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DISCUSSION PAPER

Originally published by Ipea in April 2001 as number 785 of the series Texto para Discussão.

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Steven M. Helfand
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Brasília, January 2015

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Steven M. Helfand[2]
Gervásio Castro de Rezende[3]

1. This paper was prepared for delivery at the XXIV International Conference of Agricultural Economists, Berlin, August 13-18, 2000. It was written as part of a larger project on the Brazilian economy called Núcleo de Estudos e Modelos Espaciais Sistêmicos (Nemesis). We are thankful for a grant from the Brazilian government (MCT/Finep/CNPq) under a program called Pronex. We would like to thank Albert Berry, Paulo Fernando Cidade de Araujo, Lovell Jarvis, José Garcia Gasques and Vitoria Saddi for helpful comments, and Marcos Stefan Mendonça Fazecas and Alan Levenson for valuable research assistance.
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Discussion paper / Institute for Applied Economic Research.- Brasília : Rio de Janeiro : Ipea, 1990-

ISSN 1415-4765

1. Brazil. 2. Economic Aspects. 3. Social Aspects. I. Institute for Applied Economic Research.

CDD 330.908

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RESUMO

Este trabalho descreve de modo sintético as mudanças de política econômica e de condições macroeconômicas nos anos 90 e analisa o impacto dessas mudanças sobre o setor agrícola. Procura-se enfatizar quatro aspectos que foram ignorados ou que não receberam a atenção devida pelos autores que trataram do assunto no período anterior às reformas. A primeira questão relaciona-se com a importância dos fatores macroeconômicos, sobretudo as políticas de estabilização, para a análise do tema. A segunda questão reside na importância de mudanças em outras políticas que não a mera abertura externa, como a desregulamentação dos mercados domésticos e as mudanças nas políticas de crédito rural e de preços mínimos.Um terceiro aspecto que também não recebeu a devida atenção das análises pré-reforma é o impacto das novas políticas econômicas sobre o mercado de insumos e sobre a produtividade. A quarta e última questão enfatizada neste trabalho é que os efeitos das reformas foram muito diferenciados segundo produtos, regiões ou tipos de agricultores. O trabalho sugere, ainda, que, como nem todas as reformas foram introduzidas simultaneamente, os anos 90 devem ser tratados como uma década de transição em que o velho modelo foi substituído, porém nem todas as etapas do novo modelo foram firmemente estabelecidas.

ABSTRACT

This paper describes the changes in economic policies and in macroeconomic conditions in the 1990s and analyses their impact on the agricultural sector in Brazil. We emphasize four aspects of the reform period that were either unexpected or not given sufficient attention by authors writing in the period prior to the reforms. The first issue relates to the importance that events outside of the agricultural sector, specially the stabilization problems, have not only for the performance of the sector but also for the timing and sequence of policy reform. A second issue that we emphasize is that policy reform involved far more than trade liberalization. Deregulation and the reform of rural credit and support price policy have been central as well. A third issue that was not given sufficient attention by the pre-reform analyses that focused on agricultural prices is the impact of policy reform on input markets and productivity. We identify changes in input markets as one of the key components of the adjustment process. A fourth and final issue that we address is that policy reform had a highly differentiated impact on the sector. Reform was neither uniformly beneficial, nor entirely prejudicial. Thus, our analysis seeks to distinguish between different groups of products, such as importables and exportables, geographic regions, farm sizes, and sub-periods. The paper emphasizes also that, since not all reforms were introduced simultaneously, the 1990s should be treated as a decade of transition in which the old model was replaced, but not all of the features of the new model were firmly established.

1 - INTRODUCTION

The Brazilian economy began a process of significant restructuring in the 1990s as a result of dramatic changes in economic policy. The policies associated with the import substitution industrialization (ISI) model have been abandoned and the country is in the process of shaping a new path of development. Trade has been liberalized, state owned enterprises privatized, domestic markets deregulated, and a South American Common Market (Mercosul) formed. The extent of the reforms has been profound. Nominal tariff rates for the 16 principal industrial sectors, for example, have fallen from an average of 105% in the late 1980s down to 13% in the 1994/97 period.[1] The agricultural sector has been no exception to the economy-wide redefinition of the role of the state. A profound transition has taken place from an agricultural policy regime designed for a closed economy with substantial state intervention to a new regime tailored to an open economy and a curtailed role of the state.

In this paper we analyze the impact of the policy reforms, and of the changing macroeconomic conditions, on the agricultural sector in Brazil. We emphasize four aspects of the reform period that were either unexpected or not given sufficient attention by authors writing in the period prior to the reforms. The first issue relates to the importance that events outside of the agricultural sector have not only for the performance of the sector but also for the timing, sequence, and direction of policy reform. In the ISI period it was clear that *indirect* policies such as overvalued currencies and industrial protection played a critical role in shaping the performance of the agricultural sector, and it was expected that the reform of these policies would have a positive impact on the sector [Krueger (1992), Schiff and Valdés (1992)]. What was unexpected—and this is especially true for the case of Brazil—was the difficulty and length of time that would be necessary to stabilize the economy. The numerous stabilization plans that were adopted in the 1980s and 1990s joined the more traditional indirect policies as a key force that shaped the performance of the sector in the period. In this context, the reform of agricultural policies was almost entirely subordinated to the reform of ISI policies and the painful quest for price stability.

A second issue that we emphasize in this paper is that policy reform involved far more than trade liberalization. Deregulation and the reform of credit and support price policy have been central as well. In fact, the most dramatic transformations in the agricultural sector have taken place for those products that were most heavily regulated, such as wheat, milk, sugar, and coffee. The products that lost import protection or gained a reduction in export taxation as a result of trade liberalization have also been affected, but to a lesser degree. For this group, the evolution of credit and support price policy has been extremely important.

A third issue that was not given sufficient attention by the pre-reform analyses that focussed on the determinants of agricultural prices is the impact of policy reform on input markets and productivity.[2] We identify changes in input markets as one

[1] The data is reported in Rossi Jr. and Ferreira (1999).
[2] Quiroz and Opazo (1998) have recently addressed this issue.

of the key components of the adjustment process. Liberalization has altered relative input prices and increased access to high quality imported inputs. It has also exposed domestic production to greater competition. Both of these factors have led to productivity gains and falling costs. Increases in productivity and efficiency, in addition to lower consumer prices, are among the most important measures of the success of the reforms.

A fourth and final issue that we address is that policy reform had a highly differentiated impact on the sector. Since not all reforms were introduced simultaneously, the 1990s should be treated as a decade of transition in which the old model was replaced, but not all of the features of the new model were firmly established. Reform was neither uniformly beneficial, nor entirely prejudicial. Thus, our analysis seeks to distinguish between different groups of products, such as importables and exportables, geographic regions, farm sizes, and sub-periods.

The paper is organized as follows. In Section 2, we provide an overview of the policy reforms in this period. In Section 3, we identify their expected effects on the sector. Section 4 analyzes the impact of the reforms on agricultural prices, output, trade, productivity, and input markets in the 1980/98 period. Section 5 provides a summary and the main conclusions.

2 - OVERVIEW OF POLICY REFORMS RELATED TO AGRICULTURE

In this section we describe the most important changes in policy that affected the performance of the agricultural sector in the 1990s. Since many of the policy reforms began in the 1980s as a response to the debt crisis, we provide selected information on the 1980s when necessary. We begin this section with a discussion of the macroeconomic environment of the 1980s and 1990s in order to demonstrate how events outside of the agricultural sector have conditioned both the reforms and the performance within the sector.

2.1 - The Role of the Macroeconomic Environment

A first wave of agricultural policy reform began in the early 1980s in response to the debt crisis. Macroeconomic adjustment policies led to the reform of rural credit policy, reducing the volume of credit and indexing nominal interest rates to inflation. At the same time, the government expanded the support price policy. This change in the policy mix can be explained with reference to pressures to control the fiscal deficit and generate foreign exchange to pay back the debt. The expansion of support price policy was accompanied by a state monopoly on trade for most agricultural goods. The government also used other agricultural policies in the 1980s to address the balance of payments problem. The Proalcool program based on sugarcane, and wheat policy, are two examples that will be discussed below. The use of policies to expand domestic production in the 1980s was also motivated by a desire to fight inflation. This was a problem that became progressively worse throughout the 1980s and early 1990s.

Like the debt induced adjustment policies of the 1980s, the macroeconomic environment of the late 1980s and early 1990s played a crucial role in shaping the evolution of the reforms that affected the agricultural sector. Trade liberalization and deregulation of agricultural markets, in addition to changes in rural credit and support price policies, were all measures that were adopted as part of an overall strategy to fight the threat of hyperinflation. These reforms had much more to do with the fight against inflation than with the belief that the new model would provide superior growth or development.

Macroeconomic events also caused considerable instability for the agricultural sector. The numerous stabilization plans that were adopted in this period were almost always accompanied first by euphoria and then by deep financial crises for the agricultural sector. This happened in 1986-1987 (Cruzado Plan), 1989 (Summer Plan) and in 1990-1991 (Collor I and II Plans). The instability was expressed through price cycles in agricultural asset markets (land and cattle, mainly), as well as in agricultural commodity markets, since commodity stocks also served as real assets. According to Goldin and Rezende (1993) [also see Rezende (1993)], the reduced attractiveness of financial assets that accompanied the launching of these plans caused the prices of land and agricultural commodities to rise. This, in its turn, led to increased borrowing and investment in agriculture. As these plans failed, however, financial assets became more attractive again. The consequence was an abrupt fall in the prices of agricultural assets and commodities and deep financial problems for the sector.

Interestingly, the Real Plan generated a similar cycle. As soon as the plan started to be implemented in early 1994, when the URV was created, land and other asset prices started to rise. The peak was reached in December of 1994, shortly after the final stage of the plan was launched and the new currency (the Real) was created. Although the Real Plan succeeded, in contrast to previous attempts at stabilization, extremely high interest rates once again increased the attractiveness of financial assets. The result was an abrupt fall in land prices in early 1995, accompanied by a fall in the prices of cattle and agricultural commodities. Since agricultural investment and borrowing had grown substantially in the agricultural year 1994/95, the consequence was one of the most severe financial crises agriculture has gone through in the past two decades.

It is in this light that one should consider the multiple impacts of the Real Plan on the agricultural sector.[3] On the one hand, the Plan created substantial obstacles for the sector due to the currency appreciation in the second semester of 1994 and to the asset price cycle that led to increased indebtedness. On the other hand, as we will show, the stabilization of the economy has produced important gains for the agricultural sector and for consumers.

[3] The debate about the impact of the Real Plan on the agricultural sector has been very controversial. See Homem de Melo (1999*a* and 1999*b*), Coelho (1997), Fundação Getulio Vargas (1998), and Barros and Miranda (1998).

2.2 - Trade Liberalization

Trade liberalization for the agricultural sector took place in the context of the economy wide reforms of the late 1980s. The sector benefited from a drastic fall in industrial protection, and from the elimination of taxes and quantitative restrictions on agricultural exports. In the case of coffee, for example, the export tax had been as high as 50% a decade earlier, serving to drive a large wedge between the producer and international prices. Trade reform for exports advanced further in 1996 when the 13% value added tax on primary exports was removed in an attempt to ease the balance of payments pressures without devaluing the currency.

At the same time as the initial reforms for exportables took place, importables lost their tariff and non-tariff protection. In cases like wheat, protection had contributed to raising producer prices to as much as double their international counterparts.[4] For most importables, tariffs fell from the 35%-55% range prior to 1988 down to around 10% in 1991. Non-tariff barriers were removed abruptly in 1990 when Fernando Collor became President. Shortly thereafter, Brazil signed the Treaty of Asunción which created the South American Common Market (Mercosul). Mercosul eliminated the tariffs on imports from Argentina and Uruguay, two countries with very competitive agricultural sectors.

Many agricultural goods, especially importables, had expanded in the 1980s on the basis of policies that required strict control of foreign trade by the government. As the economy was opened, not only did the agricultural sector have to face increased competition from abroad, but the previous policies that had promoted growth in the 1980s had to be changed as well. The form in which support price policy was conducted in the 1980s, for example, was incompatible with an open economy.

2.3 - Rural Credit Policy

Table 1 presents Central Bank data on the supply of rural credit since 1985. The data is disaggregated by the source of funds. In order to provide a sense of the size of the system at its peak, the table also includes the average volume for the years 1979-1980. The table shows that there was a substantial reduction in the volume of credit in the late 1980s. The contraction of credit was accelerated in 1990 when the flow of new credit fell by 43%.[5] The reduction of credit in 1990 was caused by the "Collor Plan" which was announced by the Collor Administration when it took office in March, 1990. One of the components of the Plan was an 18 month freeze on all financial assets, including the funds used to provide liquidity to the agricultural sector. The sharp reduction in the supply of rural credit right at the beginning of the new decade, therefore, was not an expression of a conscious policy decision to reduce government involvement in

[4] See Helfand (2000) for estimates of nominal protection and a description of trade and price policies in the 1970s and 1980s.

[5] Using data covering only the Bank of Brazil, Dias and Amaral (1999*b*) show that rural credit fell by 61% in 1990. This was also much more than the previous trend implied.

the financing of agriculture. It was a side effect of macroeconomic decisions aimed at combating inflation. Regardless of the reasons, the consequence was to put increased pressure on agriculture and the associated industrial and commercial sectors to develop alternative mechanisms for financing the production and marketing of agricultural products [see Gasques and Villa Verde (1995) and Araujo and Almeida (1996)].

Table 1
Agricultural Credit by Source of Funds

(Millions of R$ of 1998**)**

Years	Total	Treasury Funds	Required Lending	Rural Saving	Unrestricted Funds	FAT	FAE	Other
1979-1980	47.384	-	-	-	-	-	-	-
1985	30.298	19.469	9.729	0	0	0	0	1.100
1986	45.179	29.308	11.091	0	0	0	0	4.780
1987	35.615	13.281	12.230	8.031	0	0	0	2.073
1988	25.132	6.160	9.001	9.106	0	0	0	865
1989	22.950	5.499	3.317	11.846	1.791	0	0	497
1990	13.111	3.503	3.590	2.623	2.608	0	0	787
1991	13.527	3.271	3.027	4.369	1.396	0	0	1.464
1992	14.999	3.446	2.807	6.828	1.014	0	0	904
1993	12.879	3.434	1.422	5.566	1.512	0	0	945
1994	18.607	5.044	2.159	6.494	2.965	0	0	1.946
1995	8.073	1.590	1.061	2.911	1.316	0	0	1.194
1996	7.055	246	1.191	644	569	1.551	983	1.871
1997	10.482	154	4.589	861	615	1.884	681	1.699
1998	11.134	185	4.534	1.450	839	1.765	124	2.236

Source: Central Bank, Recor system.
Note: The values were deflated by the IGP-DI inflation index, 1998 average =100.

As private international capital flows grew in the early 1990s, the government adopted several measures intended to liberalize the country's external operations regarding both finance and foreign exchange. It is likely that the agricultural sector benefited disproportionately from this new situation of access to international finance at relatively low interest rates because the export orientation of a significant share of the sector implies that it was more capable of facing exchange rate risk. The government strengthened the connection between agriculture and external finance in 1995 when it eliminated the Financial Operations Tax (IOF) only on funds that were destined for the agricultural sector. The IOF was a tax that was used to control short run capital flows. This exemption, which became known as the *63 Caipira* (63 was the number of the original Central Bank resolution that regulated the entry of foreign capital, and *Caipira* means "hill billy"), was later extended to industrial, commercial, and trading companies for financing their operations with agriculture.

In addition to the operations that took place under the *63 Caipira*, farmers also benefited from being able to import fertilizers and other inputs with low-interest international financing that extended for as much as one year. Some analysts estimate that the financing of agriculture based on external sources amounted to

no less than US$ 4 billion in 1998. Several firms even created their own banks, specialized in borrowing abroad and in financing their operations with the agricultural sector [see *Gazeta Mercantil* (Mar. 11, 1999)].

Table 1 shows that there was a 45% increase in borrowing within the rural credit system in 1994 as a result of the agricultural cycle generated by the Real Plan. The table also shows that the requirement that banks lend a share of their deposits (now 25%) to the agricultural sector once again became a major source of funds for rural credit beginning in 1997. Required lending had traditionally been an important source of finance for the sector, but its relevance was undermined in the period of high inflation. The Worker's Support Fund (FAT), also became important from 1996 on. FAT funds were only permitted to be used in a new government program aimed at supporting small family farmers (Pronaf). According to Silva (1999), FAT accounted for 80% of Pronaf funds, most of which were used for investment. Finally, the column Other includes funds originating from external and other sources.

Another major change occurred in the 1995-1996 agricultural year when fixed nominal interest rates began to be charged again. With several brief exceptions, this had not happened since the early 1980s [Helfand (1999)]. Interest rates were fixed below market rates, but in contrast to the subsidized program of the 1970s and early 1980s, real interest rates were positive. From this point on, the Treasury stopped providing funds to finance agriculture (Table 1) and, in stead, provided resources to cover the difference between the cost of funds and the interest rates charged to the borrowers.

The analysis of credit policy in the 1990s reveals that the total volume of credit provided to the agricultural sector through the official system has fallen dramatically. In addition, funds have been increasingly based on the requirement that private banks lend a share of their deposits to the agricultural sector. As far as commercial farming is concerned, this means that the role of official banks in providing rural credit has declined and the importance of the private sector has grown. At the same time, however, the government has increased its activity in providing credit to small farmers for investment. The performance of commercial agriculture in the medium run, however, will still depend on its relationship with the official credit system because of a substantial amount of debt that farmers accumulated throughout the 1990s. Total debt with the Bank of Brazil equaled R$ 24 billion as of May, 1999, with an additional R$ 8 billion owed to private banks. There was a very high degree of debt concentration with the Bank of Brazil, with 2.1% of the debtors (those owing R$ 200,000 or more) holding 57.2% of the total debt. Delinquency also varied tremendously across groups. The delinquency rate for the group of large debtors was 71% in April 1995, while it was only 0.8% for the smaller debtor group.[6]

Since default prevents access to new credit within the official and private credit markets, as of 1995 the government began trying to devise a solution to the debt

[6] This data comes from Santiago and Silva (1999).

problem. Any solution had to involve recognition by farmers of the debt, as well as an extension of the debt's maturity and a reduction in interest rates so that farmers would be capable of paying the debt back. The government's objective was to improve farmers' financial situation so that investment in the agricultural sector could resume, and to improve the value of banks' assets. Several rounds of debt renegotiation have successfully taken place since 1995.

2.4 - The Agrarian Reform Program

In addition to targeting rural credit to small farms, the government rapidly expanded the agrarian reform program in the second half of the 1990s. More land has been redistributed since 1994 than in the 1964/94 period. Between 1995 and 1999, more than 8,7 million hectares of land was distributed to over 370 thousand families through the land reform program. It is a positive development to see the government focussing its activities on small farmers and the landless in an attempt to overcome the market failures that have so often prevented the poor from gaining access to land and credit. Some authors, however, have questioned the cost of the program and the lack of an appropriate mechanism for selecting the beneficiaries. While these are important issues, we believe that the fundamental question is whether or not the beneficiaries will succeed in becoming viable farmers in the policy environment that was created in the 1990s. The experience of the existing small farmers does not provide much grounds for optimism. In order for the new small farmers to succeed, they need more than just land and credit. It remains to be seen whether or not a new institutional environment, and a more comprehensive package of support, will be designed that can facilitate the long run success of the beneficiaries.

2.5 - Support Price Policy

The support price program was expanded in the early 1980s and reached very high levels of activity in the second half of the 1980s, precisely at the time when the subsidized rural credit policy was being phased out. The support price program was based on government purchases (AGF) and marketing loans (EGF) that operated to guarantee the minimum price. Both facets of the program were inactive in the years 1990-1991. The lack of government purchases in these two years reflects the fact that, partly due to crop failures (as well as to the price cycles associated to the stabilization plans of 1990 and 1991), market prices were well above the minimum prices. The lack of marketing loans, however, reflects the overall crisis in the official credit system that was discussed above.

Support price policy was reactivated in the period 1992/95, yet it turned out to be very problematic.[7] In the first place, the new program was much more of a complement to rural credit policy than a return to the old minimum price policy. Under the old system, support prices really were minimum market prices, and any farmer who wanted to sell to the government at the minimum price could do so. Beginning in 1992, however, only the farmers who had access to loans provided

[7] For a detailed account of this period, see Rezende (2000).

by the official credit system had access to the minimum prices. Thus, the new policy lost the universal character that the old policy possessed.

A second problem was related to the accumulation of government stocks. Even though the government desired to reduce its direct involvement in the market, it ended up acquiring large agricultural stocks at the same time as imports were carried out by the private sector. By 1995 it had about 20 million tons of grain, or one fourth of the country's total grain production in that year. These events made it clear that the policies which had begun in the agricultural year 1991-1992 needed to be changed. The first thing to be eliminated were marketing loans that carried the option to sell to the government (the EGF-COV). In its place, the government created an options contract that gave the farmer the option to sell to the government, at some specified date in the future, a given quantity of the product at a predetermined price. Farmers who wanted the option contract had to purchase it. The contract price was determined in a public auction. The purpose of the options contract was to reduce the risk of private storage. In addition, it was hoped that this instrument would stimulate banks to finance the storage and marketing of agricultural products.

Another important policy change was the creation of a Marketing Bonus [*Prêmio de Escoamento da Produção* (PEP). The government offered PEPs through public auctions to the purchasers of commodities on the condition that they would purchase the targeted crop from farmers at the minimum price, which was above the market price. The bonus was usually set at a level so that it approximately covered the difference between the minimum and market prices plus a profit margin. The auction was then won by the agent willing to accept the smallest value for the bonus. This instrument resembles deficiency payments in the United States, with the difference that the bonus is given to the buyer and not to the farmer, and it does not cover the entire production of a crop.

The analysis of support price policy in the 1990s shows that little by little the government developed means of providing price support, such as the PEP, that were consistent with an open economy and that involved a much lower fiscal cost than the traditional support price program. In addition, the government has been allocating rural credit funds for the financing of storage through a mechanism that does not have the guarantee of a government acquisition when the loan is due. It has also extended access to these funds to certain industries, such as the textile industry. The new instruments were intended to stimulate private rather than public storage. After all, the holding of public stocks in an open economy is likely to give rise to many problems, and the Brazilian experience in the first half of the decade is very revealing in this respect [Rezende (2000)].

A final aspect of the policy transition was the abandonment by the government of minimum prices as a parameter for support price policy. For example, when the government sells option contracts, it fixes the price at which individuals can exercise options in the future. This price can be fixed independently of the value of the minimum price. Since the government may end up forming stocks based on the price set in the option contract, the minimum prices lost their function as a

reference for when government purchases would begin. Reflecting their abandonment by the government, the real value of the minimum prices has fallen sharply since 1995. The minimum price of corn, which is representative of the minimum prices of other products, fell by 27% in real terms since 1995. In spite of this, there has been no pressure on the part of farmers for an increase in these minimum prices. This would seem strange were it not for the fact that the debt re-negotiation of 1995 established that the debt would be indexed to the minimum prices. Thus, even though the adjustment of minimum prices may be unnecessary from the point of view of support price policy, it is essential in order to prevent the concession of a huge (and hidden) subsidy to farmers.

In the context of a closed economy subject to a severe external constraint, the support price program of the 1980s had an economic logic. It achieved the goals — although not necessarily in the most efficient fashion — of guaranteeing an adequate domestic supply of food, saving foreign exchange, and contributing to the control of inflation. As the economy has been opened, however, and as the external conditions facing the country have changed, the rationale for this program has withered.

2.6 - The Deregulation of the Domestic Markets of Milk, Sugarcane, Coffee and Wheat

In addition to the support price policy, which was aimed primarily at corn, rice, beans, soybeans, cotton and cassava, the government utilized elaborate systems of regulation for sugarcane and its products (sugar and alcohol), wheat, coffee, and milk. In the 1980s these policies were administered outside the sphere of the Ministry of Agriculture. In the 1990s the markets for these goods were deregulated.

In the case of sugarcane, producer prices were set by the government. Producers in the Northeast were subsidized and were the only ones permitted access to foreign markets. Production quotas were used to regulate supply, and the government was the official buyer and distributor of the final products. The government also fixed the price of alcohol and was the sole buyer. Alcohol is produced from sugarcane in Brazil and is used as a fuel for automobiles. Policy was aimed at stabilizing the domestic price, ensuring adequate supplies of sugarcane to produce alcohol, and allowing sugar exports after the needs of the domestic market were satisfied. As in the case of the products included in the support price program, sugarcane policy presupposed the complete control of foreign trade by the government. Sugar exports were liberalized in the mid-1990s, and the sugarcane and alcohol markets were finally deregulated in the late 1990s.[8]

In the case of coffee, there was an export tax that reached levels as high as 50% of the FOB price in the 1970s and early 1980s. The tax was partially used to fund the Brazilian Coffee Institute (IBC). The IBC administered a minimum price policy for coffee and managed the stocks that were accumulated as a result of price support. Coffee exports were controlled in order to comply with the

[8] See Lopes and Lopes (1998), for an analysis of the sugarcane sector in the 1990s.

International Coffee Agreement and domestic price stabilization purposes. Falling coffee prices in the second half of the 1980s and early 1990s led to the gradual withdrawal of the export tax. The Collor Administration abolished the IBC in 1990 and its minimum price policy as part of its reforms aimed at liberalizing trade and deregulating the market. This coincided with the end of the International Coffee Agreement and was responsible for causing the coffee sector to enter into a state of disarray for a number of years.

Wheat had its market strictly regulated since 1967, with self-sufficiency and domestic price control as primary objectives. Government agencies located in the Ministry of Finance set prices at all levels of the market, provided subsidies to producers, millers and consumers, and held a monopoly on imports. The fiscal burden of the program increased as of 1983 when, as a result of the debt crisis, the government raised wheat prices in an attempt to save foreign exchange. However, rising inflation and an increasing fiscal deficit forced the government to abandon the policy several years later, and wheat production quickly returned to the levels of the early 1980s [see Helfand and Rezende (forthcoming)]. The phasing out of subsidies began in 1987, even before the market was deregulated in 1990. As a result, the nominal rate of protection for wheat fell from a peak of 100% in 1986 to –15% in 1989 [Helfand (1994)]. Since 1990, the government no longer set wheat prices by decree nor participated in the process of importing wheat. Wheat became just another crop, like corn or rice, in the minimum price program.

For milk, there was also a huge bureaucracy in the Ministry of Finance that fixed prices at the level of consumers and producers. The system undermined the incentives both to improve quality and productivity at the farm level as well as to modernize the processing sectors.

3 - THE EXPECTED IMPACT OF POLICY REFORM

The traditional view that agriculture was uniformly taxed as a result of ISI led some observers to expect that the sector as a whole should benefit from the move to a less interventionist and more outward oriented model [see, for instance, World Bank (1986, Chapter 4)]. A more nuanced analysis of the impact of ISI on the agricultural sector emerged in the 1980s, and was crystallized in the 18 country World Bank study headed by Krueger, Schiff, and Valdés (KSV).[9] The results of this project highlighted the importance of policies outside of the agricultural sector, such as overvalued currencies and industrial protection, and demonstrated that these *indirect* policies implicitly taxed much of agriculture more than sector specific policies may have benefited it. Within the agricultural

[9] See Krueger (1992), Schiff and Valdés (1992), and Krueger, Schiff and Valdés (1988). In the Brazilian context, Homem de Melo (1981) was one of the first to criticize the notion of uniform discrimination. Several studies done by the Companhia de Financiamento da Produção, including the one by Dias and Lopes (1983), also clearly demonstrated the differentiated impact of policies across products. The study by Brandão and Carvalho (1987), conducted as part of the 18 country World Bank project, is probably the most comprehensive analysis of the pre-debt crisis period. Goldin and Rezende (1993) and Helfand (1994) present evidence of continued differentiation of policy through the end of the 1980s.

sector, *direct* policies tended to tax exportables, protect importables, and partially compensate for indirect discrimination through input subsidies. For the sample of 18 countries, the average indirect tax was –22.5%, the average direct tax on exportables was –12.6%, and the average direct protection of importables was 14.4%. Although the average direct protection of importables was less than the average indirect tax, it was not uncommon for individual importables to receive direct protection that more than off-set the indirect discrimination. The Brazilian experience was broadly consistent with the international pattern, with the notable exception that its subsidized credit program was far larger than any of the other countries in the sample.[10]

In this context, we ask, what would the expected effect be on the agricultural sector of policy reform? We consider the broad set of reforms that were discussed in the previous section. We do not include a real depreciation of the domestic currency as one of the indirect reforms because this did not occur until January, 1999. We address the effects of currency appreciation in this section, and discuss the 1999 depreciation in the conclusions.

The expected impact of policy reform would be highly differentiated across products. The short run effects on prices would be as follows. All of agriculture would benefit from a reduction in industrial protection, which would raise the price of agricultural goods relative to the price of industrial goods. Exportables would benefit, in addition, from reduced export taxation and an elimination of quantitative and other forms of restrictions on trade. Importables, in contrast, would be harmed by the reduction in tariff and non-tariff barriers, and they would be forced to compete more directly with imported goods. If these markets had also been heavily regulated (such as wheat), deregulation would also more likely than not lead to falling product prices and increased competition. It is likely that some non-tradable goods would become importables in the new environment of reduced import protection and would be forced to compete with imports. Others could become exportables and would benefit from reduced export taxation. Thus, in terms of output prices, we would expect unambiguously positive results for exportables, negative results for importables, and mixed results for non-tradables.[11]

The evolution of the real exchange rate would also be an important determinant of relative prices in the agricultural sector. The real exchange rate in Brazil appreciated in the late 1980s, and then appreciated again with the adoption of the Real in mid-1994. The situation finally became unsustainable in January of 1999 when the Brazilian currency was allowed to float freely and depreciated by 50%.

[10] The data reported in Schiff and Valdés (1992, Chapter 6) indicate that the Brazilian credit subsidy program was of similar magnitude to the revenue earned through export taxation. For the next largest subsidizer — Colombia —credit subsidies only represented a third of export taxation. See Helfand (1999) for an analysis of the determinants of the distribution of credit subsidies across crops in the 1970s and 1980s.

[11] It is also possible, however, that if many countries reduce export taxation simultaneously there would be downward pressure on the international price. It is possible that this is what occurred in the early 1990s. This is an important area for research, but beyond the scope of this paper.

The failure to depreciate the real exchange rate in the 1990s at the same time as the other indirect and direct ISI policies were being eliminated should not be interpreted as an incomplete reform of the previous model. It resulted from the particular macroeconomic circumstances of the decade, including extremely high rates of inflation and numerous attempts at stabilization.[12] Real exchange rate appreciation implies that while a significant portion of the anti-agriculture bias in policy was removed due to the reduction of industrial protection, the bias against tradables was not. The negative impact of trade liberalization on importable agricultural products should have been even more severe, the benefits to exportables more modest, and the pressure on non-tradables considerably weaker.

There are strong grounds to believe that trade and agricultural policy reform would lead to improved resource allocation and increased productivity and efficiency. Within the agricultural sector, we would expect a change in the product mix as area shares come to more accurately reflect each crop's comparative advantage. Thus, it is likely that exportables would experience an increase in their share of area, and importables and non-tradables a decline, as relative prices within the sector improved for exportables. The fall in area for importables and non-tradables would likely lead to a rise in their average productivity as the least competitive producers would be driven out of their respective sectors. Exposure to import competition would also pressure the remaining producers of importables to search for ways to increase productivity and lower costs, which could lead to positive dynamic effects on investment, growth, and productivity. Since most exportables were already highly competitive on the international market, the short run effects on productivity would probably not be as strong for this group of products.

There are several other channels through which productivity and growth would be expected to rise in the medium run. The first is through increased investment in the sector. If profitability were to rise as a result of the policy reforms, there would be incentives for investment to grow. And if capital markets were liberalized as well, the investment could be financed with access to what have been, at least in the 1990s, lower international than domestic interest rates. In a more open trade regime, this would also permit incorporating imported technology which could enhance productivity. All of these factors would contribute to lower costs and increased productivity and growth.

The elimination of industrial protection should also lead to forces that contribute to increased productivity. To the extent that the industries that produce inputs for agriculture had been protected, as was the case in Brazil, a substantial fall in the

[12] Real exchange rate appreciation was not uncommon in Latin America in the early 1990s. Quiroz and Opazo (1998) suggest that optimistic expectations related to the policy reforms in the region could partially explain the large capital inflows of the 1990s and the resulting currency appreciations. While this seems plausible for many of the countries in the region, the 1994 real exchange rate appreciation in Brazil was much more an outcome of the adoption of a new currency and the stabilization of the economy in that year. The appreciation was then sustained through large capital inflows, which in part reflected optimistic expectations about future growth, but were also a function of unusually high domestic real interest rates and a large number of privatizations of state owned enterprises.

price of imported and domestically produced inputs, such as tractors, irrigation equipment, and fertilizer, should accompany the policy reform. This would contribute to a more intensive use of these inputs, lower unit costs, and increased productivity. Real exchange rate appreciation would enhance this effect. As Quiroz and Opazo (1998) argue, however, these changes are unlikely to be neutral across farm sizes. A fall in the price of capital and intermediate inputs relative to the price of agricultural labor would create incentives for the adoption of labor saving techniques. This process is likely to favor large scale operations, and could lead to increased migration out of the agricultural sector. Since the policy reforms are expected to produce net social gains, short run policies to assist the losers in the transition process would be warranted.

As to the reform of rural credit policy, the growth in the relative importance of the private sector in providing finance to commercial agriculture should have led to increased efficiency of resource allocation for several reasons. First, with heavily subsidized credit in the 1970s and early 1980s, a considerable portion of the highly fungible funds were diverted to non-agricultural uses. Even within the sector, the high degree of subsidy implied that credit was not always directed to the activities with the highest private (or social) returns. Second, efficiency gains should have been enhanced by the move toward a private system of credit that increased the costs of default for borrowers. The experience of several credit amnesties in the late 1980s and numerous cases of debt refinancing in the 1990s contributed to producers forming the expectation that a significant portion of the costs of default would ultimately be absorbed by the government.[13] An important consequence was excessive risk-taking by borrowers.

As to the expected impact of the reduced role of support price policy, it is possible to point out the following consequences. First, since this policy served to expand production on marginal lands in the Center-West, it can be expected that its phasing out has led to productivity gains in the 1990s. Second, since the government was not a very discriminating purchaser of agricultural goods, its involvement in the marketing of these products reduced the incentives for farmers to improve the quality of their goods. Thus, it should be expected that policy reform has led to improvements in quality. Third, the phasing out of support price policy has reduced the role of the government in storage and should contribute to considerable improvements in the country's warehousing sector. Finally, the reduction of the government's role in storage and marketing has stimulated the development of futures and insurance markets that could potentially help to facilitate storage and manage risk.

4 - AGRICULTURAL PERFORMANCE IN THE 1990s

4.1 - Agricultural Prices

In this section we analyze the evolution of agricultural prices in the 1980s and 1990s. The analysis permits us to infer the degree to which domestic prices

[13] For an analysis of the Special Credit Program for Agrarian Reform (Procera) that stresses the negative consequences of excessive subsidy and costless default on the efficacy of the program, see Rezende (1999).

diverged from international prices in the late 1980s and to isolate the impact of policy changes in the 1990s. We emphasize four key points: *a*) all agricultural prices have fallen dramatically throughout the period; *b*) the real exchange rate has been the principal force causing real agricultural prices to fall; *c*) unfavorable international price movements have more than offset the positive impact of policy reform on the relative prices of most exportables; and *d*) the products that had been heavily regulated were affected most by policy reform.

We use a methodology based on the law of one price to isolate the impact of policy changes on domestic agricultural prices.[14] In order to do this, we decompose the movements in real domestic prices into three components: changes in real international prices, changes in the real exchange rate, and a residual that captures changes in policy and other factors. If the law of one price holds perfectly, the residual should equal zero. When there are important changes in policy, or when a good is not fully tradable, then the residual measures the degree to which the domestic price does not adhere to movements in the real international price and the real exchange rate.

Tables 2 decomposes the movements in the real domestic prices of six of the most important agricultural imports and four of the most important agricultural exports in selected periods. Within each category, a simple average was calculated for those products that exhibited similar behavior in terms of the impact of policy reform. The third column of Table 2 highlights the fact that the real domestic price of all agricultural products has fallen dramatically throughout the period. The prices of all goods were 50%-60% lower in 1995-1998 than in the period 1982/86, with the exception of coffee (which fell by less) and wheat and cocoa (which both fell by more). The appreciation of the real exchange rate (column 5) has been the principal factor leading to falling domestic prices. It accumulated a 57% fall (appreciation) during the same period.[15]

The final column of Table 2 shows that the effect of policy on the real domestic price of most importables was quite limited. On average, the effect on beans, corn, cotton, and rice, only led to an 8% fall in their domestic prices in the late 1980s beyond what can be explained by the percentage changes in the real international prices of these goods and the real exchange rate. The negative effect on prices was then fully reversed in the 1990s. Given that tariffs on these products fell from the 35%-55% range prior to 1988 down to 10% in 1991 (and later 0% for imports from other Mercosul countries), it would be incorrect to conclude that these products experienced a dramatic reduction in prices as a result of trade liberalization. Rather, by the late 1980s the prices of these goods were already close to their import parity equivalents. The most significant impact on these

[14] While the econometric literature on the law of one price is enormous, as far as we know Quiroz and Valdés (1993) were the first ones to develop the approach used here as a simple tool for analyzing changes in policy. In this section we summarize the results of an earlier version of this paper (presented at the LASA meetings of March 2000, in Miami), where we provide a more detailed description of the methodology and apply it to 14 products.

[15] Prior to this period of appreciation, there was a 30% real devaluation in 1983 that was sustained for several years.

goods came from the elimination of non-tariff barriers which exposed them to increased competition with imports, and through the changes in credit and support price policy. Real prices were falling, but this was attributable to the real exchange rate appreciation.

Table 2

Decomposition of Changes in Domestic Agricultural Prices for Selected Periods

Product	Period	Real Domestic Price	Real International Price	Real Exchange Rate	Policy + Residual[a]
		Percentage Change			
Importables					
Beans, Corn, Cotton, and Rice	(1982-1986)-(1987-1989)	–32	–4	–21	–8
	(1987-1989)-(1990-1994)	–22	–3	–24	4
	(1990-1994)-(1995-1998)	–17	4	–29	8
Wheat	(1982-1986)-(1987-1989)	–46	1	–21	–26
	(1987-1989)-(1990-1994)	–45	–16	–24	–9
	(1990-1994)-(1995-1998)	–14	11	–29	7
Milk[b]	(1982-1987)-(1988-1989)	–21	42	–25	–28
	(1988-1989)-(1990-1994)	–20	–2	–18	–1
	(1990-1994)-(1995-1998)	–21	2	–29	6
Exportables					
Cocoa, Oranges and Soybeans	(1982-1986)-(1987-1989)	–21	–7	–21	6
	(1987-1989)-(1990-1994)	–42	–28	–24	3
	(1990-1994)-(1995-1998)	–16	8	–29	7
Coffee[3]	(1982-1985)-(1987-1989)	–29	–20	–21	8
	(1987-1989)-(1990-1994)	–34	–32	–24	14
	(1990-1994)-(1995-1998)	41	49	–29	35

Notes:
a) The residual is presented net of the interaction between the real international price and the real exchange rate in order to isolate the impact of policy.
b) The first two periods for Milk refer to 1982-1987 and 1988-1989.
c) The 1986 coffee prices were excluded because this was an atypical year. Prices were more than double those of 1985 and 1987.

The effect of policy reform on wheat, which involved far more than trade liberalization, was dramatic. The removal of the wheat subsidy in the late 1980s led to a 26% fall in the domestic price beyond what can be explained by the international price (1%) and the real exchange rate (–21%). The combined effect was to generate a 46% drop in the domestic price of wheat. Real wheat prices then fell by another 45% in the early 1990s as a result of low international prices (–16%), the appreciation of the real exchange rate (–21%), and the impact of trade liberalization and deregulation (–9%). The consequences of such a substantial fall in domestic prices on production and trade will be shown in the following section.

Policy reform has also had important consequences for the milk market, but it has come principally through deregulation and increased competition, rather than as a result of policy induced changes in the level of milk prices. The real domestic price of milk has followed the real exchange rate quite closely from one period to another.[16] The large negative residual in the late 1980s reflects a 42% increase in the international price that was not transmitted to the domestic price. In effect, the domestic market had been protected and the international price rose to the domestic level in this period. Subsequently, trade liberalization and market deregulation only had an indirect effect on prices in the 1990s. The main impact came through increased competition and pressures to increase quality and lower costs in the context of a real exchange rate appreciation.

Consistent with our expectations, the effect of policy reform on exportables has been positive. The prices of cocoa, oranges, and soybeans have all benefited between 10% and 20% from a combination of eliminating export taxes, quantitative restrictions, and the value added tax on exports in 1996. All three products, however, suffered from international prices that were 28% lower on average in 1990-1994 than in 1987-1989. This negative shock more than offset the gains from reform in the early 1990s. A comparison of the evolution of the real domestic prices of this group of exportables relative to the importables (beans, corn, cotton, and rice) reveals that although the prices of the importables fell by 11 percentage points more in the late 1980s, they then fell by 20 percentage points less in the first half of the 1990s. Both groups of products fell by the same amount in the second half of the decade. Thus, although policy reform had a positive impact on exportables, the offsetting influence of international prices implies that domestic relative prices did not change in their favor in the 1990s.

As we described in Section 2, coffee was one of the most heavily regulated products in the agricultural sector. As in the case of wheat, policy reform has had a profound effect on prices. The end of the international coffee agreement, and the abolition of the IBC in 1990, led to a period of extremely low international prices. Although the removal of the coffee export tax helped to partially offset the effect on domestic prices, the first half of the 1990s was marked by extreme disarray. Domestic coffee prices rebounded by 41% in the second half of the 1990s, and it was the only crop in our sample whose real price was actually higher in 1995-1998 than in 1990-1994. Rising prices reflect an increasingly organized private sector and a partial reactivation of coffee policy.[17]

Sugarcane is not listed in Table 2, but several observations are warranted. Since sugarcane is used to produce both a crucial import substitute (alcohol as a

[16] Helfand (1994) observed that real exchange rate changes alter the relative price of tradables within the agricultural sector only in the short run. In the long run, both tradable and non-tradable agricultural products follow movements in the real exchange rate. Homem de Melo (1999*b*) has attributed this to substitution in production. We believe that the effect on input prices is important as well.

[17] The size of the residual in the 1995/98 period is beyond what we would have expected and requires additional research. See Lopes and Lopes (1998), for an analysis of the coffee sector in the 1990s.

substitute for gasoline) and an important export (sugar), a decomposition of its price would be considerably more complicated. A proper analysis would require examining the influence of the international prices of sugar and of petroleum, and the domestic policies for sugarcane, sugar, and alcohol. Due to sugarcane's strategic importance in providing fuel for Brazilian automobiles, deregulation of the sector proceeded more slowly. After a 50% fall in the real domestic price of sugarcane that occurred between 1984 and 1989, prices were once again stabilized with extremely little variation in the 1990s.[18] The average price in 1995-1998 was only 6% below the 1990-1994 level, in spite of the 29% fall in the RER. Although it took place more gradually, policy reform did eventually occur for sugarcane, sugar, and alcohol.[19]

In conclusion, we have shown that all agricultural prices fell dramatically throughout the period, suggesting that there has been considerable pressure on the sector to reduce average costs. The real exchange rate was, and continues to be, the most important force determining the domestic prices of agricultural products. In addition to the influence of the real exchange rate, some products were heavily subsidized (wheat), or heavily taxed (coffee), and these products experienced substantial changes in prices due to policy reform. Policy reform did not only take place in the 1990/94 period. For many products it began earlier, and for most it continued later. Finally, the effect of the changes in policy on the domestic prices of most products has been smaller than expected, suggesting that many domestic prices were not all that distorted by the end of 1980s. For the importables, as we will show, the biggest impact has come through exposure to trade, forcing the producers of these goods to compete or to exit.

4.2 - Output and Trade of Agricultural Products in the 1990s

Aggregate Agricultural Output

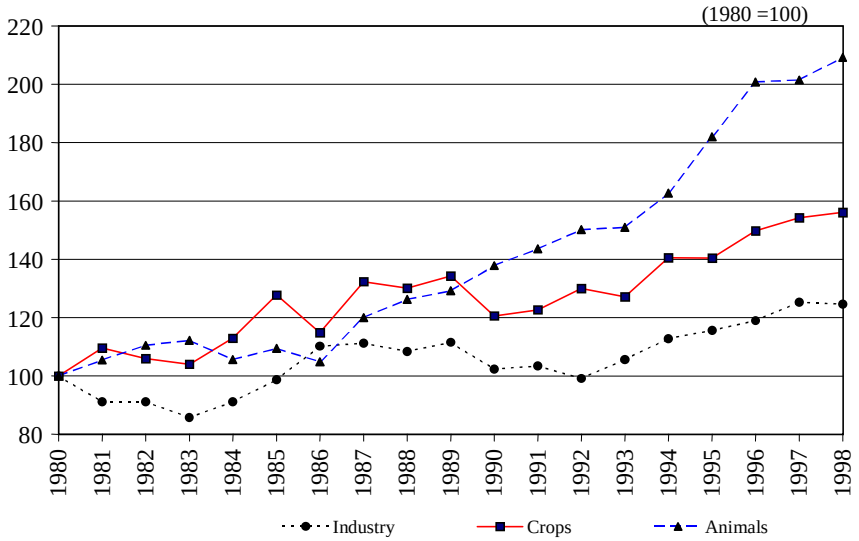
Figure 1 shows real indices of output for industry, agricultural crops, and animals, for the 1980/98 period. In contrast to the 1950/80 period, the two sub-sectors of agriculture outperformed the industrial sector in the 1980s, and both the industrial and services sectors in the 1990s. The figure shows the effect of the policies that were adopted to deal with the debt crisis in the early 1980s and the effect of the policy reforms of the late 1980s and early 1990s. The real devaluations of 1979 and 1983, together with the wheat, sugarcane, and support price policies,

[18] The coefficient of variation for the domestic price of sugarcane is smaller in the 1990s than for any of the other products in our sample. It is 35% less variable than the next product, cotton, and 65% less variable than the average of the other 13 products.

[19] Rising alcohol prices in July, 2000, in the context of a government committed to meeting inflation targets, led the government to adopt a variety of measures in an effort to increase the supply of alcohol. These included a reduction in the required alcohol content of the fuel sold for gasoline powered automobiles and an announcement that the government would begin to auction alcohol from its own stocks. The Minister of Agriculture, in addition, stated that he was studying the possibility of limiting sugar exports, and expropriating private sector stocks of alcohol. While the Minister's statements are probably empty threats, they do suggest that deregulation is potentially reversible [see *O Globo* (Aug. 5, 2000)].

generated substantial growth for agricultural crops between 1980 and 1987.[20] Growth slowed at the end of the 1980s as the currency began to appreciate again. The effect of trade liberalization and deregulation on importables crops, and low international prices for exportable crops, led to a contraction of crop output in the 1990/93 period. Thus, for a variety of reasons, the initial years of operating in an open economy were quite painful. Crop output began to recover in 1994 and has performed well since then.

Figure 1
Real Indices of Output for Industry, Agricultural Crops, and Animals —1980/98



Source: IBGE.

Although crop production outperformed animal production in the 1980s, one of the most striking features of Figure 1 is the dynamism of the animal sub-sector since 1987. Growth has been most rapid for poultry production, which has achieved rapid gains in productivity [Helfand and Rezende (1999)]. The appreciation of the currency does not seem to have created serious obstacles for chicken exports because it has simultaneously helped to lower the costs of corn and soybean—the main ingredients for feed—as well as of imported genetic material used for breeding. Although chicken production grew the fastest, tripling between 1980 and 1996, cattle and hog slaughter also grew rapidly, rising by roughly 100% and 70% respectively. Hog production, with about a decade lag, has followed the same path of modernization as poultry production, and there is evidence that beef production is now entering a period of rapid intensification as well [see *Agroanalysis* (2000)].

[20] On the positive performance of agriculture in Brazil during the 1980s, see Goldin and Rezende (1993), Schuh and Brandão (1991) and Ferreira Filho (1998). Janvry and Sadoulet (1993) show that adjustment policies favored agriculture throughout Latin America during this period, while Singh and Tabatabai (1993) argue that this positive role of agriculture was actually a world phenomenon.

Importables: Trade and Output

The reduction of tariffs and the elimination of non-tariff barriers in the early 1990s led to a dramatic increase in spending on imports. As can be seen in Table 3, the total value of agricultural imports tripled between 1985-1989 and 1995-1998, from an average of approximately 2 billion 1998 U.S. dollars per year to 6 billion. Imports increased most rapidly for wheat and milk, both of which experienced a process of complete deregulation, and cotton, which had already shown signs of difficulties in the 1980s. The impact on beans, corn, and rice was substantially smaller.

Table 3

Average Annual Trade of the Principal Agricultural Products

(Thousands of US$ of 1998)

Product	1980-1984	1985-1989	1990-1994	1995-1998
Imports				
Wheat	1.219.143	391.275	677.314	1.032.876
Cotton	6.925	108.463	386.457	702.707
Milk[a]	52.512	179.403	191.471	544.248
Rice	89.349	133.992	257.340	367.660
Corn	147.727	107.667	138.465	137.031
Beans	20.300	29.624	52.342	95.409
Subtotal	1.535.956	950.423	1.703.388	2.879.931
Index (1985-1989 = 100)	162	100	179	303
Share of Total	0,60	0,45	0,53	0,46
Total Ag. Imports	2.561.215	2.098.302	3.231.770	6.263.002
Exports				
Soybeans[b]	3.415.908	3.215.734	3.150.235	4.710.945
Orange Juice	945.264	1.080.681	1.120.730	1.197.177
Sugar[c]	1.109.854	424.950	710.759	1.821.337
Cocoad[d]	793.497	703.678	305.658	146.680
Coffee	3.187.739	2.765.706	1.661.723	2.593.105
Beef	598.885	593.680	530.222	493.221
Pork	7.152	21.224	63.072	144.250
Chicken	361.403	292.376	492.453	774.025
Subtotal	10.419.701	9.098.031	8.034.852	11.880.741
Index (1985-1989 = 100)	115	100	88	131
Share of Total	0,84	0,82	0,78	0,80
Total Ag. Exports	12.464.345	11.029.268	10.240.186	14.788.598

Source: FAO.
Notes:
a) Milk equivalent as defined by the FAO.
b) Includes beans, soy cake, and oil.
c) Includes refined and centrifugal (raw).
d) Includes cocoa butter, cake, and paste.

Consistent with our predictions of Section 3, harvested area for wheat, cotton, corn, rice, and beans fell by 20% between 1985-1989 and 1995-1998, or 6 million hectares of cultivated land (Table 4). Among these six products, there is a very clear relationship between rising imports and falling domestic production. Production fell substantially for wheat and cotton, and rose for beans and corn. The correlation between changes in relative domestic prices and changes in production, however, does not appear to be as strong.

The withdrawal of the wheat subsidy and the deregulation of the wheat market signified the end of the policy of striving for self-sufficiency and led to a substantial fall in the relative domestic price. As a result of the policy reforms, domestic production fell by more than 50% between 1985-1989 and 1990-1994 (Table 4), and by the late 1990s imports had nearly tripled (Table 3). Since wheat is produced almost exclusively in the South of Brazil, the burden of adjustment has fallen most severely on this region.

The impact of policy reform on cotton production and trade has also been dramatic. Cotton was an important export in the late 1960s and early 1970s, and in the first half of the 1980s Brazil still exported more than it imported. Insufficient domestic supply and quality problems led the domestic textile industry to push for the elimination of quantitative restrictions earlier than when it occurred for the other products. When non-tariff barriers on imports and exports were eliminated in 1988, imports definitively surpassed exports and eventually grew to 700 million per year in the late 1990s (Table 3). The inability of cotton producers to compete has, as in the case of wheat, led to a rapid decline in production. Cotton output in 1995-1998 was only half of what it was during 1985-1989. As can be observed in Table 4, however, cotton area and production have doubled in the Center-West. New varieties of cotton that are well suited to the region have contributed to the ability of this region to successfully compete with imports.

Corn, beans, and rice have experienced less dramatic changes in trade, but a significant restructuring of production has taken place. Although the quantum of corn imports has grown moderately over time, imports as a share of domestic production have been remarkably constant, falling slightly from 3.4% in 1985-1989 to 3% in 1995-1998. The total area harvested in corn has been quite stable in the 1990s, with increased output coming almost exclusively from rising yields. The Center-West has been the most dynamic region [Table 4, and Helfand and Rezende (1999)], as the growth of corn production has been pulled along by the expansion of soybeans and animal based agroindustries. Many corn producers linked to the feed and animal industries throughout the Center-South of Brazil have modernized and are capable of competing with imports.

Imports of edible beans have grown somewhat faster than corn imports, tripling in terms of value (Table 3) and as a share of domestic production. They still remain relatively modest, however, having risen from 2% of domestic production in 1985-1989 to 6% in 1995-1998. Area harvested for beans has fallen by about 20%, but like corn, output has grown due to rising yields. Bean producers are highly differentiated, with an increasing share of production coming from an irrigated second (23%) and third (7%) harvest. Although farms over 200 hectares only produced 15% of the first harvest in 1995-1996, they were responsible for a third of the second harvest and two thirds of the third harvest.[21]

The growth of rice imports has had a more significant impact than in the case of corn and beans. Like beans, they have tripled in value between 1985-1989 and

[21] Data from IBGE, *Censo Agropecuário 1995-1996*.

1995-1998, but this has come to represent a more important share of domestic production. As a share of production, imports have grown from 6% in the late 1980s, to around 15% in the late 1990s. Most of the increase in imports has come from the other Mercosul countries. Relative to the other regions in Brazil, two states in the South, Rio Grande do Sul (RS) and Santa Catarina (SC), produce a higher quality rice, use a different technology (irrigation), and obtain yields that are triple the national average. These states have suffered considerable pressure from imports, but have managed to hold their ground in the 1990s, with area actually growing in the 1992/95 period, and output and yields increasing slowly but steadily. Area and output have fallen substantially in the rest of the country.[22]

Exportables: Trade and Output

Tables 3 and 4 show that policy reform has had a positive impact on exportables. In spite of the currency appreciation, the total value of agricultural exports rose by about US$ 4 billion 1998 between 1985-1989 and 1995-1998, or the same amount as the value of agricultural imports. For imports, however, this represented a 300% increase, while for exports it was only 34%. As predicted, policy reform has also led to substitution of importables in production within the agricultural sector. Table 4 shows that an average index of production for the five importables fell by 14% between 1985-1989 and 1995-1998, while an average index of output for the five exportables rose by 13%. When cocoa is excluded, which has suffered from a devastating fungus, the output index for exports rises to 24%.

The information in Table 4 also suggests that there has been a significant improvement in the utilization of resources within the sector. When subsidies and protection were withdrawn, the area harvested for importables fell by 6 million hectares. Harvested area for exportables, in contrast, has only risen by 1.6 million hectares, implying that a considerable amount of area has been freed to be used in more productive activities or is no longer being used because it is no longer profitable to do so. The second explanation appears to be more important, as available data suggest that total harvested area has fallen by over 4 million hectares between 1985-1988 and 1994-1996.[23]

It is interesting to observe that two of the products which should have benefited the most from the elimination of export taxation — cocoa and coffee — have performed the worst in the 1990s, although for very different reasons. In the case of cocoa, Table 4 shows that output and yields fell by more than 30% in the 1990s, even though area harvested remained unaltered. The contraction is attributable to the "witches broom" fungus which spread throughout the cocoa growing region of Bahia.[24] The area harvested in coffee, in contrast, fell by 30% between 1985-1989

[22] There are new varieties of rice that are starting to be used in the Center-West that might lead to a new wave of expansion in this region. The new varieties are of the same quality as the rice produced in the South, and they are well suited to the non-irrigated conditions of the Center-West.

[23] The data comes from IBGE (s/d). Data for 1989 is not available, and 1996 is the most recent year that we have a complete set of data for.

[24] It is likely that the descaling of Ceplac's activities in 1990 severely hampered its ability to conduct research and provide technical support that could have minimized the impact of the fungus.

and 1995-1998, as the sector experienced a significant reorganization in response to the extinction of the IBC, the end of the international coffee agreement, and low international prices. As prices have recuperated since 1994, the value of exports has rebounded.

Soybeans have been a real success story since the 1970s, and the 1990s were no different. In 1970 the area harvested in corn was approximately ten times larger than that in soybeans, yet in 1998 soybeans finally surpassed corn and became the crop that occupied the largest share of area in the agricultural sector. Soybean area and output grew by more than any of the other crops in the 1990s, and virtually all of the expansion happened in the Center-West (Table 4). The value of exports was relatively constant between 1980 and 1994, yet favorable external prices in 1996-1997, combined with the elimination of the ICMS sales tax on exports contributed to raising the value of exports by around 50% in the 1995/98 period (Table 3).[25]

Sugarcane and oranges both expanded in area in the 1990s, yet by a smaller amount than soybeans, and both have increased output and to a lesser extent yields. Both of these crops have expanded principally in the state of São Paulo, where 75% of the oranges and 50% of the sugarcane in Brazil are produced. The withdrawal of subsidies to sugarcane production in the Northeast has led to a contraction of area and production in that region. After sugar exports were freed from quantitative restrictions in the mid-1990s, exports responded rapidly and increased to nearly US$ 2 billion per year (Table 3). Both of these crops continue to face significant restrictions from importing countries (such as quotas or tariffs). Concentrated orange juice exports face an additional set of obstacles, as described in Brandão (1999), including changing consumer preferences away from concentrated juice and towards fresh juice, and companies transferring production from Brazil to southern Florida.

Table 3 also provides data on meat exports. While beef exports have been stagnant in the past twenty years, chicken and pork exports have grown rapidly in the 1990s. Poultry and hog production have traditionally been concentrated in the South of Brazil, but the expansion of soybeans and corn in the Center-West has been one of the forces leading to dramatic growth in the 1990s in the production of these animals in this region [Helfand and Rezende (1999)]. This is another dimension of the challenge to the competitiveness of the South in the 1990s, and of the expansion of lucrative activities in the Center-West that are oriented toward domestic and international markets.

[25] The impact of the tax change was quite strong for soybeans. Since processed goods did not benefit from the sales tax elimination, the quantum of soy oil and soy cake exports did not increase. In fact, they fell moderately in order to permit soybean exports to grow from 3.5 million tons in 1995 and 1996 to 8.3 and 9.3 million tons in 1997 and 1998.

4.3 - Productivity Gains and Input Use in the 1990s

Initial Considerations

We begin this section with a discussion of the relationship between productivity growth, technological change, scale effects, and efficiency gains in the 1990s. We then present evidence on the growth of total factor productivity (TFP) in agriculture in the 1980s and 1990s. In light of the results for TFP, we analyze the evolution of land productivity across crops and farm sizes in order to show the differentiated effects of policy reform on the sector. We conclude by highlighting several of the most important changes in the use of inputs and their relative prices.

Productivity can increase for a number of reasons. Ideally we would like to measure changes over time in productivity at the level of farms and decompose these into the portions that are attributable to technological change (an outward shift of the production possibilities frontier), scale effects (increased productivity due to changes in the scale of operation for a given technology), and efficiency gains (movements toward the frontier of a given technology). We hypothesize that all three of these factors have contributed to increased productivity in the 1990s, although their measurement is beyond the scope of this paper.[26]

When productivity is measured at a more aggregate level, such as TFP for the entire sector, or national level yields for a single crop, these average indicators of productivity can rise for the same reasons that productivity rises at the farm level. In the context of increased competition in the 1990s due to the policy reforms, it is likely that gains in efficiency at the sectoral level, in addition to gains within the farm, have been an important reason for increased productivity. As the least productive farmers choose to exit a given activity because it is no longer profitable for them, as the least productive pieces of land are withdrawn from production, and as crops are shifted from less productive to more productive regions, average productivity rises even though there might not have been any technological change. As described in the previous section, all of these factors were at work in the 1990s. It is likely that there have also been technological and scale effects in the 1990s, especially in the Center-West where farms tend to be much larger and where expansion has occurred often by incorporating the latest technologies.[27] Productivity gains within the farm have also been important for certain activities, such as in the cases of milk, poultry, and hog production, where rapid modernization has taken place. Clearly, these are important areas for further research.

[26] We are pursuing a study of changes in productivity along these line, with county level census data for the period 1985 to 1995/96, but the research is still in the data gathering and cleaning stage.

[27] Gasques and Conceição (2000) confirm that TFP has grown extremely rapidly in the Center-West.

Total Factor Productivity

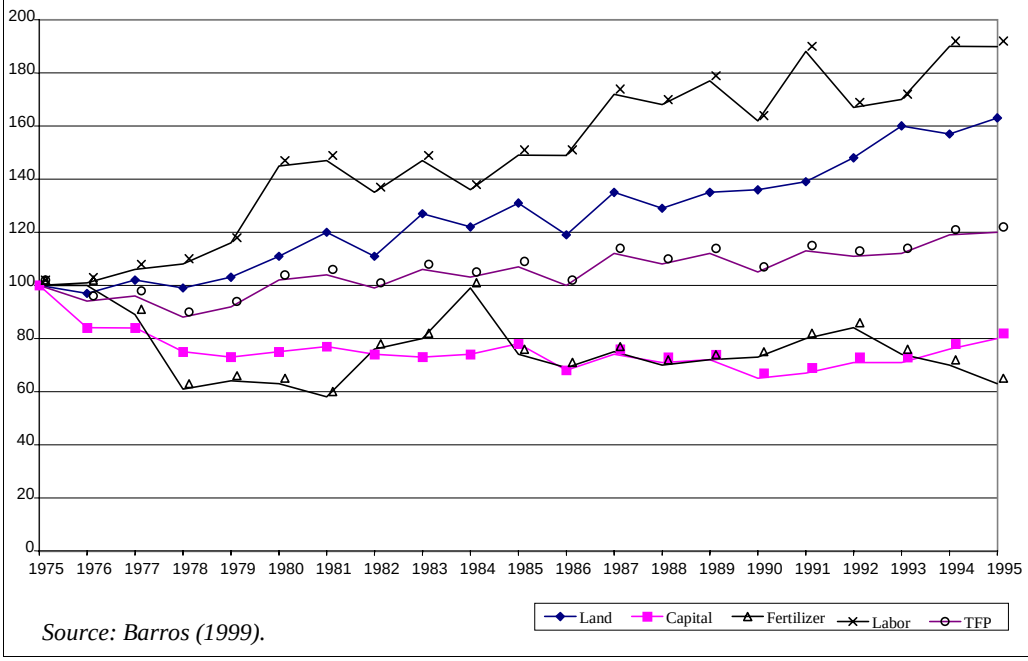
Several recent studies have attempted to measure total factor productivity at an aggregate level in the Brazilian agricultural sector over the past several decades. The results have been qualitatively similar, and in what follows we focus on Barros (1999) who carefully tests the sensitivity of the results to alternative assumptions and specifications [see Bonelli and Fonseca (1988), and Gasques and Conceição (1997)]. The author uses a non-parametric Tornquist index as well as a growth accounting approach, in which the growth rate in the value of agricultural production is a function of the growth rates in harvested area, capital services, fertilizer use (a proxy for the use of intermediate inputs), and labor. The author measures the value of agricultural production with and without animals, and he devises three different indexes to proxy for capital services which are based on the number of tractors, the horsepower of tractors, and the estimated value of the stock of tractors. Notwithstanding the huge problems of measurement error, which the author duly recognizes, the results point to some plausible conclusions.

First, as can be seen in Figure 2, although TFP measured with the growth accounting approach increased by 20% in the 1975-1995 period, all of the net growth came since 1986, and most of it in the 1990s. The correspondence with the period of policy reform is significant. Second, the growth in land and labor do not explain the growth in TFP, as both inputs changed very little over the entire period. The number of tractors and fertilizer use, in contrast, both doubled in the first ten years, with tractors growing by an additional 20% in the second decade

Figure 2

Productivity Indexes for Agriculture — 1975/95

(1975 = 100)



Source: Barros (1999).

and fertilizer use by 50%. As a result, land and labor productivity have grown by 30% in the 1985/86 – 1994/95 period, TFP by 15%, capital productivity by 7%, and fertilizer productivity by –7%.[28] This is an important result because it demonstrates that land productivity (yield) overstates the true gains in productivity in Brazilian agriculture. Finally, the estimated growth of TFP with the Tornquist approach is significantly higher, in some specifications almost double, but the qualitative results are similar.

Land Productivity

The final four columns of Table 4 show changes in yields (land productivity) for the principal importables and exportables in the 1980s and 1990s. It is important to recognize that gains in yields overestimate the gains in TFP and that they do not necessarily imply that technological change has occurred. Especially in the context of the contraction in area that many products experienced, increases in yields are likely to be more associated with increases in efficiency within the sector as low quality land is withdrawn from production and as the least productive producers exit.

The simple averages of the gains in yields show that importables have preformed better than exportables in both the 1980s and 1990s. Between 1980-1984 and 1985-1989, yields rose by 16% on average for importables, while for exportables there was no gain. Between 1985-1989 and 1995-1998, the average gain in yields for importables was 24%, while for exportables it was 16% (with cocoa excluded). This is a striking result which reverses the pattern that had prevailed in the 1970s [Goldin and Rezende (1993)]. For the 1980s it reflects, in part, a series of successful investments that the Brazilian government had made in agricultural research. Even more impressive, is that the gains took place in the context of a protected economy that induced an unsustainable expansion for most of these crops. The result for the 1990s is consistent with our predictions and is more a reflection of the changing product mix within the agricultural sector that resulted from trade liberalization and a reduced role of the government in marketing crops and in providing credit.

With the exception of corn, the other four importables experienced substantial contractions in harvested area. This should raise average yields as the least productive land and the least productive producers exit. This effect has been quite strong for rice in the Center-West and beans throughout the country, yet it is not evident for wheat. It is likely that the remaining producers of importables have been striving to increase their productivity and lower costs in order to compete with growing imports. Corn and cotton in the Center-West are the two main

[28] Barros shows that how one measures capital matters quite a bit. When capital is measured with tractors or with the horsepower of the stock of tractors, capital productivity falls over the period. But when capital is measured by the services provided by the value of the stock of tractors, appropriately depreciated, then the estimated capital productivity rises due the aging of the capital stock. This does not, however, significantly alter the other results. Similar measurement problems apply to land (quality) and labor (human capital, and effort). The failure to account for these factors suggests that the growth in land and labor productivity are probably biased upwards.

exceptions to the pattern of contraction, as they have both increased area and yields in the 1990s. Increased productivity in this region is probably associated with technological improvements and scale effects, as expansion in the Center-West has taken place via extremely large farms that have incorporated high levels of technology. Rice in the South is also a partial exception, as output expanded in the 1990s due to a combination of modest increases in area and yields.

Our expectation for exportables was that productivity gains would be less associated with policy reform, at least in the short run, because Brazil was already a highly competitive producer of these goods. Policy reform, in addition, was expected to induce an increase in area for these goods which would tend to lower their average yields. As expected, the gains in yields have been quite modest for oranges, sugarcane, and coffee, the latter in spite of a significant contraction in area.

Soybeans is the one major exception, with most of the growth coming from the Center-West. Rapid expansion of area in this region (2.9% per year in the 1990s) has been accompanied by rapid growth in yields (3.1% per year). Without a doubt, the growth in production and yields of soybeans, corn, and cotton in the Center-West, along with the associated animal based agroindustries, have combined to make this the most dynamic agricultural region in the country.

Land Productivity and Farm Size

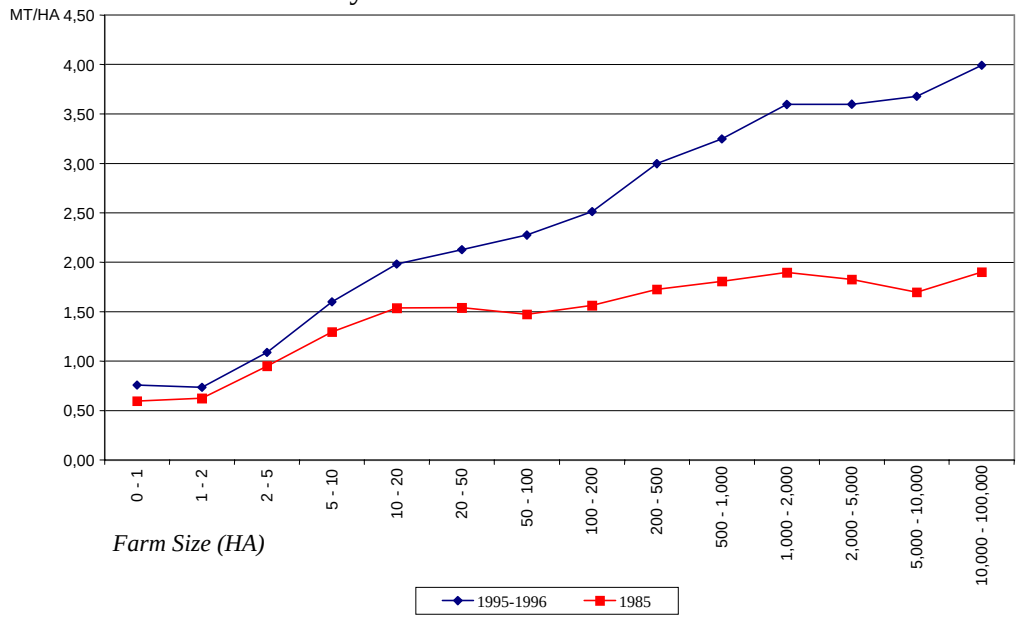
There has been considerable discussion in Brazil about the distributional impact of policy reform on the agricultural sector. Many authors have used the agricultural census of 1995-1996 to argue that the number of farms has fallen by nearly one million, or 16%, since the 1985 census, and that the number of people employed in the agricultural sector has dropped by more than 20%. The comparison of the two censuses, however, is compromised by a change in the reference period of the most recent census. Using other sources of information, we estimate that the actual drop has been less than half of the recorded drop.[29] Even if the rate of decline is considerably slower than the census suggests, it is clear that many farmers have chosen to exit and that labor saving technologies have increasingly been adopted. We present evidence for three crops, corn, beans, and rice in the South, that suggests that this trend is uneven, yet likely to continue. We choose corn and beans because they are produced by more than two million farms each, and thus the long term viability of small scale agriculture is tied to its ability to compete in the production of these crops. Rice is produced by one hundred thousand farms of all sizes in the South, and it presents an interesting contrast to the other two products.

[29] The estimate is based on data from PNAD, the annual national household survey. See Helfand and Brunstein (2000) for a discussion of the problems of comparability with the 1995-1996 census.

Figure 3 shows corn yields by farms size for 1985 and 1995/96.[30] Yields have grown by more than 75% for farms over 100 hectares, yet by less than 30% for farms under 20 hectares. This has apparently been sufficient to give large farms a competitive advantage. Even though the comparison of production shares from the two censuses should be done with caution, the share of output coming from farms over 100 hectares has grown from 35% to 56%. Figure 4 shows a similar situation for bean producers. Yields have grown between 80% and 165% for farms over 100 hectares, but by less than 30% for farms under 100 hectares. As a consequence, the share of large farms in output has risen from 21% to 29%. In the case of rice producers in the South of Brazil, in contrast, Figure 5 shows that yields have grown faster for small producers. Output shares have remained relatively constant.

Figure 3

Corn Yields by Farm Size —1985 and 1995-1996



[30] The data come from the agricultural censuses, IBGE. The use of the 1985 and 1995-1996 censuses for comparing the levels of variables is problematic, as mentioned above, because not all of the establishments that produced in 1995-1996 were present in the off-season to be interviewed. Thus, the levels of variables such as production or employment are likely to be lower than what they would have been if the census date had not been changed. Shares and ratios calculated from the 1995-1996 Census should be less influenced by the change in reference period than the levels of variables. Nevertheless, they could be subject to a sample selection bias. If certain types of establishments were systematically undercounted, such as small farmers or renters, then this could bias these calculations as well. Thus, the data we cite on production shares and yields should only be viewed as suggestive of the changes in this period.

Figure 4

Bean Yields by Farm Size —1985 and 1995-1996)

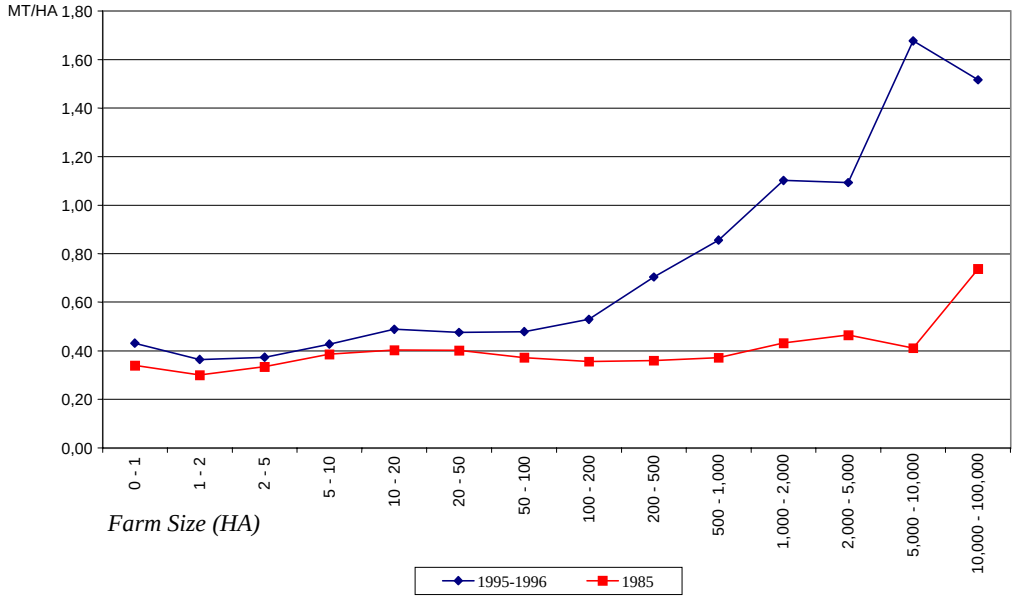
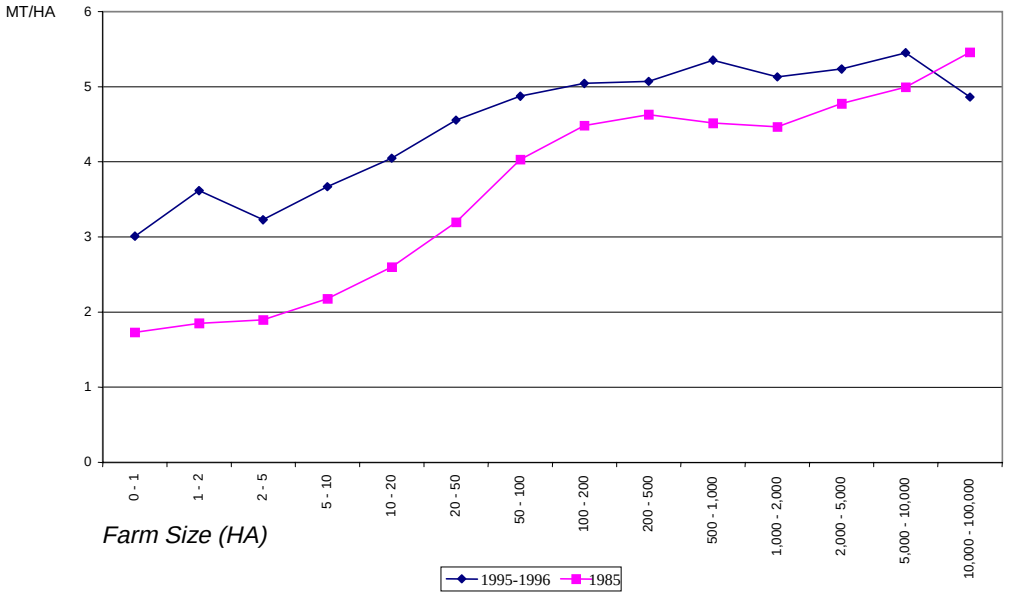


Figure 5

Rice Yields in the South by Farm Size —1985 and 1995-1996



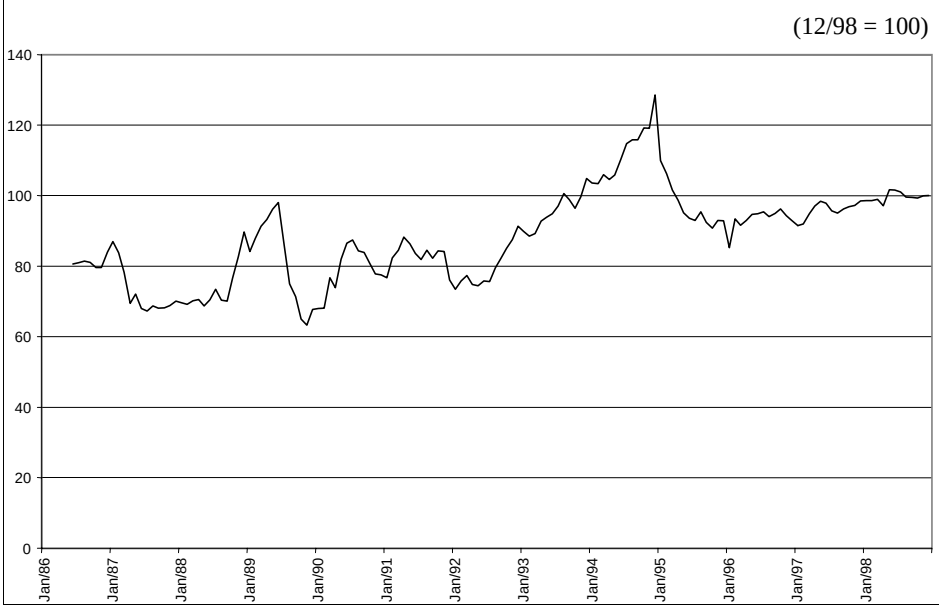
Inputs

In Section 3 of this paper we argued that policy reform would be expected to lead to a significant realignment of relative input prices within the agricultural sector. Trade liberalization and reduced protection of industry, in addition to the real exchange rate appreciation, were expected to lower the relative prices of inputs such as fertilizers, pesticides, and tractors. This, in turn, should lead to greater utilization of techniques that use these inputs intensively and that economize on the non-tradable inputs land and labor. An additional factor that reinforced the expected impact of policy reform on relative input prices was a substantial increase in agricultural wages at the beginning of the Real Plan.

Figure 6 shows an index of relative agricultural prices for the period for which the data are available (6/86–12/98). The index was calculated as the ratio of the Getulio Vargas Foundation's (FGV) agricultural output price index divided by their agricultural input price index. The figure shows that there was no distinguishable trend between mid-1986 and mid-1992. Relative output prices then rose by over 50% between June 1992 and December 1994, at which time they fell by around 20% and then stabilized for the remainder of the period, about 25% above their pre-1992 level. The principal reason for rising relative output prices in this sub-period has to do with the speed at which input prices fell. From the first half of 1992 through the second half of 1994, the real prices of fertilizers, pesticides, and tractor services all fell by over 30%, while the prices of seeds, fuel, and labor fell by 5%-10%. The combined effect of these changes was two-fold. First, the increase in relative output prices should have contributed to increasing the profitability of agricultural activities. Second, the fall in the relative prices of tradable inputs should have created strong incentives to increase their use.

Figure 6

Relative Agricultural Prices: Output Price Index / Input Price Index
— Jan./86-Jan./98



A substantial rise in agricultural wages at the beginning of the Real Plan was another reason why the incentives should have increased for producers to save labor by mechanizing and increasing their use of intermediate inputs. As Figure 7 demonstrates, wages rose by about 60% relative to the other inputs between mid-1994 and mid-1995, and then changed little in the following three years. It is likely that agricultural wages rose due to the increase in economic activity in the economy as a whole associated with the early phase of the Real Plan, as well as to the planting and harvesting of a record grain crop in the 1994-1995 agricultural year. Agricultural wages were then sustained at a higher level by the increase in the minimum wage from R$ 70 to R$ 100 in May of 1995. A change in relative factor prices of this magnitude should have a powerful effect on factor use as well as on crop mix. Living standards for those rural workers that succeeded in remaining employed should have risen, but strong pressures to shrink the rural labor force must surely have been felt.[31] The increasing mechanization of sugarcane production in São Paulo and the transfer of cotton production to the highly mechanized Center-West ae but two examples of this process.

Figure 7

Price of Labor Relative to the Input Price Index — Jan./86-Jan./98

(12/98=100)

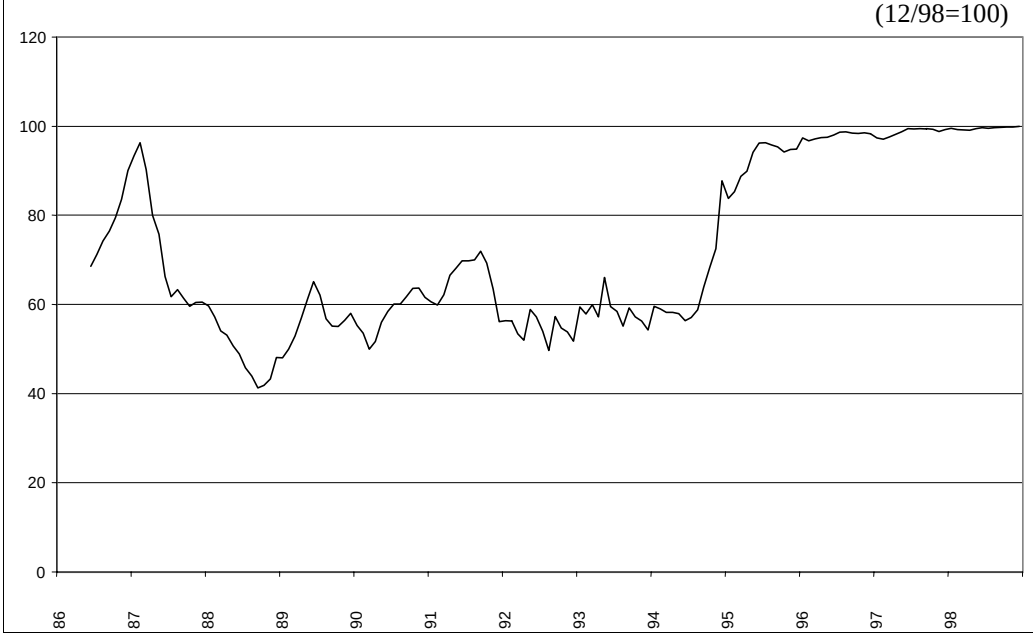


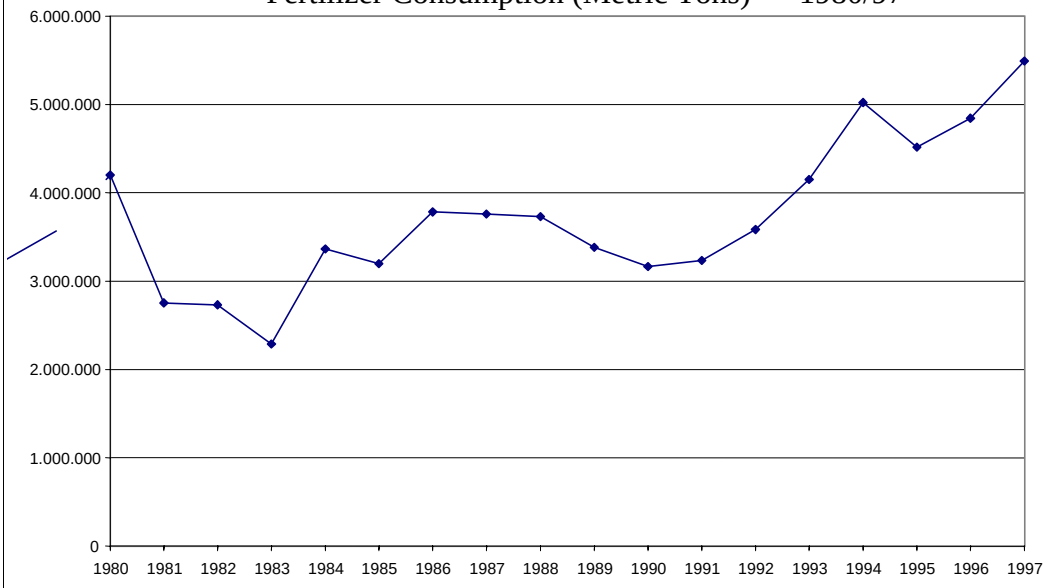
Figure 8 shows the impact on fertilizer consumption of the policy changes in this period. Fertilizer consumption rose from one to 4 million tons per year between 1970 and 1980, in large part due to substantial subsidies. After contracting in the early 1980s, consumption stabilized around 3.5 million tons from 1984 to 1992. The changing relative prices in the 1990s led to more than a 50% increase in

[31] See Alves, Rezende Lopes and Contini (1999) for an analysis of migration out of the agricultural sector since the 1940s.

fertilizer consumption between 1992 and 1997. This is one of the key factors that contributed to increasing TFP in the 1990s and it reflects the intensity of efforts to improve competitiveness in the 1990s. As the distribution of yields for corn and beans demonstrated, however, most of the gains in productivity were concentrated in large farms.

Figure 8

Fertilizer Consumption (Metric Tons) — 1980/97

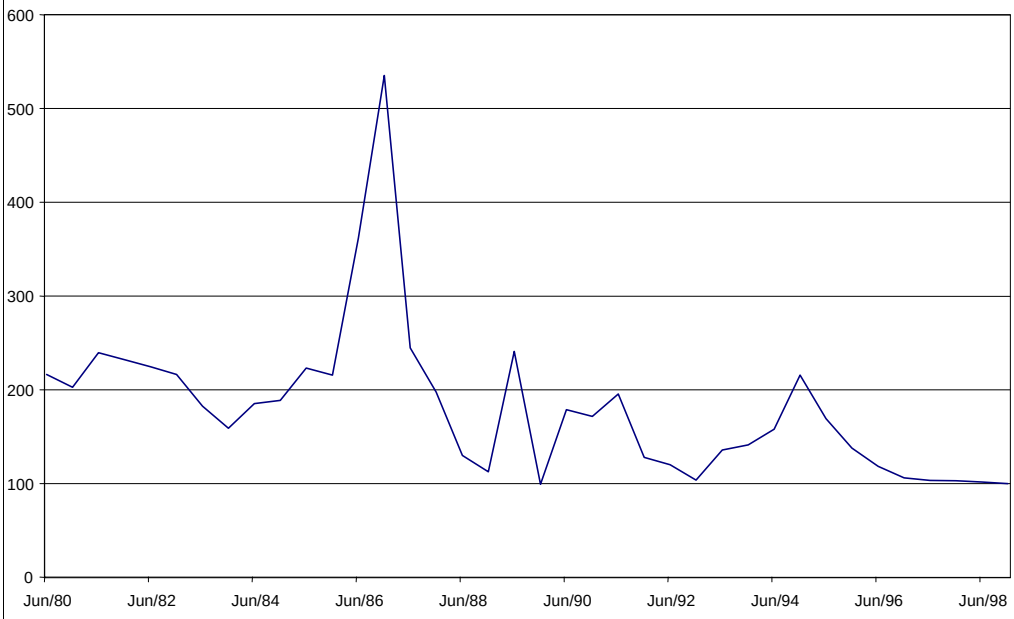


The restructuring of the agricultural sector in the 1990s has also been influenced by the many macroeconomic stabilization plans and their impact on the evolution of land prices and rural debt. The sale price of land used in agriculture reflects the present discounted value of the future stream of agricultural profits and also factors in the expected appreciation and risk of holding land as an asset. As Goldin and Rezende (1993) observed for the 1980s, it has often been the case that land prices have risen in the early phases of stabilization plans due to increased uncertainty and the desire of investors to hold real assets [see Dias and Amaral (1999*b*)].Consequently, the spikes in land prices in 1986, 1989, 1990-1991, and 1994 that can be observed in Figure 9 correspond clearly to the Cruzado Plan, the Summer Plan, the two Collor Plans, and the Real Plan. The evolution of land prices is highly correlated with the relative agricultural prices of Figure 6, and is one of the principal forces that has led to the cycles of boom and bust that contributed to the problems of debt that we discussed in Section 2. Figure 9 also shows that the real price of land (deflated by the IGP-DI general inflation index) stabilized in 1997-1998 at its lowest level in the past two decades. This should facilitate access to land for those producers most prepared to compete in the new policy environment. It has also reduced the cost of a state mediated land reform program and increased the feasibility of a market based alternative.

Figure 9

Real Price of Crop Land

(12/98 =100)



5 - CONCLUSIONS

In this paper we analyzed the impact on the agricultural sector of the wide-sweeping policy reforms that began in Brazil in the 1980s. We argued that the reform of the policies that influenced the agricultural sector was subordinated to the changing macroeconomic circumstances of the period. Events outside of the sector were also among the principal forces that conditioned its performance. In addition to the evolution of the real exchange rate and the elimination of industrial protection, the macroeconomic instability of the period was a key indirect force that led to serious problems of debt and delinquency within the agricultural sector.

The first wave of reform was debt induced. The debt crisis of the 1980s placed a premium on foreign exchange and a series of policies were adopted to increase the incentives for exports and import substitutes. The agricultural sector outperformed industry in this period as a result of the real devaluations of 1979 and 1983 and the support price, wheat, and sugar-alcohol policies. By the late 1980s, however, the threat of hyperinflation began to supercede the problem of debt. A second wave of reform was pursued that involved opening the economy to trade and scaling back or eliminating many of the sector specific policies that had contributed to growth in the 1980s. The fiscal cost of these policies had become excessive. A final phase of reform took place in the second half of the 1990s when the Real Plan succeeded in stabilizing the economy. Stabilization came at the cost of an

overvalued exchange rate and extremely high real interest rates, yet it provided a much less risky environment for planning production and investment decisions. The private sector began to play a much larger role in the provision of credit and in the marketing and storage of agricultural goods in this period. The government, in contrast, was pressured from below to pursue an ambitious program of land reform and increasingly focussed its activities on small scale agricultural.

We argued that aggregate measures of the impact of the reforms in the 1990s would be highly misleading. Although the agricultural sector grew faster than the industrial and services sectors in the 1990s, within the agricultural sector the exportable and animal sub-sectors benefited disproportionately from policy reform, while several of the importables experienced very difficult transitions. The exportables gained from an elimination of taxation and controls on exports, from a reduction in the costs of inputs and, in several cases, from an increase in access to international credit and interest rates. The importables also benefited from lower input prices, but suffered from a reduction, or in many cases complete elimination, of tariff and non-tariff protection. This led to a dramatic fall in output for several crops, and a reduction in production accompanied by an increase in imports for most of the others. Many of the gains have been concentrated in the Center-West of Brazil, while most of the difficulties have occurred in the South.

Some of the most profound transitions, however, had little to do with whether a good was exportable, importable, or non-tradable. They have come as a result of the deregulation of domestic markets and a redefinition of the role of the state. Thus, in the cases of wheat, coffee, sugarcane, and milk, the transition has resulted not only from a change in the level of protection, but also from the withdrawal of the state from its traditional role of setting prices, managing production, and regulating or monopolizing the activities of marketing and trade. This has led to more competition within the agricultural and processing sectors, and to a larger role for the market in coordinating the relationship between them.

Another way in which policy reform had a differentiated impact on the agricultural sector relates to farm size. A comprehensive analysis of this issue was hindered by problems of comparability between the 1995-1996 and previous agricultural censuses. Even though the official data overstate the magnitude of the change, the evidence suggests that there has been a significant reduction in the number of farms in the agricultural sector in the 1985/95 period. It is also likely that for crops like corn and beans, which are central to the production portfolios of millions of small farms in Brazil, large farms have been increasing yields at a much faster rate than small farms. The consequence has been a lack of competitiveness for small farms and a rise in the share of production coming from large farms. In this context, beginning in 1995 the government began to expand the agrarian reform program and has increasingly targeted the provision of credit to small farms. It is our view that land and credit alone are unlikely to be sufficient to create a sustainable source of income for the beneficiaries. Additional research is required to investigate the adequacy of the policy package

and to suggest reforms that could contribute to the long run viability of the land reform beneficiaries.

One of the most important benefits of policy reform has been to force improvements in resource allocation, productivity, and product quality within the sector, and to lower the price of food for consumers. There were two ways, however, in which the reform of policies was still incomplete at the end of 1998, and we expect that their reform will have offsetting effects on productivity and costs. The first relates to the exchange rate and the second to a series of policies that are still in need of reform. The appreciation of the currency in the 1990s undermined the competitiveness of tradable goods, yet simultaneously lowered the price of tradable inputs. The effect was to "stress" the agricultural sector [Schuh (1974)] and to force productivity gains. The 50% real depreciation that accompanied the decision to let the currency float in January, 1999, was a step in the direction of completing the reforms of the 1990s and will undoubtedly improve the competitiveness of tradable agricultural goods. We expect, however, that by reducing import competition and raising tradable input prices it will also slow productivity growth and cost reductions within the sector.

In addition to the effects of an overvalued exchange rate, the competitiveness of Brazilian agriculture was harmed in the 1990s by artificially high interest rates, poor physical infrastructure, and the comparative inadequacies of the country's tax system. For this reason, we agree with Lopes (2000) who has argued that the Brazilian agricultural sector suffered from a "partial reform." The floating of the exchange rate and the control of inflation have created the conditions in which real interest rates could fall to the levels practiced in other developing countries. The necessary investments in infrastructure and the reform of the tax system, in contrast, have been hindered on the one hand by an Administration concerned with fiscal constraint, and on the other by a Congress unable to reach agreement on the design of a new tax code.

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Composed in Adobe Garamond 11/13.2 (text)
Frutiger 47 (headings, graphs and tables)
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ISSN 1415-4765

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Secretariat of Strategic Affairs

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