	17.9	91.1	74.9	76.6	2,096	.102
Other Urban Areas, Sao Paulo	16,419	42.5	40.6	23.8	3.6	59.6	44.8	41.8	2,097	.213
Rural Sao Paulo[e]	6,998	24.3	57.0	15.2	1.0	6.8	1.6	3.4	2,113	-.084
Metropolitan Porto Alegre	11,536	20.7	40.8	24.0	1.4	31.9	25.2	16.4	2,118	.222
Metropolitan Curitiba	15,243	39.8	38.3	23.5	5.3	54.3	35.0	26.2	2,098	.184
Other Urban Areas South[f]	13,240	38.3	43.8	24.1	3.4	31.6	27.6	17.4	2,093	.147
Rural South[e/f]	5,499	20.3	61.5	15.0	0.1	0.3	0.5	0.2	2,122	.401
Metropolitan Belo Horizonte	31,613	70.7	29.1	24.2	18.9	88.8	72.1	77.3	2,079	.129
Other Urban Areas Minas Gerais/Espirito Santo	15,950	58.8	41.9	21.7	4.3	44.3	26.9	26.6	2,077	.082
Rural Minas Gerais/Espirito Santo[e]	5,422	36.1	68.2	14.8	0.4	0.2	0.2	-	2,083	.030
Frontier										
Brasilia (Federal District)	35,543	66.3	25.9	25.4	22.9	90.9	74.1	67.6	2,027	.190
Metropolitan Belem	22,284	62.9	43.7	41.0	2.7	76.5	73.8	53.2	2,017	.119
Other Urban Areas, West[g]	7,547	18.1	56.1	16.2	-	2.2	2.1	2.9	2,025	.122
Other Urban Areas, Amazon[h]	25,294	70.8	43.8	36.3	3.8	38.7	50.0	31.7	2,006	.259
Unweighted Means										
Metropolitan Areas and Brasilia	26,817	60.5	33.3	29.2	12.3	76.8	67.0	61.8	2,034	.139
Other Urban Areas	17,939	55.5	43.0	26.1	5.4	42.0	38.1	32.0	2,042	.153
Rural Areas[e]	6,412	38.6	62.3	18.4	0.5	2.2	1.4	1.2	2,071	.199

a/ FAO/WHO Low requirements. See Appendix A for details.
b/ Global monetary and non-monetary family expenditure in cruzeiros of August 1974. Estimates obtained by semilogrithmic interpolation, based on normalized per capita consumption and the logarithm of normalized per capita family expenditure.
c/ Consumption per comensal dia. See Appendix A for details.
d/ Arc elasticity of normalized per capita caloric consumption with respect to normalized per capita annual family expenditure around the class containing the families with 200 calorie per capita deficits.
e/ Outside metropolitan areas.
f/ Parana, Santa Catarina and Rio Grande do Sul.
g/ Goias and Mato Grosso.
h/ Rondonia, Acre, Amazonas, Roraima, Para (excluding Belem), and Amapa.

Sources: Calculated from data in IBGE, Estudo Nacional da Despesa Familar: Despesas das Familias; Dados Preliminares (Rio de Janeiro: 1978) 4 Vols., Tables 7 and 14, and unpublished ENDEF data.

Table B.4: TOTAL EXPENDITURE AND PATTERNS OF FOOD EXPENDITURE, CALORIE CONSUMPTION, AND DURABLE GOODS OWNERSHIP FOR FAMILIES WITH PER CAPITA CALORIE CONSUMPTION EQUAL TO REQUIREMENTS IN 22 ENDEF SUBREGIONS, 1974/1975[a/]

	Total Family Expenditure[b/] (Cr$)	Percentile in Family Expenditure Distribution	Food Expenditure as a % of Total Expenditure	Expenditure on Meat and Fish as a % of Food Expenditure	Percent of Families Owning				Normalized Per Capita Calorie Consumption[c/]	Calorie Elasticity[d/]
					Automobile	Television	Refrigerator	Blender		
Northeast										
Metropolitan Salvador	58,894	80.8	18.6	36.4	60.8	96.3	98.8	93.0	2,146	.036
Metropolitan Recife	49,784	87.2	23.0	33.2	62.4	96.8	97.0	95.9	2,135	.052
Metropolitan Fortaleza	60,319	95.5	18.3	32.7	68.0	97.6	99.0	99.0	2,143	.027
Other Urban Areas	34,864	92.8	32.0	34.3	44.3	71.9	77.7	73.4	2,136	.088
Rural[e/]	8,598	85.2	64.2	26.8	28.8	18.7	23.0	15.0	2,122	.213
Southeast										
Metropolitan Rio de Janeiro	30,486	67.7	32.0	27.5	20.4	92.6	92.9	78.7	2,288	.116
Other Urban Areas, Rio de Janeiro	29,033	78.8	32.4	27.3	31.4	90.8	89.2	78.7	2,260	.104
Rural Rio de Janeiro[e/]	16,017	82.5	49.4	23.1	7.3	81.9	29.0	20.5	2,296	.024
Metropolitan Sao Paulo	45,614	73.1	22.8	26.5	55.0	95.4	92.8	91.0	2,297	.104
Other Urban Areas, Sao Paulo	41,366	81.3	23.7	29.2	53.4	91.5	90.8	83.0	2,284	.086
Rural Sao Paulo[e/]	9,635	39.9	57.8	24.7	2.5	13.2	6.9	5.9	2,296	.250
Metropolitan Porto Alegre	19,736	44.4	35.0	28.0	9.5	73.3	68.7	50.5	2,304	-.002
Metropolitan Curitiba	39,540	77.7	22.8	28.3	62.4	92.8	90.7	81.6	2,295	.062
Other Urban Areas, South	18,860	52.8	37.9	27.7	12.1	48.5	66.4	38.2	2,292	.147
Rural South[e/f/]	6,213	25.1	61.0	15.1	0.2	0.8	1.4	0.4	2,355	.401
Metropolitan Belo Horizonte	56,856	85.8	19.0	25.7	55.9	95.2	94.9	90.6	2,283	.027
Other Urban Areas, Minas Gerais/Espirito Santo	39,012	85.7	25.3	27.5	47.9	87.8	86.6	79.8	2,270	.106
Rural Minas Gerais/Espirito Santo[e/]	7,502	52.0	65.0	15.4	0.2	0.6	0.7	1.2	2,278	.243
Frontier										
Brasilia (Federal District)	69,433	86.5	16.1	28.0	81.0	95.8	92.5	91.1	2,233	.067
Metropolitan Belem	32,116	97.5	35.9	41.3	64.4	99.0	99.0	99.0	2,221	.238
Other Urban Areas, West[g/]	17,614	56.3	42.7	25.8	4.1	33.8	21.7	15.9	2,220	.110
Other Urban Areas, Amazon[h/]	44,127	95.2	32.9	32.0	39.7	81.1	95.9	79.1	2,220	.077
Unweighted Means										
Metropolitan Areas and Brasilia	46,278	79.6	24.4	30.8	54.0	93.5	92.6	87.0	2,235	.073
Other Urban Areas	32,125	77.6	32.4	28.8	33.3	72.2	75.5	64.1	2,240	.103
Rural Areas[e/]	9,593	56.9	59.5	20.1	7.8	23.0	12.2	8.6	2,269	.226

a/ FAO/WHO Low requirements. See Appendix A for details.
b/ Global monetary and non-monetary family expenditure in *cruzeiros of August 1974. Estimates* obtained by semilogarithmic interpolation, based on normalized per capita consumption and the logarithm of normalized per capita family expenditure.
c/ Consumption per comensal dia. See Appendix A for details.
d/ Arc *elasticity of normalized* per capita calorie consumption with respect to normalized per capita annual family expenditure around the class containing the families which just meet their FAO/WHO low calorie requirements.
e/ Outside metropolitan areas.
f/ Parana, Santa Catarina and Rio Grande do Sul.
g/ Goias and Mato Grosso.
h/ Rondonia, Acre, Amazonas, Roraima, Para (excluding Belem), and Amapa.

Sources: Calculated from data in IBGE, Estudo Nacional da Despesa Familiar: *Despesas das Familias; Dados Preliminares* (Rio de Janeiro: 1978) 4 Vols., Tables 7 and 14, and unpublished ENDEF data.

Table B.5: ARC ELASTICITIES OF NORMALIZED PER CAPITA DAILY CALORIE CONSUMPTION WITH RESPECT TO NORMALIZED PER CAPITA ANNUAL FAMILY EXPENDITURE BETWEEN FAMILY EXPENDITURE GROUPS FOR 22 ENDEF SUBREGIONS[a/]

Expenditure Groups	NORTHEAST					RIO DE JANEIRO[d/]			SAO PAULO		
	Metropolitan Salvador	Metropolitan Recife	Metropolitan Fortaleza	Other Urban	Rural	Metropolitan Rio de Janeiro	Other Urban	Rural	Metropolitan Sao Paulo	Other Urban	Rural
Group I to Group II[b/]											
Average Expenditure[c/]	2,097	1,701	1,285	1,256	820	2,346	1,959	1,434	3,299	2,484	1,716
Elasticity	-.014	-3.329	.449	.354	.888	.935	-2.449	.475	.552	.160	-.717
Group II to Group III											
Average Expenditure[c/]	2,109	1,784	1,503	1,471	909	3,078	2,332	1,758	4,161	3,465	1,753
Elasticity	.300	.401	.188	.261	.612	.266	.232	.272	.312	.213	-.084
Group III to Group IV											
Average Expenditure[c/]	2,276	1,975	1,743	1,737	984	4,068	3,173	2,339	5,309	4,778	1,891
Elasticity	.423	.443	.170	.021	.959	.212	.190	.024	.192	.087	6.538
Group IV to Group V											
Average Expenditure[c/]	2,472	2,150	1,900	1,966	1,060	5,145	4,240	3,401	7,300	6,790	2,012
Elasticity	.312	-.122	-.156	.403	.376	.144	.076	.119	.102	.003	.250
Group V to Group VI											
Average Expenditure[c/]	2,689	2,472	2,144	2,149	1,175	-	-	-	11,079	9,624	2,192
Elasticity	-.555	.270	.471	.228	.445	-	-	-	.104	.086	.457
Group VI to Group VII											
Average Expenditure[c/]	3,119	2,994	2,676	2,585	1,258	8,120	6,027	5,193	17,318	14,655	2,644
Elasticity	.410	.217	.001	.162	.507	.116	.104	.101	-.006	.053	.179
Group VII to Group VIII											
Average Expenditure[c/]	4,078	3,776	3,562	3,349	1,485	18,179	12,101	9,751	25,481	19,614	3,606
Elasticity	.233	.236	.246	.175	.213	.013	.035	-.094	.010	-.113	.162
Group VIII to Group IX											
Average Expenditure[c/]	11,774	8,399	7,495	6,661	3,698	47,386	35,347	41,145	50,990	32,158	7,146
Elasticity	.036	.052	.027	.088	.063	.002	-.019	.077	-.002	.022	.043

a/ Normalized per capita daily calorie consumption is consumption per comensal dia. Normalized per capita annual family expenditure is annual family expenditure divided by the average number of comensais dia per day observed for families in each expenditure group. See Appendix A for details.
b/ Elasticities between Group I and Group II are often unusual because Group I contains many one person families who eat many meals outside the home with relatives and as a result their consumption patterns differ sharply from larger families.
c/ Sum of normalized per capita annual family expenditure for the two groups divided by two, in Cruzeiros of August 1974.
d/ Rio de Janeiro state has only eight expenditure groups for this exercise.
e/ Parana, Santa Catarina, and Rio Grande do Sul.
f/ Goias and Mato Grosso.
g/ Rondonia, Acre, Amazonas, Roraima, Para (excluding Belem) and Amapa.

Source: Calculated from data in IBGE, Estudo Nacional da Despesa Familiar: Despesas das Familias; Dados Preliminares 4 Vols. (Rio de Janeiro: 1978) and unpublished ENDEF data.

(Part II)

Table B.5: ARC ELASTICITIES OF NORMALIZED PER CAPITA DAILY CALORIE CONSUMPTION WITH RESPECT TO NORMALIZED PER CAPITA ANNUAL FAMILY EXPENDITURE BETWEEN FAMILY EXPENDITURE GROUPS FOR 22 ENDEF SUBREGIONS[a/]

Expenditure Groups	SOUTH[e/]				MINAS GERAIS/ESPIRITO SANTO			FRONTIER			
	Metropolitan Porto Alegre	Metropolitan Curitiba	Other Urban	Rural	Metropolitan Belo Horizonte	Other Urban	Rural	Brasilia	Metropolitan Belem	West[f/] Urban	Amazon[g/] Urban
Group I to Group II[b/]											
Average Expenditure[c/]	3,086	1,770	1,770	1,489	2,054	1,412	834	2,576	720	677	560
Elasticity	-.026	.293	.537	.401	1.307	.272	.742	.567	.289	.149	.683
Group II to Group III											
Average Expenditure[c/]	3,358	2,500	2,322	1,919	2,401	1,891	1,035	2,916	810	792	650
Elasticity	.222	.294	.287	.360	.139	.243	.359	.017	-19.506	.270	.323
Group III to Group IV											
Average Expenditure[c/]	4,282	3,677	3,252	2,601	2,736	2,316	1,146	3,209	866	948	853
Elasticity	.200	.184	.147	.214	.415	.285	1.030	.675	-.013	.029	.220
Group IV to Group V											
Average Expenditure[c/]	5,542	5,041	4,634	3,538	3,234	2,914	1,312	3,615	1,058	1,265	1,124
Elasticity	.097	-.002	.176	.091	-.066	.082	.243	.321	.233	.122	.059
Group V to Group VI											
Average Expenditure[c/]	7,325	7,168	6,219	4,590	4,123	3,959	1,605	4,556	1,475	1,757	1,527
Elasticity	-.002	.060	.032	.128	.154	.094	.418	.073	.172	.017	.138
Group VI to Group VII											
Average Expenditure[c/]	11,701	11,240	8,714	6,446	5,682	5,429	2,172	6,201	2,290	2,594	2,260
Elasticity	.078	.062	.027	.008	.129	.046	.173	.190	.085	.110	.076
Group VII to Group VIII											
Average Expenditure[c/]	19,079	17,754	14,726	10,184	8,600	7,539	3,079	9,174	3,732	3,846	3,158
Elasticity	-.019	.008	.036	.053	.026	.106	.102	.054	.119	.157	.259
Group VIII to Group IX											
Average Expenditure[c/]	42,904	49,873	34,955	22,883	23,971	14,575	5,900	15,515	4,798	5,637	5,770
Elasticity	.007	.002	.023	.022	.027	.053	.019	.067	.238	.028	.077

a/ Normalized per capita daily calorie consumption is consumption per comensal dia. Normalized per capita annual family expenditure is annual family expenditure divided by the average number of comensais dia per day observed for families in each expenditure group. See Appendix A for details.
b/ Elasticities between Group I and Group II are often unusual because Group I contains many one person families who eat many meals outside the home with relatives and as a result their consumption patterns differ sharply from larger families.
c/ Sum of normalized per capita annual family expenditure for the two groups divided by two, in Cruzeiros of August 1974.
d/ Rio de Janeiro state has only eight expenditure groups for this exercise.
e/ Parana, Santa Catarina, and Rio Grande do Sul.
f/ Goias and Mato Grosso.
g/ Rondonia, Acre, Amazonas, Roraima, Para (excluding Belem) and Amapa.

Sources: Calculated from data in IBGE, Estudo Nacional da Despesa Familiar: Despesas das Familias; Dados Preliminares 4 Vols. (Rio de Janeiro: 1978) and unpublished ENDEF data.

APPENDIX C

Educational Statistics

Table C.1 FORMAL EDUCATION ENROLLMENT BY LEVEL AND REGION, SELECTED YEARS, 1960-1973
(thousands of students)

Level and Region	1960	1965	1970	1973
A. All Levels				
Brazil	8,729	12,233	17,331	18,939
Northeast	1,913	2,726	4,075	4,815
Southeast	6,206	8,580	11,649	12,218
Frontier	610	927	1,608	1,906
B. Grades 1-8				
Brazil	8,368	11,568	15,895	16,302
Northeast	1,852	2,614	3,830	4,389
Southeast	5,922	8,063	10,559	10,203
Frontier	595	892	1,506	1,711
C. Grades 9-12				
Brazil	267	509	1,003	1,682
Northeast	47	88	185	318
Southeast	208	393	746	1,233
Frontier	12	28	72	131
D. Higher Education				
Brazil	93	156	433	955
Northeast	15	25	59	109
Southeast	76	124	344	781
Frontier	3	7	30	64

Source: SEEC/MEC, Anuario Estadistico de Educacao, various years.

Table C.2

POPULATION IN AGES 7-14 AND ENROLLMENT IN GRADES 1-8, BY REGION, SELECTED YEARS, 1951-1972
(thousands of students)

Year and Region	Population in Ages 7-14	Enrollment in Grades 1-8
1955		
Brazil	11,538	6,204
Northeast	4,139	1,393
Southeast	6,551	4,420
Frontier	848	391
1958		
Brazil	13,333	7,566
Northeast	4,618	1,702
Southeast	7,653	5,350
Frontier	1,061	514
1962		
Brazil	15,245	9,633
Northeast	5,120	2,129
Southeast	8,898	6,798
Frontier	1,227	706
1968		
Brazil	18,478	14,314
Northeast	5,870	3,402
Southeast	10,885	9,668
Frontier	1,723	1,244
1970		
Brazil	19,834	15,895
Northeast	6,187	3,830
Southeast	11,702	10,559
Frontier	1,945	1,506
1974		
Brazil	21,666	18,597
Northeast	6,968	4,673
Southeast	12,447	12,174
Frontier	2,251	1,750

SOURCES: Population: Demographic Projections, Annex I.
Enrollment: Jurandir Santiago, Modelo de Analise do Sistema Educacional, Convenio MEC/FUB, n.d., pp. 51-76 (all years except 1974); MEC/SEEC, op. cit. (for 1974).

Table C.3
ENROLLMENT IN GRADES 1-8, BY GRADE, REGION AND LOCATION, 1974.
(thousands of students)

	Northeast		Southeast		Frontier	
Grade	Urban	Rural	Urban	Rural	Urban	Rural
1st	712.9	1,236.2	1,843.4	1,235.0	301.5	335.6
2nd	462.7	315.0	1,393.0	644.4	188.1	114.0
3rd	408.0	150.4	1,244.0	482.8	161.6	63.5
4th	364.0	68.8	1,148.6	338.5	131.7	32.2
5th	338.5	8.2	1,243.1	59.8	154.8	6.4
6th	248.3	4.3	1,036.2	21.4	107.9	2.6
7th	200.8	2.8	822.4	14.1	91.8	1.5
8th	150.6	1.6	637.7	10.2	55.6	0.8
All Grades:	2,885.8	1,787.3	9,368.4	2,806.2	1,193.0	556.6
Urban + Rural (all grades)	4,673.1		12,174.6		1,749.6	
Grand Total			18,597.3			

Source: IBGE, Indicadores Sociais (Rio de Janeiro: 1977); table 3, p. 244.

Table C.4 Population in Ages 7-14

	BRA		NE		SE		FR	
	U	R	U	R	U	R	U	R
Year	(Total)		(Total)		(Total)		(Total)	
1960	6326	8236	1631	3310	4245	4168	450	758
	(14562)		(4941)		(8413)		(1208)	
1962	7002	8436	1779	3381	4705	4248	518	807
	15438		5160		8953		1325	
1968	9510	9077	2309	3604	6409	4498	792	975
	18587		5914		10907		1767	
1970	10535	9306	2519	3682	7104	4585	912	1039
	19841		6201		11690		1951	
1972	11353	9362	2774	3796	7561	4490	1018	1076
	20715		6570		12051		2094	
1974	12238	9428	3055	3913	8047	4400	1136	1115
	21666		6968		12447		2251	
1976	13198	9539	3364	4034	8565	4350	1269	1155
	22737		7398		12915		2424	
1978	14236	9606	3704	4159	9116	4250	1416	1197
	23842		7863		13366		2613	
1980	15362	9794	4079	4288	9702	4266	1581	1240
	25156		8367		13968		2820	

Note: BRA=Brazil, NE = Northeast, SE = Southeast, FR= Frontier; U = Urban, R = Rural;

Source: Baseline Demographic Projections (see Annex I).

Table C.5: ENROLLMENT IN GRADES 9 - 12, BY REGION, SELECTED YEARS, 1960 - 1976

(thousands of students)

Year	All Regions	Northeast	Southeast	Frontier
1960	267.1	46.9	208.5	11.8
1965	509.1	87.6	393.3	28.2
1970	1003.5	185.2	746.0	72.2
1975	1830.9	342.8	1344.4	143.7
1976	2002.3	375.6	1468.8	158.0

Note: Enrollments for 1960, 1965 and 1970 correspond to the category "Ensino Medio de 2º Ciclo" in the data source; for 1975 and 1976 they correspond to the category "2º Grau", and are preliminary.

Source: MEC/SEEC, Annuario Estatistico da Educacao, various years.

Table C.6 POPULATION IN AGES 15-19 BY REGION AND LOCATION, SELECTED YEARS, 1960-1980

(thousands)

Year	BRA U F (Tot)	N. E. U R (Tot)	S. E. U R (Tot)	FR. U R (Tot)
1960	3203 3955 (7158)	855 1552 (2407)	2128 2039 (4167)	220 364 (584)
1965	4298 4221 (8519)	1070 1648 (2718)	2909 2132 (5041)	316 437 (753)
1970	5768 4504 (10272)	1338 1749 (3087)	3977 2230 (6207)	453 525 (978)
1975	7009 4695 (11704)	1670 1943 (3613)	4754 2180 (6934)	582 563 (1145)
1976	7288 4734 (12022)	1746 1984 (3730)	4927 2171 (7098)	612 571 (1183)
1980	8517 4894 (13411)	2084 2158 (4242)	5684 2132 (7816)	749 604 (1353)

Note: BRA=Brazil, N.E.= Northeast, S.E. = Southeast, FR= Frontier; U= Urban, R= Rural

Source: Baseline Demographic Projections (see Annex I).

Table C.7: SECONDARY ENROLLMENT BY CERTAIN TRACKS, SELECTED YEARS, 1960-74

(thousands)

Track	1960	1965	1970	1974
"Academic"	113.6	189.6	462.4	628.2
Teacher training	64.8	169.7	262.7	270.7
Commercial	81.2	121.8	219.2	475.7
Industrial	6.0	24.3	49.5	163.6
Agricultural	1.6	3.7	8.1	23.3
Paramedical	0.0	0.0	0.1	112.9
Other "non-academic"	0.0	0.0	1.4	3.2
Sub-total: "non-academic"	153.6	319.5	541.0	1049.4
Total: All tracks	267.2	509.1	1003.4	1677.6

Note: Enrollments for 1960, 1965 and 1970 correspond to the category "Ensino Medio de 2º Circle: in the data source; for 1974 they correspond to the category "2º Grau".

Source: MEC/SEEC, Anuario Estatistico da Educacao, various years.

APPENDIX D

ENROLLMENT AND RECURRENT COSTS IN GRADES 1 TO 8:

NOTES ON METHODOLOGY OF PROJECTIONS 1/

Projections of Enrollment in Grades 1-8

Enrollment data by single grades and ages for the two consecutive years 1970-71, for Brazil as a whole, are presented in columns (2) and (6), Table D.1. To compute the number of 1970 students promoted to the next grade in 1971 (col. 3), from intake in 1971 (col. 4), and repeaters in 1971 (col. 5), some assumptions are necessary. For simplicity it is first assumed that no simultaneous drop-out and intake occurs in any grade. Thus, Table D.1 shows newcomers to first grade (but no drop-outs) up to the 9 year-old group. For older age groups, there are only drop-outs (but no intake) from first, second or third grade (and no intake into these grades); in 1970 drop-out numbers are not shown, but may be computed as the difference between first grade enrollment, in one hand, and promotion from first grade plus repetition in first grade, in the other hand. Small errors (less than 5%) are generated by this assumption when the intake is a large proportion of the normative entrance age group. 2/

The assumptions stated above can be translated into the following set of computational rules: First, promotions are set equal to the difference between enrollment and repeaters reported for the subsequent grade in the following year. Second, the balance of students not promoted represents the number of repeaters in the same grade in the next year. Third, if there are fewer students in the previous year in the preceding grades (i.e., the pool of potential promotions) than the balance of enrollments less repeaters, the gap will be taken as the number of newcomers (intake) to the system. Fourth, when the computed number of potential repeaters exceeds enrollment, the difference is taken as the number of drop-outs, and the number of repeaters is set equal to enrollment. These rules generate the figures presented in the columns labeled "promoted," "intake" and "repeaters" in Table D.1.

Enrollments and repeaters by ages in Table D.1 are rearranged and aggregated for each grade in Table D.2. The addition of both columns provides the "enrollment" and "repeaters" in each grade and the corresponding

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1/ These notes, and related projections, were prepared by Ernesto Schiefelbein.

2/ E. Schiefelbein, "Estimation of Enrollment Flow Rates," paper No. 39 (Center for Studies in Education and Development, Harvard University, 1978).

Table D.1: BRAZIL, STUDENT FLOWS COMPUTED FROM ENROLLMENTS: BY AGES AND GRADES, 1970-1971

Grades (1)	Enrollment 1970 (2)	Promoted (3)	Intake (newcomers) (4)	Repeaters (5)	Enrollment 1971 (6)
	less than 7 years of age				7 year olds
1°	422.3		1408.4	243.3	1651.7
2°	12.8	179.0		12.8	191.8
3°					
4°					
sub-total	435.1	179.0	1408.4	256.1	1843.5
	7 year olds				8 year olds
1°	1526.5		361.6	860.9	1222.5
2°	150.3	665.6		11.1	676.7
3°	12.9	139.2		12.9	152.1
sub-total	1689.7	804.8	361.6	884.9	2051.3
	8 year olds				9 year olds
1°	1168.0		162.9	683.3	846.2
2°	596.7	484.7		142.1	626.8
3°	115.1	454.6		5.8	460.4
4°	12.0	109.3		12.0	121.3
sub-total	1871.8	1048.6	162.9	843.2	2054.7
	9 year olds				10 year olds
1°	842.2		88.7	544.6	633.3
2°	589.7	297.6		212.3	509.9
3°	415.8	377.4		97.2	474.6
4°	96.9	318.6		48.0	366.6
5°	14.1	48.9		14.1	63.0
sub-total	1958.7	1042.5	88.7	916.2	2047.4
	10 year olds				11 year olds
1°	635.7			428.8	428.8
2°	490.8	150.1		216.8	366.9
3°	438.3	274.0		127.0	401.0
4°	324.7	311.3		68.1	379.4
5°	49.7	256.6		15.3	271.9
6°	7.9	34.4		7.9	42.3
sub-total	1947.1	1026.4		863.9	1890.3
	11 year olds				12 year olds
1°	420.5			301.2	301.2
2°	351.2	10.7		251.0	261.7
3°	375.0	100.2		215.2	315.4
4°	343.6	159.8		171.8	331.6
5°	259.8	171.8		150.8	322.6
6°	25.7	109.0		16.9	125.9
7°		8.8			8.8
sub-total	1775.8	560.3		1106.9	1667.2
	12 year olds				13 year olds
1°	308.9			191.1	191.1
2°	258.2			166.7	166.7
3°	301.3			218.5	218.5
4°	310.3	73.4		176.9	250.3
5°	307.5	133.4		170.8	304.2
6°	113.2	136.7		36.3	173.0
7°	7.6	76.9		0.6	77.5
8°		7.0			7.0
sub-total	1607.0	427.4		960.9	1388.3
	13 year olds				14 year olds
1°	192.0			125.0	125.0
2°	162.2			99.4	99.4
3°	209.7			128.8	128.8
4°	238.5	3.4		155.8	159.2
5°	287.7	82.7		168.9	251.6
6°	151.7	118.8		42.8	161.6
7°	70.8	108.9		12.4	121.3
8°	5.4	58.4			58.4
sub-total	1318.0	372.2		733.1	1105.3
	14 year olds				+14 year olds
1°	265.6			162.5	162.5
2°	181.0			106.2	106.2
3°	222.2			118.9	118.9
4°	261.0	5.0		131.6	136.6
5°	723.8	129.4		428.2	557.6
6°	571.5	295.6		191.8	487.4
7°	551.5	379.7		111.8	491.5
8°	468.2	439.7		40.0	479.7
sub-total	3244.8	1249.4		1291.0	2540.4

Source: Jurandir Santiago, Modelo de Analise do Sistema Educacional, Convenio MEC/FUB, n.d.

Table D.2: BRAZIL, REPETITION BY GRADES, 1970

Age (1)	Enrollment (2)		Repeaters (3)
First Grade			
-7	422.3		243.3
7	1526.5		860.9
8	1168.0		683.3
9	842.2		544.6
10	635.7		428.8
11	420.5		301.2
12	308.9		191.1
13	192.		125.0
14	265.6		162.5
Total	5781.7		3540.7
Rate		61.2	
Second Grade			
-7	12.8		12.8
7	150.3		11.1
8	596.7		142.1
9	589.7		212.3
10	490.8		216.8
11	351.2		251.0
12	258.2		166.7
13	162.2		99.4
14	181.0		106.2
Total	2792.9		1218.4
Rate		43.6	
Third Grade			
7	12.9		12.9
8	115.1		5.8
9	415.8		97.2
10	438.3		127.0
11	375.0		215.2
12	301.3		218.5
13	209.7		128.8
14	222.2		118.9
Total	2090.3		924.3
Rate		44.2	
Fourth Grade			
8	12.0		12.0
9	96.9		48.0
10	324.7		68.1
11	343.6		171.8
12	310.3		176.9
13	238.5		155.8
14	261.0		131.6
Total	1587.0		764.2
Rate		48.2	
Fifth Grade			
9	14.1		14.1
10	49.7		15.3
11	259.8		150.8
12	307.5		170.8
13	287.7		168.9
14	723.8		428.2
Total	1642.6		948.1
Rate		57.7	
Sixth Grade			
10	7.9		7.9
11	25.7		16.9
12	113.2		36.3
13	151.7		42.8
14	571.5		191.8
Total	870.0		295.7
Rate		34.0	
Seventh Grade			
11	-		
12	7.6		0.6
13	70.8		12.4
14	551.5		111.8
Total	629.9		124.8
Rate		19.8	
Eighth Grade			
13	5.4		-
14	468.2		40.0
Total	473.6		40.0
Rate		8.4	

Source: Table D.1

rates of repetition are computed. 1/ For the first grade the repetition rate (61.2%) is 2.6 times higher than the rate computed from school registration data.

Repetition and enrollment rates by grades are presented in Table D.3. The difference between the 1971 enrollments and the number of repeaters from the previous year correspond to the number of "newcomers" in first grade and of "promotion" from the previous grade in 1970 in the remaining grades. The number of repeaters and promoted students are deducted from the 1970 enrollments to compute the number of "drop-outs." Therefore, it is possible to compute the three transition rates for 1970 using 1970 enrollments as divisor.

There is an abrupt discontinuity in drop-out rates between grades three and four. There are two reasons for this. First, the calculation assumes that the stipulated volume of drop-outs is filled, first from grade one, then from grade two if potential drop-outs in grade one are insufficient, and so on. The drop-out quota usually gets filled with members of the first three grades. Thus it results in most cases that there are no apparent drop-outs from grades beyond the third. Second, since the intake of the 7 years old population in 1971 was 88%, many Brazilian children never join the educational system. For example, supposing that 8% in each age group have never been enrolled in the school system, there is still a 3.5 percent that drop out when at the same time there were some newcomers of the same age group joining the system for the first time (violating the initial assumption). Compared with the reliability of other estimates involved in making these projections, the error implied by the discontinuity in drop-outs is probably small. Moreover, the rates computed for the year 1970 were tested for the 1965-1972 period and the results fitted historical enrollment data rather well.

To project enrollment to the year 2000 it is assumed that in 1990 Brazil would reach the present promotion levels of the most advanced Latin American countries. The figures are presented in Table D.4. The table also presents the values for 1980 obtained using logarithmic interpolation for the "promotion" and "drop-out" rates and computing "repetition" as the balance. A second alternative was also computed to take into account a sudden change in the repetition rate for the second grade in 1975. However, differences in total primary enrollments were less than 2 percent in 1990 and less than one percent in year 2000, and therefore they are not reported here.

In Table D.5 an approximation of the annual "intake" was computed for the 1971-1976 period using the repetition rate computed for 1970. The ratio between the intake computed for 1976 and the 7 year old population was used as the basis of the projection. It is assumed to increase logarithmically to 100 percent intake in the year 2000 (see Table D.6). That is,

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1/ Since there is no data for the ninth grade, an aggregate number was estimated using fragmentary evidence.

Table D.3: BRAZIL, TRANSITION RATES BY GRADES, 1970 TO 1971

Grades	Promotion rates a/	Enrollments 1970	Promoted	Drop-outs	Repeaters	New-comers	Enrollments 1971	1970 Dropout rates b/
I	30.9	5790.8	1787.1	459.8	3543.9	2491.5	6035.4	7.9
II	48.1	2799.4	1345.2	233.7	1220.5		3007.6	8.3
III	46.7	2094.4	979.0	189.7	925.7		2270.9	9.1
IV	51.7	1590.3	822.5	1.3	766.5		1745.4	0.1
V	42.2	1644.8	694.2	1.6	949.0		1771.5	0.1
VI	66.0	870.8	574.6	0.1	296.1		990.3	-
VII	80.2	630.6	505.7	0.0	124.9		699.5	-
VIII	91.6	473.6		0.0	39.8		545.5	-

Notes: a/ Estimates based on the difference between the 1971 enrollment in the subsequent grade and repetitions computed using the 1971 rates.

b/ Estimates based on the difference between 1970 enrollments in each grade and repeaters plus non-repeaters.

Source: Tables D.1 and D.2.

Table D. 4: BRAZIL, PROJECTED TRANSITION RATES, 1970-1990

ALTERNATIVE A

	I	II	III	IV	V	VI	VII	VIII
1970 Prom.	30.9	48.1	46.7	51.7	42.2	66.0	80.2	91.6
Rep.	61.2	43.6	44.2	48.2	57.7	34.0	19.8	8.4
1980 Prom.	49.7	63.9	64.1	68.2	61.6	79.2	87.2	93.3
Rep.	46.3	31.3	30.8	30.2	36.3	18.8	10.8	4.7
1990 Prom.	80.0	85.0	88.0	90.0	90.0	95.0	95.0	95.0
Rep.	20.0	14.0	11.0	7.0	6.0	1.0	1.0	1.0

Sources: Table 3 for 1970 and best guesses for 1990.

ALTERNATIVE B

1975 Prom.	30.9	33.8	46.7	51.7	42.2	66.0	80.2	91.6
Rep.	61.2	57.9	44.2	48.2	57.7	34.0	19.8	8.4
1980 Prom.	49.7	53.6	64.1	68.2	61.6	79.2	87.2	93.3
Rep.	46.3	42.1	30.8	30.2	36.3	18.8	10.8	4.7

Sources: Same as Alternative A but second grade repetition rate is computed for 1975 and used as the base for projections.

Table D.5: BRAZIL, NEWCOMERS AS A PROPORTION OF THE SEVEN-YEARS-OLD GROUP, 1971-76

Year	First grade enrollments	Repetition rate	Newcomers (intake)	7 years old population	Intake as a percentage of age group
1970	5790.1	61.2	-	2752.0	-
1	6035.4	61.2	2491.5	2814.1	88.5
2	6206.8	61.2	2513.0	2877.6	87.3
3	6440.8	61.2	2642.7	2942.5	89.8
4	6532.8	61.2	2591.0	3008.9	86.1
5	6691.4	61.2	2693.3	3076.8	87.5
6	6850.1	61.2	2755.0	3146.0	87.6

Sources: Estadisticas de Educacao Nacional, 1960-71, Rio de Janeiro, SEEC, 1972;
Demographic projections, Annex I.

Table D.6: BRAZIL, POPULATION AND NEWCOMERS TO EDUCATIONAL SYSTEM 7 YEARS OF AGE, PROJECTED FOR SELECTED YEARS, 1970-2000

(thousands)

Year	Individuals 7 Years of Age	
	Total	Newcomers
(1)	(2)	(3)
1975	3,077	2,693
1980	3,440	3,081
1985	3,799	3,497
1990	4,195	3,970
1995	4,608	4,483
2000	5,062	5,062

Sources: Col. (2): Demographic projections, Annex I.
Col. (3): For 1975, Table D.2.

all the Brazilian population of school entrance age would be entering the educational system. This goal may be somewhat optimistic, but certainly not unattainable. The same goes for the transition rates, i.e., those that govern the rate of flow through the educational system. This flow could be somewhat slower and more children could be bunching in the initial grades than assumed in this projection. A more pessimistic projection might have generated gross enrollment up to 10 percent or even 20 percent larger than the corresponding population.

The final computation of projected enrollment is done as follows. Initial enrollments are used to compute enrollments for the next year by applying repetition and promotion rates in a similar way to that indicated in Table D.3. To arrive at first grade enrollment, repeaters are added to the intake estimated in Table D.6. The process is repeated for each successive year to the year 2000. Enrollment for 1971, as shown in Table D.3, was used as the base of the projection. Results by grades for 1980, 1990 and 2000 are presented in Table D.7.

This projection differs substantially from the enrollment projections presented in the study by Jurandir Santiago referred to in the text. Santiago's study includes 7 different projections, but the assumptions underlying all of them did not appear compatible with other parts of this report. For example, in his projections, total enrollment reached levels of at least 1.4 times the projected size of the 7-14 year-old population (in the case of one projection, this multiple reached the level of 2.2 times). The reason for these seemingly implausible results appear to be that Santiago was trying to show that some commonly suggested policy options are shown to be unfeasible when simulated in the context of enrollment projections.

Projections of Recurrent Costs, Grades 1-8

Only recurrent costs are considered in these projections because data for total costs are quite unreliable. However, recurrent costs can be safely assumed to account for most of total costs in grades 1-8, probably, no less than 75%.

Yearly data from 1960 to 1972 on enrollment and recurrent costs were used to fit a linear regression equation specified as

$$c = a + bt,$$

where: c = recurrent cost per student in the first four grades of primary

t = single years starting from 1960=0. a/

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a/ Estimated parameter values were: $a = 122.37$; $b = 2.66$.

Table D.7: ENROLLMENT BY GRADES 1-8 AND POPULATION 7-14; PROJECTIONS: 1980, 1990, AND 2000
(millions of persons)

	1980	1990	2000
Enrollment in Grade			
First	7.6	7.2	6.3
Second	4.0	5.1	5.7
Third	3.2	4.5	5.3
Fourth	2.7	4.0	4.9
Fifth	3.0	4.2	4.5
Sixth	1.9	3.2	4.0
Seventh	1.5	2.8	3.8
Eighth	1.2	2.6	3.6
A. Total Enrollment in Primary Level	25.1	33.6	38.1
B. Population 7-14	25.2	34.1	40.5
Gross enrollment ratio [A / B]	0.99	0.98	0.94

To obtain the cost per student for the last four grades in 1972 the following computations were made:

- Total recurrent expenses in education in 1972	Cr$ 9,402.6	a/ b/
- Percentage allocated to primary education	46%	c/
- Total recurrent costs in primary education in 1972	Cr$ 4,325.2	a/
- Enrollments in the first four grades in 1972	14,082	d/
- Value of c in 1972 (for t=12)	Cr$ 154.3	
- Total recurrent expenses in the first four grades	Cr$ 2,172.9	a/
- Total recurrent expenses in the last four grades	Cr$ 2,152.3	a/
- Enrollments in the last four grades in 1972	5,588	d/
- Unit recurrent cost per student in the last four grades in 1972	Cr$ 385.13	

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a/ In millions of current cruzeiros.
b/ Jurandir Santiago, op. cit., p. 229.
c/ E. Schiefelbein, Financial Implications of Changes in Basic Education Policies (IDA, Nov.-Dec. 1978), p. 20.
d/ In millions of students.

Assuming that the relationship between the unit costs of both levels is constant over time it is possible to compute total expenditures in primary education in the period under study (Table D.8).

Average unit cost for the whole primary level are computed adding the total costs of each cycle and dividing by the total enrollment.

Average unit costs increased at an average annual rate of 3.0% during the sixties. The projections imply a rate of only 1.6% per year in the nineties. Therefore, these may be considered as a "low" alternative. The historical rate for the 1960-70 period may be taken as a "higher" alternative. A consideration bearing on its plausibility is that most of the recurrent costs correspond to teachers' salaries. These are low in comparison to other professions and it is probable that they will continue to increase their relative level in the long run, as is happening in more developed countries. On the other hand, future outlays on equipment and facilities will tend to increase educational productivity. Thus, the historical trend does not appear to be excessively rapid. Table D.9 presents both of these alternative cost projections.

Table D.8: RECURRENT COSTS, FIRST AND LAST FOUR GRADES, 1960-2000

Year	First four grades			Last four grades			Average Unit Cost of the First 8 grades [a]
	Enrollment ('000s)	Unit Cost [a]	Total Cost [b]	Enrollment ('000s)	Unit Cost [a]	Total Cost [b]	
1960	7,458	123.27	919.35	910	308.18	280.54	143.39
1970	12,815	149.37	1,913.73	3,082	373.43	1,151.14	192.82
1980	17,482	175.64	3,070.49	7,605	439.10	3,339.55	255.51
1990	20,806	202.28	4,208.60	12,794	505.70	6,470.15	317.82
2000	22,137	228.91	5,067.60	15,984	572.28	9,147.52	372.88

a/ In 1972 Cruzeiros.

b/ In millions of 1972 Cruzeiros.

Sources: Enrollments for 1960 and 1970 were obtained from Santiago's study, and for the remaining years, from the enrollment projections above (Table D.7).

Table D.9: ANNUAL RECURRENT COSTS, GRADES 1-8, ESTIMATES AND PROJECTIONS, SELECTED YEARS, 1960-2000

Year	Enrollment (millions)	Unit Cost Assumption [a]		Total Cost Projection [b]	
		Low	High	Low	High
1960	8.4	—— 35.5 ——		—— 297 ——	
1970	15.9	—— 47.8 ——		—— 759 ——	
1980	25.1	63.3	64.2	1,588	1,610
1990	33.6	78.7	86.2	2,645	2,898
2000	38.1	92.4	115.9	3,521	4,418

a/ In US$ of 1976.

b/ In millions of US$ of 1976.