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Brazil: Agriculture at the Crossroads

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A Research Paper

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Brazil: Agriculture at the Crossroads [Redacted]

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A Research Paper

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**Brazil: Agriculture at
the Crossroads**

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Summary*Information available
as of 18 February 1988
was used in this report.*

During more than 20 years in power, Brazil's military rulers focused attention on rapidly expanding the production of export crops. Brazil now ranks only behind the United States in net export revenues earned from agriculture and competes directly with many US agricultural exports, such as soybeans, poultry, and processed products ranging from frozen orange juice to soybean meal and oil. These achievements came at the cost of stagnating and, in some cases, declining production of domestic food crops, however. This, in conjunction with a rapidly expanding population, caused per capita consumption of basic foodstuffs to sharply decline during the military government.

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The civilian government of President Jose Sarney came to office in 1985 pledging a set of reforms that would capitalize on the country's enormous agricultural potential. It outlined an ambitious two-track policy designed to expand lucrative exports and to push aggressively for growth in domestic food production. The political, financial, administrative, and technical obstacles to balancing these goals have been formidable, but the Sarney administration has begun to take a number of steps to address many of Brazil's longstanding agricultural problems. It has:

- Set investment targets to expand rural infrastructure, such as agricultural storage and irrigation facilities.
- Improved credit access for small farmers engaged in food staple production.
- Raised support levels for food crops.
- Provided broader access to farmland through land reform and by opening up new production areas in the frontier.
- Slightly reduced the government's role in the agricultural marketplace.
- Expanded research funds for both domestic and export crops, but with emphasis on food crops.

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These policies have had mixed results. The agricultural sector has recovered from a drought-induced setback in 1986, and in 1987 boasted record crops—a turnaround that helped Brazil achieve an expected \$11 billion trade surplus for 1987. Nonetheless, major problems remain:

- Subsidies used to spur an agricultural rebound are contributing to the massive public-sector deficit, and have heightened inflationary pressures.
- Brazil's overall precarious economic situation puts in question the government's ability to continue heavy subsidies in the agriculture sector and inhibits private investment.
- High inflation has eroded real gains in credit access and research funding.

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- Land reform remains stalled by a scarcity of government funds and by the resistance of landed elites.
- General policy drift has prevented action on cutting back inefficient state enterprises involved in agricultural marketing commodities such as wheat and sugar.

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Despite Brazil's precarious economic situation, it has virtually unlimited potential to make even greater strides in expanding agricultural production:

- *Vast undeveloped areas.* Enormous untapped agricultural areas—especially the promising Cerrados region of west-central Brazil—exist where only a small portion of the total arable land has been developed to date. The Cerrados is slightly larger than the state of California, with about 50 million hectares recognized by agricultural experts as being potentially productive.
- *Underutilized agrotechnology.* The Brazilians can also further expand agricultural production significantly through better use of existing agrotechnologies—hybrid plant varieties, for instance, and fertilizers—for improving crop yields. While some effort has been made to use technological advances more extensively, they have been used largely in the cultivation of export crops. Yields of food crops are quite low by world standards.

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Brazilian agricultural policy currently stands at a crossroads, with several alternatives open to it. We believe Sarney, given his approach thus far and the many constraints on taking new initiatives that he faces, is most likely to steer a course we term *More Balanced Growth*. This would be characterized by moderate export promotion, but, with increased attention to food crops through improved support policies for food producers, including greater access to land for small farmers, improved production loan and price supports for food crops, larger investments in rural infrastructure, and food research funding. Although we consider them less likely, we believe the government has two other options. One is *Enhanced Export Promotion* in which Brasilia turns away from recent policy initiatives and again emphasizes the production of export crops. In our judgment, the government could lean toward this option if the economy markedly deteriorates and Brasilia is obliged to maximize foreign exchange earnings. Finally, we can envision circumstances in which a seriously

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weakened Sarney government bows to growing popular political pressure to significantly *Improve Food Production* at the expense of export crops.

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We have examined these scenarios and projected the following consequences:

- Should Brasilia decide to continue the recent policy of moderate export promotion and increased attention to the production of food crops, the value of net exports by 1992 would increase more than 90 percent from 1986—the base year for our forecasts—and provide an additional US \$4-5 billion in revenues. The cost of food imports in 1992 would be about US \$1.3 billion—still substantially less than under the *Enhanced Export Promotion* scenario—but considerably more than in 1986 because population growth would lead to an increased demand for food.
- Alternatively, should Brasilia again emphasize export at the expense of food crops, net export earnings by 1992 would increase dramatically—amounting to \$7.5 billion more than in 1986. However, the cost of food imports—more than US \$2 billion in 1992—would more than double that of the base year.
- Should the government increase food production at the expense of export crops, the cost of food imports would increase due to population growth, but by only US \$300 million over that of the base year to about US \$1.2 billion in 1992. The value of net exports, however, would still be greater than the base year—roughly a US \$2.5 billion increase.

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Given Brazil's size, resources, agricultural potential, and already well-established role in international agricultural markets, we believe that whatever policies it pursues will have an impact on US-Brazilian relations. An expansion of exports of coffee, cocoa and sugar, for example, will mean lower prices for US consumers and a reduced US agricultural import bill. An increase in the production of orange juice, tobacco, soybeans, and poultry, however, will intensify already sharp competition with the United States for third country markets. The United States has already objected to the GATT about Brazil's export subsidies on soybean products, while Brazil has accused the US of subsidizing exports of poultry. These trade tensions almost certainly will intensify if, as we expect, Brazil continues to try to have the best of both worlds by pursuing aggressively its export policy while restricting access to its own domestic market.

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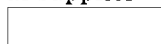
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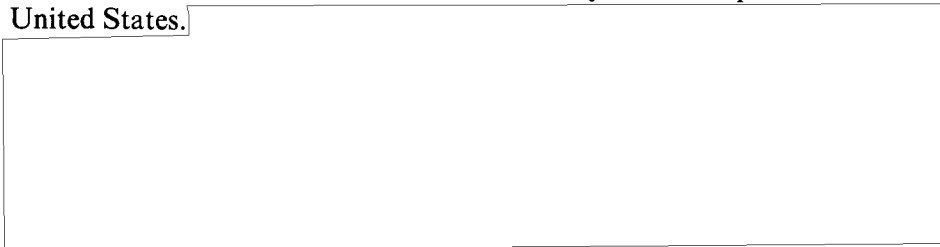
Scope Note

This Research Paper focuses on the performance and prospects of the Sarney government in capitalizing on Brazil's enormous agricultural potential. The paper highlights options available to Brasilia for managing a growing dilemma—whether to expand production of agricultural exports or domestic food crops. In particular this paper evaluates the implications for the United States of Brazil's position as a leading agricultural supplier and its increasing importance as a competitor in other markets.



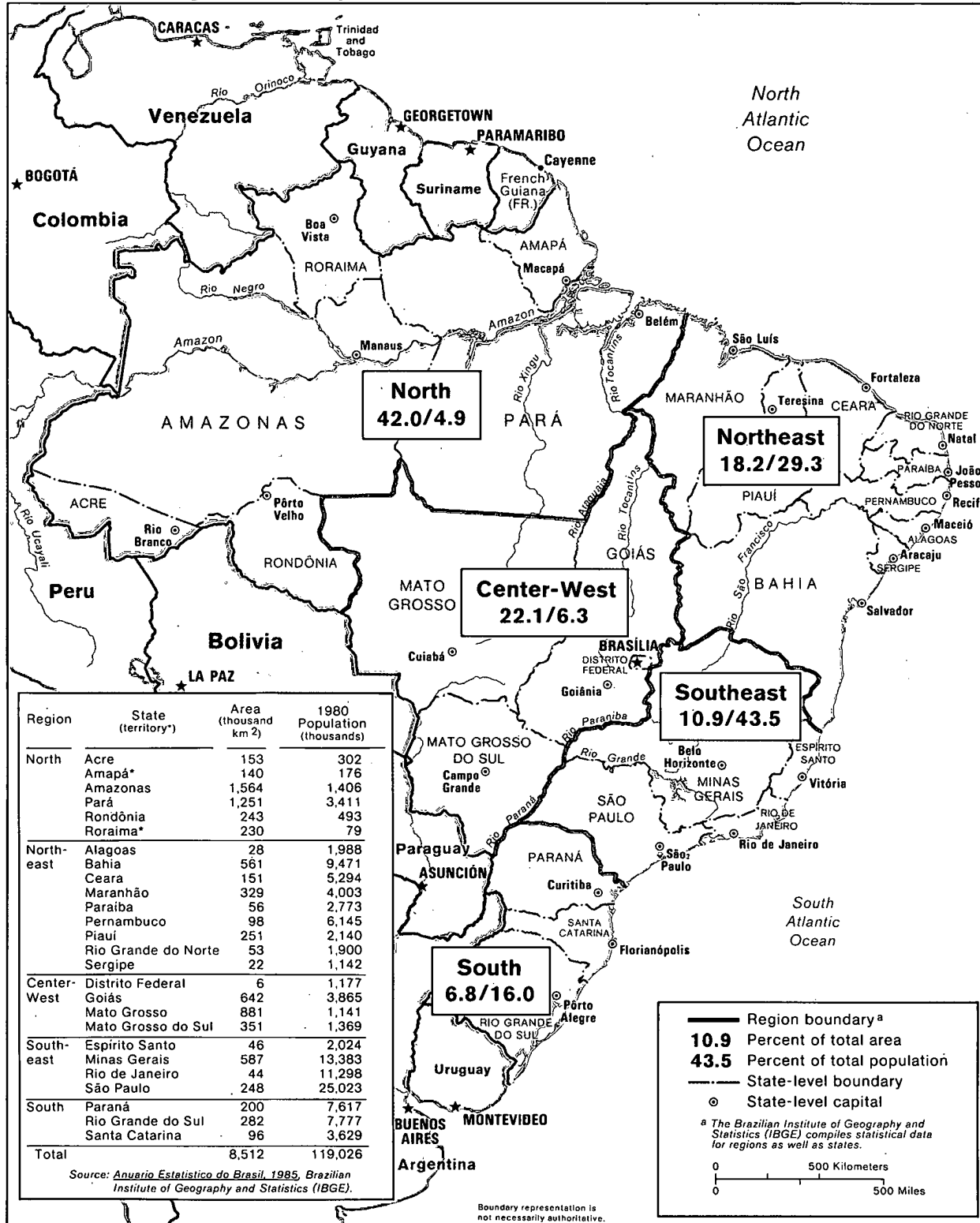
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This study is part of a continuing effort within the Directorate of Intelligence to scrutinize the Brazilian economy and its impact on the United States.



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Figure 1
Brazil: Area and Population, by Region and State



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Brazil: Agriculture at the Crossroads

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Introduction

The Sarney government took office in 1985 counting on a robust performance in the agricultural sector to help bolster Brazil's long-run economic development. The government's ambitious development plans called for an expansion of agricultural production that would provide increased export revenues, produce more food for the domestic market, and decrease dependence on imported petroleum by increasing the output of fuel alcohol. Brazil's agricultural sector now stands at a crossroads, with difficult choices facing the country's civilian leaders. Brasilia's policy direction will have a strong effect on global agricultural markets as well as on the availability of foodstuffs for the rapidly expanding Brazilian population (see figure 2).

This paper is our first comprehensive analysis of Brazil's agricultural sector since the late 1970s. Building on Embassy reports, industry studies, and contract research, it profiles Brazil's push to become a leading exporter of agricultural products and notes the social costs associated with that policy. It also examines the priorities set for agriculture since the country's return to civilian rule in 1985, and analyzes the successes and failures of the Sarney government's pursuit of its goals. In an effort to estimate possible future trends in Brazil's agriculture in the early 1990s, the paper posits three scenarios for agricultural production and trade and evaluates the implications of each for Brazil and for its bilateral relationship with the United States.

Roots of the Export Boom

During more than 20 years in power, Brazil's military rulers pursued a broad range of policies designed to expand the production of cash crops and boost export sales. Throughout the 1970s and into the 1980s, military governments provided highly subsidized production loans and price supports, especially to large farmers growing export crops. In addition to granting

Brazilian Agriculture in a Nutshell in 1987

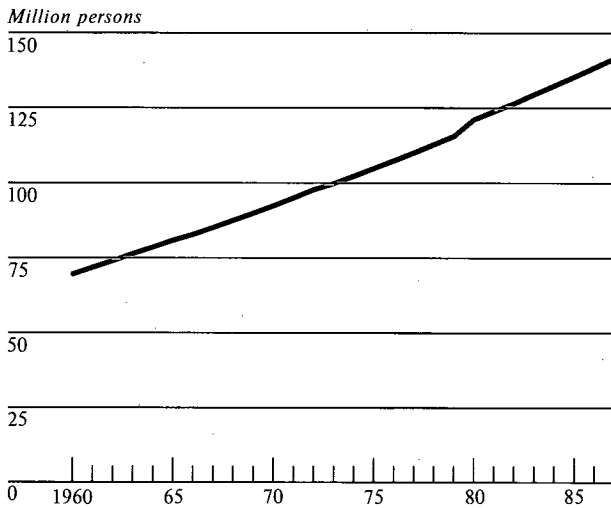
- *Agriculture accounts for 35 percent of national employment and generates 30 to 40 percent of total annual exports since 1980.*
- *Brazil is one of the most diverse agricultural producers in the world, with products including traditional tropical commodities like Brazil nuts and black pepper from the Amazon Basin, sisal and carnauba wax from the dry northeast, and soybeans and wool from the more temperate south.*
- *Brazil maintains the world's fourth-largest cattle herd of over 130 million head and the world's largest bioenergy program, producing about 13 billion liters (50.4 million barrels of oil equivalent) of fuel alcohol from sugarcane in 1987.*
- *Brazil is the world's largest exporter of coffee, orange juice, and soybean meal, and ranks among the world's top three exporters of sugar, cocoa beans, soybeans, beef, tobacco, and spices.*
- *Averaging almost US \$9 billion in earnings annually over the last six years, Brazil ranks behind only the United States in net export earnings from agriculture.*
- *Most of Brazil's agricultural exports are marketed in OECD countries but, increasingly, new markets are being sought in the Middle East and East Asia.*
- *Brazil is not a major wheat producer and is forced to import from Argentina, Canada, France, and the United States.*

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Figure 2
Brazil: Population Growth, 1960-87



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preferential financing for equipment purchases, low export taxes, and tax credits, Brasilia also subsidized fuel and transportation costs for opening new producing areas and sponsored research to enhance productivity. As a consequence, Brazilian exporters were able to attract an increasing share of global markets by offering competitive prices; Brazil today ranks only behind the United States in net trade revenues earned in world agricultural markets, according to UN statistics. [redacted]

Keys to Success

The significant growth in agricultural output between 1970 and 1985 was in large part a result of the expansion of area planted. Government statistics indicate that during this 15-year period Brazil's cropland increased 46 percent, to nearly 50 million hectares, with the area in export crops more than doubling to nearly 22 million hectares. Over one-quarter of the expansion took place in the Center-West Region,

Government Policies Spurring Growth of Agricultural Exports

To help stimulate agricultural exports, especially processed agricultural exports, Brazil's military governments used a variety of measures including preferential export financing and tax concessions. For example, processed agricultural exports such as orange juice, soybean meal, and sisal cordage have been exempt from the federal value-added tax on processing (IPI tax). Brazil also has utilized differential export taxes to encourage soybean oil and soybean meal exports over raw bean exports. The US oilseed industry believes this practice increases profit margins, thus constituting a subsidy that enables Brazil to export below world prices. [redacted]

According to a US Trade Representative (USTR) report, the price advantage has been instrumental in displacing US exports and in producing excess oilseed crushing capacity in Brazil—25 million metric tons when production averaged only 14.7 million tons from 1980 to 1984. In addition, Brasilia's preferential financing on soybean imports—to feed its excess crushing capacity—has added to US industry concerns. USDA reports that the US share of the world soybean meal market fell from 38 percent in 1977/78 to 20 percent in 1984-85, and the US share of the world soybean oil market fell from 35 percent to 21 percent. [redacted]

largely made up of the wooded savanna geographic zone known as the Cerrados (see figure 3 and inset); this in part reflects the emphasis placed on soybean production in response to increased global demand. In the state of Goias, for example, soybean production tripled to over 860,000 metric tons annually during the 1979-84 period and stands at over 1 million tons per year, according to Embassy reporting. In the more remote states of the Cerrados—Mato Grosso, Mato Grosso do Sul, and Rondonia—virgin land was opened up to those producing mainly export crops, according to press reports. [redacted]

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Figure 3
The Cerrados Region



**The Cerrados: Brazil's Potential
Agricultural Powerhouse**

The Cerrados Region is situated in central Brazil between latitude 6° S and 20° S in a semitropical environment. According to Brazilian land survey statistics, the region occupies roughly 180 million hectares—about one-fifth of the national territory. Although 50 million hectares—more than the total area of California—are potentially arable, less than 20 percent of the region's gently rolling to flat topography has been developed to date, in part because of lack of infrastructure and heavy startup costs.

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Soils in the Cerrados are high in iron and acidity and low in nutrients, but when treated with lime and managed well can be highly productive. Weather is favorable: temperatures are mild and fairly uniform throughout the year, and rainfall averages between 1,000 and 2,000 millimeters with the greatest concentration occurring from November to April. The availability of ground water and streams allows the development of irrigation for agriculture during the May-October dry season (appendix B).

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In southern Brazil, agricultural experts report, the military governments' policies encouraged many established commercial farmers and ranchers to abandon production of food staples and livestock in favor of export crops and sugarcane for fuel alcohol:

- In the state of Sao Paulo, for example, the area planted with orange trees has nearly doubled since 1975 from under 400,000 hectares to over 700,000 hectares.
- During the same period, data from Brazil's Coffee Institute indicates, the nation's coffee tree inventory expanded by 21 percent, growing from some 2.8 billion trees to 3.4 billion trees. Expansion was greatest in the state of Minas Gerais, with the doubling to over 1 billion trees—reflecting the government's \$1 billion coffee rehabilitation program following the devastating 1975 frost.
- Government subsidies also encouraged the growing of sugarcane for fuel-ethanol (alcohol) production at the expense of domestic food crops. Nearly 2 out of

According to Brazilian agricultural experts, the Cerrados has the resource potential for achieving yields on a par with developed country producers for soybeans, rice, corn, wheat, and dry beans. Brazilian experts foresee the Cerrados as having considerable potential for wheat production in the future, thereby offering the opportunity for gradually shifting production out of the difficult wheat-producing areas in the south, especially Rio Grande do Sul. Moreover, the Region has the potential to support coffee production and tropical tree crops—such as mangos and papayas—as well as livestock.

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4 million hectares of sugarcane—mostly in Sao Paulo state—now produce nearly 13 billion liters—includes small amount of manioc-produced ethanol—(50.4 million barrels of oil equivalent) annually compared with under 1 billion liters in the mid-1970s.

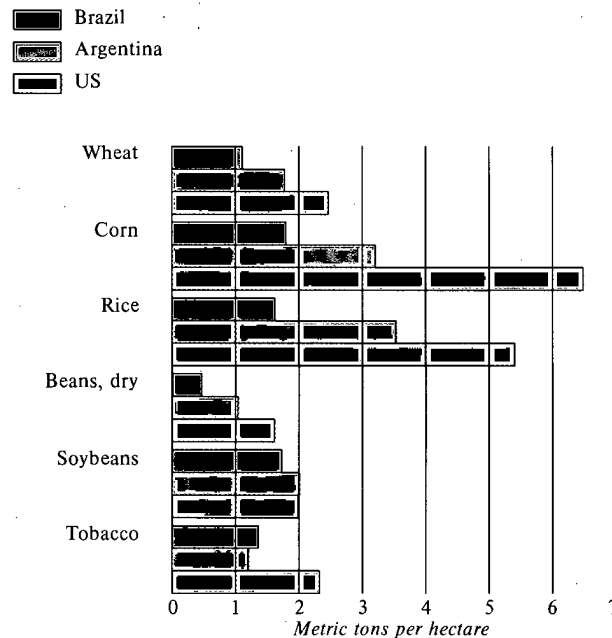
- Brazil also has become a major exporter of poultry, nearly tripling commercial production over the last decade. Although not a large user of land directly, the poultry industry is a large consumer of corn and other domestic feedstuffs.

Industry experts indicate that improvements in crop yields and the management of livestock have been more modest and less even, but nevertheless have helped those growing crops for export more than those concentrating on supplying the domestic marketplace. Advances in agrotechnology—hybrid plant varieties, yield-improving fertilizers, specialized pesticides and herbicides, for example—have been largely limited to export crops. As a result, during the 1981-85 period the yield of Brazil's food crops was less than one-half that of the worldwide average and about one-third that of average US yields, according to UN statistics. By contrast, the yield of Brazil's traditional export crops—coffee, cocoa, and sugarcane—exceeded the world average but with the exception of soybeans and tobacco was still only two-thirds as productive as the United States (figure 4).

The increased output of soybeans, oranges, tobacco, and poultry has allowed Brazil to increase its agricultural exports at an average annual rate of 12 percent since 1970 and has made Brazil a major competitor of the United States for third-country markets. Competition has been particularly intense in soybeans and soya products, orange juice, poultry, and tobacco, all of which Brazil now efficiently produces, processes, and markets.¹ In 1975 these four products accounted for only US \$1.5 billion from shipments of 7.0 million tons, but by 1985 they represented US \$4.0 billion from 14 million tons. Earnings from the export of soy products alone increased from a little over US \$1 billion in 1975 (from 6.7 million tons) to US \$2.5 billion in 1985 (from 13 million tons). Although earnings from agriculture as a whole in 1987 accounted for only about one-third of total export earnings compared with over 50 percent a decade ago, the

¹ Production and processing of soybeans, oranges, and tobacco—all geared primarily for the export market—benefit from the technologies and expertise of multinational agricultural firms. For example, tobacco producers receive technical support from international tobacco firms such as R. J. Reynolds, and Liggett and Meyers.

Figure 4
Average Yields of Selected Crops:
Brazil, Argentina, and US, 1980-85



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value of current agricultural exports is roughly double that of pre-1975 annual sector earnings (table 1).

Social Impact

The emphasis by the former military government on exports caused domestic food production to stagnate and in some years actually to decline. At the same time, Brazil's population was rapidly expanding—55 million were added during the 1965-85 period, creating sharp declines in the per capita availability of

Table 1
Brazil: Value of Selected
Agricultural Exports

Billion US \$

| | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---------------------------|------|------|------|------|------|------|------|
| Coffee | 1.8 | 2.1 | 2.3 | 2.8 | 2.6 | 2.4 | 2.0 |
| Soybeans ^a | 3.2 | 2.1 | 2.6 | 2.6 | 2.5 | 1.6 | 2.4 |
| Cocoa | 0.6 | 0.4 | 0.6 | 0.7 | 0.8 | 0.6 | 0.6 |
| Sugar | 1.1 | 0.6 | 0.5 | 0.6 | 0.4 | 0.4 | 0.4 |
| Orange juice | 0.7 | 0.6 | 0.6 | 1.4 | 0.8 | 0.6 | 0.8 |
| Meat (beef and poultry) | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 | 0.6 | 0.4 |
| Tobacco | 0.4 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 |
| Others ^b | 1.0 | 0.4 | 1.0 | 1.2 | 1.0 | 0.7 | 1.0 |
| Total | | | | | | | |
| Agricultural exports | 9.6 | 7.4 | 8.9 | 10.5 | 9.3 | 7.3 | 8.0 |
| Merchandise exports | 23.3 | 20.2 | 21.9 | 27.0 | 25.6 | 22.4 | 26.2 |
| Merchandise imports | 22.1 | 19.4 | 15.4 | 13.9 | 13.2 | 14.0 | 15.1 |
| Merchandise trade balance | 1.2 | -0.8 | 6.5 | 13.1 | 12.4 | 8.4 | 11.1 |

Note: These data are based on Embassy reporting and CIA estimates.

^a Including soya products.

^b Includes a wide range of products from Brazil nuts, cashews, and black pepper to sisal twine, animal hides, and castor oil.

basic foodstuffs. According to official Brazilian statistics, shortages of manioc and dry beans, for example—the main staples of the poor—typify the problem. Manioc production, concentrated in the impoverished Northeast, totaled 25 million tons in 1965 but only 23 million tons in 1985, reflecting generally declining yields and smaller acreage devoted to the crop. Dry bean production during the period remained relatively static at about 2.3 million tons as declining yields more than offset expanded acreage.

With food in shorter supply, prices rose and the poor reduced their consumption not only of basic staples but also of beef—consumption of which had already been declining (table 2). World Bank, FAO, and USDA reports show the average nutritional level of

Livestock Sector: Productivity Declining,
Per Capita Consumption Lower

Despite Brazil's cattle herd of more than 130 million head, its meat production for 1987 was only about 2.2 million metric tons, the same level as at the beginning of the decade. Productivity is very low. The ratio between the number of animals slaughtered and the total size of the herd currently does not exceed 12 percent, half of Argentina's level. This deterioration of the cattle sector reflects failure to improve pastures and herds because of poor returns in the marketplace. Poor nutrition has led to low calving rates and downward trending productivity. The cattle herd's rate of growth was 23.1 million head for the period 1970-75, 16.4 million head for 1975-80, but only 9.6 million head during 1980-85. Brazil's dairy herd averages only 800 liters of milk per cow per year compared to 5,600 liters in the United States. Supplies of milk for the domestic market, which increased 40 percent between 1975 and 1980, declined to only 7.5-percent growth between 1980 and 1985, according to the Ministry of Agriculture.

The problem confronting the Sarney government is how to establish a pricing policy that both spurs cattle and dairy production and places it within the purchasing power of Brazilian consumers. A solution advocated by the Beef Cattle National Council is increasing productivity through the expanded use of feed lots in Brazil to fatten cattle and by reducing the slaughter age from 4.5 years to 3.5 years. Development of this strategy, however, hinges on the plentiful supply of cheap grains as the primary feed source.

Brazilians, especially those in low-income groups, has been falling since the early 1960s.² Statistics compiled by the World Bank indicate that during this period

² In this study we assume that food crops supply about 60 percent of the total intake of calories per day per person as in the early 1960s.

Table 2
Brazil: Average Per Capita
Availability of Traditional
Food Staples

Kilograms per person

| | 1961-63 | 1981-85 | Percent Change |
|---------------|---------|---------|----------------|
| Beans, dry | 22.0 | 16.6 | -24.5 |
| Corn, meal | 21.7 | 20.8 | -4.1 |
| Manioc, fresh | 134.9 | 88.7 | -34.2 |
| Rice, milled | 44.4 | 42.0 | -5.4 |
| Wheat, flour | 25.2 | 37.1 | 47.2 |

many people in the Northeast Region suffered from malnutrition. In our judgment, the nutrition problem may have been even worse for those urban poor who were cut off from the support of the rural extended family. [redacted]

In an effort partially to offset the decline in the production of domestic staples, Brasilia began to increase its imports of wheat in the 1970s, while encouraging plantings, although wheat is difficult to grow in southern Brazil.³ Wheat consumption grew by over 115 percent between 1975 and 1985 to an estimated 8.4 million tons. According to Brazilian trade statistics, over the last decade Brazil has spent about \$700 million annually to import wheat. The military government also subsidized consumer prices for both domestically grown and imported wheat products—at a cost of over \$1 billion annually—contributing to the perennial public-sector deficit, according to Embassy reporting. Even with these actions, per capita bread consumption in Brazil in 1985 was only 22.6 kilograms, compared with over 50 kilograms in the United States. With the exception of wheat imports, military governments opted not to utilize revenues generated from agricultural exports for food imports to ensure an adequate diet for all

³ Heavy rains and high humidities at harvest are a perennial problem for wheat in southern Brazil, the traditional growing area, leading to disease problems, crop losses, and low yields. These conditions have spurred government programs fostering a shift of wheat production to the Cerrados where the climatic conditions are generally better. [redacted]

Brazilians.⁴ Foreign exchange surpluses were instead used largely to help pay for Brazil's mushrooming oil import bill, to help buy capital goods for industrial development, and to help finance such prestige projects as the world's largest hydroelectric facility at Itaipu, nuclear power facilities, and a military arms industry. Only in food crisis situations, such as in times of severe drought or rioting over lack of food—which occurred in Rio de Janeiro in the early 1980s—did the military government rush to import basic foodstuffs. [redacted]

Civilians Take Stock

New Priorities

The Sarney government came into office aware of the problems and inequities associated with export agriculture, and pledged long-term agricultural reforms to bring unused, potentially arable land into food production. In a series of conferences held in late 1984, the agricultural business community emphatically underscored Brazil's emerging food crisis—the nation's food output had dropped 13 percent during the 1977-84 period while export crop output increased 19 percent. The businessmen warned that, if pre-1984 trends persisted, malnutrition would worsen and Brazil would have no choice but to become a permanent large importer of grain. According to Embassy reports, Sarney's program included the development of frontier lands, notably the Cerrados, as well as land reform. The latter program, aimed at redressing a highly skewed land distribution pattern—10.4 percent of the farms made up 80 percent of farmland in 1980—called for the transfer of approximately 50 million hectares of underutilized government or expropriated private land to 1.4 million landless families over a four-year period (table 3). Farmers were to receive increased government financial support for

⁴ Wheat and wheat products (bread, noodles, flour, and bakery products) are mainly urban middle- and upper-class consumption goods. Accordingly, increased wheat production and imports only marginally improve the diet of lower income urban dwellers, rural workers, peasants, and the landless. [redacted]

Table 3
Brazil: Size Distribution
of Farms by Number
and Area, 1980^a

| Size (hectares) | Number (percentage) | Area (percentage) |
|---------------------|------------------------|----------------------|
| Total | 100.0 | 100.0 |
| Less than 10 | 50.4 | 2.5 |
| 10-100 | 39.2 | 17.7 |
| 101-1,000 | 9.5 | 34.8 |
| 1,001-10,000 | 0.9 | 28.7 |
| Greater than 10,000 | NEGL | 16.4 |

^a Source: Brazilian Institute of Geography and Statistics, Anuario Estatístico, 1985.

Note: Land ownership concentration is greater in the North, Northeast, and Center-West and smallest in the South. This reflects both the great variety of socioeconomic conditions and the different types of agricultural activities found in the different regions of Brazil—ranging from small family farms of descendants of European immigrants in southern Brazil, to the cooperatives of Japanese Brazilians in Sao Paulo and Parana to the giant ranges of Mato Grosso and the traditional sugar estates in northeastern Brazil.

growing basic foodstuffs, especially beans, manioc, and corn. Sarney in part justified the policy by the need to reduce the growing number of land-related conflicts; the press, for example, reported some 950 separate incidents and 180 deaths in 1984.

Fostering Growth

In other agricultural policy initiatives, Sarney called for the promotion of greater free enterprise in some respects, but pushed expansion of supports for food production. More specifically, Brasilia earmarked three major government organizations for possible reorganization or elimination—the Brazilian Coffee Institute, the Institute of Sugar and Alcohol, and the Wheat Board, according to Embassy reporting. In addition, it announced a Plan of Goals in July 1986 that called for expansion of grain and oilseed production from the 49-million-ton average for the 1980-84 period to 72 million tons by the 1989/90 crop year. The plan also called for increased rural credit, higher minimum price support programs, and an expansion of agricultural storage facilities; it also pledged to

reverse the disproportionate allocation of government financial and technical resources to export crops.

The government envisioned an expenditure of \$140 billion cruzados (approximately US \$3.5 billion in current dollars) in new investments through 1989. Embassy reports indicate that significant funds were made available to expand production and marketing infrastructure—rural road construction, electrification power and communication services, transportation and storage facilities, and irrigation and drainage systems—with the Cerrados Region and the impoverished, drought-ridden Northeast the primary beneficiaries.

To help finance these and other projects, Brasilia aggressively sought foreign assistance. The Japanese, in particular, have increased investment in rural Brazil, providing technical and financial assistance to develop the frontier, according to Embassy reporting. In 1985, for example, the Japanese Government committed US \$150 million for the second phase of a project in the Cerrados to expand cultivation on 150,000 hectares, comprising 400 to 500 farms that concentrated on soybeans, corn, wheat, sorghum, and rice production.⁵ The Japanese are also reportedly interested in financing a railroad to serve the producing areas of the Cerrados. In addition, since mid-1984, the World Bank has approved US \$1.9 billion in loans for agricultural and rural development, especially in the Northeast Region, which would focus on irrigation development, research and extension, credit and land tenure and resettlement, marketing reform, and livestock disease control. Also during this period the World Bank has approved new loans worth US \$1.7 billion, aimed at improving physical infrastructures such as roads, highways, bridges, railroads, and electric power generation and transmission—projects that support the growth of the agricultural sector.

⁵ This project, and the pilot project covering 50,000 hectares that began in 1980, are part of the Japanese-Brazilian Agricultural Development Program involving government and private organizations to develop large-scale agriculture in Brazil in an effort to increase food production.

Mixed Success

Implementation of these ambitious programs has been mixed. A severe drought during the first year of the Sarney administration significantly undercut Brasilia's efforts to increase food production. A combination of real wage hikes, a price freeze, and expanded social services for the poor spurred consumer food demand just as drought in southern Brazil reduced the output of soybeans by 27 percent to 13 million tons and caused significant losses to cattle herds as pastures deteriorated. According to Embassy reporting, in 1986 the Sarney government responded to widespread food shortages by importing a record US \$2 billion worth of foodstuffs, but internal demand nonetheless outran supplies.⁶ Moreover, lower volumes of exportable commodities—coffee production was halved to under 17 million 60 kilogram bags (1 million tons)—coupled with generally weak world prices, reduced Brazil's agricultural export earnings about 22 percent to \$7.3 billion (table 1). [redacted]

Agricultural Rebound Aids the Economy

In addition to increasing imports, the Sarney government responded to the crisis with a number of stopgap measures designed to quickly boost food production. In addition to increasing farm credit and setting higher crop support prices, it set price controls on production inputs at the time of planting in order to encourage farmers to use fertilizer and pesticides to improve yields. Price controls and new financial regulations induced large landowners to shift funds from money market instruments into farm production investments. These factors paid off in a sharp expansion of acreage under food cultivation; corn and rice acreage alone went up 20 percent—approximately 1.9 million hectares in 1987 compared with 1986 levels. [redacted]

Embassy reporting suggests that 1987 harvests reflect the impact of government policies as well as excellent growing conditions. According to the Ministry of

⁶ In addition to US \$900 million in corn, rice, and wheat imports, Brasilia's Interministerial Food Supply Council (CINAB) also authorized liberal imports of milk, beef, pork, and horticultural products. [redacted]

Agriculture, Brazil enjoyed a record grain and oilseed crop—estimated at 64 million tons, 20 percent above the drought-reduced 1986 crop—and a record coffee crop of 38 million bags (2.3 million tons). Corn production was up 31 percent to a record 27 million tons, shifting Brazil from a net importer to a potential exporter. The US Department of Agriculture estimates that Brazil's 1987 soybean production totaled 17.3 million tons, up 23 percent from 1986. The volume of beef and soya exports also was up sharply in 1987, reflecting both stronger international demand and slackening domestic demand. Orange production in the state of Sao Paulo—accounting for 80 percent of national output—reportedly rebounded to 240 million 40.8 kilogram boxes, up 15 percent from 1986, while frozen concentrated orange juice exports for 1987 are estimated at 785,000 tons.⁷ Finally, excellent growing conditions in 1987 were reflected in a record wheat crop, in the traditional southern producing states, as well as in the Cerrados state of Mato Grosso do Sul where 540,000 tons were harvested this year—compared with only 113,000 tons in 1982. All told, the 1987 wheat harvest is a record 6 million tons, up 7 percent from the good 1986 crop and more than double the average annual production during the previous decade. The narrowing gap between domestic wheat production and demand in 1988 apparently will be met by imports of about 2.2 million tons costing between US \$200 and US \$250 million—compared with average annual imports of 4.4 million tons costing US \$850 million annually during the period 1980-85. [redacted]

Brazil's recent agricultural bonanza also has had several ancillary benefits that have helped the troubled domestic economy, according to Embassy and press sources. The large summer harvest in 1987, for example, required employment of an estimated 2 million seasonal farmworkers, while the agricultural processing industries employed many of the workers laid off from industrial jobs. The marketing of the record crop from farm to retail outlets and export terminals also added thousands of new jobs for

⁷ Tons in 65 degree Brix (percent by weight of sugar).

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truck-drivers, warehousemen, and stevedores. Plentiful food supplies also helped temper price hikes for staples, despite high inflation.⁸

The across-the-board agricultural production boom is also reflected in an upturn in 1987 agricultural exports. Even though world prices for key exports such as coffee, cocoa, and sugar continue to be depressed, the Embassy reports that Brazil has gleaned US \$8 billion in foreign exchange earnings from agriculture in 1987, 10 percent above the 1986 level and about one-third of total export earnings. In addition, improved domestic supplies and low wheat import prices will save more than \$1 billion in foreign exchange. Moreover, the agricultural boom has translated into an 8-percent jump in the sector's contribution to Brazil's 1987 GDP. This has offset the sharp decline in the industrial sector and has allowed the economy to achieve a modest 2-percent growth level for the year (figure 5).

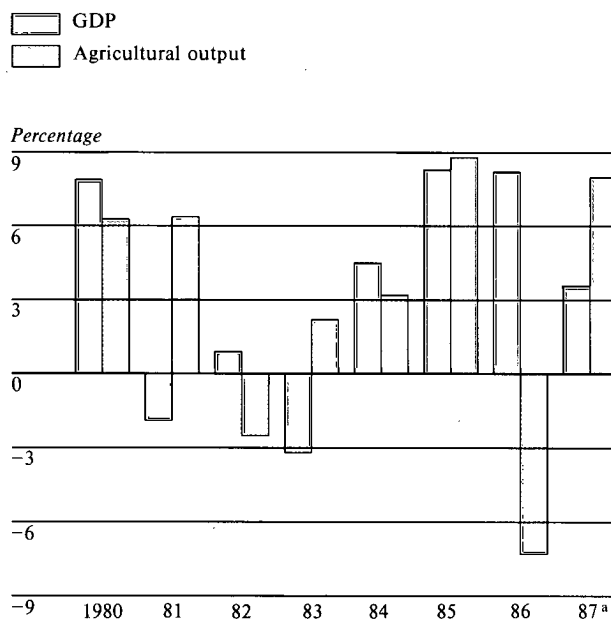
Some Progress Toward Fundamental Change . . .

Preliminary reporting—including information from the World Bank and Brazilian agricultural experts—indicates that some longer term institutional changes are beginning to take hold, increasing the chances that Brazil will remain a major agricultural exporter in the years ahead. Government investments in research, in particular, are beginning to bear fruit. Brasilia's Agricultural Research Enterprise (EMBRAPA), for example, recently announced that, after a seven-year study and test period, the Cerrados Research Center has developed the first high yielding hybrid corn in the world tolerant of the region's acid soils. The new hybrid reportedly has yields comparable to those in the United States and more than triple Brazil's current average national corn yields. In addition, public and private investments made in response to high international prices for coffee, citrus, and cocoa in the late 1970s are also beginning to pay off. According to Embassy and USDA reporting, by the early 1990s Brazil could produce:

- Forty to 45 million bags of coffee, up 5 to 18 percent from this year's record production.

⁸ According to the Wholesale Price Index of the Getulio Vargas Foundation, agricultural prices rose 147 percent for the period January to July 1987 compared with a 222-percent price rise for industrial prices during the same period.

Figure 5
Brazil: Changes in Gross Domestic Product and Agricultural Output, 1980-87



^a Estimated.

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- Approximately 350 million boxes of oranges, 19 percent above this year's record.
- 550,000 tons of cocoa beans, one-third higher than the 1984/85 record harvest.

In contrast to past practice, Brasilia's new emphasis on the parallel expansion of major seasonally planted crops could permit an expansion of grain and oilseed production to 72 million tons by the 1989/90 crop year. The harvest of 64 million tons in 1987 already puts the plan ahead of schedule, although early indications for the 1988 crops point to an expansion mainly of soybean acreage at the expense of food crops such as corn and rice.

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Brasilia also is making some progress in reducing agricultural budget expenditures by reducing subsidies. For example, the Embassy reported that in mid-June 1987 Brasilia reduced the wheat subsidy, which had cost the government over \$1 billion annually. All imported and domestically produced wheat is now sold to flour mills at US \$155 per ton, up from about US \$25 a ton charged under the subsidy. Brasilia has also authorized incremental increases in wheat flour and bread prices to consumers. For example, in December 1987 the price of wheat flour increased 25 percent and the price of a 50-gram loaf of French bread went up 15 percent. At the same time, according to USDA, Brasilia lowered the price paid to farmers for the 1987 wheat crop. The guaranteed purchase price by the Bank of Brazil, which buys the entire crop, in December 1987 was US \$182 per ton, well below the price of US \$204 per ton and US \$224 per ton in effect in 1986 and 1985, respectively. [redacted]

The government also has begun to back away from the traditional use of subsidized production credit, relying more on price support to stimulate production. According to statements made by the Agriculture Minister, Sarney favors incentives that benefit honest producers instead of subsidized financing, which he suspects is often diverted to other uses, such as land speculation and financial instruments. For harvests beginning in early 1988, the Ministry of Agriculture has increased minimum support prices for basic food crops by 218 percent in nominal terms compared with 1987 and for cash export crops by 205 percent.⁹ By combining these increases with a modified production credit program, the Agriculture Minister hopes to encourage farmers to produce 70 million tons of grain and oilseeds in 1988. [redacted]

Finally, Sarney abolished the Brazilian Coffee Institute early this year. This institute had long held a monopoly on coffee exports and imposed support policies that rankled private traders. Moreover, past audits found serious administrative irregularities and overstaffing. [redacted]

⁹ These new support prices announced in August 1987 will be indexed to National Treasury bonds, which normally follow the inflation rate. [redacted]

... But Major Problems Remain

The policies that have stimulated the production bonanza have not been without cost, however. According to Embassy and press reports, the dip in farm prices in 1987 below guaranteed levels forced Brasilia to buy and store 24 percent of the 1987 rice harvest, 20 percent of the corn output, and a significant share of the near record coffee crop. This support was expected to total about 1.2 percent of the 1987 GDP—an estimated US \$3.2 billion—according to a statement made by President Sarney. Agricultural spending is also a major contributor to the public-sector deficit, which is now nearing 7 percent of GDP and fueling triple-digit inflation. [redacted]

The government's poor financial position and a series of changes in the leadership of the Ministry of Land Reform also have left agrarian reform in disarray. [redacted]

The Embassy reported that in 1985 the cost of the reform effort was envisaged at US \$8 billion, but since then the lack of operational funds has stymied achievement of interim goals for redistributing land and settling families. Moreover, in rural areas, the frequency of clashes between landlords and squatters has increased, according to the press, and landowners are resorting to strong-arm methods with little fear of retribution from Brasilia or state capitals. The Rural Democratic Union, a rightwing organization founded to fight agrarian reform, has grown in size and influence. As a result, land reform provisions in Brazil's new Constitution are likely to reflect the traditional interests of the landed elite. [redacted]

The Brazilian Wheat Board, an agency of the Bank of Brazil, continues its monopoly, annually setting quotas for the nation's wheat mills.¹⁰ Likewise, the Sugar and Alcohol Institute still sets crop and mill production goals and controls all exports. The Institute is under attack by Copersucar, the country's largest sugar cooperative, for its price policies that eliminate

¹⁰ In 1967, there were nearly 570 wheat mills in Brazil; today there are only 180. As mills closed, they sold their registrations to remaining ones, thus leaving some regions of Brazil without a single operating mill. Many of those still operating are not functioning at full capacity and many are operating inefficiently, according to grain milling specialists. [redacted]

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competition between growers and mills and thus reduce efficiency. In addition, Copersucar has charged that mismanagement by the institute cost Brazil over \$70 million a year between 1979 and 1986. [redacted]

Despite considerable speculation in mid-1987 that Brasilia was preparing to back away from the heavily subsidized sugarcane-based fuel alcohol program, the government—following recommendations of the National Energy Commission's Task Force for the Evaluation of the National Program—recently announced that it will expand production of alcohol from the current annual output of 13 billion liters (50.4 million barrels of oil equivalent) to 20 billion liters by 1992 as well as maintain the 35-percent price advantage that pure alcohol has over gasoline. To achieve this increase, the government will need to invest an estimated US \$1.2 billion, according to press sources. While increased yields will be sought, the new production target is likely to result in an additional 1-1.5 million hectares planted to sugarcane for alcohol. This will mean that less land will be available for food production, especially in Sao Paulo, the leading fuel alcohol-producing state (see appendix C). [redacted]

Also moving slowly are Brasilia's plans for certain infrastructure projects, particularly new storage facilities.¹¹ Inadequacies were especially evident with this year's record grain harvest. As a result, Brasilia announced in June that it would lend US \$110 million from the National Development Fund to farmers to construct silos in producing areas. In addition, Brazil's ports system is reaching its saturation point and action is required to avoid export bottlenecks in the near future. [redacted]

[redacted]. Modernization projects are on the drawing boards for the port of Santos in the state of Sao Paulo, the primary export terminal for coffee and orange juice, and the National Development Bank announced in June that it would spend US \$6 million on expanding the port of Paranagua in the

¹¹ Brazil's state storage firm Cibrazem estimates current national grain storage capacity at 60 million tons. The shortage of 3 to 4 million tons of storage, especially in the Center-West, forced growers in 1987 to sell below floor prices or face crop losses. [redacted]

Brazil: Railroad Projects Proposed

North-South Railroad 1,600 km linking Brasilia/ Anapolis to city of Acailandia in Maranhao where it will intersect with the Carajas Railroad to Sao Luis on the coast. Status on hold as of 15 June 1987 as part of the new Economic Stabilization Program (in mid-November, President Sarney indicated that he would go forward with the project). [redacted] 25X1

Cerrados Railroad linking Center-West states of Mato Grosso and Goias with western Minas Gerais to port of Tubarao in Espirito Santo, 1,820 km. First part will link existing Vitoria-Minas Railroad to Cerrados. Status on hold as of 15 June 1987. [redacted] 25X1

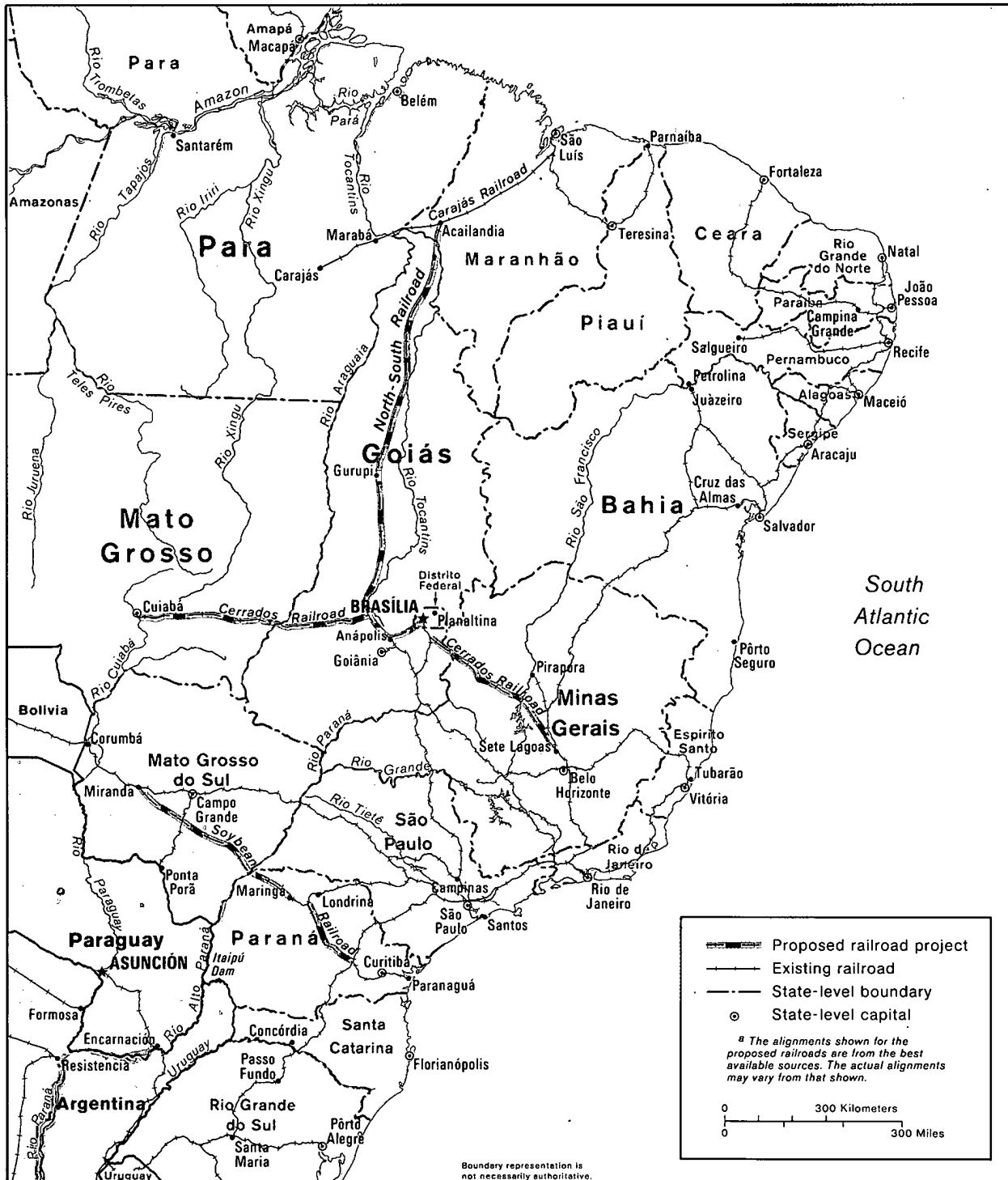
Soybean Railroad line to be built between port of Paranagua and city of Miranda, Mato Grosso do Sul, length 1,263 km. Parts already completed. Status on hold as of 15 June 1987. [redacted] 25X1

southern state of Parana, the main soybean outlet. On other projects—such as improving farm transportation to markets—the government record is mediocre. In mid-1987, Sarney was forced to shelve his much publicized agricultural railroad projects because of the burgeoning financial deficit. Yet in November, Sarney announced he will push ahead with his pet North-South Railroad project, estimated to cost US \$2.4 billion (figure 6). Of more immediate importance, much needed irrigation programs for the Northeast are behind schedule and over cost, and have been scaled back, according to Embassy reporting. Studies by Sao Paulo's Economic and Social Planning Institute found that the ambitious National Irrigation Program created in 1986 is underfunded and unlikely to meet its goals. The program was supposed to increase irrigated land by 2 million hectares, which could produce an additional 8 million tons of grain. [redacted] 25X1

[redacted] 25X1

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Figure 6
Proposed Brazilian Railroad Projects^a



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Plans to improve the quality and quantity of the Brazilian diet also are a long way from being achieved. Despite last year's production bonanza, rampant inflation and the declining purchasing power of the average Brazilian continue to have an impact on his diet. For example, according to agricultural experts, the minimum monthly wage in Brazil, which 10 years ago bought 47 kilograms of beef, today barely buys 22 kilograms. Brazil's Beef Export Association now estimates per capita consumption at 11 kilograms, the lowest level since 1970 and in sharp contrast to the 60 to 80 kilograms consumed per capita in the United States and Argentina. Current milk production, if distributed to all the population, would provide only one glass of milk for each inhabitant of the country for the year, according to agricultural experts. [redacted]

Future Paths

Looking ahead, we believe Sarney and his successors will have difficulty charting a consistent course for agriculture into the next decade. Sarney has little latitude for major policy initiatives, given his lack of clout with Congress, his consistent inability to outmaneuver other politicians, and his lameduck status. Moreover, the government is under growing pressure to cut spending in the face of a massive deficit. Furthermore, we do not envision an improvement in Brazil's economic situation during the next year or two—when a successor to Sarney will be chosen. As such, the next president will almost certainly face the same economic constraints and political difficulties. Finally, Brazil's options will also be limited by world market demand and the trading practices adopted by other major agricultural producers. [redacted]

In these circumstances, we expect Sarney to continue to pursue a policy designed to achieve *More Balanced Growth* between export and food crops—by opting for moderate export promotion, but with some increased attention to food crops. For purposes of analysis, we set out below a scenario to illuminate the likely implications of this most likely policy, as well as scenarios illustrating two other, in our view less likely, policy options. One is *Enhanced Export Promotion*, in

which Brasilia turns away from recent efforts to boost food production and again emphasizes the production of export crops. This could occur if the economy deteriorates further and emergency conditions oblige Brasilia to maximize foreign exchange earnings at the expense of food crops. Finally, in a scenario we term *Improved Food Production*, we envision circumstances in which the ever weakening Sarney government bows to political pressure from the center-left to increase food production at the expense of export crops.¹² To implement any of these approaches, the government would use a combination of price incentives, credit policies, and government investment focused on the type of products being emphasized. [redacted]

More Balanced Growth

Our projections of agricultural production under this most likely policy option indicate that output of most food and export crops would increase steadily through 1992. Export crops—especially soybeans—would continue to lead this growth (table 4). We estimate that soybean production would increase by 47 percent over the 1981-85 levels, exceeding 22 million tons in 1992 (table D-1, appendix D). Brazil would earn about US \$9.6 billion in net exports from the sales of major export crops—especially soybeans, oranges, and coffee (figure 7). [redacted]

In this scenario wheat production would decline significantly—down 30 percent in 1992 from the 1981-85 average level—due to decline in both area harvested and yields reflecting a drop in the producer subsidy (table D-1, appendix D). As a result, approximately US \$1.3 billion would be needed to cover imports in 1992, but food consumption per capita would still decline about 10 percent from the average 1981-85 level because of rapid population growth. This would mean that consumption in 1992 would be about 20 percent below the adjusted national daily calorie requirement, according to World Bank studies. [redacted]

¹² Analysis is based on Brazil's seven major export crops (cocoa, coffee, cotton, oranges, soybeans, sugarcane, and tobacco) and five leading food crops (dry beans, corn, manioc, rice, and wheat). (See appendix D for a detailed explanation of the methodology used to develop the scenarios.) [redacted]

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Table 4 *Millions*
Brazil: Comparison of Area and Production for Major Agricultural Crops, Base Year 1986 and Scenarios 1992

| | Food Crops | | Export Crops | |
|---------------------------------|-----------------|--------------------------|-----------------|--------------------------|
| | Area (hectares) | Production (metric tons) | Area (hectares) | Production (metric tons) |
| Base year, 1986 | 29.2 | 64.4 | 20.3 | 25.9 |
| More balanced growth, 1992 | 29.3 | 65.5 | 22.9 | 39.9 |
| Enhanced export promotion, 1992 | 26.4 | 59.5 | 25.8 | 45.7 |
| Improved food production, 1992 | 32.8 | 83.4 | 19.5 | 34.3 |

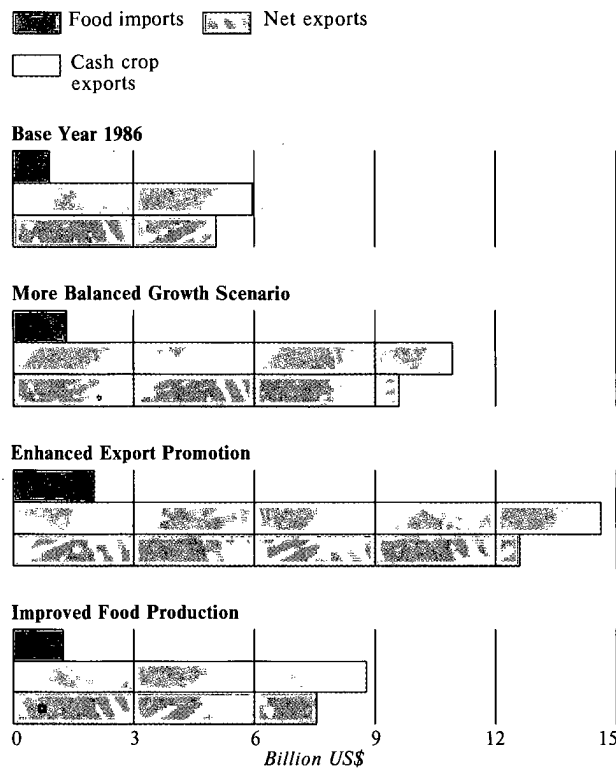
Note: Estimates for individual crops appear on tables D1-3.

Enhanced Export Production

Should Brasilia again emphasize export crops, net export earnings by 1992 would increase dramatically—earning US \$9 billion more than in 1986, the base year for our forecasts (table 4 and figure 7). However, the cost of food imports—more than US \$2 billion—would more than double that of the base year—if Brasilia opts to provide its population with compensating food imports. For this scenario, we found that output of export crops would increase significantly over current levels, and, according to World Bank agricultural price forecasts, Brazil would have the potential to earn about US \$13 billion (current dollars) in 1992 or roughly US \$8 billion more than for 1986 (see tables 4 and 7).¹³ For this scenario, soybean production, spurred by strong global demand and firm prices, would increase at nearly 11 percent per year, reaching nearly 25 million tons in 1992 and allowing exports to increase from \$1.6 billion in 1986 to US \$4.6 billion in 1992. The production of other products that compete with US agricultural exports—orange juice and tobacco, for instance—would increase rapidly as well, averaging about 18 and 20 percent per year, respectively (table D-4).

¹³ These estimates are based only on the 12 major crops in our model. Minor exports such as meat, nuts, sisal, animal hides, and castor oil are not included. In the aggregate these exports earned an additional US \$1.3 billion in 1986 for Brazil.

Figure 7
Brazil: Comparative Value of Food Imports and Cash Crop Exports, Base Year 1986 and Scenarios 1992



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The major economic cost to Brazil of enhancing its export potential would be a 125-percent rise in the cost of food imports. World Bank price forecasts suggest Brasilia would have to spend an additional US \$350 million per year through the early 1990s just to maintain daily caloric consumption per person at about 90 percent of the average 1981-85 level. We estimate that, under this scenario, Brazil would have to import 3.2 million tons of corn, 6.2 million tons of

wheat, and nearly 1.4 million tons of rice in 1992—this compares with 6.1 million tons of actual imports of these three grains in 1986 (table D-4, appendix D).

Improved Food Production

Alternatively, should the Sarney government opt to respond to political pressure for food production at the expense of export crops, the cost of food imports would increase US \$300 million over that of the base year to about US \$1.2 billion in 1992. The value of net exports, however, would still be 50 percent greater than the base year—roughly a US \$2.5 billion increase.

To increase per capita food production substantially through 1992, Brasilia would need to encourage through financial incentives the expansion of the area devoted to food crops and improve yields. Projections of food production based on these assumptions indicate that output would sharply increase through 1992. This would allow Brasilia both to raise per capita food availability and to cut food imports. In particular, wheat import requirements could be cut 18 percent. On a per capita basis, food staples would supply about 1,625 calories per day in 1992—approximately 20 percent above current levels. Moreover, there would be a marked improvement in the diet of lower-class Brazilians (table 5).

The adoption of this policy, however, would result in considerable reductions of net agricultural export earnings—a 21-percent cut, to about US \$7.5 billion—from net export earnings under the *Balanced Growth* scenario. Reduced earnings from three major commodities—soybean products, tobacco, and frozen concentrated orange juice—would account for over 90 percent of the total reduction in export proceeds by 1992 (table D-4).

Implications for the United States

Given Brazil's size, resources, agricultural potential, and already well-established role in international agricultural markets, whatever policies it pursues will have an impact on US-Brazilian relations. An expansion of traditional exports of coffee, cocoa, and sugar, for example, would mean lower prices for US consumers and a reduced US agricultural import bill. Brazil

Table 5
Brazil: Average Per Capita
Availability of Traditional
Food Staples^a

Kilograms per person

| Commodity | 1981-85 | 1992 | Percent Change |
|---------------|---------|------|----------------|
| Dry beans | 16.6 | 22.9 | 38.0 |
| Corn, meal | 20.8 | 27.5 | 32.2 |
| Manioc, fresh | 88.7 | 86.7 | -2.3 |
| Rice, milled | 42.0 | 43.4 | 3.3 |
| Wheat, flour | 37.1 | 43.9 | 18.3 |

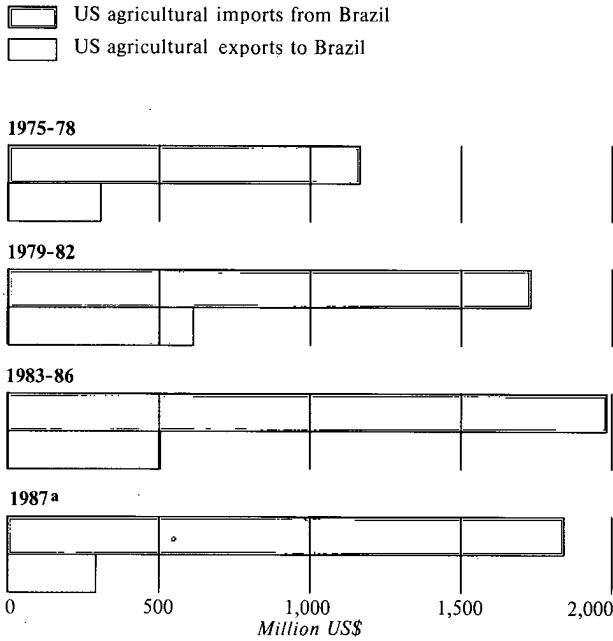
^a Actual in 1981-85 and assuming improved food production scenario in 1992.

is the largest supplier of US agricultural imports, averaging about US \$2 billion annually over the last five years. Coffee, cocoa, and sugar alone account for 85 percent of total imports from Brazil (figure 8). An expanded Brazilian presence in markets in which the United States and Brazil compete, however, would aggravate trade frictions. Brasilia's aggressive marketing of soybeans and products in the Far East and poultry meat in the Middle East has already raised trade tensions. The United States has complained to the GATT about Brazil's use of export subsidies on soybean products; Brazil, in turn, has accused the United States of subsidizing exports of poultry to the Middle East via USDA's Export Enhancement Program. Because of a changing supply picture in the United States, exportable surpluses of Brazilian- and US-produced orange juice and tobacco appear headed for intense competition for market shares. If Brasilia keeps its exchange rate competitive, competition with the United States is likely to become even fiercer.

A significant increase in food production, as described in the third scenario, would be likely to result in a sharp contraction in US grain exports to Brazil. US exports to Brazil have traditionally been dominated by wheat and corn with an aggregate value of US \$500 million annually for the period 1982-86, with wheat being the largest year-to-year export earner. Brazil's drive toward self-sufficiency in wheat, however, combined with larger imports from Argentina

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Figure 8
United States: Average Annual Agricultural Trade With Brazil, 1975-87



^a Preliminary.

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under the new trade agreement, purchase commitments with Canada, and heavy purchases of subsidized French wheat have already diminished US opportunities. In 1986, US wheat exports to Brazil were valued at only US \$66 million, the lowest in a decade. Prospects for US wheat sales to Brazil in 1988 look even dimmer; but this might be partially offset by substantial corn exports to ease Brazil's possible domestic corn supply shortages during 1988.¹⁴

¹⁴ Currently, US corn shipped from Gulf ports can be imported into the north of Brazil more cheaply than transshipping corn from producing areas concentrated in central and southern Brazil. In recent years Brasilia has repeatedly turned to the United States to service deficits in supplies in the northern part of Brazil. However, this shipping advantage for the United States may change in the coming years with the construction of the North-South Railroad.

Repercussions in the New GATT Round

Brazil's agricultural trade policies are coming under close scrutiny during the current round of negotiations by the General Agreement on Tariffs and Trade in Uruguay. This eighth round of multilateral trade negotiations, launched in September 1986 in Punta del Este, features agricultural trade reform as the centerpiece for negotiations, which will cover the gradual elimination of import restrictions and subsidies that directly or indirectly affect agricultural trade. Brazil has pressed for special treatment for developing countries—for example, allowing both protection of the domestic market and special access into OECD markets for Brazilian farm exports. The Sarney government is expected to offer minimal concessions—a stance likely to win few friends for Brazil among OECD countries, but one that will enable it to maintain its leadership role in the G-77 negotiating group.

Opportunities for US agricultural exports have also diminished in recent years due to Brasilia's tariff and nontariff barriers and outright import prohibitions. Reduced market access, along with a series of recent dumping cases in the US market, have led to a strain in bilateral relations. These tensions, in turn, will almost certainly spill into the new GATT round, where agricultural trade issues will be highlighted, and where Brazil will be on the defensive for its use of export subsidies, dumping practices, and nontariff barriers. We believe Brasilia will be under increasing international pressure to back away from its mercantilistic approach to trade. Nevertheless, Brasilia's continuing payments problems and the current wave of economic nationalism suggest that the Sarney government will move in this direction only grudgingly.

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Appendix A

Brazil: Production and Trade of Major Export and Food Commodities, 1975-86 ¹

Leading Export Commodities

Table A-1
Brazil: Cocoa

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Cocoa Bean Production (1,000 metric tons) | Beans and Byproducts ^a Export Volume (1,000 metric tons) | Beans and Byproducts ^a Export Value (million \$) |
|---------------|------------------------------------|------------------------------------|--|---|---|
| 1975 | 451 | 0.63 | 282 | 238 | 320 |
| 1976 | 407 | 0.57 | 232 | 193 | 352 |
| 1977 | 413 | 0.61 | 250 | 182 | 767 |
| 1978 | 444 | 0.64 | 284 | 223 | 815 |
| 1979 | 454 | 0.74 | 336 | 267 | 935 |
| 1980 | 483 | 0.66 | 319 | 243 | 694 |
| 1981 | 505 | 0.67 | 336 | 250 | 594 |
| 1982 | 533 | 0.66 | 351 | 236 | 427 |
| 1983 | 591 | 0.64 | 380 | 291 | 553 |
| 1984 | 586 | 0.56 | 330 | 245 | 658 |
| 1985 | 640 | 0.66 | 420 | 318 | 771 |
| 1986 | 657 | 0.70 | 460 | 262 | 618 |

^a Includes beans, cocoa butter, cake, and liquor (products export volumes not converted to green bean equivalent).

[Redacted]

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¹ Based on official data from the Fundacao Instituto Brasileiro de Geografia e Estatistica (IBGE), Bank of Brazil Foreign Trade Office (CACEX), FAO Trade Yearbooks, and supplemented with data from the Agricultural Counselor, US Embassy, Brasilia. [Redacted]

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Table A-2
Brazil: Coffee

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Coffee Production ^a (1,000 metric tons) | Coffee Export ^b Volume (1,000 metric tons) | Coffee Export Value (million \$) |
|---------------|------------------------------------|------------------------------------|---|---|--|
| 1975 | 2,217 | 0.57 | 1,272 | 813 | 955 |
| 1976 | 1,121 | 0.34 | 376 | 849 | 2,399 |
| 1977 | 1,941 | 0.50 | 975 | 544 | 2,625 |
| 1978 | 2,183 | 0.58 | 1,268 | 665 | 2,295 |
| 1979 | 2,406 | 0.55 | 1,333 | 615 | 2,327 |
| 1980 | 2,434 | 0.44 | 1,061 | 825 | 2,773 |
| 1981 | 2,618 | 0.78 | 2,032 | 873 | 1,761 |
| 1982 | 1,895 | 0.51 | 958 | 938 | 2,130 |
| 1983 | 2,346 | 0.71 | 1,665 | 978 | 2,324 |
| 1984 | 2,505 | 0.54 | 1,353 | 1,076 | 2,850 |
| 1985 | 2,483 | 0.76 | 1,877 | 1,067 | 2,607 |
| 1986 | 2,260 | 0.44 | 998 | 586 | 2,359 |

^a Green bean equivalent.^b Soluble coffee export volume not converted to green bean equivalent.

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Table A-3
Brazil: Cotton

| Calendar Year | Area Harvested (1,000 hectares) | Yield/Hectare (metric tons) | Cotton Production ^a (1,000 metric tons) | Export Volume ^b (1,000 metric tons) | Export Value ^b (million \$) |
|---------------|------------------------------------|--------------------------------|---|---|---|
| 1975 | 3,876 | 0.45 | 1,748 | 107 | 98 |
| 1976 | 3,409 | 0.37 | 1,262 | 6 | 7 |
| 1977 | 4,097 | 0.46 | 1,901 | 35 | 41 |
| 1978 | 3,951 | 0.40 | 1,569 | 45 | 53 |
| 1979 | 3,646 | 0.45 | 1,636 | ...c | ...d |
| 1980 | 3,699 | 0.45 | 1,676 | 9 | 11 |
| 1981 | 3,511 | 0.49 | 1,732 | 30 | 41 |
| 1982 | 3,624 | 0.53 | 1,928 | 56 | 62 |
| 1983 | 2,927 | 0.55 | 1,598 | 180 | 189 |
| 1984 | 3,114 | 0.69 | 2,160 | 33 | 42 |
| 1985 | 3,583 | 0.79 | 2,841 | 102 | 80 |
| 1986 | 3,161 | 0.73 | 2,315 | 37 | 17 |

^a Cotton (with seeds) from annual and perennial cotton plants. Less than 0.5 thousand metric tons.^b Raw lint cotton only. Less than US\$ 0.5 million.^c Less than 0.5 thousand metric tons.^d Less than US\$ 0.5 million.

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Table A-4
Brazil: Oranges and Orange Juice

| Calendar Year | Area Harvested (1,000 hectares) | Yield per Hectare (metric tons) | Orange Production (1,000 metric tons) | Orange Juice Concentrate Production ^a (1,000 metric tons) | Orange Juice Concentrate Export Volume ^a (1,000 metric tons) | Orange Juice Concentrate Export Value (million \$) |
|---------------|------------------------------------|------------------------------------|--|---|--|---|
| 1975 | 403 | 12.77 | 5,145 | 189 | 181 | 82 |
| 1976 | 414 | 14.11 | 5,842 | 211 | 210 | 101 |
| 1977 | 422 | 13.84 | 5,839 | 229 | 214 | 177 |
| 1978 | 455 | 14.02 | 6,378 | 400 | 356 | 333 |
| 1979 | 475 | 14.49 | 6,883 | 424 | 292 | 281 |
| 1980 | 575 | 15.44 | 8,877 | 479 | 401 | 339 |
| 1981 | 575 | 16.15 | 9,286 | 586 | 639 | 659 |
| 1982 | 590 | 16.01 | 9,444 | 550 | 502 | 552 |
| 1983 | 624 | 15.19 | 9,476 | 508 | 554 | 609 |
| 1984 | 632 | 16.66 | 10,526 | 726 | 911 | 1,425 |
| 1985 | 663 | 17.45 | 11,570 | 860 | 438 | 753 |
| 1986 | 708 | 15.34 | 10,861 | 575 | 752 | 636 |

^a Frozen concentrate orange juice, 65 degree Brix.

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Table A-5
Brazil: Soybeans

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Soybean Production (1,000 metric tons) | Soybean and Products ^a Export Volume (1,000 metric tons) | Soybean and Products Export Value (million \$) |
|---------------|------------------------------------|------------------------------------|---|--|---|
| 1975 | 5,824 | 1.70 | 9,892 | 6,731 | 1,304 |
| 1976 | 6,416 | 1.75 | 11,227 | 7,506 | 1,778 |
| 1977 | 7,070 | 1.77 | 12,513 | 8,444 | 2,143 |
| 1978 | 7,782 | 1.23 | 9,541 | 6,582 | 1,515 |
| 1979 | 8,256 | 1.24 | 10,240 | 6,348 | 1,652 |
| 1980 | 8,774 | 1.73 | 15,156 | 8,875 | 2,264 |
| 1981 | 8,501 | 1.77 | 15,007 | 12,360 | 3,191 |
| 1982 | 8,203 | 1.56 | 12,836 | 8,977 | 2,097 |
| 1983 | 8,137 | 1.81 | 14,582 | 10,872 | 2,564 |
| 1984 | 9,421 | 1.65 | 15,541 | 10,103 | 2,569 |
| 1985 | 10,153 | 1.80 | 18,279 | 13,051 | 2,545 |
| 1986 | 9,450 | 1.49 | 14,100 | 8,126 | 1,562 |

^a Includes soybeans, meal, and oil (crude and refined). Soybean product export volumes not converted to bean equivalents.

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Table A-6
Brazil: Sugarcane

| Calendar Year | Sugarcane Area Harvested for Alcohol and Sugar (1,000 hectares) | Alcohol Production (million liters) | Sugar Production (1,000 metric tons) | Sugar Export Volume ^a (1,000 metric tons) | Sugar Export Value ^a (million \$) |
|---------------|---|-------------------------------------|--------------------------------------|--|--|
| 1975 | 1,969 | 580 | 6,186 | 1,731 | 1,100 |
| 1976 | 2,093 | 642 | 7,598 | 1,167 | 307 |
| 1977 | 2,270 | 1,388 | 8,760 | 2,455 | 463 |
| 1978 | 2,391 | 2,359 | 7,767 | 1,962 | 350 |
| 1979 | 2,537 | 3,437 | 7,027 | 1,829 | 364 |
| 1980 | 2,608 | 3,746 | 8,547 | 2,572 | 1,288 |
| 1981 | 2,826 | 4,211 | 8,393 | 2,701 | 1,062 |
| 1982 | 3,084 | 5,647 | 9,312 | 2,587 | 559 |
| 1983 | 3,479 | 7,986 | 9,576 | 2,461 | 515 |
| 1984 | 3,656 | 9,165 | 9,100 | 3,015 | 574 |
| 1985 | 3,778 | 10,700 | 7,810 | 2,509 | 364 |
| 1986 | 4,056 | 11,300 | 7,850 | 2,332 | 368 |

^a Includes raw, crystal, and refined sugar.

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Table A-7
Brazil: Tobacco

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Leaf Tobacco Production ^a (1,000 metric tons) | Leaf Tobacco Export Volume (1,000 metric tons) | Leaf Tobacco Export Value (million \$) |
|---------------|---------------------------------|---------------------------------|--|--|--|
| 1975 | 254 | 1.13 | 286 | 98 | 142 |
| 1976 | 280 | 1.07 | 299 | 101 | 161 |
| 1977 | 311 | 1.15 | 357 | 101 | 186 |
| 1978 | 328 | 1.23 | 405 | 110 | 239 |
| 1979 | 326 | 1.29 | 422 | 126 | 284 |
| 1980 | 316 | 1.28 | 405 | 128 | 284 |
| 1981 | 298 | 1.20 | 357 | 132 | 356 |
| 1982 | 317 | 1.32 | 420 | 145 | 463 |
| 1983 | 312 | 1.26 | 393 | 155 | 458 |
| 1984 | 282 | 1.47 | 414 | 161 | 450 |
| 1985 | 287 | 1.43 | 411 | 170 | 438 |
| 1986 | 280 | 1.38 | 387 | 149 | 396 |

^a Farm sales weight is roughly 15 percent higher than dry weight.

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Table A-8
Brazil: Beef and Poultry

| Calendar Year | Beef and Veal (1,000 metric tons) | Beef Export Volume ^a (1,000 metric tons) | Beef Export Value ^a (million \$) | Poultry Production (1,000 metric tons) | Poultry Export Volume (1,000 metric tons) | Poultry Export Value (million \$) |
|---------------|--------------------------------------|---|---|--|---|---|
| 1975 | 2,150 | 48 | 86 | 534 | 3 | 3 |
| 1976 | 2,230 | 67 | 144 | 604 | 20 | 20 |
| 1977 | 2,400 | 102 | 173 | 691 | 33 | 31 |
| 1978 | 2,200 | 64 | 121 | 858 | 51 | 47 |
| 1979 | 2,100 | 49 | 140 | 1,096 | 81 | 81 |
| 1980 | 2,150 | 79 | 266 | 1,326 | 169 | 207 |
| 1981 | 2,250 | 145 | 417 | 1,491 | 294 | 354 |
| 1982 | 2,400 | 197 | 439 | 1,596 | 296 | 281 |
| 1983 | 2,400 | 248 | 515 | 1,580 | 290 | 243 |
| 1984 | 2,300 | 260 | 543 | 1,398 | 277 | 261 |
| 1985 | 2,400 | 274 | 545 | 1,530 | 279 | 244 |
| 1986 | 1,900 | 450 | 354 | 1,620 | 225 | 220 |

^a Includes fresh and frozen beef, beef extract and canned corn beef, and cooked frozen beef (not including horsemeat).

Leading Food Commodities**Table A-9**
Brazil: Corn

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Corn Production (1,000 metric tons) | Corn Import Volume (1,000 metric tons) | Corn Export Volume (1,000 metric tons) |
|---------------|---------------------------------------|---------------------------------------|---|--|--|
| 1975 | 10,855 | 1.50 | 16,335 | 2 | 1,148 |
| 1976 | 11,118 | 1.60 | 17,751 | 2 | 1,418 |
| 1977 | 11,797 | 1.63 | 19,256 | 1 | 1,420 |
| 1978 | 11,125 | 1.22 | 13,569 | 1,262 | 15 |
| 1979 | 11,319 | 1.44 | 16,306 | 1,526 | 10 |
| 1980 | 11,451 | 1.78 | 20,372 | 1,594 | 6 |
| 1981 | 11,520 | 1.83 | 21,117 | 902 | 7 |
| 1982 | 12,620 | 1.73 | 21,843 | ^a | 544 |
| 1983 | 10,706 | 1.75 | 18,731 | 213 | 766 |
| 1984 | 12,018 | 1.76 | 21,164 | 254 | 178 |
| 1985 | 11,802 | 1.87 | 22,020 | 262 | ^a |
| 1986 | 12,215 | 1.68 | 20,541 | 2,500 | ^a |

^a Less than 0.5 thousand metric tons.

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Brazil: Dry Beans and Manioc

| Calendar Year | Dry Beans | | | Manioc | | |
|---------------|--------------------------|-------------------------------------|-----------------------------------|--------------------------|-------------------------------------|-----------------------------------|
| | Area (1,000 hectares) | Yield (metric tons/ hectares) | Production (1,000 metric tons) | Area (1,000 hectares) | Yield (metric tons/ hectares) | Production (1,000 metric tons) |
| 1975 | 4,146 | 0.55 | 2,282 | 2,041 | 12.79 | 26,118 |
| 1976 | 4,059 | 0.45 | 1,840 | 2,094 | 12.15 | 25,443 |
| 1977 | 4,551 | 0.50 | 2,289 | 2,176 | 11.92 | 25,928 |
| 1978 | 4,617 | 0.48 | 2,193 | 2,149 | 11.85 | 25,458 |
| 1979 | 4,212 | 0.52 | 2,186 | 2,111 | 11.82 | 24,962 |
| 1980 | 4,643 | 0.42 | 1,968 | 2,015 | 11.64 | 23,466 |
| 1981 | 5,027 | 0.47 | 2,340 | 2,100 | 11.90 | 25,000 |
| 1982 | 5,926 | 0.49 | 2,902 | 2,105 | 11.64 | 24,500 |
| 1983 | 4,069 | 0.39 | 1,586 | 2,020 | 10.40 | 21,000 |
| 1984 | 5,319 | 0.49 | 2,615 | 1,770 | 11.30 | 20,000 |
| 1985 | 5,317 | 0.48 | 2,550 | 1,860 | 12.37 | 23,000 |
| 1986 | 5,490 | 0.42 | 2,280 | 2,000 | 12.75 | 25,500 |

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Table A-11
Brazil: Rice

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Rough Rice Production (1,000 metric tons) | Milled Rice Import Volume (1,000 metric tons) | Milled Rice Import Value (million \$) |
|---------------|------------------------------------|------------------------------------|--|--|--|
| 1975 | 5,306 | 1.47 | 7,782 | 63 | 24 |
| 1976 | 6,656 | 1.47 | 9,757 | 17 | 5 |
| 1977 | 5,992 | 1.50 | 8,994 | ^a | ^b |
| 1978 | 5,624 | 1.30 | 7,296 | 30 | 8 |
| 1979 | 5,452 | 1.39 | 7,595 | 711 | 245 |
| 1980 | 6,243 | 1.57 | 9,776 | 239 | 99 |
| 1981 | 6,102 | 1.35 | 8,228 | 143 | 77 |
| 1982 | 6,025 | 1.62 | 9,735 | 137 | 47 |
| 1983 | 5,018 | 1.54 | 7,742 | 315 | 113 |
| 1984 | 5,351 | 1.69 | 9,027 | ^a | ^b |
| 1985 | 4,764 | 1.89 | 9,019 | 340 | 76 |
| 1986 | 5,594 | 1.86 | 10,405 | 800 | 180 |

^a Less than 0.5 thousand metric tons.^b Less than US \$ 0.5 million.

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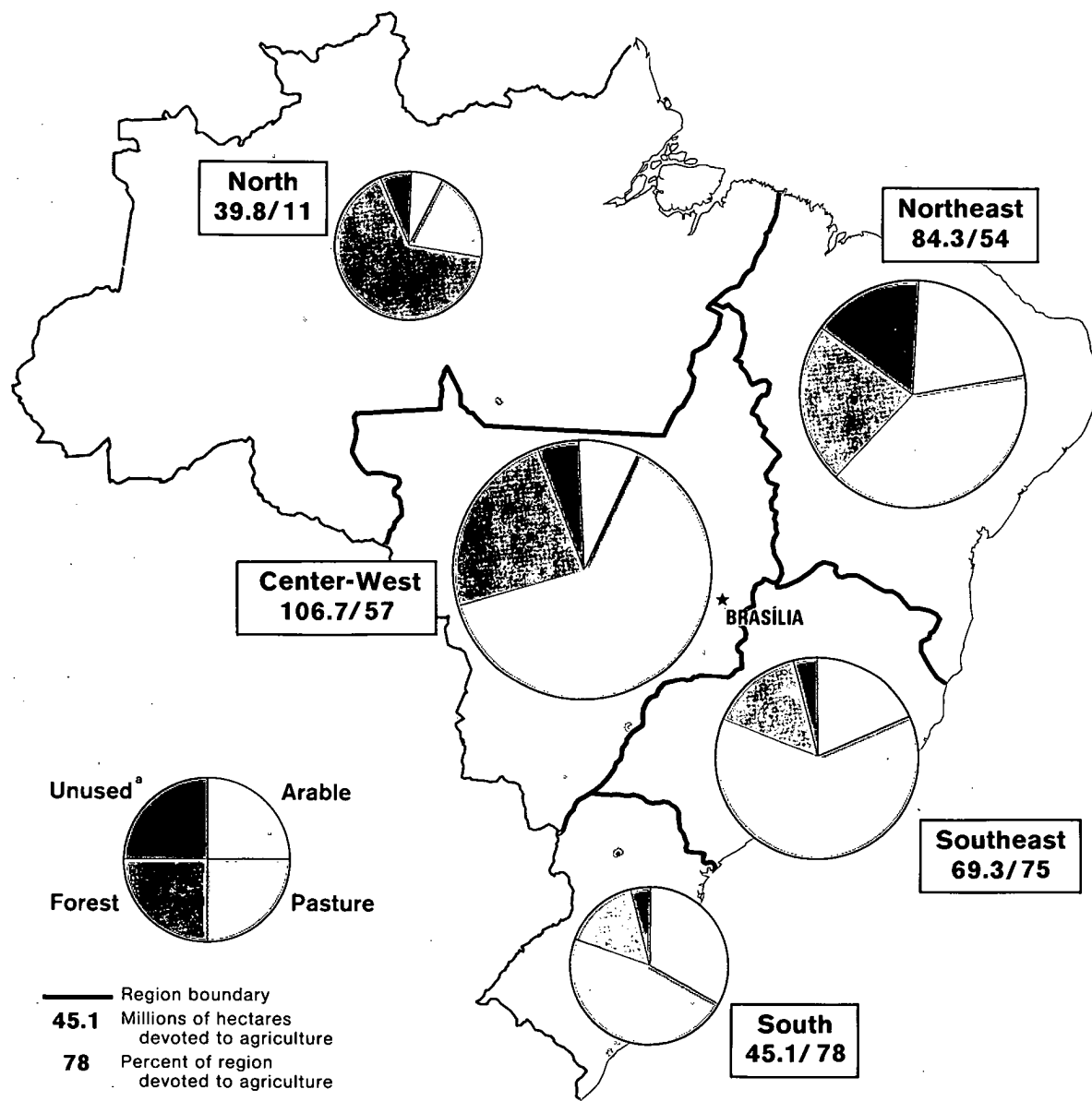
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Table A-12
Brazil: Wheat

| Calendar Year | Area Harvested (1,000 hectares) | Yield Per Hectare (metric tons) | Wheat Production (1,000 metric tons) | Wheat Import Volume (1,000 metric tons) | Wheat Import Value (million \$) |
|---------------|------------------------------------|------------------------------------|---|--|------------------------------------|
| 1975 | 2,931 | 0.61 | 1,788 | 2,098 | 357 |
| 1976 | 3,540 | 0.91 | 3,216 | 3,428 | 548 |
| 1977 | 3,153 | 0.66 | 2,066 | 2,624 | 295 |
| 1978 | 2,812 | 0.96 | 2,691 | 4,335 | 601 |
| 1979 | 3,831 | 0.76 | 2,927 | 3,655 | 630 |
| 1980 | 3,122 | 0.87 | 2,702 | 4,755 | 1,051 |
| 1981 | 1,920 | 1.15 | 2,210 | 4,460 | 962 |
| 1982 | 2,828 | 0.65 | 1,849 | 4,224 | 852 |
| 1983 | 1,879 | 1.19 | 2,237 | 4,182 | 805 |
| 1984 | 1,742 | 1.12 | 1,956 | 4,867 | 841 |
| 1985 | 2,672 | 1.62 | 4,323 | 4,041 | 591 |
| 1986 | 3,900 | 1.45 | 5,638 | 2,192 | 248 |

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Figure 9
Brazil's Agricultural Land, by Region



^a Suitable for agriculture, but not currently in use.

Boundary representation is not necessarily authoritative.

Source: Brazilian Institute of Geography and Statistics, 1980.

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Appendix B

Brazil: Agriculture's Resource Base

The evolution of the Brazilian economy has been heavily influenced by its enormous resource base: the natural environment (land area, soils, and climate), agricultural research and technology, labor, and production and marketing infrastructure. [redacted]

Brazil's total land area, encompassing 851 million hectares—of which about 9 percent is land under cultivation—endows it with a vast potential to expand agricultural production. More than two-thirds of Brazil's huge land area consists of flat to hilly forests, woodlands, and savannas that are sparsely populated—fewer than four persons per square kilometer. The remaining third of the land area contains roughly 90 percent of Brazil's population—currently estimated at about 141 million—living mainly in the prosperous South and Southeast economic regions (figure 9). [redacted]

The soils of Brazil are mostly tropical, but temperate soils cover much of the South. These soil types are extremely diverse. Tropical soils alone have extremely variable properties, ranging from the high base status found in the drought-prone area of the Northeast Region to acid infertile soils covering a large portion of Brazil—from the Amazon Basin in the North Region to the Cerrados in the Center-West and Southeast Regions.¹⁴ [redacted]

Vagaries in weather conditions are the principal source of year-to-year changes in Brazilian crop yields and production. Extended periods of frost and inadequate rainfall pose risks in the South and Southeast

¹⁴ High base status and acid soils are mainly distinguished by their active clay properties and very low natural fertility. High base status soils are almost universally nitrogen deficient. A much more important constraint, however, has been severe soil erosion caused by overgrazing and intensive cropping. The major constraint of acid-infertile soils is aluminum toxicity together with phosphorous, potassium, and nitrogen deficiencies, and low water-holding capacity. These physical limitations are not as serious as those of high base status soils. [redacted]

Regions.¹⁵ The severe frost of July 1975 that hit the southern coffee zone killed millions of coffee trees and led to record world prices and an expensive program to replant coffee in less frost-prone areas. Crops lost to weather from the approximate calendar year 1985-86 drought were coffee (47 percent), soybeans (23 percent), cotton (19 percent), and oranges and orange juice (6 and 33 percent respectively). Drought is a problem in the Center-West and North-Northeast Regions as well. For example, the 1983 dry spell significantly reduced output of dry beans (67 percent), corn (65 percent), rice (64 percent), and cotton (58 percent) in the North and Northeast Regions. Heavy rains and high humidity at harvest are a perennial problem for wheat in southern Brazil, the traditional wheat-growing area, leading to disease problems, crop losses, and low yields. These conditions have spurred government programs fostering a shift of wheat production to the Cerrados. [redacted]

Research to improve production technology—such as development of high-yielding varieties—has great potential to increase Brazil's agricultural output. With the creation in 1973 of the Brazilian Agricultural Research Enterprise (EMBRAPA) and the Brazilian Enterprise for Technical Assistance and Rural Extension (EMBRATER), Brazil launched a massive program to reorganize basic investments in agricultural technology (both institutions are connected to the Ministry of Agriculture). Research is carried out through 11 National Centers for Product-Specific Research, three regional Resource Centers, and

¹⁵ The agroclimatic areas in the Northern Hemisphere analogous to Brazil's regions are: South—North Carolina; Southeast—South Carolina and Georgia; Center-West—Georgia; and North-Northeast—the lowland tropical rain forest area of Central America and the humid coastal and semiarid area of northwestern Mexico near the Gulf of California. [redacted]

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through national, regional, and state research institutions concerned with specialized topics.¹⁶ [redacted]

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Brazil's total agricultural labor pool is large and growing, but its distribution is changing. The agricultural sector currently employs about one-third of the working population—and is adding nearly 40 to 50 thousand new farm jobs each year. The basis for this growth, in part, is natural population increase, averaging some 2.6 percent per year. At the same time, higher paying urban jobs have lured away thousands of farmworkers in the South and Southeast Regions of Brazil, which have responded to their growing rural labor shortage with increased mechanization and by hiring the urban unemployed, especially at harvest time, to meet the demands of expanding agricultural output. But in the aggregate, the migration of workers from the impoverished Northeast to the agricultural frontiers of the Center-West and North Regions more than offsets losses in the agricultural labor force in the South. All told, 1 million new workers have entered Brazilian agriculture since 1965, according to the World Bank. [redacted]

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Brazil's production and marketing infrastructure—power and communication, transportation, storage, irrigation, and drainage—is large and growing. However, infrastructure development still remains inadequate, particularly in the frontier areas of the Center-West, and North Regions. Brazil's Ministry of Agriculture acknowledges that lack of crop storage facilities and transportation services is causing post-harvest crop losses and marketing bottlenecks. [redacted]

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¹⁶ Some of EMBRAPA's Product Centers and their locations are:

- Cotton—Northeast (Campina Granda, Paraiba);
- Rice and black beans—Center-West (Goiania, Goias);
- Manioc and fruit—Northeast (Cruz das Almas, Bahia);
- Corn and sorghum—Southeast (Sete Lagoas, Minas Gerais);
- Wheat—South (Passo Fundo, Rio Grande do Sul);
- Soybeans—South (Londrina, Parana); and
- Swine and poultry—South (Concordia, Santa Catarina).

Three of EMBRAPA's regional centers by specialization and location are:

- Agriculture of the Cerrados—(Planaltina, Distrito Federal);
- Tropical agriculture—North (Belem, Para); and
- Semi-arid, tropical agriculture—Northeast (Petrolina, Pernambuco).

The major state research institutions are the National Center for Genetic Research, the Brazilian Coffee Institute, the Sugar and Alcohol Institute, and the Cocoa Research Center. [redacted]

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Appendix C

Brazil: Agriculture-Based Energy Program

Brazil is unique in the scale on which it uses its agricultural sector to produce energy. In response to the 1973 oil shock, Brazil in 1975 began PROALCOOL—the government’s program to substitute imported petroleum with fuel alcohol (ethanol) produced from sugarcane. A decade later, Brazil is recognized as the first country to develop, on a large scale, an agriculturally derived source of renewable energy and, at the same time, an alternative use for sugarcane. [redacted]

Annual production capacity from over 500 distillers is currently estimated at approximately 13 billion liters (50.4 million barrels of oil equivalent), of which about one-half is concentrated in the state of Sao Paulo (table C-1). Currently, alcohol production supplies over 1 million domestically produced vehicles running on 100 percent hydrated alcohol, as well as helping fuel the rest of Brazil’s automobiles, which run on a mixture of about 20 percent anhydrous alcohol and 80 percent gasoline. [redacted]

According to its proponents, the program since its inception has saved Brazil several billions of dollars in foreign exchange by substituting alcohol for imported oil. Other benefits widely discussed by the press are increased rural employment, a heightened industrial base with the construction of hundreds of alcohol distilleries throughout the country, and an alternative use for sugarcane during a period of weak international prices for sugar and changing structural demand for sweeteners in the United States, Brazil’s primary market. [redacted]

The benefits of the fuel alcohol program, however, have come at a high cost. The program has been heavily subsidized, with support going for sugarcane growers, distillers, and distributors. For example, as late as 1984, PROALCOOL was making available three-year loans at 3-percent interest for the formation or expansion of sugarcane plantations. Eight-year

Table C-1 *Billion liters*
Brazil: Production of Fuel Alcohol From Sugarcane

| | North/ Northeast | Center-West/ South | Total |
|---------|---------------------|-----------------------|--------------|
| 1975/76 | NA | NA | 0.57 |
| 1980/81 | 0.65 | 3.01 | 3.71 |
| 1981/82 | 0.83 | 3.41 | 4.24 |
| 1982/83 | 1.19 | 4.63 | 5.82 |
| 1983/84 | 1.13 | 6.74 | 7.87 |
| 1984/85 | 1.59 | 7.68 | 9.27 |
| 1985/86 | 2.02 | 9.80 | 11.82 |
| 1986/87 | 2.16 | 9.57 | 11.73 |

loans at 3-percent interest have been available for acquisition of farm equipment—market commercial borrowing rates have been 30 to 40 percent. Brasilia has also offered 12-year loans at 4- to 6-percent interest for expansion and modernization of alcohol distilleries and for installation of storage facilities. For government-approved projects, modernization and expansion of facilities could be financed to a level of 80 percent of the fixed investment. [redacted]

To increase demand, subsidies have been extended to the consumer level as well, with alcohol sold at 65 percent of the price of gasoline. During the course of the program, however, incentives have outstripped demand, leading to a costly buildup of stocks. To alleviate the stock problem, Brasilia authorized alcohol exports in 1985 at low prices, mainly to the US market. These exports were later found to have been sold at less than fair market prices and US authorities imposed countervailing duties. [redacted]

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Critics believe, however, that the program was ill-advised and that it has led to unforeseen consequences, mainly the delay in aggressive domestic oil exploration during the 1970s. As a result, Brasilia is committed to an alcohol program costing the oil equivalent of \$40 to \$60 per barrel at a time when the state oil enterprise has been producing oil at \$15 to \$25 a barrel. Moreover, the initial objective of the program—producing the bulk of Brazil's alcohol in the underdeveloped North and Northeast—remains unrealized. Production is concentrated in the South, particularly in the state of Sao Paulo. The expansion of sugarcane acreage for alcohol has displaced both food and potential export crops. Nationwide, an estimated 4 million hectares are devoted to sugarcane grown on some of the most productive farmland in Brazil.

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Despite the economic trade-offs from the program and the need to cut the public-sector deficit, the Sarney government in September 1987 announced that it planned to expand production of alcohol from the current annual 13 billion liters to 20 billion liters annually (77.5 barrels of oil equivalent) by 1992 as well as maintain the 35-percent price differential with gasoline. This decision follows recommendations of the National Energy Commission's Task Force for the Evaluation of the National Alcohol Program that included increased utilization of existing distillery capacity and renewal and expansion of sugarcane planting. To achieve the more than 50-percent increase in alcohol output by 1992, the Sarney government will need to invest an estimated US \$1.2 billion, according to press sources. While increased yields will be sought from sugarcane acreage devoted to alcohol production, the new production target is likely to result in an additional 1.0 to 1.5 million hectares being planted to sugarcane for alcohol.

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Appendix D

Brazil: Forecasting Agricultural Trend-Methodology

The performance of Brazilian agriculture during the next five years will depend on a variety of factors. In our judgment, the most significant determinants of the crop-mix, crop production levels, and crop profitability in Brazil are weather conditions and domestic and world commodity prices in a particular year. Governmental policy instruments, such as credit terms and availability, minimum support prices, and trade policies, also are important factors affecting agricultural output and earnings of Brazilian farmers. This paper forecasts probable agricultural production of major agricultural crops to 1992 by first forecasting the regional crop area harvest and yield and then examining how government policies could affect these estimates. [redacted]

To investigate the impact of different government policy initiatives, we developed a set of three different plausible policy-mix scenarios that we believe represent the range of options open to Brasilia. We see as the most likely scenario what we call the *More Balanced Growth* case. In this instance, government policymakers continue to provide incentives for both production for the local market, to offset the potential shortfalls in food supplies, and for exports to boost foreign exchange earnings. The second scenario we examine is the *Enhanced Export Potential* case, in which policies would work to increase cash-crop exports that in turn could be used to finance increased food and other imports. The last scenario we examine is the *Improved Food Production* case, where the government stimulates local food production for humanitarian and security considerations. [redacted]

For each scenario, we used time series analysis models to forecast regional crop area and yields for 1992.¹⁷ Output for each crop in each scenario is the product of area harvested and average yields per hectare. Once national production figures were aggregated, we developed a simulation model to compare production with domestic consumption requirements and to analyze the impact of the different policy mixes on Brazil's ability to feed itself and on its export potential. For each scenario, we used World Bank world commodity price assumptions. Weather conditions were assumed to be similar to those that prevailed during the period 1950-86. [redacted]

Time series model building followed an iterative strategy, starting with a plot of the raw data and ending with a statistical model for each major crop. Data for the 1950-84 period were gathered from official Brazilian sources: the Instituto Brasileiro de Geografia e Estatistica (IBGE), as presented in various issues of the Anuario Estatistico do Brasil. Data for 1985 and 1986 were provided by IBGE press releases and reports from the Agricultural Counselor, US Embassy, Brasilia. Statistical criteria determined our choice among models. A total of 90 distinct time series analysis models were used to forecast the area harvested and yields of Brazil's major crops. [redacted]

Tables D-1 to D-4 present the statistical results of our analysis. In particular, tables D-1 to D-3 present historical data for 1986 and scenario forecasts for 1992 of total area harvested, average yield, and total production by major crop. Table D-4 presents net exports of major agricultural products for 1986 and for 1992 by scenario. [redacted]

¹⁷ The SPSS-X software package was used for all model building and area and yield forecasting exercises. [redacted]

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Table D-1
Brazil: Area, Yield, and Production:
1986 Compared With *More Balanced*
Growth Scenario for 1992

| Major Crops | Area | | Yield | | Production | |
|-------------------------------|--------------------------|--------------------------|--------------------------------------|--------------------------------------|--------------------------------|--------------------------------|
| | 1986 (1,000 hectares) | 1992 (1,000 hectares) | 1986 (metric tons per hectare) | 1992 (metric tons per hectare) | 1986 (1,000 metric tons) | 1992 (1,000 metric tons) |
| Food crops | | | | | | |
| Total | 49,771 | 52,243 | | | 91,049 | 105,327 |
| Beans, dry | 5,490 | 5,123 | 0.42 | 0.41 | 2,280 | 2,113 |
| Corn | 12,215 | 13,959 | 1.68 | 1.88 | 20,541 | 26,219 |
| Manioc | 2,000 | 2,089 | 12.75 | 11.56 | 25,500 | 24,147 |
| Rice, rough | 5,594 | 6,518 | 1.86 | 1.73 | 10,405 | 11,255 |
| Wheat | 3,900 | 1,647 | 1.45 | 1.05 | 5,638 | 1,724 |
| Subtotal | 29,199 | 29,336 | | | 64,364 | 65,458 |
| Export crops | | | | | | |
| Cocoa, beans | 657 | 733 | 0.70 | 0.60 | 460 | 442 |
| Cotton with seeds | 3,161 | 2,708 | 0.73 | 0.65 | 2,315 | 1,769 |
| Coffee ^a | 2,260 | 2,439 | 0.44 | 0.61 | 998 | 1,483 |
| Oranges, FCOJ ^b | 708 | 789 | 15.35 | 16.38 | 575 | 813 |
| Soybeans | 9,450 | 11,506 | 1.49 | 1.95 | 14,100 | 22,436 |
| Sugarcane, sugar ^c | 4,056 | 4,335 | 61.73 | 62.78 | 7,850 | 12,367 |
| Tobacco ^d | 280 | 397 | 1.38 | 1.41 | 387 | 559 |
| Subtotal | 20,572 | 22,907 | | | 26,685 | 39,869 |

^a Coffee beans, green.

^b Area and yields in oranges and production of FCOJ (frozen concentrated orange juice; 65 degree Brix, percent by weight of sugar in the juice).

^c Area and yields in sugarcane for both sugar and alcohol, production is only centrifugal sugar (raw value).

^d Tobacco leaf.

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Table D-2
Brazil: Area, Yield, and Production:
1986 Compared With Enhanced Export
Promotion Scenario for 1992

| Major Crops | Area | | Yield | | Production | |
|-------------------------------|--------------------------|--------------------------|--------------------------------------|--------------------------------------|--------------------------------|--------------------------------|
| | 1986 (1,000 hectares) | 1992 (1,000 hectares) | 1986 (metric tons per hectare) | 1992 (metric tons per hectare) | 1986 (1,000 metric tons) | 1992 (1,000 metric tons) |
| Food crops | | | | | | |
| Total | 49,771 | 52,241 | | | 91,049 | 105,199 |
| Beans, dry | 5,490 | 4,430 | 0.42 | 0.41 | 2,280 | 1,827 |
| Corn | 12,215 | 13,232 | 1.68 | 1.88 | 20,541 | 24,852 |
| Manioc | 2,000 | 1,915 | 12.75 | 11.56 | 25,500 | 22,140 |
| Rice, rough | 5,594 | 5,101 | 1.86 | 1.73 | 10,405 | 8,808 |
| Wheat | 3,900 | 1,748 | 1.45 | 1.05 | 5,638 | 1,830 |
| Subtotal | 29,199 | 26,426 | | | 64,364 | 59,457 |
| Export crops | | | | | | |
| Cocoa, beans | 657 | 757 | 0.70 | 0.70 | 460 | 532 |
| Cotton with seeds | 3,161 | 3,977 | 0.73 | 0.81 | 2,315 | 3,214 |
| Coffee ^a | 2,260 | 2,827 | 0.44 | 0.70 | 998 | 1,967 |
| Oranges, FCOJ ^b | 708 | 878 | 15.35 | 24.52 | 575 | 1,571 |
| Soybeans | 9,450 | 12,000 | 1.49 | 2.08 | 14,100 | 24,912 |
| Sugarcane, sugar ^c | 4,056 | 4,809 | 61.73 | 70.84 | 7,850 | 12,367 |
| Tobacco ^d | 280 | 567 | 1.38 | 2.08 | 387 | 1,179 |
| Subtotal | 20,572 | 25,815 | | | 26,685 | 45,742 |

^a Coffee beans, green.

^b Area and yields in oranges and production of FCOJ (frozen concentrated orange juice; 65 degree Brix, percent by weight of sugar in the juice).

^c Area and yields in sugarcane for both sugar and alcohol, production is only centrifugal sugar (raw value).

^d Tobacco leaf.



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D-3**Brazil: Area, Yield, and Production:
1986 Compared With Improved Food
Production Scenario for 1992**

| Major Crops | Area | | Yield | | Production | |
|-------------------------------|--------------------------|--------------------------|--------------------------------------|--------------------------------------|--------------------------------|--------------------------------|
| | 1986 (1,000 hectares) | 1992 (1,000 hectares) | 1986 (metric tons per hectare) | 1992 (metric tons per hectare) | 1986 (1,000 metric tons) | 1992 (1,000 metric tons) |
| Food crops | | | | | | |
| Total | 49,771 | 52,241 | | | 91,049 | 117,715 |
| Beans, dry | 5,490 | 5,572 | 0.42 | 0.51 | 2,280 | 2,847 |
| Corn | 12,215 | 15,010 | 1.68 | 2.24 | 20,541 | 33,593 |
| Manioc | 2,000 | 2,387 | 12.75 | 12.66 | 25,500 | 30,211 |
| Rice, rough | 5,594 | 6,641 | 1.86 | 1.82 | 10,405 | 12,093 |
| Wheat | 3,900 | 3,177 | 1.45 | 1.48 | 5,638 | 4,689 |
| Subtotal | 29,199 | 32,787 | | | 64,364 | 83,433 |
| Export crops | | | | | | |
| Cocoa, beans | 657 | 607 | 0.70 | 0.60 | 460 | 366 |
| Cotton with seeds | 3,161 | 2,413 | 0.73 | 0.65 | 2,315 | 1,576 |
| Coffee ^a | 2,260 | 1,884 | 0.44 | 0.61 | 998 | 1,146 |
| Oranges, FCOJ ^b | 708 | 616 | 15.35 | 16.38 | 575 | 562 |
| Soybeans | 9,450 | 9,417 | 1.49 | 1.90 | 14,100 | 17,893 |
| Sugarcane, sugar ^c | 4,056 | 4,253 | 61.73 | 62.78 | 7,850 | 12,367 |
| Tobacco ^d | 280 | 264 | 1.38 | 1.41 | 387 | 372 |
| Subtotal | 20,572 | 19,454 | | | 26,685 | 34,282 |

^a Coffee beans, green.^b Area and yields in oranges and production of FCOJ (frozen concentrated orange juice; 65 degree Brix, percent by weight of sugar in the juice).^c Area and yields in sugarcane for both sugar and alcohol, production is only centrifugal sugar (raw value).^d Tobacco leaf.

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Table D-4
Brazil: Net Volume and Value of Trade in Major
Agricultural Products, Base Year (1986) and
Scenarios for 1992^a

| Major Crops and Byproducts | Historical Base Year 1986 | | More Balanced Growth Scenario, 1992 | | Enhanced Export Promotion Scenario, 1992 | | Improved Food Production Scenario, 1992 | |
|----------------------------|---|-----------------------|---|-----------------------|--|-----------------------|---|-----------------------|
| | Quantity (1,000) (metric tons) | Value (million \$) | Quantity (1,000) (metric tons) | Value (million \$) | Quantity (1,000) (metric tons) | Value (million \$) | Quantity (1,000) (metric tons) | Value (million \$) |
| Net exports | 6,400 | 5,055 | 12,494 | 9,597 | 13,536 | 12,603 | 10,310 | 7,548 |
| Food crops | | | | | | | | |
| Beans, dry | 140 | 47 | 158 | 68 | -92 | -40 | -1,044 | -453 |
| Corn | -2,500 | -220 | -1,920 | -246 | -3,231 | -414 | 0 | 0 |
| Rice | -1,400 | -480 | 47 | 14 | -1,437 | -409 | 580 | 165 |
| Wheat | -2,192 | -248 | -6,206 | -1,166 | -6,206 | -1,148 | -5,092 | -948 |
| Subtotal | -5,952 | -901 | -7,921 | -1,330 | -10,966 | -2,011 | -5,556 | -1,236 |
| Export crops | | | | | | | | |
| Cocoa beans ^b | 295 | 618 | 386 | 850 | 476 | 1,046 | 310 | 682 |
| Coffee ^c | 655 | 2,359 | 1,085 | 3,405 | 1,085 | 3,405 | 1,085 | 3,405 |
| Cotton ^d | 37 | 17 | -48 | -55 | 500 | 572 | -122 | -139 |
| FCOJ ^e | 752 | 636 | 803 | 1,023 | 1,561 | 1,990 | 552 | 703 |
| Soybeans ^f | 1,200 | 243 | 1,500 | 425 | 1,500 | 425 | 1,500 | 425 |
| Soybean meal | 6,542 | 1,181 | 12,435 | 2,848 | 14,189 | 3,249 | 9,217 | 2,111 |
| Soybean oil ^g | 390 | 138 | 1,215 | 721 | 1,636 | 972 | 441 | 262 |
| Sugar | 2,332 | 368 | 2,774 | 1,071 | 2,774 | 1,071 | 2,774 | 1,071 |
| Tobacco | 149 | 396 | 265 | 639 | 781 | 1,884 | 109 | 264 |
| Subtotal | 12,352 | 5,956 | 20,415 | 10,927 | 24,502 | 14,614 | 15,866 | 8,784 |

^a Negative figures represent net imports.

^b Cocoa beans and products in bean equivalent.

^c Coffee bean, green, and soluble (bean equivalent).

^d Cotton, lint.

^e FCOJ, 65 degree Brix (percent by weight of sugar in the juice).

^f Soybeans quantity figures for 1992 are assumed.

^g Soybean oil, includes crude and refined, in crude equivalent.

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