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Distortions to Agricultural Incentives

In Brazil

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Distortions to Agricultural Incentives in Brazil

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During the period since 1950, agricultural policies in Brazil experienced major changes. A policy of forced industrialization and import substitution lasted for the first four decades. This included a period of strong policy interventions to promote industrialization through import substitution, and a period where taxation of agriculture was combined with domestic support policies based on subsidized credit and a Minimum Price Policy (MPP). By contrast, the most-recent 15 years have seen less government policy intervention in agricultural markets, fiscal disciplines, and strong control over monetary policy designed to contribute to macroeconomic stabilization, and substantial trade liberalization.

In the earlier period a large number of government interventions were imposed on the agricultural sector, resulting in price distortions caused by both direct and indirect forms of taxation (Brandão and Carvalho 1991). One form of indirect taxation used was a chronic overvaluation of the exchange rate. Since purchased inputs in agriculture were modest, the effect of the overvalued exchange rate on the price of agricultural outputs tended to dominate and worsen the agricultural terms of trade (Oliveira 1981, p. 267). A form of direct intervention was export taxation, the so-called “confisco cambial” which was mainly applied to coffee. In the early 1960s, it reached approximately 50 percent of the value of exports (Veiga 1974).

Brazil’s population underwent a marked change in composition during the period under analysis. About 31 percent of the Brazilian population in 1950 was urban. By 1980, 70 percent was living in urban areas. The population reached 189 million in 2006, with around 85 percent urban and only 15 percent rural. Migration from rural areas was in part induced by the taxation imposed on agriculture.

Brazil experienced continued economic growth after World War II. Industry became the leading sector with an average annual rate of industrial growth of 9 percent from 1950 to 1973. During the so-called “economic miracle” period (1968 to 1973), Brazil enjoyed even

higher rates of growth. On average, GDP grew at an annual rate of about 10 percent (and 7 percent during the rest of the 1970s), and industry grew at 13 percent. Agricultural growth rates lagged behind at an average rate of 5.4 percent.

The strong growth trend was reversed in the early 1980s, when the effects of the second petroleum price shock and a sharp increase in international interest rates brought economic stagnation. For two decades, the Brazilian economy stagnated, experiencing some years of negative or very low growth and a sharp decline in per capita incomes. During the 1980s and the early 1990s inflation worsened. Annual inflation rates rose to 200 percent in the early 1980s and exceeded 1,000 percent in the early 1990s.

Agricultural production in Brazil is geographically concentrated in the Center South. This region includes the South, the Southeast and the Center West regions, where 75 percent of agriculture production is generated.

During the period analyzed, agriculture changed considerably as a share of GDP (Table 1). Since the mid-1980s it has contributed less than 10 percent of GDP having been 55 percent in 1950. It is more important in terms of employment though, generating 37 percent of all existing jobs. Its share of exports was 50 percent until the late 1970s but declined as the industrial sector took the lead. Nonetheless, agricultural exports are diversified, with increasing exports of lightly processed food supplementing traditional export products such as coffee, sugar, cocoa, and cotton. Soybeans and soybean products have been important exports since 1970. More recently, meat products, orange juice and sugar have become the most important exporting products. The agrifood sector – comprising agricultural commodities, lightly processed products and industrialized food – accounted for 30 percent of total exports in 2004.

Wheat is by far the single most important agricultural import, although corn, rice, and edible beans were sometimes imported as a result of production shortages resulting from policies that distorted incentives. But agricultural products have not exceeded 12 percent of total imports since 1970.

Despite much labor out-migration from farms during the period studied, there was a wide gap between incomes in the farm and non-farm sectors. According to the 1980 census, average income in agriculture was Cr\$6,668 per month (cruzeiros of August 1980) compared to Cr\$13,913 in the non-farm sector. The comparable figures for 1970 were Cr\$3,965 and Cr\$10,778 (Denslow and Tyler 1983). These figures indicate a small reduction in the gap

between farm and non-farm incomes (from 2.7 to 2.1) during the 1970s. The 1980 census also showed that income concentration increased more in agriculture than in the urban sector.

After a period of intense industrialization, from the mid-1950s until 1989, the policy drive to extract income from agriculture was near exhaustion. Agriculture was no longer capable of sustaining an outstanding performance in either export crops or in basic staples. Taxation of exports and a “cheap food policy” to keep urban and industrial wages relatively low, and interventions in trade to provide the industry with cheap raw material for industrialization, were near collapse.

Rather than removing price distortions, a new policy was adopted: a subsidized rural credit policy designed to “induce modernization and technological change” in agriculture, mainly through subsidies for purchasing modern inputs (fertilizer and machinery). This policy was issued in the mid-1960s, and a growing budgetary transfer was channeled to the sector until a phasing-out of those expenditures beginning in the late 1980s. The National System of Rural Credit (SNCR) was created in response to supply shocks and food shortages. Investments in agricultural research were insignificant at the time, except for the coffee and cotton sectors. During the rest of the decade and for most of the 1970s, the interest rates on loans from the system were independent of the rate of inflation. Real interest rates were negative throughout the 1970s. The nominal rates were adjusted at the end of the decade, but the real rates remained negative until the late 1980s, when the phasing-out period began. This policy of “compensation” benefited some products more than others, thus representing uneven income transfers to producers: farmers with higher use of purchased inputs and easy access to official subsidized agricultural credit were able to offset somewhat the effect of the implicit taxation on products. The majority of farmers, however, experienced net taxation. The credit policy was clearly regressive, thus contributing to the level of poverty in agriculture.

The policy of compensation, intended to neutralize the negative allocative effects of taxing agricultural products, was not fully effective: supply shocks persisted and became more frequent by the late 1970s. Severe food shortages triggered more and more government intervention in domestic markets, draining resources that otherwise could have financed the needed investments in agriculture to reduce food shortages.

During the 1980s, supply shocks persisted and inflation accelerated, and new instruments of trade interventions were frequently used including quantitative controls, licensing, and export quotas and embargoes. The main target of policy intervention was the control of inflation. On import-competing crops new policy instruments included tariff

exemptions on imports, the imposition of ceiling prices at the retail level, and imports of the major staples by state owned companies. In some cases (e.g., maize and cotton), instead of having free exports subject to temporary suspensions, the government permanently banned them with temporary authorizations to export surpluses. Domestic production declined or stagnated and these products became importables during most of the 1980s and 1990s. The disincentives to produce were made worse by the massive purchases of grains under the MPP, because subsequent sales of those government stocks were below normal costs plus interest rate charges.

The stock of grains held by the government in the 1980s implied great risk in the market. Processors and traditional buyers reduced their purchases, which left the government as one of the most important buyers at the harvest season. In addition to purchases through the MPP, public stocks were enlarged by government imports of rice, maize and beef — adopted at the time of the Cruzado Plan (1986) — as an attempt to avoid price instability coming from a crop failure. Government imports thus brought uncertainty to commodity markets, and price premiums were not enough to compensate for carrying stocks by the private sector under this market instability.

The Government bore the cost of storage, transportation and state taxes on grain purchased through its intervention in commodity markets. A new policy was introduced to set fixed rules for the sale of government stocks and for all kinds of interventions on agricultural markets. The experience demonstrates that when a government disrupts commodity markets, it can produce a “crowding out” of private storage agents, and the government has to pay the price of carrying stocks from harvest to off-season. And farmers were somewhat taxed by having to sell their produce at harvest time below world market parities at the farm-gate. These unintended government stocks under the MPP peaked during the 1980s, prompting supposedly quick action to avoid the continuation of such policies.

As noted by Krueger, Schiff and Valdes (1988, p. 262), price policies in Brazil, once in place, have tended to have a life of their own with results often quite different from those intended: Brazilian agriculture remained more or less closed to trade (both imports and exports) until the mid-1990s.

Economic and trade reforms

The restructuring of the Brazilian Economy began in the late 1980s. It was triggered by a financial crisis in the first half of the 1980s. The reform was aimed at promoting a more open economy and greater exposition to foreign competition as a means to bring hyperinflation under control.

From 1989 to 1992 Brazil experienced the first major change in trade policy, with the permanent removal of the main instruments of the import substitution drive. Inter alia, unilateral trade liberalization was implemented, along with a comprehensive tariff reduction and the elimination of the export control apparatus. The extent of the reforms was pervasive: average industrial tariffs were lowered from an average of over 100 percent to 31 percent in the period 1994 to 1997. With less protection for industrialized goods, the implicit taxation of agricultural exports became less. But at the same time agricultural tariffs were reduced even further, to 10 percent in rice, wheat and edible beans and 8 percent for maize, cotton and soybeans. On a few occasions tariffs for cotton and edible beans were eliminated.

In 1994, after several macroeconomic plans,¹ Brazil attempted to stabilize key macroeconomic variables such as inflation with the implementation of the Real Plan. A fixed exchange rate was the key instrument to be used to control inflation. Parity was fixed at 1:1 (R\$ to the dollar) and in two years the exchange rate reached the unprecedented rate of R\$0,86 to the dollar (Appendix Figure 1). In addition, restrictions were imposed on government expenditures. The economy-wide reform was accompanied by a sharp increase in interest rates.

The drive to trade liberalization was complemented by the Mercosul Agreement signed in January 1995. Despite the existence of lists of exception by each member country, tariffs within the countries were otherwise set to zero and the Common External Tariff (CET) started to be implemented (Brandão et al. 2001).

Another important change in trade policy that affected the agricultural sector was the elimination of export taxation. In 1996 Congress removed the value added tax (ICMS) of 13 percent that remained on agricultural exports. Other sectors were already exempt from the ICMS on their exports. This measure was adopted at a time of an overvalued exchange rate and was equivalent of a devaluation of 5 to 6 percent in the exchange rate. The elimination of

¹ Brazil made four attempts to macro stabilization in the 1980s: in 1986, with the Cruzado Plan; in 1987, with the Bresser Plan; in 1989, with the “Summer Plan”; and in 1990 with the Collor Plan. None proved to be successful until the Real Plan, issued in 1994.

export taxation signified a radical change towards alleviating intersectoral price distortions and the anti-export bias that prevailed in agriculture for decades.

The combination of trade reform and the strong appreciation of domestic currency introduced by the Real Plan caused the current account of the balance of payments in 1995 to show a deficit of the order of US\$18 billion. As a tradable sector, agriculture was hurt by the deficit. During this period there was a sharp increase in import flows by the private sector including feed grains, cereals, food grains, oilseeds, fibers and other agricultural commodities. Total expenditures on imports of these agricultural commodities reached US\$1.6 billion. Imports of rice, which were around 250,000 tons in the late 1980s, reached around 1.2 million tons (of a total consumption of 10 million tons), and maize reached 1.3 million tons in 1994 (of a total consumption of 22 million tons). For most commodities the country was dependent on imports to supplement domestic production.

In addition to the deterioration of the external accounts, other indicators suggest that the strong appreciation of the local currency after the Real Plan was causing recurrent trade deficits. In August 1996 the Getulio Vargas Foundation estimated that the appreciation of the exchange rate *vis-a-vis* the wholesale price index was in the order of 21 percent for the period 1988 to 1996. Another indicator is the evolution of the price indexes of tradables and non-tradables. Brandão and Martini (1996) estimate that since August 1994 the ratio of tradables to nontradables in the consumer price index dropped from 1 to 0.68. These indicators show the extent to which the Brazilian currency appreciated.

Finally, in January 1999 a major devaluation of the currency was implemented and a floating exchange rate regime was adopted. The exchange rate was allowed to fluctuate within a band system and later a full floating exchange rate was adopted.

Agricultural policy reforms

Since 1988, with the financial crises in government, the MPP policy has been adjusted depending on the availability of fiscal funds. In some years, the reduction of government funds was so large that the government was unable to defend minimum prices effectively, creating credibility problems for the MPP policy. From the 1990s, the MPP was intentionally funded with fewer and fewer resources in a deliberate attempt to place less emphasis on government instruments that create instability in the market.

Government purchases of agricultural commodities were eliminated after 1995 due to a growing consensus that this policy was not consistent with the elimination of tariffs within Mercosul. Policy makers realized that the MPP was guaranteeing higher prices to producers of other partners in the new customs union. The process of eliminating price supports in Brazil moved fast and was replaced by other mechanisms that are not broad sector-wide interventions (OECD 2005).

The elimination of marketing boards was another important reform in the agricultural sector, including an elimination of fiscal funds devoted to marketing activities. From 1988 to 1991, public funds were reduced by 75 percent for coffee, 91 percent for sugar and alcohol, and by almost 100 percent for cocoa and wheat (Gasques 2000). The deregulation of the domestic markets for these products resulted in strong participation of the private sector at all levels of marketing channels.

Government expenditures in agriculture from 1986 to 1991 were reduced from 4.2 percent of agricultural GDP to 1.7 percent. Total public funds allocated to agriculture, including credit from official sources and from state-owned banks, decreased from US\$12.3 billion in 1986 to US\$3.4 billion; and cut in public funds continued thereafter. Agricultural credit, provided by private banks under regulated conditions, dropped from US\$10.2 billion in 1991 to US\$5 billion in 1995 (Gasques 2000).

During the period of 1995 to 2005 price support was considerably reduced. Budget expenditure of the so-called “new money” (credit granted on top of existing pending debts) for production credit was considerably constrained. According to Gasques (2005), the annual credit support resources supplied to the agricultural sector declined from a peak in 1979, when it reached 54 billion reais, to 12 billion reais in 1999 (in constant R\$). Part of the decline in availability of resources for farm credit is related to the failure of farmers to pay back their loans due to general insolvency (which peaked in the period 1986 to 1994).

Brazil was to experience a “freer” trade in a market environment still dominated by strong price distortions. The Uruguay Round achieved much less than expected, as assessed by policy makers and analysts at the time negotiations ended. Nevertheless, the round had a positive indirect effect: several countries undertook unilateral reform of their trade regime and engaged in regional trade agreements. This was particularly so in Latin America, where Brazil followed the examples of Chile, Argentina, Bolivia, Colombia and Mexico, to mention just a few.

Impacts of policy reforms on the agricultural sector

The main results of the agricultural policy reforms can be divided into two periods: a transition period from 1990 to 1999, and the post-2000 period. In the 1990s transition period, import flows of competing agricultural commodities increased significantly, imposing the need for strong cost adjustments by Brazilian producers. This period was marked by strong appreciation of the exchange rate, combined with low international prices of agricultural commodities resulting in cheap imports. These drastic changes depressed prices in the domestic market and provided adjustment incentives to the agricultural sector that required a strong commitment to higher efficiency, better product quality and higher productivity to succeed in the new environment.

Due to the strong control on fiscal policy adopted after the Real Plan of 1994, very little support was granted to farmers to assist adjustment. Crops that were not linked to international markets in the previous period (cotton, milk, maize, rice and wheat) suffered the most from competition with cheap imports during this transition period. In addition to low international market prices, export subsidies in other countries also had a major impact on the Brazilian agricultural market.

Following the success in macroeconomic stabilization brought about by the Real Plan, other important policy reforms helped build a more favorable environment that enhanced agricultural growth.

The second period of effects from agricultural reform began in 2000 and was marked by a boom in exports. This resulted from the devaluation of the domestic currency due to the introduction of the new regime of floating exchange rate (1999), and a parallel increase in international prices of agricultural commodities. The strengthened price incentives enhanced the competitiveness of Brazilian exports, particularly in the Center-West (the new agricultural frontier), where commercial farmers that dominate modern technology increased significantly the production of soybean, maize, cotton, cattle, pigs and chicken. The boom in agricultural production during this period was the result of strong productivity gains, rather than an expansion of area planted (Figure 1). A leading role was played in the export boom by efficient producers using modern technology. This new pattern of agricultural production, based on the adoption of modern technology, was a result of public investment in agricultural

research by the agricultural research network headed by EMBRAPA (Brazilian Company of Agricultural Research).

Two important changes happened with Brazil's recent export growth. First, the Brazilian share of world commodity markets increased, since most of the additional output generated by the improved technology was channelled to exports. Second, exports became increasingly diversified with the larger export of lightly processed products, including soybean meal, vegetable oil, chicken meat, bovine meat, swine meat and fruits. Most of the increase in exports came from soybeans.

Another aspect of the wide-ranging economic reform was the rescheduling of farm debt. The escalation of inflation in the mid-1980s triggered several attempts to bring debt under control through macro-stabilization plans. All plans included measures of price freeze for the consumption basket. This policy mechanism generated a cumulative gap between production costs (relatively higher) and sales revenues (relatively lower), which affected farmers relatively more intensively due to the time span between planting and harvesting. The effects of the price freeze mechanism were exacerbated by the Collor Plan, when inflation rate reached 70 percent per month, opening a wide gap between interest rates on farm loans and sales revenue. General insolvency resulted, followed by a deep cut in the availability of funds for farm credit. The negotiations of the farm debt began in 1992, and by 1995 the first program was approved for debt rescheduling. This program had a strong positive incentive to production growth, as farmers recovered their borrowing capacity.

The 2000s: increases in farm production and exports

By 2000, a new agriculture was emerging as measures undertaken since the mid-1980s to reform agricultural and other policies matured. The outstanding performance of Brazil's agriculture from the mid-1990s to 2004 was a result of the major reforms in macroeconomic and sectoral policies. Three other developments were also important in the enhanced performance of the agricultural sector: renewed investments in agricultural research for crops and livestock (started in 1974 and maturing in the 1990s), which made available a stock of new productive technology that gave support to output growth; the adoption of new varieties and improved management practices, which made possible increased output per hectare to help the most efficient farmers survive the unfavorable environment of lower domestic prices

for agricultural products that prevailed during the 1990s; and cheaper fertilizers and other imported inputs during most of the 1990s, due to the strong appreciation of the local currency.

The pattern of agricultural growth changed radically and relied mainly on productivity growth. The base acreage planted increased by an average rate of 1.8 percent a year from 1990 through 2004. Output growth in the same period averaged 4.9 percent a year. This implies that output had doubled since the 1990 crop year while acreage increased by just under than 30 percent (Figure 1). Investments in research on livestock, poultry and hog production produced outstanding results too (Figure 2).

The combination of macroeconomic reforms, agricultural policy reforms and trade liberalization, together with the ability of farmers to implement strong structural adjustment, resulted in unprecedented export-led growth in Brazilian agriculture. The agricultural sector was leading the growth of the country's GDP, with an average rate of growth of 5.3 percent a year during 2000 to 2004 when the industrial sector was growing at just 1.7 percent. In 2004, Brazil ranked first in the world in the production of alcohol, sugar, coffee and orange juice; second in the production of soybeans and soybean by-products, beef and tobacco; and third in poultry meat, pig meat, fruits and maize. Brazil also ranks first in the export of alcohol, sugar, coffee, orange juice, soy complex, beef, tobacco, and poultry meat, and third in the export of pig meat. Higher international prices and a booming demand for food abroad contributed to this performance.

How did the income profile of Brazilian agriculture change during the reform period? Based on the Agricultural Census data of 1995/96, Lopes (2004, p. 157) finds that of a total 4.8 million farms in Brazil, 3.3 million fell within the legal definition of family farming in the Brazilian PRONAF Program (a program designed to promote family farms with access to subsidized credit). These farms represented 68 percent of the total number of farms, but they generate only 24 percent of total gross income in agriculture. By contrast, commercial farmers (small, medium and large farms) representing 32 percent of the total number of farms generated 76 percent of agricultural income. Those commercial farmers produce 96 percent of sugar cane, 86 percent of oranges, 80 percent of cotton, 79 percent of coffee, 78 percent of grains, cereals and oilseeds, 76 percent of potatoes, 58 percent of horticulture, 91 percent of poultry meat, 90 percent of beef, 83 percent of eggs and 72 percent of pig meat. Family farmers dominate mainly in tobacco (86 percent) and manioc and manioc flour (73 percent). Small commercial farmers are responsible for much of the production of intensive livestock,

but they are heavily dependent on maize and soybeans produced by large commercial farmers, showing a clear complementarity within agriculture between farm sizes.

Out of 3.3 million farms that lie within the profile of the PRONAF program, approximately 2.0 million can be considered subsistence family farms. They represent the contingent of extremely poor farm families. For this group of farmers it is very unlikely that agriculture can do anything to help them in providing a minimum caloric intake or a minimum income for the subsistence for the whole family. In Brazil, the bulk of poverty is in agriculture (Valdes 2001). Despite some concentration of those farms in the North and particularly in the Northeast regions, the rural poor in Brazilian agriculture are scattered across all other regions, including the South and the Southeast.

Mid-size commercial farmers (257 000 farms) represent 5.1 percent of the total number of farms in Brazil and produce 20 percent of the total agricultural production in the country. Their performance indicators show that they are economically viable, suggesting that they deserve closer attention from public policymakers in terms of mechanisms designed to facilitate the adoption of technology. Large commercial farmers amount to 375 000 farms and are responsible for 52 percent of total domestic production. In general, the majority of Brazilian farms have low levels of absolute income. Recent estimates from the 2000 Demographic Census show that 61 percent of households in agriculture were below the poverty line in 2000, while the share in the urban sector was 25 percent.

Past evidence of direct price and indirect assistance to agriculture

Krueger, Schiff and Valdes (1988) identify four policies that affected agriculture in developing countries: “a) developing countries have attempted to encourage the growth of industry through policies of import substitution and protection against imports competing with domestic production; b) overvalued exchange rates have often been maintained through exchange-control regimes and import licensing mechanisms even more restrictive than those that would have been adopted in connection with import substitution; c) developing countries have attempted to suppress producer prices of agricultural commodities through government procurement policies (especially agricultural marketing boards), export taxation, and/or export quotas; and d) some governments have attempted to offset part or all of the disincentive effect on producers by subsidizing input prices and investing in irrigation and

other capital inputs”. These broadly match with the policy regime in Brazil. The only policies Brazil did not pursue were government imports of basic staples, direct price control of food prices, and subsidies for the production of imported food items.

Schiff and Valdés (1992, Table 2-3) summarize their empirical estimates of the direct and indirect government assistance net of taxation to Brazilian agricultural producers. Their direct estimates are expressed as the percentage by which the domestic producer price diverged from what would have prevailed in a well-functioning market at free trade, the exchange rate and industrial protection regimes in place. This measure is equivalent to the nominal rate of protection (NRP). The authors find that the most important importables (such as wheat) tended to be protected, while the most important exportables (such as soybeans) tended to be taxed. Specifically, their estimated NRP for importables is 83 percent in 1969-72 and 3 percent in 1976-83; and for exportables the NPRs are –27 percent in 1969-72 and –1 percent in 1976-83. Their total NPR for all covered farm products is 46 percent in 1969-72 and 0 percent in 1976-83. Their estimates of the indirect effects on farmers’ incentives of trade and macroeconomic policies via the real exchange rate and the protection afforded to nonagricultural commodities are negative in both periods (–17 percent in 1969-72 and –19 percent in 1976-83) so their sum of direct and indirect effects in Brazil is 28 percent in 1969-72 and –19 percent in 1976-83. Schiff and Valdés (1992, Table 7-2) also provide estimates of the net income transfers to or from agriculture as a result of direct and indirect price and non-price interventions. Measured as a percentage of agricultural GDP for 1970-83, and depending on their assumptions, the price transfer estimates range from 6 to 13 percent, the non-price transfer is 12 percent, and so the sum of price and non-price transfers is between 18 and 25 percent.² That is, overall the price related income transfers (output and intermediate inputs) to Brazil’s farmers were positive during 1970-83: despite some negative NRPs for certain agricultural products as result of direct price interventions, they were more than offset by transfers resulting from price intervention on inputs (including credit subsidies), non-price transfers (including public investment in agricultural research and extension and land improvement) and the effect of exchange rate misalignment. In a later study, Valdés (1996, Table A-7) finds that positive picture had vanished for the period 1985-92, when the price-related transfer as a percentage of agricultural GDP was –4 percent in terms of output, 3 percent in terms of inputs, 1 percent for non-price related transfers (credit subsidies) and hence a net average income transfer in those years of just 0.1 percent.

² For details of the way each measure has been calculated, see page 118 of the Schiff and Valdés (1992, p. 118 and the footnotes to Table 7-2 on p. 130).

In 2005, the OECD published a report on the changing pattern of distortions to economic incentives to agriculture in Brazil, for the period 1995 to 2004. It shows that broad reforms to macroeconomic, trade and sectoral policy since the late 1980s resulted in a further decline in the level of direct support to Brazilian agriculture. They find their aggregate producer support estimate (PSE) averaged just 3 percent of the gross value of production in that ten-year period. The decline affected most products, the exceptions being import-competing products such as rice and cotton whose PSEs averaged 12 and 6 percent, respectively, for the period 2000-2004 (OECD 2005). The OECD report attributes the decline in support to macroeconomic stabilization in 1994 and to trade reforms beginning in the late 1980s that brought tariffs on agricultural imports into the range of 5 to 10 percent. Deregulation of domestic markets, the elimination of marketing boards (coffee, sugar, wheat), and a restricted role for the MPP through reduction of minimum price levels relative to market prices all contributed too.

The OECD results highlight the closer integration of domestic agricultural markets and world markets. A clear convergence of domestic to international prices occurred, as policy distortions were considerably reduced. The results show that despite this overall clear picture, the path of convergence was not smooth, and that wheat, rice, maize, and other products faced targeted local and temporary interventions in some specific years, although they only had a modest impact on market distortions. Fluctuations in the level of support were motivated by underdeveloped infrastructure, excess supply in the new frontier, and sudden declines of external prices.

The OECD study also noted a slight increase in preferential credit to the agricultural sector through the allocation of public funds for subsidies on interest rates. This was attributed to the rescheduling of farm debt that originated with the stabilization plans of the late 1980s. As part of the government's attempt to control inflation, monetary correction was introduced in rural credit contracts as a means of restricting the expansion of credit. Farmers began to face increasing costs on their borrowing balances. It took nearly a decade for hyperinflation to be brought under control with the Real Plan. During this decade, several policies contributed to depressing farm prices: price controls at the retail level, exchange rate overvaluation, the opening of trade, and duty-free imports from Mercosul. As a result, rising costs of credit coupled with lower repayment capacity began to spread among commercial farmers, giving rise to a debt crisis. After 1994 the appreciation of the real exchange rate, and extremely high interest rates, aggravated the crisis. New bank lending to farmers was virtually nil by 1995. The Government was convinced that farm debt resulted from extreme

economy-wide instability and that it could have broad implications for the rural credit system. A large-scale restructuring program began late 1995, but debt negotiation has been a long process. According to the OECD (2005, p. 49), “At the end of 2004, the outstanding restructuring debt stood at BRL 21.8 billion (USD 8.0 billion) with overdue repayments reaching BRL 3.8 billion (USD 1.4 billion).” The impact of the restructuring of farm debt was to reduce farmers’ commitments in the short run. However, it crowded out new government lending, with the result that government funds channeled to the rural credit system were substantially reduced from previous levels.

The present study’s estimates of policy distortion indicators

The present study’s methodology (Anderson et al. 2008) differs somewhat from both the Krueger, Schiff and Valdes and OECD studies, even though the main focus is still on government-imposed distortions that create a gap between domestic prices and what they would be under free markets. Since it is not possible to understand the characteristics of agricultural development with a sectoral view alone, the project’s methodology not only estimates the effects of direct agricultural policy measures (including distortions in the foreign exchange market), but it also generates estimates of distortions in non-agricultural sectors for comparative evaluation.

More specifically, this study computes a Nominal Rate of Assistance (NRA) for farmers including an adjustment for direct interventions on tradable inputs (border protection on fertilizers) and on non-tradable inputs (credit subsidies to farmers). It also generates an NRA for nonagricultural tradables, for comparison with that for agricultural tradables via the calculation of a Relative Rate of Assistance (RRA – see Anderson et al. 2008).

Estimation of the NRAs is difficult in an environment of high inflation rates and major changes in exchange rates during the year.³ The problem of high rates of inflation also affects the estimation of nominal values for all non-product specific subsidies (such as expenditures on research and extension, agricultural training, inspection services, etc.) for

³ The exchange rate changed dramatically in 1989, for example, so the annual average rate was not representative. To obtain a more-representative number, the agricultural NRA for that year was assumed to be the average of the NRAs in 1988 and 1990 and the exchange rate used for that year was adjusted to generate that average, taking domestic product prices in local currency and border prices in US dollars as given. This required altering the depreciation that year compared with the previous year such that the local currency fell relative to the US dollar by 84 instead of 77 percent.

periods prior to 1995. Estimates for non-product specific subsidies therefore are accurate only for recent years.⁴

To compute NRAs we compare domestic and border prices at the wholesale level, wherever available. In a few cases, a wholesale equivalent value is estimated using the margins from farm-gate to wholesale prices, because in Brazil wholesale prices have declined in terms of their relevance as representative prices in the market. Few transparent quotes are now available for wholesale prices of primary and lightly processed products. For some products such as maize and soybeans, wholesale prices are inferred from the prices paid by mills and crushing plants closer to the production point, but these businesses are far from the ports and are somewhat different from the traditional wholesale concept. For earlier years we draw on estimates from previous empirical analysis of similar indicators and on data in Valdés and Schaeffer (1996), Brandão and Carvalho (1991), and Schiff and Valdés (1992).

Product selection

The set of activities selected for this study include the following crops: wheat and paddy rice as importables; soybeans, sugar cane and coffee as exportables; and maize and cotton with changing trade status. The lightly processed products included are wheat flour, milled rice, and raw sugar, while the livestock activities are cattle, poultry and pigs as primary products and beef, broilers and pig meat as their lightly processed export counterparts.⁵ Together the selected products account for between two-thirds and three-quarters of the total value of agricultural production at undistorted prices (see also Figure 3).

Price comparisons at a particular point in the marketing chain

For computing NRAs, the point of price comparison of domestic to border prices should be at the wholesale level and bearing in mind domestic transport costs. In this study, we take CIF and FOB prices at the most important Brazilian ports for each product. We make an adjustment for quality (by using registered prices at the export and import agency, and where necessary, taking international prices with a quality adjustment for a similar product). We

⁴ Brazil experienced inflation of 30 to 40 percent in the early 1970s, of 100 to 1700 percent in the 1980s, and of 1450 to 2640 percent right before the stabilization plan of 1994 when monthly inflation rates reached 80 percent. From 1964 to 2004 Brazil changed its currency eight times and tried to control inflation five times with stabilization plans. Only the last plan – the Real Plan – succeeded in bringing inflation down to an average close to 5 percent a year from 1995 to present.

⁵ Pig meat has historically faced sanitary import barriers abroad, but with the easing of those barriers by an increasing number of countries and the improvement in sanitary controls on the part of Brazilian authorities, pig meat exports are growing in importance. The BSE disease elsewhere in the world has provided market opportunities for Brazil's beef, such that the country became the world largest exporter of beef in 2003.

subtract port charges, transportation and other related expenses for exportables while adding these costs items for importables,⁶ to generate equivalent FOB or CIF prices at the wholesale point.

Wherever available, we took the domestic wholesale price after checking that the price indeed represented actual trade and commercial transactions. In a few cases, a composite of prices was used to estimate a wholesale price equivalent, adding a margin to the farm-gate price to represent transportation and processing costs.⁷

Direct comparisons between border prices and wholesale prices were possible for some products that are traded as primary products and for which a wholesale price was either collected or estimated (soybean, maize, wheat). For other products the comparisons were made between the border price and the equivalent lightly processed product price at the wholesale level. For example, live cattle was converted into boneless beef, poultry into broilers, pigs into pig meat, wheat into wheat flour, paddy rice into milled rice and sugar cane into raw sugar. For all lightly processed products the price comparisons were made between wholesale and border prices.

The transmission elasticity for wholesale to farmgate price is assumed to be one for all products. This is valid especially during the most recent ten years as Brazilian agriculture has experienced increasing competition in product markets at the farm level as international trading companies compete with cooperatives for a larger share of marketed output. Improved farmer association information systems, government agencies and trade boards are playing an important role in the dissemination of market prices to distant farmers. Even small commercial farmers – the producers of poultry and pigs – are usually well integrated into marketing channels.

Estimates of NRAs for exportable primary products

In earlier periods, the negative NRAs for exportable products reflect high levels of taxation. The highest estimated rates are for sugar, coffee, soybeans and poultry. Quantitative temporary restrictions on exports, discretionary export prohibitions and embargoes, and

⁶ All of these expenses are well known in the market by private agents for recent years. Data for earlier years are taken from previous studies or assumed the same as more recent periods where data are not available.

⁷ In order to achieve the most accurate calculations, a careful examination of reported prices for the wholesale market was necessary. This is because in recent years the wholesale prices have not been recorded on a regular monthly basis and/or have not been representative of actual transactions. The bulk of the supply to buyers (supermarkets, processors, and retailers of all sizes) came from direct sales by cooperatives, processing and crushing plants, millers, direct importers, etc. It was therefore difficult to find reliable prices and to know how they were derived.

export taxes were the main instruments used by the government to keep down prices in domestic markets. Together with the chronic overvaluation of the domestic currency during most periods under analysis, both implicit and explicit forms of taxation discriminated against export crops until the latter 1980s (Table 2).

For sugar, the average rate of taxation (negative of the NRA) was more than 50 percent until the early 1990s. Regulations under the marketing board for sugar and alcohol (Institute of Sugar and Alcohol - IAA) restricted exports of sugar, making it one of the most discriminated export commodities in Brazil. But during the past few years that taxation has disappeared and its NRA is now close to zero.

For coffee, the NRA estimates show average taxation ranging of 48 percent in 1980-84 and 18 percent in 1985-89, but thereafter the NRA has been slightly positive. Brazil is the largest producer of coffee in the world and the crop was the single most important export product for a long time. Under the coffee marketing board (Brazilian Institute of Coffee, IBC), the government maintained a strong regulatory regime, retained export proceedings, and had a government stock policy to reduce market price fluctuations. This latter policy lasted even after the reform introduced by President Collor, which extinguished the marketing board in 1990. In 1992 coffee prices and exports were fully liberalized and a strong process of adjustment began. Brazilian costs of production of coffee are very competitive, particularly in the Southeastern states. Despite all the disincentives created by earlier intervention policies, the country maintained its leadership in coffee exports.

Taxation also is revealed in our soybean NRA estimates, as previous studies found (Santana 1984, Araújo, 1997). Those NRAs range from -5 percent to -15 percent up to the mid-1990s, as part of the government's attempts to stabilize inflation. In addition to quantitative restrictions, exports of beans were also subject to a value added tax (ICMS) of the order of 13 percent until 1996. Exports of soybean meal and soybean oil were exempt from this tax, providing assistance to processors but not necessarily farmers. Trade restrictions inhibited growth, and soybean production remained stagnant at around 10 to 11 million hectares from the crop year 1983/1984 to 1996/1997. The level of taxation of soybeans declined after 1995, allowing domestic prices to converge to international prices. The turning points for soybean growth were the elimination of the value added tax on exports (1996), and the new floating exchange rate policy that followed the sizeable devaluation of the currency in 1999. Between 1996 and 2005, production jumped from 23 to 55 million tons, allowing exports of beans to boom.

The estimated NRAs for poultry also were negative until 1995, as was beefs in the first half of the 1990s. Again the change beginning in 1995, when taxation was eliminated, led to a boom in beef and poultry exports such that Brazil is presently among the largest exporters of both beef and poultry in the world.

Estimates of NRAs for importable primary products

The estimated NRAs for wheat show high levels of protection up to the mid-1980s, consistent with regulations that established a state monopoly over production, imports and marketing — the Wheat Marketing Board. Under the regulated system that lasted from 1967 through the 1980s, prices at the farm level were set well above international prices and the NRA ranged between 20 and 65 percent. This stimulated domestic production to reach a record of 6.1 million tons in the late 1980s. The radical deregulation of the wheat sector in 1990 saw all instruments of state control eliminated and the Wheat Marketing Board extinguished. Private imports of wheat have prevailed since then, with Mercosul (Argentina) becoming the main supplier. Domestic prices at the farm level became integrated with world markets in the mid-1990s and domestic prices dropped considerably from previous levels. As a result of these reforms, domestic production nearly halved to 3.3 million tons in 1990/91, and further to 2.1 million tons by 1993/94.

For rice, the estimated NRA is slightly negative in earlier periods, even though it is an import-competing crop. However, rice is the most important staple in Brazilian food consumption, which meant it was subjected to frequent discretionary government interventions in order to keep down domestic prices. Frequent supply shortages saw the government resort to massive imports of rice through a state agency (CONAB), and the imported product was sometimes sold in the domestic market below CIF prices. After 1995, the rice NRA became positive. Rice was one of the crops most affected by the Mercosul regional trade agreement introduced in 1995. The elimination of tariffs and lower transportation costs allowed increasing imports of milled rice from Uruguay and Argentina below the prevailing domestic prices. During the period of 1994/1999, the government attempted to offset the trend of declining rice prices with high minimum prices to support the income of rice producers. But this proved to be inconsistent with free trade within Mercosul, and was discontinued. During the past decade imports of rice have accounted for around 10 percent of domestic consumption. Unlike most of other grain crops, there has not been significant productivity growth in the rice sector.

Brazil is now a major world exporter of maize, largely for animal feed. It was an exporter up to the mid-1970s too, but then as domestic production of poultry and pigs expanded, maize exports were restricted and later banned in order to satisfy the domestic supply chain at cheap prices. These government interventions explain the taxation of maize even though it was an importable product in the period 1984-1993. With the establishment of Mercosul in 1995, cheap imports by the private sector in Brazil induced a major adjustment in maize production. Maize farmers were forced to adopt new technologies and reduce costs in order to remain competitive in domestic markets and abroad. Macroeconomic stabilization policies and fiscal deficit controls after 1994 brought a stop to government interventions. As production increased, the maize sector's performance was supported mainly by productivity growth. Exports of maize boomed after 2000.

The role of input price distortions

The above NRAs include the product price equivalent of input subsidies and taxes, which comprised two main forms: subsidized interest rates on production and marketing credit channeled to each product, and import tariffs on tradable inputs used by farmers (mainly fertilizer). The first distortion was a positive transfer to producers,⁸ the second a negative one. Empirically, the former outweighed the latter in all periods, so these input distortions made a positive contribution to the NRA estimates in Table 2.

Aggregate NRAs and relative rates of assistance

For covered farm products as a whole, the NRA averaged -19 percent in the 30 years to the mid-1990s, and since then has averaged 2 percent.⁹ The dispersion of rates around the mean value also has diminished in the past decade, suggesting there would be less welfare loss from the distortions to incentives within the agricultural sector (bottom of Table 2). For most products during the majority of years, farmers producing exportables faced negative rates of assistance while import-competing agriculture experienced positive or at least less negative

⁸ The re-scheduling of farm debt had an especially important impact on estimated values of credit subsidies. The rise in protection after 2000 can also be explained by the additional rescheduling of the farm debt in 2001. We use the OECD's estimates of credit subsidies for 1995 to 2005.

⁹ This average of almost zero since 1995 is close to the average obtained by the OECD (2007) when its PSE is expressed as an NRA (that is, in terms of the impact as a percentage of production valued at undistorted rather than distorted prices). As the last four columns of Table 1 show, it is only in beef, coffee, cotton and rice that our NRAs are a little above the OECD's. Differences in these estimates can be attributed partly to methodological differences: our study measures prices at the wholesale level, while OECD measures them at the farm level.

rates of assistance. For the farm sector overall, Figure 4 shows the average NRA was negative in most periods but it has become slightly positive in the past decade.

Following the OECD, we assume the NRA for non-covered products is the same as the average for covered products (row 2 of Table 3). We then adjust for policies that are not product-specific, such as federal government expenditures on research, extension, rural education, sanitary and phytosanitary inspection, and public stockholding (row 4 of Table 3). That provides an NRA for all agriculture. Since we assume all farm products are tradable, this is also the average for tradable agriculture (row 6 of Table 3).

The NRA for tradable agriculture can be compared with the average NRA for non-agricultural industries producing tradables. The latter has been estimated by dividing up each of the non-farm sectors into exportable, nontradable and import-competing sub-sectors. Those sectors include non-agricultural primary products, highly processed food, non-food manufactures, and the service sector. Their average NRA is estimated directly from information on import tariffs in the case of import-competing tradables. Prices of exportables and nontradables in non-farm sectors are assumed to be undistorted, including for the whole of the service sector. Those NRAs are summarized in row 7 of Table 3. The rate of assistance to all non-agricultural tradables averaged a little over 30 percent in the 1970s and 1980s, but it has gradually fallen since the reforms began and is now only 5 percent and in the present decade to date. This is illustrated in Figure 5, together with the trend in the average NRA for agricultural tradables and the relative rate of assistance (RRA, derived from those two NRAs, as described in footnote d of Table 3). It shows that, relative to other sectors, the taxing of agriculture was sustained at more than 40 percent in the 1970s and most of the 1980s, but during the past two decades the RRA has gradually become less negative and in the past few years has been close to zero, since the NRA for agriculture is now similar that for non-agricultural tradables at about 4 or 5 percent.

Consumer tax equivalents

Average levels of taxation of food consumers, as measured by the percentage by which domestic prices exceed those at the border (the CTE), are shown on Table 4. The patterns in the estimates are similar to those for the NRAs. Apart from wheat these are mostly negative prior to the mid-1990s, indicating that consumers were being subsidized. This was provided mostly at the expense of producers rather than taxpayers. Then from 1995 the CTEs become

basically zero apart from rice (because of the occasional support via import restrictions to encourage domestic production).¹⁰

Conclusions

The results of this study indicate rapidly decline since the early 1990s in the price distortions that for so long had discriminated against Brazilian agriculture and favored the country's net buyers of food. In particular, the NRA and CTE estimates after 1995 are negligible for most of the exportables, indicating a high degree of integration of the most competitive parts of the farm sector into world markets. Subsidized credit also has been phased down, with credit lines being re-scheduled and the financing of agriculture gradually moving to market rates. Even though import-competing crops still have some degree of protection in place, the reforms are dramatic – and can be credited with having contributed to the recent spectacular boom in Brazil's farm exports.

In terms of MPP and the benefits granted through state-owned companies and marketing boards, reduced spending along these lines is now part of the new fiscal discipline. Agricultural policy changes contributed to fiscal discipline and economic stabilization, and the sector in turn has benefited from macroeconomic stability. Even the lowering of agricultural tariffs during the unilateral tariff reform period did not damage the agricultural sector as expected. On the contrary, it led to a quick response on the part of farmers in terms of expanded investments and higher productivity. Together with other reforms, lower tariffs boosted Brazilian agricultural competitiveness.

The reduction of industrial tariffs also had an important impact in terms of the alleviation of the implicit taxation of agriculture. As is clear from Figure 5, the upward convergence of the relative rate of assistance line to the zero axis is as much due to declines in non-agricultural assistance as to declines in agricultural taxation. The reductions meant productive factors were re-allocated to activities in which Brazil has a stronger comparative

¹⁰ The OECD (2007) reports CTEs as zero during 2000-05 for all of these except rice, for which their estimated CTE is 18 percent compared with our 16 percent. Our CTE results for that period need to be interpreted with caution, due to the extreme volatility of the exchange rate. The volatility, which peaked in 2003, has been attributed to the economy-wide perceived risk and uncertainty leading up to the election (which resulted in a member of the Labor Party (Lula da Silva) taking the presidency).

advantage. The consequent gains in overall efficiency have placed Brazil among the world's leading exporters of farm products.

In short, as a result of the trade and agricultural policy reforms of the early 1990s, Brazilian agriculture enjoyed a far more favorable environment for growth. Both exports and imports were freed from government interventions, as import tariffs were reduced to very low levels. Administrative controls on imports and exports also were eliminated. These factors stimulated a major process of adjustment in the agricultural sector. The new environment of trade liberalization and direct competition from Mercosul member countries forced the farm sector to adopt new technologies, to improve management practices and invest in large scale operations. Government support to agriculture declined and remains very low, although there is selective protection to low-income family farms. With favorable commodity prices on international markets, agriculture has experienced a period of high growth rates particularly since 2000. With inflation under control, the government's need to impose restriction on farm exports has dissolved. The urban bias in sector growth is changing and for the first time agricultural growth has been leading the country's overall growth.

Where to now?

These changes are putting in place a new Brazilian agricultural sector which is quite different from what prevailed in the past. Prices declined in 2005 to levels more aligned with the long run trends for soybeans, maize, wheat and cotton, but they have risen again in 2007. Brazilian farmers, particularly those located on the new agricultural frontiers, have and will again face hardships when world prices fall.

To be even more competitive on world markets, a large share of Brazilian agriculture could benefit from investments in roads, railways, ports and logistics. At present, producers in the Center-West frontier are faced with pressures to change the crop mix towards activities less handicapped by poor infrastructure.

Stagnant domestic consumption (in the 1980s and 1990s) associated with slow economic growth channeled most of the increased agricultural output to foreign markets, producing a sharp increase in agricultural exports. Whether this continues will depend in part on domestic income growth among lower-income groups. Recent improvements in income

distribution suggest good prospects for domestic consumption of food if Government social programs can be sustained in the future.

Future growth also depends on the ability of the Brazilian government to bring the exchange rate to levels consistent with long run equilibrium rates, given the important role of this variable in the incentives and disincentives to agriculture. After the successful stabilization program brought about by the Real Plan (1994) inflation was brought under control (to less 5 percent a year), but the exchange rate varied in the range of R\$0.86 to R\$3.90 per dollar until 2004. After 2005, the value of the real exchange rate increased, again reaching levels below R\$2.00/US\$. These wide fluctuations have imposed wide variations on the export revenue of tradable sectors. To consolidate agricultural growth in the future, it will be crucial to have stable economic fundamentals, particularly the exchange rate.

The most important factors limiting future growth of Brazil's agriculture are: a strong real exchange rate; farm debt; the high costs of transportation and a lack of adequate infrastructure; the high cost of inputs (compared to costs in the neighboring Mercosul countries) due to remaining protection of the domestic input industry; and relatively high interest rates. The high prevailing interest rates are related to macroeconomic policy and result from inadequate control over fiscal spending. This reduces the supply of credit and is a strong constraint to further investments in the near future.

The so-called low-income problem of agriculture remains a critical issue, and may worsen as modernization of large-scale agriculture requires capital investments that tend to leave behind traditional and subsistence farmers. In order to facilitate the process of trade liberalization and to reduce the impact of the income problem in subsistence agriculture, some support targeted at poor rural households could be warranted. Indeed a substantial share of government spending is now going into this area.

Brazilian future agricultural growth is increasingly dependent on the elimination of distortions and trade barriers in international markets – something that the Doha Round of multilateral trade negotiations could deliver if the Round could be resuscitated.¹¹ Brazil would benefit more than almost any other country if global agricultural trade was liberalized (Anderson and Martin 2006, Ch. 12) and the poor in almost every province would be among the gainers (Hertel and Winters 2006, Ch. 7).

¹¹ For the role of restrictions to market access faced by Brazilian exporters in foreign markets see, for example, OECD (2005) and Lopes *et al.* (2006).

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Table 1: Key economic indicators, Brazil, 1970 to 2004

	1970-75	1976-80	1981-85	1986-93	1994-99	2000-04
Population (million)	102	116	130	148	165	179
Rural share of population (%)	42	36	31	26	21	18
GDP per capita (current US\$)	740	1700	1820	2570	4200	3000
Agric. share of GDP (%)	12.8	12.3	10.7	8.9	8.5	9.0
Arable land (million ha)	29	44	47	51	57	59
Agr value added/worker (\$US)	510	1240	1320	1880	3550	2390
Agricultural exports (US\$ m.)	391	441	773	1049	1939	2910
Agricultural imports (US\$ m.)	326	305	372	528	476	337

Source: World Bank (2007).

Table 2: Nominal rates of assistance to covered products,^f Brazil, 1966 to 2005

	(percent)								OECD results ^a	
	Author's results								1995-99	2000-04
	1966-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-05		
Exportables	-8.4	-33.2	-30.0	-31.5	-29.5	-18.2	0.4	1.3	na	na
Beef	n.a.	n.a.	n.a.	15.3	2.7	-24.3	4.4	3.1	0.0	0.0
Coffee	n.a.	n.a.	n.a.	-47.6	-25.0	11.2	6.8	6.3	0.1	0.1
Cotton	-8.6	-0.2	-17.2	-20.5	-28.9	n.ap.	n.ap.	10.4	2.2	5.6
Maize ^b	-9.0	0.2	-2.6	-1.8	n.ap.	n.ap.	n.ap.	1.7	5.1	5.8
Pigmeat ^c	n.a.	n.a.	n.a.	n.ap.	n.ap.	13.2	1.4	1.0	0.0	0.0
Poultry	n.a.	n.a.	n.a.	-8.2	-13.7	-13.2	1.0	2.3	0.0	0.0
Soybeans	0.0	-4.7	-15.6	-11.8	-20.8	-10.5	-1.2	-2.5	0.1	0.0
Sugar	n.a.	-65.8	-52.4	-63.7	-55.3	-42.4	-10.3	1.7	-25.6	0.0
Import-competing products	41.4	26.6*	-1.9	-6.8	-22.5	-17.2	8.3	12.0	na	na
Maize ^b	n.ap.	n.ap.	-26.0	-39.9	-33.9	-22.9	4.0	n.ap.	5.1	5.8
Cotton	n.ap.	n.ap.	n.ap.	n.ap.	n.ap.	-16.6	6.5	n.ap.		
Pigmeat ^c	n.a.	n.a.	n.a.	0.6	-19.3	n.ap.	n.ap.	n.ap.	0.0	0.0
Rice	n.a.	7.8	-11.1	-0.9	3.8	5.1	17.2	16.6	8.4	3.1
Wheat	41.4	20.0	65.8	41.6	-5.8	5.1	8.2	0.3	3.1	1.4
Total of covered products	-6.1	-27.3	-23.3	-28.0	-27.6	-18.0	1.8	2.1	-2.0	1.2
Dispersion of covered products ^d	28.1	37.2	41.0	35.9	25.5	27.4	8.5	7.6	11.7	5.2
% coverage (at undistorted prices)	33	69	69	71	64	64	71	75	73	77

^a OECD NRA defined as 100*(NPC-1).

^b Maize classified as exportable up to 1977, in 1982-83 and from 2001, and import-competing in other years.

^c Pigmeat classified as import-competing on 1982-89 and exportable on 1990-2005.

^d Dispersion is a simple 5-year average of the annual standard deviation around the weighted mean of NRAs of covered products.

^e NRA import-competing in 1970-74 includes rice only for 1973 and 1974.

^f n.a. = data not available; n.ap. = not applicable (because shown elsewhere in the table with the opposite trade status)

Source: Authors' spreadsheet and OECD (2007).

Table 3: Nominal rates of assistance to agricultural relative to non-agricultural industries, Brazil, 1966 to 2005

(percent)

	1966-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-05
Covered products ^a	-6.1	-27.3	-23.3	-28.0	-27.6	-18.0	1.8	2.1
Non-covered products	-6.1	-27.3	-23.3	-28.0	-27.6	-18.0	1.8	2.1
Non-product-specific (NPS) assistance	-6.1	-27.3	-23.3	-28.0	-27.6	-18.0	1.8	2.1
Total agricultural NRA (incl. NPS)^b	-6.1	-27.3	-23.3	-25.7	-21.1	-11.3	8.0	4.1
Trade bias index ^c	-0.35	-0.47	-0.27	-0.21	-0.09	-0.01	-0.07	-0.09
<i>Assistance to just tradables:</i>								
All agricultural tradables ^b	-6.1	-27.3	-23.3	-25.7	-21.1	-11.3	8.0	4.1
All non-agricultural tradables	n.a.	34.7	35.7	33.6	29.6	8.3	7.8	5.1
Relative rate of assistance, RRA^d	n.a.	-46.1	-43.5	-44.4	-39.1	-17.9	0.2	-0.9

^a NRAs including product-specific input subsidies.

^b NRAs including product-specific input subsidies and non-product-specific (NPS) assistance. Total of assistance to primary factors and intermediate inputs divided to total value of primary agriculture production at undistorted prices (%).

^c Trade Bias Index is $TBI = (1 + NRA_{agx}/100)/(1 + NRA_{agm}/100) - 1$, where NRA_{agm} and NRA_{agx} are the average percentage NRAs for the import-competing and exportable parts of the agricultural sector.

^d The RRA is defined as $100 * [(100 + NRA_{agt}) / (100 + NRA_{nonagt}) - 1]$, where NRA_{agt} and NRA_{nonagt} are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

Source: Authors' spreadsheet

Table 4: Consumer tax equivalent, by product, Brazil, 1970 to 2005

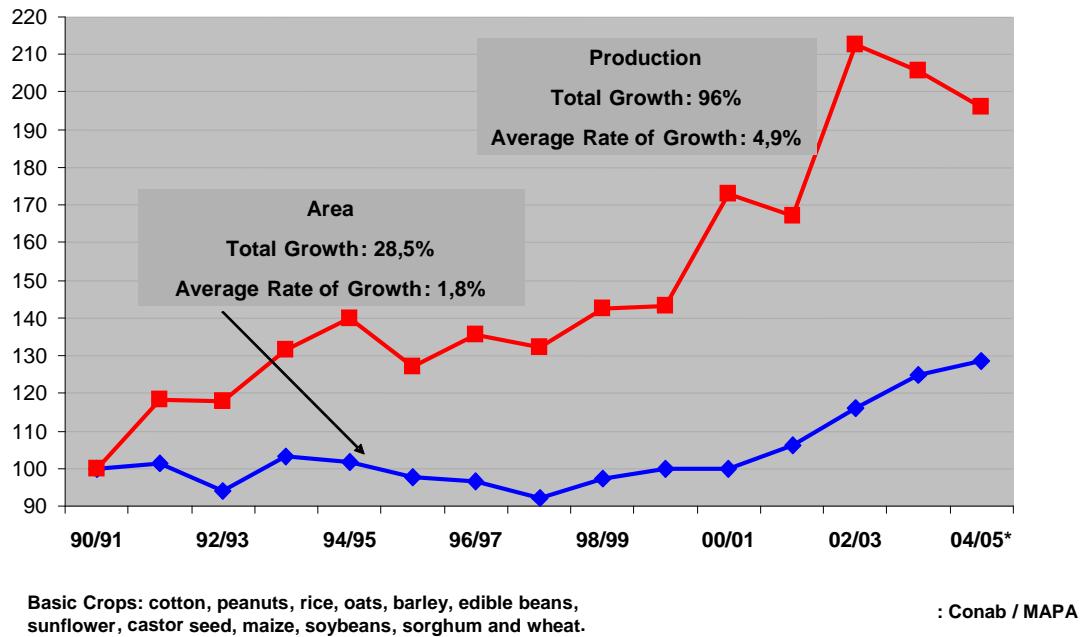
(percent)

	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-05
Rice	n.a.	0	-7	6	-3	9	16
Wheat	20	66	38	1	0	-5	-5
Maize	0	-12	-29	-28	-27	-5	0
Soybean	-11	-21	-21	-24	-28	3	3
Sugar	-62	-47	-65	-52	-44	-13	3
Beef	n.a.	n.a.	11	11	-29	3	2
Poultry	n.a.	n.a.	-13	-10	-18	0	1
Pig meat	n.a.	n.a.	n.a.	-16	9	0	0

Source: Authors' spreadsheet

Figure 1: Crop area, production and yield growth, Brazil, 1991 to 2005

(a) Area and production



(b) Yield per hectare (kg)

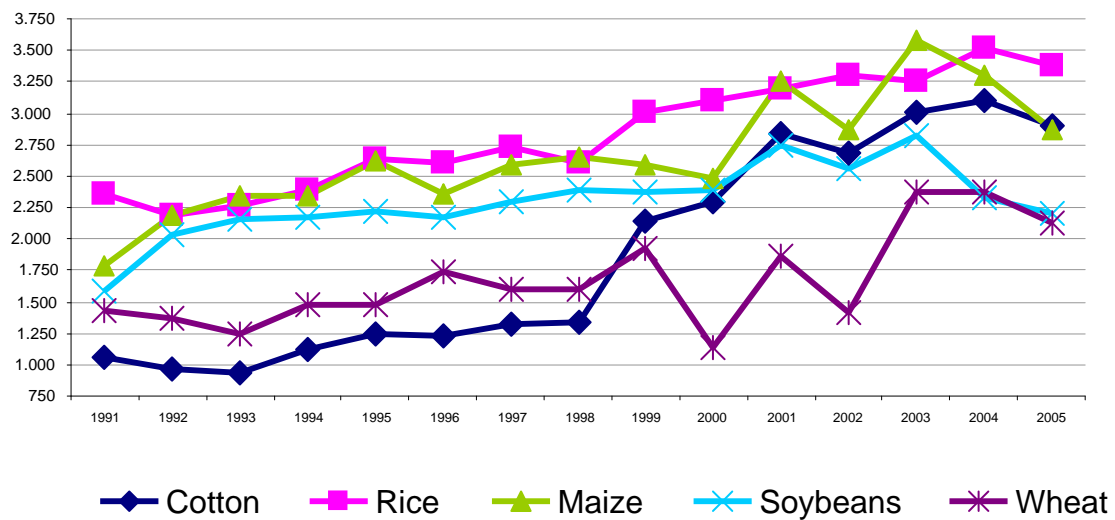


Figure 2: Meat production growth, Brazil, 1994 to 2005

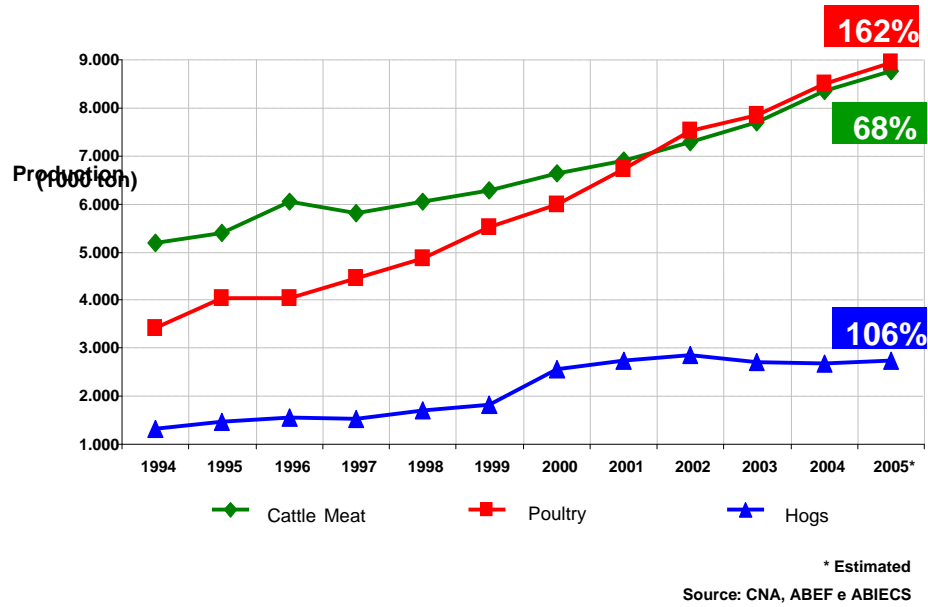
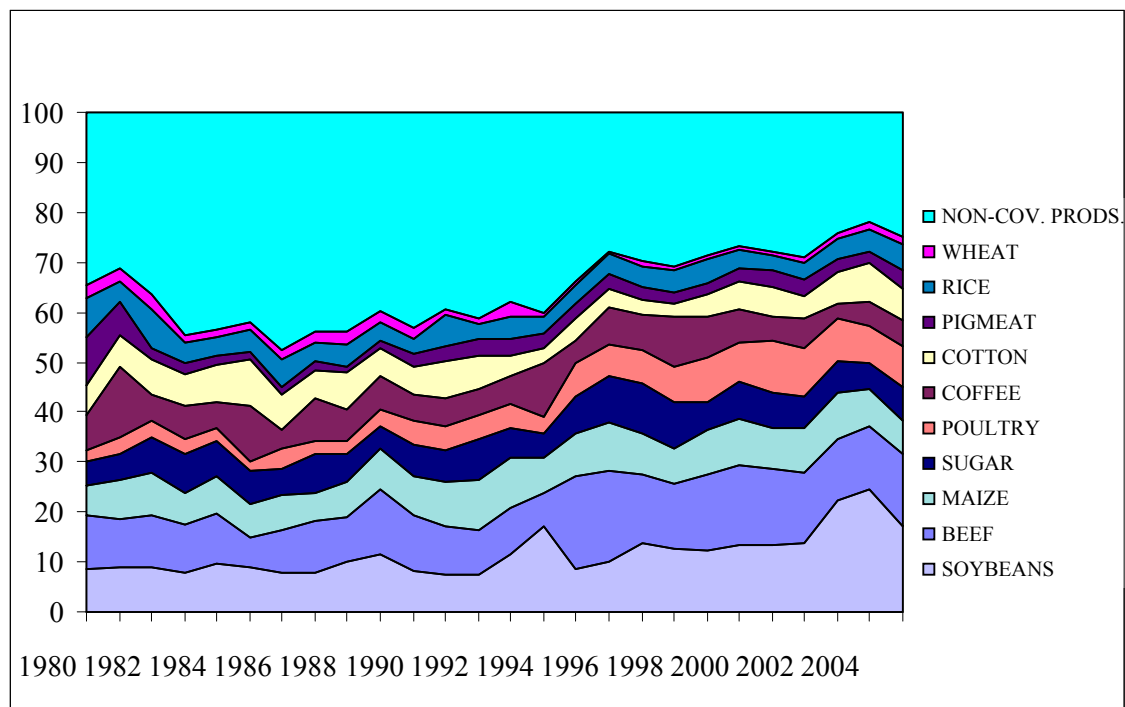


Figure 3: Shares of gross values of farm production at distorted prices, selected products, Brazil, 1980 to 2005

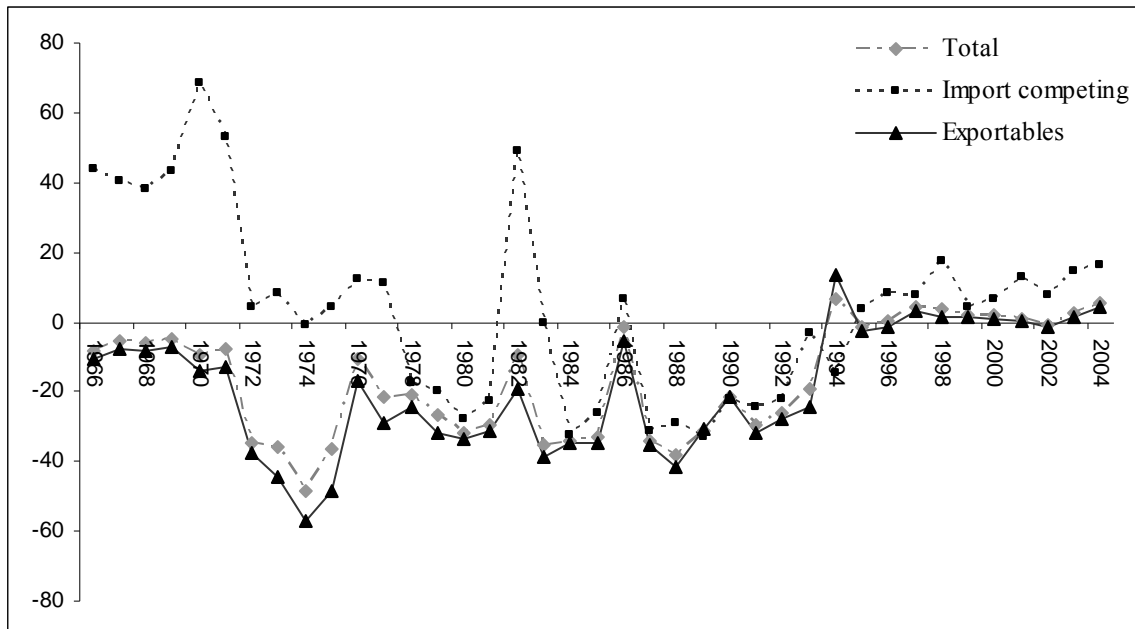
(percent)



Source: Authors' spreadsheet

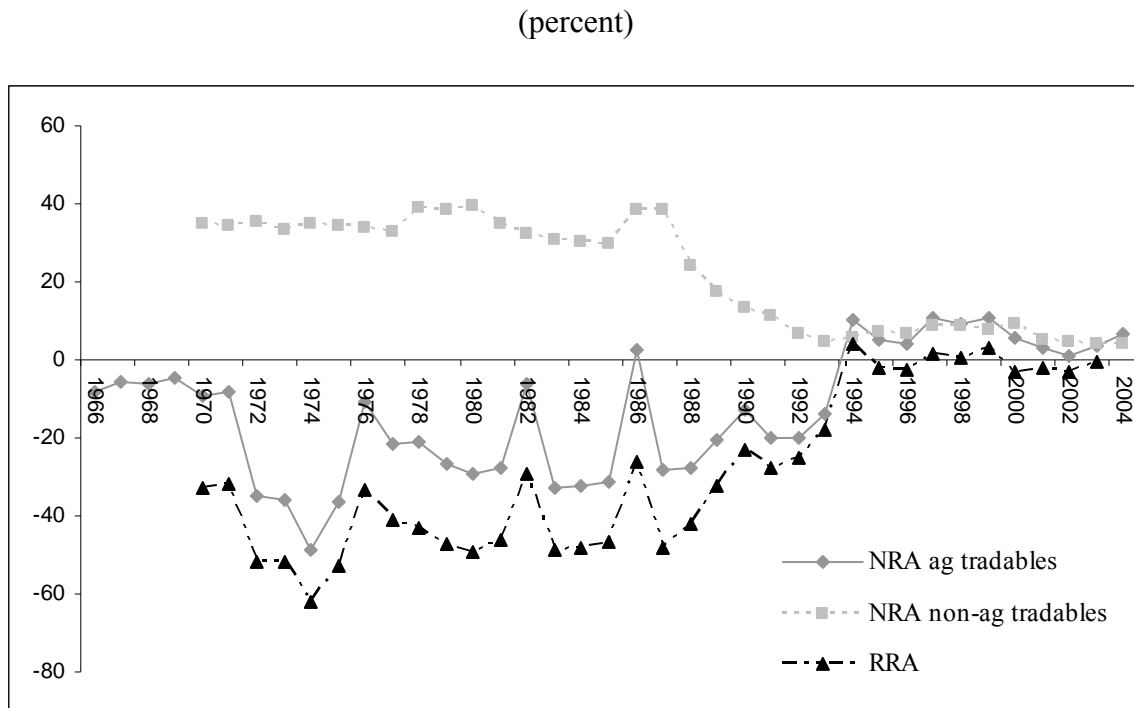
Figure 4: Nominal rates of assistance to exportable, import-competing and all covered products, Brazil, 1966 to 2004

(percent)



Source: Authors' spreadsheet

Figure 5: Nominal rates of assistance to all non-agricultural tradables, all agricultural tradable industries, and relative rates of assistance^a, Brazil, 1966 to 2004



^a The RRA is defined as $100 \cdot [(100 + \text{NRA}_{\text{ag}}^t) / (100 + \text{NRA}_{\text{non-ag}}^t) - 1]$, where NRA_{ag}^t and $\text{NRA}_{\text{non-ag}}^t$ are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

Source: Authors' spreadsheet

Appendix: Sources of data

Below are the details of the sources of the data that appear in the spreadsheet used to calculate the NRAs and RRAs reported above (Lopes et al. 2008). The acronyms used are summarized in the last page of this Appendix. The numbered 'lines' refer to the rows in the Excel spreadsheet.

PART 1: SPECIFIC DATA FOR GENERIC SPREADSHEET

Wheat

Part 1: Quantities

Primary Good

Line 3 - Crop Area: CFP/IBGE covers the periods 1970-1987 and IBGE/PAM covers the period 1990-2005; the period 1988-1989 was calculated by the formula *Production/Yield* (CONAB).

Line 4 - Production: FAOSTAT covers the period 1970-1986; CONAB (Supply and Disappearance) covers the period 1987-2005.

Line 5 to line 7 - Imports, Exports and Change in Stocks: FAOSTAT covers the period 1970-1986 and CONAB (Supply and Disappearance) the period 1987-2005.

Line 8 to line 9 - Own input use (feed or seed): FAOSTAT covers the period 1970-2005.

Line 10 - Input into food processing: Author's estimate. Domestic Utilization (Production + Imports – Exports – Change in stocks) minus Input Use (Feed and Seed).

Line 11 - Input into industrial use: ZERO. Production remains on farm to seed or feed uses or is processed to wheat flour.

Line 12 - Domestic final consumption of primary product: Wheat is not consumed as primary.

Processed Good

Line 15 - Conversion Factor: Information from ABITRIGO: 1 ton of wheat yields 0.75 ton of wheat flour.

Line 16 and line 17 - Exports and Imports: ALICEWEB covers the period 1989-2004

Line 18 - Change in Stocks: Assumed ZERO by the authors. No data available.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W): For the period, 1996-2001, SEAB data. For periods 1970-1996 and 2002-2005: $P_W = P_1 \times 1,11$, where: P_1 = Producer Price from CONAB, and 1,11 is the average of P_W/P_1 , relative to 1996-2001.

Line 21 - Wholesale price for processed good (P_{WP}): For the period, 1997-2004, IEA data. For periods 1970-1996 and 2005: $P_{WP} = P_1 \times 2,05$, where: P_1 = Producer Price from CONAB, and 2,05 = is the average of P_W/P_1 , relative to 1997-2004.

Part 3: International Variables

Line 37 - Primary good. CIF import price (P_M): CONAB (Hard Red Winter Number 2 – 645) (1970 – 2005), plus the costs to wholesale in Sao Paulo (International Costs + Wholesale costs) from CIF Price Equivalent (Source: World Bank, 1989).; the data has been completed for the period 1989-2005 with author's estimates using the same proportions for the period 1970-1988.. This source covers the period 1970-2005.

Line 44 - Processed good. CIF import price (P_{MP}): ALICEWEB (Wheat Flour from Argentinean Ports). Average price = Total Value of Imported Wheat / Total Quantity of Imported Wheat, plus costs to Wholesale in Sao Paulo (International Costs + Wholesale costs) from CIF Price Equivalent (Source: World Bank, 1989). The data series have been completed for the period 1989-2005 with author's estimates using the same proportions for the period 1970-1988. This source covers the period 1989-2005.

Rice

Part 1: Quantities

Primary Good

Line 3 - Crop Area: FAOSTAT for 1975 and 1976. CONAB Time series data for harvested area, for the period 1977-2005.

Line 4, 5, 6 and 7 - Production, Imports, Exports and Change in Stocks: FAOSTAT covers the period 1975-1979; ALIMANDRO et al (2001) covers the period 1996-1999; CONAB (supply and disappearance tables) covers the periods 1981-1995 and 2000-2005.

Line 8 to line - Own input use (feed or seed): Not mentioned in the CONAB supply and disappearance tables. It is assumed to be zero.

Line 10 - Input into food processing: All paddy rice is processed to produce milled rice

Line 1 - Input into industrial use: Not mentioned in the CONAB supply and disappearance tables. It is assumed to be zero.

Line 12 - Domestic final consumption of primary product: Rice is not consumed as primary.

Processed Good

Line 15 - Conversion Factor: Information from IRGA: 1 ton of paddy rice yields 0.68 ton of milled rice.

Line 16 and line 17 - Exports and Imports: ALIMANDRO et al (2001) covers the period 1980-2001; IRGA covers the period 2002-2005.

Line 18 - Change in Stocks: ALIMANDRO et al (2001) 1980-2001; author's estimates 2002-2005.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W): Price Received by Farmers (CONAB), plus freight to Pelotas (CIF Equivalent Price from ARAÚJO, 1997) completed with author's estimates using the same proportions for the periods 1970-1982, plus other costs to processor

(CIF Equivalent Price from ARAÚJO, 1997) completed with author's estimates using the same proportions for the periods 1970-1982. This source covers the period 1975-2005.

For the period 1992-2004 an annual growth rate equivalent to the prices of FAOSTAT was applied. This was the only possible process to circumvent the problems of frequent changes in currency and high inflation rates.

Line 21 - Wholesale price for processed good (P_{WP}): IRGA (wholesale prices in SP) covers the period 1975-2005. For the period 1992-1994 it was applied an annual growth rate equivalent to the prices of FAOSTAT. This was the only possible process to circumvent the problems of frequent changes in currency and high inflation rates.

Part 3: International Variables

Line 44 - Processed good. CIF import price (P_{MP}): Price at Brazilian Port (CIF Equivalent Price, from ARAÚJO, 1997) completed with Author's Estimates using the same margins for the periods 1970-1982 and 1993-2005, plus costs to wholesale (CIF Equivalent Price, from ARAÚJO, 1997) completed with author's estimates using the same proportions for the periods 1970-1982 and 1993-2005. This source covers the period 1975-2005.

Maize

Part 1: Quantities

Primary Good

Lines 3 - Crop Area: For the period 1977-2005, CONAB (time series of harvested area). FAOSTAT for 1975 and 1976.

Lines 4, 5, 6 and 7 - Production, Imports, Exports and Change in Stocks: CONAB (Disappearance and Supply) for the period 1981-2005. From 1970 to 1980, FAOSTAT.

Line 8 - Own input use (feed): Author's estimates: Domestic Utilization 10%.

Line 9 - Own input use (seed): Author's estimates: Domestic Utilization 75%.

Line 10 - Input into food processing: Author's estimates: Domestic Utilization 15%.

Lines 11 and 12 - Input into industrial use and domestic final consumption of primary product: Author's estimates: Domestic Utilization 0%.

Processed Good

There is no processed good

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W): From 1970 to 1981, ANUÁRIO ESTATÍSTICO CFP (yellow corn). For the period 1982-89, SIMA. And, Author's estimates for 1990 and 1991. For the period 1992-1994 it was applied an annual growth rate equivalent to the prices of FAOSTAT. For the period 1995-2005, IEA (Yellow Corn, CIF Campinas).

Part 3: International Variables

Line 37 - Primary Product: CIF import price (P_M). CIF Price Equivalent: 1970-1977, and 1982-1983.

Line 38 - Primary Product: FOB Export Price (P_X): FOB Price Equivalent: 1978 –1981, and 1984-2000. For the period 2001-2005, ALICEWEB: Average price = Total Value of Exported Maize/Total Quantity of Exported Maize .

Pigs

Part 1: Quantities

Primary Good

Line 4 - Production: PINAZZA, 2001, for the period 1980-1999 and ABIPECS Report, from 2000 to 2005.

Line 5 to line 7 - Imports, Exports and Change in Stocks: Zero: live animals are not traded.

Line 8 to line 9 - Own input use (feed or seed): Zero: all the primary production is processed.

Line 10 - Input into food processing: The same as Production (Line 4), since all primary production is processed.

Line 11 - Input into industrial use: Zero: all the primary production is processed.

Line 12 - Domestic final consumption of primary product: Zero: all the primary production is processed.

Processed Good

Line 15 - Conversion Factor: (Live Animal to Half-Carcass). Information from CONAB.

Line 16 and line 17 - Exports and Imports: PINAZZA, 2001, for the period 1980-1999 and ABIPECS Report from 2000 to 2005.

Line 18 - Change in Stocks: Assumed ZERO by the authors.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W): since there is no wholesale market for this product, it is considered: $P_W = P_{WP} \times \text{conversion factor}$.

Line 21 - Wholesale price for processed good (P_{WP}): SIMA: unclassified and half carcass at São Paulo's market. For the period: Chilled Half Carcass: IEA for the period 1995-2005.

Part 3: International Variables

Line 44 - Processed good: CIF import price (P_{MP}). ALICEWEB. Average price = Total Value of Imported Carcass and Half carcass of Pig Meat Frozen/Total Quantity of Imported Carcass and Half Carcass of Pig Meat, frozen. This source covers the period 1989-2005. For the remaining years, FOB price equivalent.

Line 45 - Processed good: FOB export price (P_{XP}): ALICEWEB. Average price = Total Value of Exported Carcass and Half Carcass of Pig Meat Frozen/Total Quantity of Exported Carcass and Half Carcass of Pig Meat, frozen. This source covers the period 1989-2005. For the remaining years, FOB price equivalent.

Soybeans

Part 1: Quantities

Primary Good

Line 3 to line 5 - Crop Area, Production and Imports: Data from IBGE for the period 1995-1980. From 1981 to 2005, data from CONAB. Crop Area: time series data on harvested area. Production and Imports: “Disappearance and Supply Tables” from CONAB.

Line 6 to line 7 - Exports and Change in Stocks: FAOSTAT for the period 1961-1980.

For the period 1981-2005, CONAB “Disappearance and Supply” Tables.

Line 8 - Own input use (feed): FAOSTAT, from 1961 to 1980. For the remaining years: assumed to be zero. No data available.

Line 9 - Own input use (seed): FAOSTAT for the period 1961-1993. For the period 1994-2005, ABIOVE.

Line 10 - Input into food processing: FAOSTAT for the period 1961-1980. For the period 1981-2005, CONAB.

Line 11 - Input into industrial use: CONAB and ABIOVE.

Line 12 - Domestic final consumption of primary product: Data from FAOSTAT for the period 1961-1980. From 1981-2004, CONAB.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W). Wholesale price, Word Bank (1990), from 1970 to 1978. Bolsa de Cereais – São Paulo, for the period 1979-2005.

Line 21 - Wholesale price for processed good (P_{WP}). São Paulo Commodity Exchange for the period 1980-1988. For the period 1989-2005, ABIOVE.

Part 3: International Variables

Line 38 - Primary good: FOB export price (P_X). FOB Price Equivalent at wholesale level, from 1970 to 1988, World Bank (1990), and ABIOVE, FOB prices minus the margin from port to wholesale, for the period 1989-2005. Margin, Araújo (1998).

Line 45 - Processed good: FOB export price (P_{XP}). For the period 1970-1984, data from BRANDAO and CARVALHO (1991). From 1989 to 2005, ABIOVE.

Cotton

Part 1: Quantities

Primary Good

Line 3 to line 4 - Crop Area and Production: Data from IBGE for the period 1955-1976. From 1977 to 2005, data from CONAB.

Line 5 – Imports: Data from CFP for the period 1955-1976. From 1977 to 2005, data from CONAB.

Line 6 – Exports: From 1955 to 1959, data from CFP. For the period 1960-1976, data from CACEX. For the remaining years, CONAB.

Line 7 - Change in Stocks: Data from CONAB.

Line 8 - Own input use (feed): Author's estimates: Domestic Utilization 0%.

Line 9 - Own input use (seed): Author's estimates: Domestic Utilization 0%.

Line 10 - Input into food processing: Author's estimates: Domestic Utilization 0%.

Line 11 - Input into industrial use: Author's estimates: Domestic Utilization 100%.

Line 12 - Domestic final consumption of primary product: Author's estimates: Domestic Utilization 0%.

Processed Good

Line 15, 16, 17 and 18 - Conversion Factor, Imports, Exports and Change in Stocks. The product isn't processed.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W): From 1960 to 1991, data from CFP.

For the period 1992-1994 it was applied an annual growth rate equivalent to the prices of FAOSTAT.

Line 21 - Wholesale price for processed good (P_{WP}). The product isn't processed.

Part 3: International Variables

Line 37 - Primary good: CIF import price (P_M). CIF Price Equivalent from 1970 to 1999.

Line 38 - Primary good: FOB export price (P_X): ALICEWEB, Average price = Total Value of Exported Cotton Lint/Total Quantity of Exported Cotton Lint. This source covers the period 2000-2005.

Poultry

Part 1: Quantities

Primary Good

Line 4 - Production. Data from PINAZZA (2001), for the period 1980-2000. For the period 2001-2005, APA.

Line 5 to line 7 - Imports, Exports and Change in Stocks: zero. Live animals are not traded.

Line 8 and line 9 - Input use (feed and seed): zero. All primary product is processed.

Line 10 - Input into food processing. The same as Production (Line 4), once all primary production is processed.

Line 11 and 12 - Input into industrial use and Domestic final consumption of primary product: zero. All primary product is processed

Processed Good

Line 15 - Conversion Factor. Data from CONAB.

Line 16 and line 17 - Imports and Exports: Data from PINAZZA (2001), for the period 1980-2000. For the period of 2001-2005, APA.

Line 18 - Change in Stocks. There are no stocks.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W). Since there is no wholesale market, it is considered: $P_W = P_{WP} \times \text{conversion factor}$.

Line 21 - Wholesale price for processed good (P_{WP}). Data from SIMA for the period 1980-1988. For the period 1991-2004 it was applied an annual growth rate equivalent to the prices of FAOSTAT

Part 3: International Variables

Line 45 - Processed good: FOB export price (P_X): FOB Price Equivalent from 1980 to 1989. For the remaining years: ALICEWEB, average price = Total Value of Exports / Total Quantity of Exports.

Live Cattle

Part 1: Quantities

Primary Good

Line 4 – Production: Data from PINAZZA (2001), for the period 1980-2000. For the period 2001-2005, ABIEC.

Line 5 to line 7 - Imports, Exports and Change in Stocks: zero. Live animals are not traded.

Line 8 and line 9 - Input use (feed and seed). Zero. All the primary production is processed.

Line 10 - Input into food processing: The same as Production (Line 4), since all primary production is processed.

Line 11 and 12 - Input into industrial use and domestic final consumption of primary product: zero. All primary production is processed.

Processed Good

Line 15 - Conversion Factor: Data from CONAB

Line 16 and line 17 - Imports and Exports: Data from PINAZZA (2001) for the period 1980-2000. For the period 2001-2005, ABIEC.

Line 18 - Change in Stocks: There is no reliable data on stocks.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W): Since there is no wholesale market, it is considered: $P_W = P_{WP} \times \text{conversion factor}$.

Line 21 - Wholesale price for the processed product (P_{WP}): For the period 1980-1991 prices were constructed or estimated according to the following steps: $PW = \{[(Pd + Pt)/2] \times 0,8\} / 0,79 \times 1,05$, where: Pd = Wholesale Price of the front part of half carcass from SIMA/IEA; Pt = Wholesale Price of the back part of half carcass from SIMA/IEA ; 0,8 - Ratio between average prices at wholesale of SIMA and IEA, and wholesale prices of half carcass by CEPEA in years which were coincident (1999-2004); Marketing margin used to make possible to compare the price constructed as above. 0,79 = conversion factor which refers to the gain in weight when met is processed as boneless. 1,05 - conversion factor refers to the mean price difference between back part and frozen part. For the period 1992-1994 it was applied an annual growth rate equivalent to the prices of FAOSTAT. So far everything was done to make the prices at wholesale compatible to the FOB price, for meat frozen and chilled, which are the two types of meat usually exported.

Part 3: International Variables

Line 45 - Processed good: FOB export price (P_{XP}). FOB Price Equivalent from 1980 to 1989. For the period 1990-2005: ALICEWEB, average price = Total Value of Exported Carcass and Half Carcass / Total Quantity of Exported Carcass and Half Carcass

Sugar

Part 1: Quantities

Primary Good

Line 3 and line 4 - Crop Area and Production: Data from PINAZZA (2001), for the period 1980-1998. For the period 1999-2005, UNICA.

Line 5 to line 7 - Imports, Exports and Change in Stocks: zero. Sugar cane is not traded.

Line 8 and line 9 - Input use (feed and seed): zero. All the primary product is processed.

Line 10 - Input into food processing: Data for sugar production, PINAZZA (2001).

Line 11 - Input into industrial use: Data for alcohol production, from PINAZZA (2001)

Line 12 - Domestic final consumption of primary product: zero. All primary production is processed.

Processed Good

Line 15 - Conversion Factor: Data from sugar industry: 1 ton of sugar cane, when processed to sugar, yields 120,4 kg of processed sugar and 11 liters of anhydrous alcohol.

Line 16 - Imports: zero. No reliable data is available.

Line 17 - Exports: Data from PINAZZA (2001).

Line 18 - Change in Stocks: zero. No reliable data is available.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W). Data from FGV and SIFRECA. The wholesale price for sugar cane was estimated following the steps below: $P_W = P_p + \text{Freight}$ (From farm to the Port of Santos), where: P_W is the price of sugar at wholesale level; P_p is the price received by the farmer; Freight = The value of the freight from the interior in São Paulo state to the port of Santos. The marketing margin of 2006 was applied to prices received by farmers since 1970. This source covers the period 1970-2006. For the period 1992-1994 it was applied an annual growth rate equivalent to the prices of FAOSTAT.

Line 21 - Wholesale price for processed good (P_{WP}): For the period 1997-2005, CEPEA/ESALQ. Prices for Cristal Sugar + Freight from Araras to São Paulo. For the period 1992-1994 it was applied an annual growth rate equivalent to the prices of FAOSTAT. For the period 1970-2006, $P_{wp} = P_W \times 16,6$, where: 16,6 = average margin between the two prices for the period 1997-2005.

Part 3: International Variables

Line 45 - Processed good: FOB export price (P_{XP}): For the period 1970-1988, SUGAR REPORT (World Bank), 1989. For the remaining years: ALICEWEB. Average price = Total Value of Exported Cristal, demerara and mascavo prices/Total Quantity of Exported cristal, demerara and mascavo prices.

Coffee

Part 1: Quantities

Primary Good

Line 3 - Crop Area: Data from IBGE/PAM for the period 1990-2005.

Line 4 to Line 7 - Production, Imports, Exports and Change in Stocks: Data from CIC for the period 1975-2005.

Line 8 and line 12 - Input use (feed and seed), input into food processing, input into industrial use and domestic final consumption of primary product: it has not been filled. Only primary product.

Part 2: Domestic Variables

Line 20 - Wholesale price for primary good (P_W). Data from CEPEA/ESALQ and BM&F for the period 1992-2005. (Café Arábica Tipo 6, BC-Duro).

Part 3: International Variables

Line 38 - Primary good: FOB export price (P_X): $P_X = \text{NY Price} + \text{Freight} + \text{Port Operation Costs} + \text{Costs to Wholesale}$. FOB equivalent price for Freight, Port Operation Costs and Costs to Wholesale. Source: EMBRAPA.

PART 2: DATA FOR GENERIC SPREADSHEET

Line 57 - Primary good - Import tariff ($t_m < 0$ if a subsidy). Ministério do Desenvolvimento, Indústria e Comércio Exterior.

Line 59 - Processed goods - Import tariff ($t_{mp} < 0$ if a subsidy). Ministério do Desenvolvimento, Indústria e Comércio Exterior.

Line 63: Official exchange rate. Banco Central do Brasil: annual average.

Fertilizers

Line 74 - Share in value of production of this primary good. CONAB: Cost of Production.

Line 75 - Wholesale domestic price (P_{wn}) (only if tradable). CONAB.

Line 76 - Cif import price (P_{mn}) (only if tradable). Author's estimates.

Line 81 - Consumption tax ($c_t < 0$ if a subsidy). Secretaria da Receita Federal e Secretarias Receitas Estaduais.

Line 82 - Production subsidy ($s_n < 0$ if a tax) (only if non-tradable). Zero.

Line 83 - Proportion of distortions passed to farmers ($1 - \lambda_n$) (only if non-tradable). Default: 1.

Credit

Line 98 - Share in value of production of expenditure with credit. CONAB: Production costs.

Line 99 - Consumption tax ($c_t < 0$ if a subsidy). CPMF - Contribuição Provisória sobre Movimentação Financeira. A tax rate of 0,38% over all financial operations.

Line 100 - Production subsidy ($s_n < 0$ if a tax). Ratio between the government expenditure over the total value of the production. At each product level, from 1995 to 2004, OECD.

Line 101 - Proportion of distortions passed to farmers ($1 - \lambda_n$) (only if non-tradable). Default = 1.

PART 3: AGGREGATED AGRICULTURE

Value of Production and DRA of 30% Remaining Primary Agricultural Production

For the following lines, Line S7: Value of Production (Importable), Line S8: Value of Production (Exportable); Line S9: Value of Production (Non-tradable), there has been used the following sources:

Crops: value of the production of permanent crops and annual crops from the FGV databank, of IBRE/PAM, from 1990 to 2005. All products were classified as importables, exportables and non-tradables.

Livestock: value of production of the remaining products of livestock has been calculated, as quantity produced times prices in local currency. All remaining livestock products were considered non-tradables.

Line S10 to S12 - DRA guesstimate (Importable, Exportable and Non-tradable): Average Import Tariffs from SECEX/MDIC for importables. No distortion was considered for exportables and non-tradables.

Value of Hhld Consumption and CTE of 30% Remaining Primary Agricultural Production: no reliable data was available.

Value of Hhld Consumption and CTE of 30% Remaining Lightly Processed Agricultural Production: no reliable data was available.

Exchange Rate Distortion

Line S32 and S33 - Exchange Rate (Importables e Exportables). Zero (from general spreadsheet).

The exchange rate changed dramatically in 1989, so the annual average rate was not representative. To obtain a more-representative number, the agricultural NRA for that year was assumed to be the average of the NRAs in 1988 and 1990 and the exchange rate used for that year was adjusted to generate that average, taking domestic product prices in local currency and border prices in US dollars as given. This required altering the depreciation that year compared with the previous year such that the local currency fell relative to the US dollar by 84 instead of 77 percent.

Non-product specific subsidies net of abnormal taxes for primary agriculture

Line S36 to S41 - Research & Extension, Agricultural Training Schools, Inspection Services, Marketing and Promotion, Public Stockholding, Other Government Expenditures in Agriculture: From 1980 to 2005, Ministério da Fazenda. Secretaria do Tesouro Nacional. Execução do Orçamento Oficial da União. All years available. Since in 2000 the system of classifying the items of expenditure has changed from specific “activities” to “programs”, making difficult to have a long time series of consistent types of expenditures, all specific items were added to the total of “Agriculture”, according to the classification of the Secretaria do Tesouro Nacional. The aggregation system followed Gasques (2005). All items were included in the item “Other”. Gasques, J. G. *Gastos Públicos Para o Desenvolvimento Agrícola e Rural*. FAO. Santiago. Chile. 2005

PART 4: AGGREGATED NON-AGRICULTURE

Food Processors I (lightly processed food products)

Line X4 - Value of Production of Importable, Exportable and Non-tradables in the Remaining Lightly Processed Food Production (30%): IBGE/PIA – Pesquisa Industrial Anual.

The "lightly processed" products considered were, according to the CNAE/PIA classification: Slaughter and processing of cattle and fish; Fruit and Vegetable processing and preserves; Production of vegetable oil and animal residues; Dairy products; Milling and production of rations and feed mix for animal feeding; Production and refining of sugar. The available variable on PIA data bank for this level of disaggregation is "gross income". The trade status of these products was defined by the author.

Line X9 - Share of TOTAL (100%) lightly processed food production in total NON-Agricultural production: Total Lightly Processed Food: PIA values for remaining lightly food plus total value of production of processed products from the templates. Total non-agricultural production = Sum of the PIA values for Highly Processed Food, Non-agricultural Primary, Non-food manufacture, services (from GDP/IBRE statistics) and Total Lightly Processed Food as defined above.

Food Processors II (highly processed food products)

Line X12 to X14 - Share of Importable, Exportable and Non-tradable in total highly processed food production. Those values followed the same method employed for the estimations of the "lightly processed food" for items such as: a) Coffee-milled and roasted; b) Processing of other food products; c) Production of beverages; and, d) Production of tobacco products.

Line X16 - Share of highly processed food production in total NON-Agricultural production. Total Highly Processed Food: Total sum of the items above. Total non-agricultural production = Sum of the PIA values for Highly Processed Food, Non-agricultural Primary, Non-food manufacture, services (from GDP/IBRE statistics) and Total Lightly Processed Food as defined above.

Non-Agricultural Primary Producers

Line X19 to X21 - Share of Importable, Exportable and Non-tradable in total Non-Agricultural Primary Production: Those values followed the same method employed for the estimations of the "lightly processed food" items: Products from extractive industry; Production of coal; Oil refining; Nuclear fuel production; Production of ethanol; Production of chemical products; Production of non-metallic minerals.

Non-Food Manufactures

Line 26 to 28: Share of Importable, Exportable and Non-tradable in Non-Food Manufactures. Those values followed the same method used to estimate the "lightly processed food" for the following items: Production of textile products; Production of clothing and related products; Production of leather products; Production of wood pulp and paper; Production of rubber and plastic products; Production of basic metal products (except machinery and equipment); Production of machinery and equipments; production of office equipments and computer supplies and equipments; Production of electrical machines and equipments; Production of electronic and communications equipments; Production of medical equipment and related products; Production of optical instruments; Production for industrial automatization; Production of watches; Production of automobiles and vehicles and related products; Production of transportation equipment; Production of furniture and related products.

Services

Line X33 to X35 - GDP for services, considered a non-tradable item: GDP for services, from IBGE data bank considered a non-tradable item.

Line X37 - Share of services in total NON-Agricultural production: Share of GDP for services in Total non-agricultural production = Sum of the PIA values for Highly Processed Food, Non-agricultural Primary, Non-food manufacture, services (from GDP/IBGE statistics) and Total Lightly Processed Food as defined above.

Sources referred to in the spreadsheet

ACRONYMS	
FAOSTAT	The FAO Statistical Database
ABIEC	Associação Brasileira das Indústrias Exportadoras de Carne
ABIPECS	Associação Brasileira da Indústria Produtora e Exportadora de Carne Suína
APA	Associação Paulista de Avicultura
IRGA	Instituto Rio Grandense do Arroz
CONAB	Companhia Nacional de Abastecimento
CFP/ ANUÁRIO ESTATÍSTICO CFP	Comissão de Financiamento da Produção
ABITRIGO	Associação Brasileira da Indústria do Trigo
ABIOVE	Associação Brasileira das Indústrias de Óleos Vegetais
PINAZZA	PINAZZA, Luiz Antonio e outros (org). <i>Agenda para a competitividade do agribusiness brasileiro</i> . Rio de Janeiro: FGV; São Paulo:ABAG, 2.001.
ALICEWEB	Sistema de Análise das Informações de Comércio Exterior via Internet/ Secretaria de Comércio Exterior (SECEX)/ Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC),
SIMA	Preços nos mercados atacadistas: anuario estatistico 1989
IEA	INSTITUTO DE ECONOMIA AGRICOLA - SP: Anuario de informações estatísticas da agricultura : anuario IEA (1995 - 2005)
SEAB	Secretaria da Agricultura e do Abastecimento do Paraná
CEPEA	Centro de Estudos Avançados em Economia Aplicada (CEPEA) - Esalq/USP
ÚNICA	União da Agroindústria Canavieira de São Paulo
SIFRECA	Sistema de Informações de Fretes - Escola Superior de Agricultura "Luiz de Queiroz" (ESALQ/USP)
CIC	Centro de Inteligência do Café
BM&F	Bolsa de Mercadorias e Futuros
SUGAR WB	Sector Report Brazil Sugar Subsector Review, 1989, World Bank
BRANDAO	Brandão, A. S. and Carvalho, J.L. <i>Trade, exchange rate, and agricultural pricing policies in Brazil</i> . World Bank. Washington, D.C. 1991.
IBGE/PAM	Instituto Brasileiro de Geografia e Estatístico/ Pesquisa Agrícola Municipal
FOB Price Equivalent/ CIF Price Equivalent	Working Material for the World Bank Report (1990)
	World Bank (1990), Brazil Agricultural Sector Review: Policies and Prospects v.1, Washington DC.
	World Bank (1990), Brazil Agricultural Sector Review: Policies and Prospects v.2, Washington DC.
FGV	Fundação Getúlio Vargas
CACEX	Câmara de Comércio Exterior

Appendix Table 1: Key economic indicators, Brazil, 1970 to 2004

	Year	1970-75	1976-80	1981-85	1986-93	1994-99	2000-04
Population	Population total (mill)	102	116	130	148	165	179
	Proportion rural (%)	42	36	31	26	21	18
GDP	GDP (Current US\$ mill)	76,366	197,929	236,103	381,654	692,909	536,134
	GDP per capita (current US\$)	738	1,698	1,819	2,569	4,198	2,998
Share GDP	Agriculture (%)	12.8	12.3	10.7	8.9	8.5	9.0
Agricultural land & employment	Number employed in agriculture (1000)	16,476	17,252	17,174	15,563	13,975	12,808
	Arable land area (1000 ha)	38,667	44,180	46,800	50,618	56,947	58,621
	Agricultural value added/worker (US\$)	507	1,235	1,320	1,883	3,545	2,393
Exports	Total goods & services exports (US\$ mill)	5,781.46	14,845.19	25,021.65	35,893.41	55,848.53	78,885.63
	Exports of goods and services (% of GDP)	7.60%	7.50%	10.60%	9.40%	8.10%	14.70%
	Total Merchandise Exports (US\$ mill)	5,409.00	14,056.60	23,602.20	31,729.00	48,323.83	68,646.04
	Agricultural, fishing & Forestry(US\$ mill)	390.77	441.23	773.06	1,049.37	1,939.18	2,910.15
	Food exports (US\$ mill)	3,182.46	7,297.65	9,271.51	8,849.07	14,366.09	18,852.42
	Manufactures exports (US\$ mill)	1,147.11	4,562.73	9,565.19	17,070.63	26,147.97	37,153.34
Imports	Total goods & services imports (US\$ mill)	8,116.30	18,271.16	19,966.40	26,789.41	68,601.00	70,518.77
	Imports of goods and services (% of GDP)	10.60%	9.20%	8.50%	7.00%	9.90%	13.20%
	Total Merchandise Imports (US\$ mill)	7,682.00	17,360.40	18,298.20	20,543.75	53,999.00	56,641.60
	Agricultural, fishing & Forestry(US\$ mill)	325.81	304.75	372.06	528.23	476.36	337.4
	Food imports (US\$ mill)	1,732.42	1,740.25	2,502.79	3,827.48	4,602.75	4,689.09

Source: World Bank (2007).

Appendix Table A2.2: Annual distortion estimates, **Brazil**, 1966 to 2005(a) Nominal rates of assistance to covered products
(percent)

	Beef	Coffee	Cotton	Maize	Pigmea t	Poultry	Rice	Soybea n	Sugar	Wheat	All
1966	na	na	-16	-9	na	na	na	0	na	44	-8
1967	na	na	-5	-9	na	na	na	0	na	41	-6
1968	na	na	-9	-9	na	na	na	0	na	38	-6
1969	na	na	-6	-9	na	na	na	0	na	43	-5
1970	na	na	4	-9	na	na	na	-3	-35	69	-9
1971	na	na	-6	7	na	na	na	7	-45	53	-8
1972	na	na	-7	20	na	na	na	0	-78	4	-35
1973	na	na	1	-5	na	na	19	-24	-82	-30	-36
1974	na	na	8	-12	na	na	-3	-3	-89	5	-49
1975	na	na	-9	0	na	na	-4	-6	-84	39	-37
1976	na	na	-9	-5	na	na	1	-16	-36	81	-11
1977	na	na	-29	-3	na	na	-13	-23	-55	115	-22
1978	na	na	-9	-17	na	na	-32	-14	-40	80	-21
1979	na	na	-30	-35	na	na	-7	-19	-47	14	-27
1980	1	-43	-17	-37	na	-21	-28	-10	-68	17	-32
1981	14	-43	-27	-35	na	6	-25	-15	-61	76	-29
1982	19	-41	-11	22	7	4	51	1	-60	107	-10
1983	7	-57	-25	-26	-7	-20	2	-17	-64	4	-35
1984	36	-53	-23	-48	1	-10	-4	-17	-66	3	-34
1985	-23	-27	-14	-45	-9	-37	18	-28	-59	3	-33
1986	35	5	-15	-14	-13	34	60	30	-56	29	-2
1987	-21	-43	-32	-49	-15	-29	-12	-23	-50	-4	-34
1988	-34	-46	-16	-38	-52	-40	5	-28	-63	-23	-38
1989	55	-14	-67	-23	-8	3	-52	-56	-48	-34	-31
1990	22	-19	-35	-23	-48	18	4	-26	-54	-7	-21
1991	-38	-23	-36	-29	12	-24	9	-34	-49	-14	-30
1992	-47	20	18	-31	24	-28	11	-32	-30	-21	-26
1993	-40	26	-6	-15	24	-21	7	-24	-40	42	-19
1994	-18	53	-23	-18	55	-11	-6	62	-38	25	7
1995	6	3	9	-5	2	0	25	-3	-25	4	-1
1996	4	5	8	4	2	2	15	-6	-12	6	0
1997	4	10	8	3	5	4	19	2	-2	1	4
1998	2	10	4	15	-4	-7	19	1	1	25	4
1999	6	6	4	2	1	6	7	-1	-13	5	2
2000	-1	4	12	5	-5	-1	10	-2	10	9	2
2001	6	5	13	-14	1	6	16	-3	3	-2	1
2002	1	19	8	5	4	4	11	-14	-4	-1	-1
2003	6	3	22	-1	2	1	20	0	-1	-3	2
2004	5	4	1	3	0	2	23	7	2	0	5
2005	2	2	7	16	3	2	19	-2	0	-1	3

Appendix Table A2.2 (continued): Annual distortion estimates, **Brazil**, 1966 to 2005
 (b) Nominal and relative rates of assistance to all^a agricultural products, to exportable^b and import-competing^b agricultural industries, and relative^c to non-agricultural industries
 (percent)

	Total ag NRA				Ag tradables NRA			Non-ag tradables	
	Covered products		Non-covered products	All products (incl NPS)	Exportables	Import-competing	All		
	Inputs	Outputs						NRA	RRA
1966	0	-8	-8	-8	-10	44	-8	na	na
1967	0	-6	-6	-6	-8	41	-6	na	na
1968	0	-6	-6	-6	-8	38	-6	na	na
1969	0	-5	-5	-5	-7	43	-5	na	na
1970	0	-9	-9	-9	-14	69	-9	35	-33
1971	0	-8	-8	-8	-13	53	-8	35	-32
1972	0	-35	-35	-35	-38	4	-35	36	-52
1973	0	-36	-36	-36	-44	8	-36	34	-52
1974	0	-49	-49	-49	-57	-1	-49	35	-62
1975	0	-37	-37	-37	-48	4	-37	34	-53
1976	0	-11	-11	-11	-17	12	-11	34	-33
1977	0	-22	-22	-22	-29	11	-22	33	-41
1978	0	-21	-21	-21	-24	-17	-21	39	-43
1979	0	-27	-27	-27	-32	-20	-27	38	-47
1980	5	-36	-32	-29	-33	-28	-29	39	-49
1981	5	-34	-29	-28	-32	-22	-28	35	-46
1982	4	-14	-10	-6	-19	49	-6	32	-29
1983	4	-39	-35	-33	-39	0	-33	31	-49
1984	4	-38	-34	-33	-35	-32	-33	30	-48
1985	3	-35	-33	-31	-35	-26	-31	30	-47
1986	10	-12	-2	2	-6	7	2	38	-26
1987	3	-37	-34	-28	-35	-31	-28	38	-48
1988	11	-49	-38	-28	-41	-29	-28	24	-42
1989	-15	-17	-31	-21	-30	-33	-21	18	-32
1990	3	-24	-21	-13	-22	-20	-13	13	-23
1991	3	-33	-30	-20	-33	-21	-20	11	-28
1992	8	-34	-26	-20	-28	-21	-20	7	-25
1993	5	-24	-19	-14	-25	-3	-14	5	-18
1994	4	2	7	10	14	-14	10	6	4
1995	2	-3	-1	5	-3	4	5	7	-2
1996	5	-4	0	4	-1	8	4	7	-2
1997	4	0	4	11	3	7	11	9	2
1998	5	-1	4	9	1	16	9	9	0
1999	5	-3	2	11	2	4	11	8	3
2000	3	-1	2	6	1	7	6	9	-3
2001	2	-1	1	3	1	13	3	5	-2
2002	3	-3	-1	1	-1	7	1	4	-3
2003	2	0	2	4	2	14	4	4	0
2004	2	4	5	7	4	16	7	4	3
2005	-3	6	3	4	2	14	4	4	1

^a NRAs including assistance to nontradables and non-product specific assistance.

^b NRAs including products specific input subsidies.

^c The Relative Rate of Assistance (RRA) is defined as $100 * [(100 + \text{NRA}_{\text{ag}}^t) / (100 + \text{NRA}_{\text{nonag}}^t) - 1]$, where NRA_{ag}^t and $\text{NRA}_{\text{nonag}}^t$ are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively.

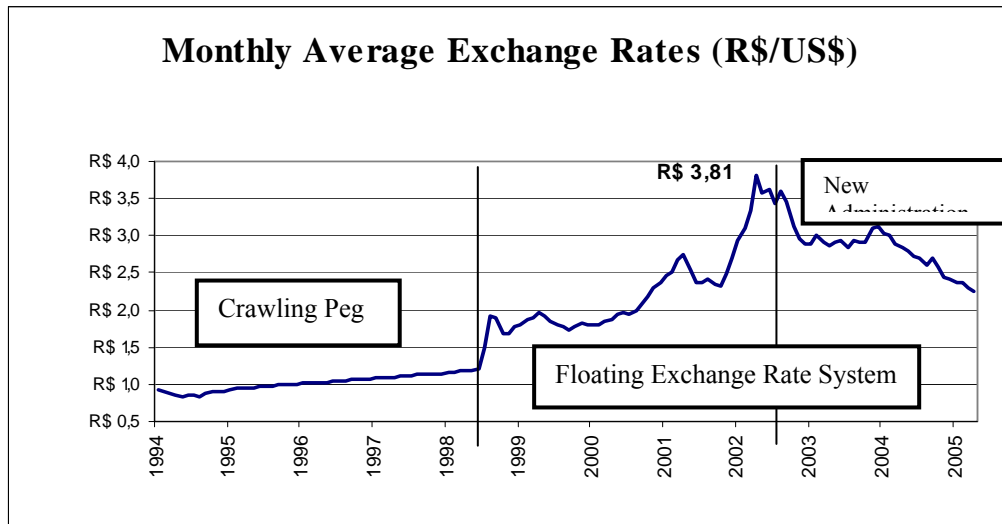
Appendix Table A2.2 (continued): Annual distortion estimates, **Brazil**, 1966 to 2005
(c) Value shares of primary production of covered^a and non-covered products,
(percent)

	Beef	Coffee	Cotton	Maize	Pigme at	Poultr y	Rice	Soybea n	Sugar	Wheat	Non- covered
1966	na	na	9	20	na	na	na	2	na	1	67
1967	na	na	7	22	na	na	na	2	na	1	69
1968	na	na	10	19	na	na	na	2	na	2	67
1969	na	na	10	21	na	na	na	3	na	2	64
1970	na	na	11	27	na	na	na	6	19	4	32
1971	na	na	15	22	na	na	na	6	21	5	31
1972	na	na	10	14	na	na	na	6	33	4	32
1973	na	na	7	13	na	na	9	11	28	2	30
1974	na	na	5	10	na	na	7	8	36	3	31
1975	na	na	3	10	na	na	12	10	29	3	33
1976	na	na	6	17	na	na	13	17	13	2	31
1977	na	na	8	11	na	na	10	23	16	2	32
1978	na	na	6	15	na	na	15	16	16	2	31
1979	na	na	6	17	na	na	11	16	15	4	30
1980	10	12	2	9	na	3	11	9	14	2	27
1981	8	23	3	11	na	3	5	9	12	2	24
1982	9	9	3	8	2	3	6	9	18	1	32
1983	8	13	2	7	2	3	4	9	19	1	32
1984	6	9	3	12	2	2	3	11	18	1	32
1985	7	14	3	11	1	2	3	11	14	1	32
1986	7	4	3	9	2	3	4	6	13	2	46
1987	11	13	2	9	2	3	3	8	13	2	32
1988	11	10	3	10	2	3	4	12	13	3	31
1989	6	6	4	7	1	2	6	16	7	2	42
1990	8	6	3	9	5	4	3	10	13	2	37
1991	14	6	4	11	2	6	5	9	11	1	32
1992	15	4	2	13	2	6	3	9	10	1	35
1993	15	4	1	11	2	6	4	13	9	2	33
1994	9	8	2	10	2	4	4	9	8	1	43
1995	18	5	1	9	3	7	3	9	10	1	33
1996	18	7	1	9	3	6	4	13	11	1	27
1997	14	7	1	9	3	7	4	16	11	1	29
1998	13	10	1	7	2	8	4	14	10	1	30
1999	15	8	2	9	3	9	5	14	7	1	28
2000	17	7	2	9	3	8	3	16	7	1	26
2001	15	5	2	10	3	10	3	16	7	1	27
2002	14	5	2	9	3	10	3	20	7	1	28
2003	13	3	2	10	3	9	4	24	7	1	24
2004	14	5	3	8	3	9	4	23	6	2	23
2005	15	5	2	6	4	8	5	23	7	2	24

^a At farmgate undistorted prices, US\$

Source: Lopes et al. (2007)

Appendix Figure A1: Foreign exchange rate, Brazil, 1994 to 2005



Source: Banco Central do Brasil.

Appendix Figure A4: Net trade balance in agribusiness and other sectors, Brazil, 1980 to 2005

