The Distribution of Subsidized Agricultural Credit in Brazil: Do Interest Groups Matter?

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ABSTRACT

This article examines the unequal distribution of credit and credit subsidies in the Brazilian agricultural sector from 1969 to 1990. Total credit subsidies exceeded US$ 40 billion in this period. The distribution across crops is studied econometrically. After controlling for area, the crops that benefited most had superior access to credit institutions, were tradeable, had high prices, and were not perennials. Proxies for collective action by crop were an unimportant determinant of credit policy, while a bias in favour of large producers was evident. Alternative explanations for this bias are discussed, including collective action by farm size and transaction costs in lending.

INTRODUCTION

It is a well-established fact that agriculture was taxed indirectly in developing countries that followed an import substitution industrialization strategy. Within the agricultural sector, price and trade policy placed an even greater burden of taxation on exports, while import-competing goods were often protected (Krueger, 1992; Schiff and Valdés, 1992). The pattern of policies within each category, however, was quite heterogeneous. Some exports suffered from severe discrimination while others faced relatively benign policies.

Many developing countries used subsidized credit as a form of compensation to partially offset the negative effects on output and income of the indirect and direct policies that taxed agricultural goods. Of these, Brazil relied particularly heavily on credit subsidies as a form of compensation. The results of an eighteen country World Bank study on the political

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economy of agricultural pricing policy revealed that in the period 1966–83 Brazil was the only country in which credit subsidies were of the same magnitude as export taxation. For the next largest subsidizer — Colombia — credit subsidies represented only a third of export taxation (Schiff and Valdés, 1992: Ch. 6).

Since taxation in Brazil exhibited a differentiated pattern across crops (Brandão and Carvalho, 1991; Helfand 2000), the degree of 'compensation' through credit subsidies should also be analysed at the crop level. While the literature on credit subsidies in Brazil is large, little of it has examined the subsidies obtained by each product. Similarly, there has been little written in the international literature about the determinants of the distribution of credit across products. This article seeks to fill this gap. It analyses the importance of a variety of factors that are hypothesized to influence the allocation of credit, and credit subsidies, across crops. These factors include technical criteria, transaction costs in lending, government objectives such as generating foreign exchange, and interest group influence. The article focuses on the 1970s and 1980s, a period which encompasses the rise and decline of credit subsidies as an important policy instrument.

In the literature that seeks to explain the determinants of agricultural protection in developing and developed countries, a theory of collective action based on Olson (1965, 1986) and Becker (1983) has proved useful (see Binswanger and Deininger, 1997; Gardner, 1987; Helfand, 2000; Jaramillo and Durán, 1999). For this reason, a key objective of this article is to test whether proxies for the ability of crop-based interest groups to organize pressure groups are a significant determinant of the distribution of subsidies. As I will argue below, there are strong reasons to believe that product-based interest groups are *not* a significant determinant of the distribution of agricultural credit. The other explanations explored in this article are likely to play a more important role. If it can be shown that the determinants of credit and trade protection differ, then future studies of interest group influence need to exercise caution in their specification of a dependent variable because the results can depend crucially on this choice.

The rest of the article is organized as follows. First, the research is placed in the context of the international literature on agricultural credit markets and the Brazilian literature on rural credit subsidies, and the hypotheses that will be tested in the article are presented. The following two sections then explain the methodology used for estimating the real value of agricultural credit and credit subsidies, and analyse the magnitude, distribution, and evolution over time of credit and credit subsidies. An econometric analysis of the distribution of credit and credit subsidies across crops is then presented. This seeks to answer the question of why some crops received more credit, and more subsidies, than their share of area in the agricultural sector. The article closes with a short conclusion, and some thoughts on future research.

THE LITERATURE AND THE HYPOTHESES

The International and Brazilian Literature on Rural Credit

Traditional agricultural credit programmes based on the provision of subsidized credit came under attack as early as the mid-1970s. These programmes were criticized for generating allocative inefficiencies, contributing to income and wealth concentration, worsening public deficits and inflation, and for generally failing to achieve their objectives of promoting agricultural modernization, increasing output, and redistributing income to the rural poor (see, among others, Adams and Graham, 1981; Adams et al., 1984; Donald, 1976). Little, however, was written about the distribution of credit subsidies across crops.

Since the early 1980s, a new rural credit literature has emerged that focuses on issues of imperfect information, adverse selection, moral hazard, market failures, and interlinked transactions (including Bardhan, 1984; Besley, 1994; Hoff and Stiglitz, 1993; Stiglitz and Weiss, 1981). This research agenda has tended to focus on informal credit, in part due to the demise of cheap formal credit programmes, and in part due to the influence of the Asian context. Nothing, to my knowledge, has been written in the vein of imperfect information and market failures that has focused on crop-specific differences in the allocation of credit.

In the 1970s and 1980s in Brazil, the formal credit programme was so huge that it is reported to have undermined much of the informal credit market (see, for example, Anderson, 1986). Even if, as is likely to be the case, informal credit markets continued to exist in Brazil in the 1970s and 1980s, the Brazilian literature on rural credit has focused almost exclusively on the formal credit programme. Many criticisms of the programme echoed the international literature. Early papers focused on the concentration of credit across states, farm sizes, and to a lesser extent, two groups of crops — export and domestic food (Araujo and Meyer, 1977; Hoffman and Kageyama, 1987; Pinto, 1981; Rego and Wright, 1981). Other authors questioned the effectiveness of the credit programme, arguing that subsidized credit was being diverted to investments outside agriculture and that the expansion of rural credit was contributing to the budget deficit and the acceleration of inflation (Mata, 1982; Sayad, 1984). Several comprehensive studies of the subsidies implicit in the credit programme were done in the late 1980s, with a focus on farm size, agriculture versus livestock, regional distribution, and subsidies in different lines of credit — production, investment, and marketing (for example, Fagundes, 1987; Shirota, 1988). A final line of inquiry was to show that subsidized credit increased land prices and, by extension, land concentration, and that increased land concentration was associated with a deterioration in the distribution of rural income.[1] In short,

1. Brandão (1992) demonstrated the first relationship and Hoffman (1990) the second.

the literature on rural credit in Brazil has covered nearly every aspect of the programme, with one notable exception — the distribution of credit across crops.[2]

The Determinants of the Distribution of Rural Credit: Hypotheses

The hypotheses to be tested later in this article relate to technical criteria, government priorities, transaction costs in lending, and collective action. They are formulated as follows.

- *Crops that occupy a large share of area in the agricultural sector should receive more credit than crops that occupy a small share of area*. The reason for this is that the Brazilian government set loan limits per hectare for each crop. Thus, the maximum amount of credit that could be borrowed in the official credit programme at regulated interest rates was a function of planted area. The loan limits were largely based on technical criteria — factors such as production costs and productivity measures. However, there was also a discretionary component of the loan limits that could have been the target of interest group influence. This will be discussed below.
- *Tradeable crops should receive more credit than non-tradeable crops*. Import substitution industrialization policies led to a binding foreign exchange constraint that could be eased by stimulating agricultural exports and import substitutes. In the context of discriminatory trade policies and over-valued exchange rates in the 1970s, credit policy was one of the tools the government could have used to achieve this objective. Even in the mid-1980s when a more competitive exchange rate policy was pursued, generating foreign exchange in order to meet foreign debt obligations was essential. Thus, it is likely that credit continued to be directed disproportionately to those crops most capable of contributing (or saving) foreign exchange.
- *High value crops should receive more credit than low value crops*. From the banks' point of view, more money can be lent to high value commodities without exceeding reasonable loan/revenue ratios that would increase the likelihood of default. High value commodities, in addition, are usually highly liquid, which sometimes allows them to serve as collateral.
- *Crops that are produced by farmers who have greater access to credit institutions should receive more credit than crops produced by farmers with less access*. Access to credit institutions depends on many factors,

2. Brandão and Carvalho (1991) do use estimates of credit subsidies by crop in order to calculate effective protection by crop, but they do not analyse the distribution of credit on its own.

not all of which are readily observable. Several of these include possession of title, other forms of collateral, farm size (see below), the existence of financial institutions in a given region, and alternative institutions — such as co-operatives — that facilitate access. If it can be established that greater access (measured ex-post) does indeed lead to more credit for a given crop, then from a policy perspective it would be valuable to know which factors were most important in facilitating access. At this stage of the analysis, attention will be restricted to testing whether, and to what degree, access matters.

- *The characteristics of product specific interest groups, such as group size and geographical concentration, should not be an important determinant of the distribution of credit across crops*. With product-specific trade protection or price subsidies, it is not possible to exclude group members from the benefits of protection. The situation is analogous to a public good from the point of view of the group, and the Olsonian analysis of identifying factors associated with lowering the costs of organizing a group to lobby in favour of protection is relevant. This is the type of analysis that has been conducted with crop-specific nominal rates of protection by Gardner (1987), Helfand (2000), Jaramillo and Durán (1999) and others. Subsidized credit, in contrast, is not a policy that provides benefits to all members of a product-specific group. Access to the benefits of this policy depends on access to credit, which can require that individual producers have land title, collateral, personal contacts, or other attributes. The implication is that the producers of a specific product must each discount the potential benefits of devoting resources to lobbying not only by the probability that the group will be successful, but, in addition, by their individual probabilities of obtaining a loan. Unconditionally, the probability of obtaining credit was only in the neighbourhood of 15 per cent throughout the period, thus significantly undermining the incentives to lobby. Consequently, I hypothesize that crop-specific interest groups were unlikely to have been a significant determinant of the distribution of rural credit in Brazil. Proxies for the ease of overcoming the free-rider problem, such as group size or geographical concentration, should provide little if any power to explain the distribution of credit across crops.
- *Crops that are produced by large farmers should receive more credit than crops that are produced by small farmers*. The interpretation of this hypothesis is complicated by the fact that it is consistent with a variety of alternative arguments. The first relates to the previous hypothesis. The share of large farmers could be considered a crop-specific interest group characteristic that would increase the likelihood of successful lobbying. The reason is that the potential benefits for a subset of the group, such as the large farmers, could be sufficient to motivate them to lobby in favour of the group. While this interpretation is plausible, others seem more convincing. The second interpretation relates to

transaction costs. Banks are likely to have lower transaction costs when they make a small number of large loans, rather than a large number of small loans. Large customers are also likely to be less risky, thus leading to a lower default rate, and lower legal and enforcement costs. Both reasons should lead banks to prefer lending to large customers. A third interpretation is that in addition to more secure title and better collateral, large farmers are likely to have better personal contacts, thus facilitating individual access for them to the rationed subsidized credit.[3] A final interpretation focuses on interest groups that operate by farm size rather than by crop. Producer organizations in many developing countries, such as the National Confederation of Agriculture or the Brazilian Rural Society in the case of Brazil, have historically been dominated by large producers and have principally represented their interests. The answer, then, to the question 'do interest groups matter?' depends crucially on how one defines the relevant groups. It is my contention that, with regard to subsidized rural credit in Brazil, large farmers constitute a relevant group.

- Two final hypotheses are presented for completeness. First, *annual crops should receive more credit than perennial crops*. The reason is that they generally require access to greater amounts of working capital to cover the costs of replanting each year. Second, *regional differences should be an important determinant of the distribution of credit*. While there are (sometimes contradictory) arguments for and against each region, relating to differences in the relative density of credit institutions, the relative strength of regional lobbies, and other factors, it will be important to explore these factors empirically.

THE ESTIMATION OF CREDIT SUBSIDIES

The 1965 legislation that created the National Rural Credit System (NRCS) delegated to the National Monetary Council (NMC) the responsibility for determining the operational norms of the system. Among other things, the NMC set the percentage of commercial banks' portfolios that were required to be lent to the agricultural sector, loan limits per hectare, loan periods, and the interest rates at which compulsory funds had to be lent. As described below, credit was a policy instrument that responded not only to long-run goals, but was also subject to a considerable amount of fine tuning. While much of the variation in policy can be captured, a number of simplifying assumptions must be made in order to make the estimation of subsidies

3. Personal contacts can also be thought of as a mechanism that reduces transaction costs. The distinction between the second and third interpretations relates to the focus on banks versus large farms.

tractable. The discussion of the methodology begins by describing an innovative approach that was used to estimate the real value of loans in a period of high and variable inflation. The allocation of investment credit across crops is then addressed. Finally, the interest rates, loan periods, and opportunity cost of credit are explained.

The Real Value of Loans

Most studies of rural credit in Brazil are based on annual nominal data on disbursed loans from the Central Bank's *Rural Credit Statistical Yearbooks* (*Anuário Estatístico do Crédito Rural*, Central Bank of Brazil, various years). The data are usually converted to real values by deflating with an annual inflation index. The yearly totals can be quite misleading, however, when compared across crops and years, due to differences in seasonal patterns and inflation. Production credit for wheat, for example, is taken mostly in May, while the same credit for soybeans is taken between August and October. Consequently, in an inflationary context, the annual nominal values for soybeans will appear far larger than for wheat simply because they occur later in the year, and the degree to which they will be overstated will depend on the rate of inflation.

While the Central Bank did not publish monthly data on rural credit in the 1970s and 1980s, I was able to obtain monthly data for 1991 by crop and line of credit directly from the Central Bank. This permitted me to identify the monthly distribution of real credit for each crop. A system of simultaneous equations was then constructed that yielded a unique solution for the monthly values of nominal credit for each year, crop, and for the two lines of credit that have clear seasonal patterns — production and marketing credit.[4] The estimated monthly nominal credit was then deflated and aggregated. The only assumption imposed on the data was that the real monthly distribution of credit within each year remained constant over the twenty-two year period. While political or bureaucratic factors could delay the disbursement of credit in a particular year, planting and harvesting periods depend on nature and thus are relatively constant over time.

The magnitude of the errors involved in simply deflating annual nominal credit by annual inflation, rather than using the approach described above, can be illustrated for the case of 1991. Since monthly data are available for 1991, 'real' credit can be calculated with both approaches and the solutions compared. The annual approach over-estimated the credit taken by the principal crops (cotton, rice, corn, and soybeans) by approximately 20 per cent, reflecting the fact that credit for these crops is taken later in the year.

4. Since there is no *a priori* reason to believe that investment credit follows a seasonal pattern, this line of credit was dealt with on an annual basis as in other studies.

The reverse was true for cocoa and wheat, which were under-estimated by approximately 30 per cent. For those years in which inflation was higher than in 1991, the errors created by using the annual approach would be even greater.

The Allocation of Investment Credit Across Crops

In contrast to production and marketing credit, the loans that fall into the investment credit category do not specify which crops are the beneficiaries. This is the case because the investments are not necessarily crop-specific. When producers borrowed money in 1988, for example, to buy tractors (21 per cent of investment credit), to build storage space (10 per cent), or for irrigation (9 per cent), it was quite possible that the investment benefited more than one crop. The question, then, is how to divide the total of all investment credit that went to crops in the agricultural sector among the ten crops under study. One solution would be to identify a proxy correlated with the degree of utilization of rural investment credit by crop and then use this proxy to assist in dividing up total investment credit. Following the lead of Brandão and Carvalho (1991), I used the share of each crop in the total value of agricultural production — the assumption being that the quantity of investment credit that a producer will borrow is related to the total value of production of his/her crop. Since investment credit data are available for each state throughout the entire period, the estimation was conducted at the level of each state and then summed over all states. The gain from working at the state level was significant. In 1988, for example, the national approach under-estimated investment credit for rice and soybeans relative to the state approach by approximately 40 per cent, while it over-estimated coffee by 71 per cent.

Interest Rates, Loan Periods, and the Opportunity Cost of Credit

In order to calculate the real interest rate for each type of loan, a reference rate with which the nominal loan rates were compared needed to be chosen. The real interest rate adjusted for the duration of the loan could then be multiplied by the real value of the loans in order to obtain the subsidy estimates. The estimates in this study follow the tradition established by most Brazilian authors and use the inflation rate, as measured by the General Price Index (IGP-DI) of the Getúlio Vargas Foundation, as the comparator. It should be pointed out that this is a conservative choice. A zero real interest rate, according to this methodology, would have permitted paying back the inflation-corrected values of the original loans. It is likely, however, that the opportunity cost of the capital lent to the agricultural sector was considerably higher. This choice of comparator leads to a downward bias in the subsidy estimates.

Nominal interest rates were also chosen to ensure that the subsidy estimates represented a lower bound.[5] Special interest rates existed for mini and small farmers, certain less developed regions of the country, fertilizer and modern inputs (only in the 1970s), and for crops, privileged programmes, or disaster areas, that were occasionally given high priority. Nevertheless, the interest rates chosen for the subsidy estimates were those that were applicable to medium and large farmers who were not located in the priority regions of the country. These rates were selected not only to ensure estimating a lower bound on credit subsidies, but also because it was medium and large farmers that borrowed the majority of credit. Since credit subsidies were transferred to borrowers via regulated negative real interest rates, a little background on the evolution of interest rates seems warranted.

In the 1970s, real interest rates were negative because the NMC set nominal interest rates for rural production and marketing loans below the rate of inflation. In addition to the fixed nominal rate, multi-year investment loans had a variable portion that was determined each year in order to accompany inflation. As inflation accelerated, the NMC began to peg the interest rates to the index that was used to adjust treasury bond rates (ORTN). This first occurred in December 1979 when the rates were set at 5 per cent interest plus a fraction of the ORTN index in the period December to December of the previous year. In spite of the partial indexation, with inflation accelerating and only a portion of it being incorporated into the next period's interest rates, real interest rates remained negative. Fixed nominal interest rates returned for the 1981 calendar year, and only the investment loans were indexed with the ORTN during 1982. When inflation began to rise again in 1983 (passing the 200 per cent mark), all interest rates became a function of the ORTN index, although production and marketing loans only incorporated 85 per cent of the ORTN variation. In December 1983, interest rates on all of the loans considered in this study finally began to float as a function of 100 per cent of the ORTN index. As a result, most 1984 interest rates were positive (or nearly so) in real terms for the first time since the early 1970s.[6] The Cruzado stabilization plan of March 1986 abolished floating interest rates. Nominal interest rates on rural credit were set at 3 per cent and several months later were raised to 10 per cent. By February 1987, when inflation began to rise again and it was clear that the stabilization plan had failed, interest rates began to float again at 10 per cent per year plus 100 per cent of the agricultural Producer Price Index. The index used to adjust rural loans changed several more times in the 1980s.

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5. The nominal interest rates were taken from the NMC resolutions related to agricultural credit reproduced in a 90 page appendix by Fagundes (1987). For 1987–90, the relevant rates were obtained directly from CONAB.
6. Even with full indexation it was possible for real interest rates to remain slightly negative in the 1980s because the ORTN index did not fully accompany the price changes measured by the IGP-DI inflation index.

The final piece of information that was necessary to estimate the subsidies concerned the loan periods. Loans for marketing credit were the most straightforward. The Production Finance Company (CFP),[7] which was responsible for the support price programme in which marketing loans were an integral component, was charged with setting the loan lengths and repayment schedules for every crop in the support price programme. As a result, the regulated loan periods and repayment schedules for most crops in this study were obtained from the archives of CFP. The crops that were not regulated by CFP norms were assumed to reflect the CFP average. While Fagundes (1987) and Shirota (1988) set marketing loan periods at three months, the information contained in CFP documents and confirmed by academic and government sources led me to use loan periods that varied between three and six months, depending on the crop and year. The average was five months up until 1984, and four months from 1985 on.

Information about production and investment loan periods and repayment schedules was more difficult to obtain. Shirota (1988), following in the footsteps of Araujo (1980), used nine months for production loans and twelve months for investment loans. Fagundes (1987) also used twelve months for investment loans, but only seven months for production loans. The choice of twelve months for investment loans seemed like a significant under-estimation, which led me to conduct a series of interviews with government officials in the Central Bank, the Ministry of Agriculture, and directors of rural credit departments in private and state-owned banks. The consensus was that production loans had been shortened over time, from an average of nine months prior to 1984 down to seven months as of 1985, and that perennial crops borrowed production credit for an average of twelve months. These were the values that I used to estimate the subsidies. Investment loans, in contrast, were assumed to last for three years, with equal payments made at the end of each year. While this is longer than what has been used in previous studies, it is still likely to provide a lower bound, with many loans lasting for five to eight years.

CREDIT AND CREDIT SUBSIDIES

Table 1 provides several aggregate indicators of the National Rural Credit System. The NRCS covers credit for agriculture as well as for livestock (livestock credit is not addressed in this article). Agricultural activity has always accounted for the lion's share of all credit — approximately 70 per cent of total credit in the 1970s and 85 per cent in the credit-constrained 1980s. Agricultural credit is divided into three categories: production,

7. CFP (Companhia de Financiamento da Produção) became part of CONAB (Companhia Nacional de Abastecimento) in the early 1990s when it was merged with two other government agencies.

marketing, and investment credit. Production credit has always been the most important component, accounting for an average of 52 per cent in the 1970s and 67 per cent in the 1980s. Marketing credit represented an average of 23 per cent, and investment credit 17 per cent, throughout the entire period. With the importance of production credit in mind, Column 2 of Table 1 shows the real interest rate on production credit for the crops that borrowed most heavily. Real interest rates were close to zero from 1969 to 1972 and then became increasingly negative until reaching negative 35 per cent in 1979 and negative 31 per cent in 1980. These were the two years that the subsidies hit record highs. The effect of partial indexation is reflected in the rising interest rates for the early 1980s and, in 1984, real interest rates became positive for the first time since 1972. This year marks the end of the period in which agricultural credit was intentionally used either to induce modernization or to compensate for other forms of policy discrimination. While real interest rates hit an unprecedented low in 1986, this was a result of the failed Cruzado stabilization plan and not of policy intention. The same can probably be said of 1987 and 1988, with the interest rates in these years reflecting macroeconomic instability and inadequate indexing, rather than policy goals.

Column 3 of Table 1 shows the evolution of total agricultural credit in millions of 1996 US dollars.[8] The expansion of credit mirrors the evolution of real interest rates. The total real value of agricultural credit increased rapidly in the 1970s, growing from US$ 3.9 bn to nearly US$ 17 bn in 1975. Agricultural credit remained in the US$ 17–19 bn range from 1975 to 1982, and then fell precipitously in 1983 and 1984 at the same time as interest rates were rising. Total credit recovered in 1986 and then remained in the US$ 10–12 bn range through 1989. In 1990, the total value of agricultural credit fell to about what it had been in 1972, and to its lowest level as a share of the value of agricultural production during the entire period (see Column 8).

Column 4 of Table 1 shows the total subsidy in agricultural credit. It reflects the combined effect of the real interest rate and the volume of credit. The total subsidy for the period 1969–90 is estimated at over 44 bn (1996) dollars. Like total credit, the heyday of subsidized agricultural credit was from 1975 to 1982. However, 1979 and 1980 stand out far above the other years in terms of the sheer volume of subsidies implicit in the loans. Credit subsidies to agriculture were in the neighbourhood of US$ 6 bn in each of these years. They represented nearly a third of credit (Column 6) and over a fifth of the value of agricultural production (Column 7).[9] Credit subsidies

8. The estimated monthly credit values in Brazilian currency were converted to dollars at the average monthly official exchange rate. The dollar values were deflated by US producer prices with a 1996 base taken from the IMF's *International Financial Statistics Yearbook*.
9. The estimated subsidy as a share of the value of agricultural production is similar to Shirota (1988), providing some validation for these estimates. The main difference is that my estimates are available by crop as well.

Table 1. Agricultural Credit and Credit Subsidy: Selected Indicators[a]

Year	Real Interest Rate[b]	Ag. Credit	Ag. Subsidy	Ag. Value	Subsidy/ Credit	Subsidy/ Ag. Value	Credit/ Ag. Value
	%	millions of 1996 US$			%		
1969	−0.14	3,902	32	12,711	0.82	0.25	30.70
1970	−1.84	4,971	96	13,085	1.93	0.73	37.99
1971	0.16	5,777	73	15,137	1.27	0.48	38.17
1972	0.14	7,229	106	17,224	1.47	0.62	41.97
1973	−11.91	9,846	912	21,460	9.27	4.25	45.88
1974	−6.09	12,080	1,376	24,809	11.39	5.55	48.69
1975	−14.86	16,886	2,525	25,522	14.96	9.90	66.16
1976	−16.26	17,824	3,334	26,462	18.70	12.60	67.36
1977	−13.32	17,660	2,767	31,410	15.67	8.81	56.22
1978	−16.47	17,005	3,250	27,349	19.11	11.88	62.18
1979	−34.81	19,263	6,237	26,697	32.38	23.36	72.15
1980	−30.83	18,224	5,578	25,423	30.60	21.94	71.68
1981	−19.07	17,888	3,434	27,582	19.20	12.45	64.86
1982	−26.72	17,157	4,053	24,120	23.62	16.80	71.13
1983	−13.11	9,857	1,641	20,684	16.64	7.93	47.66
1984	7.95	6,050	96	21,747	1.59	0.44	27.82
1985	−1.88	8,674	360	25,254	4.14	1.42	34.35
1986	−36.34	13,558	4,416	25,825	32.57	17.10	52.50
1987	−15.69	11,834	1,541	24,898	13.02	6.19	47.53
1988	−22.31	10,129	1,964	28,842	19.39	6.81	35.12
1989	22.51	11,612	187	39,435	1.61	0.47	29.45
1990	7.15	7,478	131	27,683	1.76	0.47	27.01

Notes:
[a] Livestock is not addressed in this paper and is not included in the Tables.
[b] This is the real interest rate for production credit on the principal annual crops (corn, cotton, rice, and soybeans). This rate reflects the month the loan is assumed to originate, September, and the duration of the loan. See text for details.
Source: The agricultural value of production comes from IBGE's *Produção Agrícola Municipal*. All other data are the author's estimates. See text for details.

fell dramatically in the period 1983–85, but were never fully eliminated due to the pegging of interest rates to an index that did not rise as quickly as inflation.

Table 2 shows the benefits in terms of credit subsides that the producers of each crop obtained.[10] All of the crops follow the same general pattern of expansion of subsidies in the 1970s, contraction in the mid 1980s, reversal in the late 1980s, and near elimination of subsidies by the end of the period. Some crops benefited far more than others, largely reflecting differences in the quantities borrowed. Soybeans, for example, borrowed about twenty times as much as cocoa and received ten times more subsidies. As Table 2 demonstrates, four crops captured an average of over US$ 200 m in subsidies per year, while three crops received an average of under US$ 100 m.

10. For simplicity, I will often refer to crops borrowing money and receiving subsidies. In fact, of course, it is the producers of crops that borrow and are subsidized.

Table 2. Average Agricultural Credit and Credit Subsidy by Crop for Selected Periods (millions of 1996 US$)

Period	Cocoa	Cassava	Beans	Wheat	Cotton	Sugarcane	Corn	Coffee	Rice	Soybeans	Total
Credit											
1969–72	46	125	174	298	294	677	766	557	676	689	5,470
1973–83	178	402	675	915	1,063	1,339	1,691	1,528	1,913	3,154	15,790
1984–85	87	126	299	419	522	635	486	900	1,130	1,702	7,362
1986–88	141	197	416	961	782	1,010	793	1,596	1,797	2,426	11,840
1989–90	44	118	267	612	687	662	625	1,362	1,395	2,682	9,545
Average	128	273	477	736	802	1,048	1,194	1,289	1,554	2,432	12,041
Subsidy											
1969–72	1	4	4	4	8	6	9	16	10	8	77
1973–83	58	118	146	156	236	292	323	394	387	552	3,192
1984–85	4	11	27	78	11	33	27	32	24	41	228
1986–88	61	60	82	183	140	295	362	237	321	534	2,641
1989–90	3	14	14	59	3	24	17	24	10	29	159
Average	38	70	88	116	140	192	217	237	242	357	2,005

Source: Author's estimates. See text for details.

The volume of credit and subsidies is interesting in that it provides a sense of the magnitude and distribution of benefits in what was perhaps the largest subsidized rural credit programme among all developing countries. The levels of credit and credit subsidies can be rather misleading as a measure of benefits across crops, however, because the relative size of each crop in the sector, prices, and the distribution of credit across farm sizes, vary considerably. Each of these issues suggests a different benchmark for measuring the relative importance of credit. Even though soybeans captured the largest share of subsidies, for example, its share of subsidies was only 7 per cent larger than its share of area in the sector. When analysed per ton, wheat's relatively modest subsidy, equivalent to one third of what soybeans received, actually represented 27 per cent of the price of a ton of wheat in the 1975–82 period. These issues will be addressed in the econometric analysis below, and regressors will be introduced to capture their relative importance. But, first, bearing in mind the importance of the hypothesis regarding collective action by farm size, evidence is presented about the size distribution of subsidies.

As could be expected, subsidies were extremely concentrated in a relatively small share of farms. According to the agricultural censuses of 1970, 1975, 1980 and 1985, an average of only 15 per cent of all farms had access to credit institutions. While farms of all sizes did have access to loans, the large farms captured a much greater share of the subsidies. Table 3 provides loan data broken down by farm size for 1980, the census year that reflects the greatest degree of subsidization. In this year, 21 per cent of all farms took loans (Column 6). Farms under 20 ha represented 65 per cent of the farms (Column 3) and 44 per cent of the borrowers (Column 5), yet only accounted for 11 per cent of the credit (Column 7). Farms larger than 200 ha, in contrast, accounted for 5 per cent of the farms, 9 per cent of the borrowers, and 51 per cent of the credit taken.

The final two columns of the Table provide data on the distribution of credit by farm size category and estimates of the subsidy per borrower. Since the census data on the number of farms and borrowers refer to agricultural *and* livestock establishments, the estimated subsidy for 1980 was inflated to account for the 19 per cent of rural credit that was taken by farms involved in animal-based activities. The total subsidy in rural credit for this year, US$ 6.88 bn, was then distributed across farm size categories according to each category's share of the value of loans (Column 7). The average subsidy per borrower in each farm size class was then obtained by dividing the subsidy for each class by the number of farms that actually took loans in each size class. Column 8 shows that the average subsidy per borrower for farms under 20 ha was fairly similar, in the US$ 1000–2000 range. A more important difference among farms in these size classes related to access to credit institutions. Less than 2 per cent of farms under 1 ha had access to credit. Nearly 30 per cent of farms between 10 and 20 ha, in contrast, succeeded in borrowing. At the other end of the spectrum, there were more than 16,000 farms larger than 1000 hectares that borrowed in 1980. They

Table 3. Subsidy in Agricultural Credit by Farm Size: 1980

Farm Size	Establishments		Borrowers		Access*	Value of Loans	Subsidy per Recipient
Hectares	Number	Share	Number	Share	Share	Share	1996 US$
0–1	469,091	0.09	7,917	0.01	0.02	0.00	1,642
1–2	515,515	0.10	20,579	0.02	0.04	0.00	1,091
2–5	903,590	0.18	86,275	0.08	0.10	0.02	1,207
5–10	709,823	0.14	135,321	0.12	0.19	0.03	1,438
10–20	771,330	0.15	225,621	0.21	0.29	0.06	1,979
20–50	854,051	0.17	282,537	0.26	0.33	0.14	3,330
50–100	391,393	0.08	135,725	0.13	0.35	0.12	5,871
100–200	260,714	0.05	89,155	0.08	0.34	0.13	9,848
200–500	169,455	0.03	63,476	0.06	0.37	0.18	19,328
500–1000	58,352	0.01	21,714	0.02	0.37	0.11	36,419
1000–2000	27,145	0.01	9,924	0.01	0.37	0.09	60,236
2000–5000	14,832	0.00	4,837	0.00	0.33	0.07	92,968
5000–10,000	3,519	0.00	1,031	0.00	0.29	0.03	190,223
10,000–100,000	2,292	0.00	603	0.00	0.26	0.03	361,779
100,000–	53	0.00	13	0.00	0.25	0.00	758,588
Total	5,159,851	1.00	1,085,058	1.00	0.21	1.00	6,346

* Access is defined as the number of borrowers divided by the number of establishments in each farm size class.
Source: IBGE, *Censo Agropecuário 1980*, and author's estimates.

received an average of at least US$ 60,000 each in subsidies. Even more striking is that in the largest farm size class (over 100,000 ha), those farms that took out loans in 1980 received an average of over US$ 750,000 each in subsidies. Perhaps due to rationing, only one quarter of the fifty-three farms in this size class actually reported taking a loan.

The conclusion that can be drawn from Table 3 is that the benefits from gaining access to credit at the peak of the subsidy programme were huge. Most of the subsidies, however, were captured by a relatively small group of large farmers. This fact strengthens our expectation that farm size should be an important determinant of the distribution of credit.

THE DETERMINANTS OF THE DISTRIBUTION OF AGRICULTURAL CREDIT

Table 4 presents descriptive statistics for the variables used in the econometric analysis. The construction of the 'credit' and 'subsidy' variables was explained above. The 'area' variable is calculated for each year as the share of each crop in the total area of the twelve most important crops in the agricultural sector.[11] The 'concentration' variable is based on data from

11. The annual data comes from IBGE's *Produção Agrícola Municipal: Culturas Temporárias e Permanentes, Brasil,* various years.

the same source. It is a Herfindahl index based on the share of a crop's production in each state, and is equal to the sum of squared production shares. Values close to zero indicate that production was spread widely over many states. A value of one, in contrast, would indicate that 100 per cent of production occurred in a single state. The '500–' variable measures the share of area in each crop held by farms over 500 ha. It is calculated from the 1970, 1975, 1980 and 1985 agricultural censuses, and is interpolated for the years between censuses and extrapolated linearly for the 1986–90 period. The 'access' and 'producers' variables are also calculated with the census data. For each crop, access is defined as the number of farms that borrowed divided by the total number of farms, whereas 'producers' measures the number of farms for each crop in each year. The 'crop value' variable is each crop's price per ton measured in 1996 US dollars. The monthly producer prices come from the Getúlio Vargas Foundation. They were converted into US dollars at the official exchange rate, and then deflated by the US producer price index obtained from the IMF's *International Financial Statistics*, various years. A final variable, which is not shown in Table 4 due to limitations on space, is the share of each crop that is produced in each of the five principal regions of the country (North, Northeast, Southeast, South, and Centre-West). The data come from the same IBGE source used to construct the area variable.

The upper portion of Table 4 reveals a considerable degree of heterogeneity in the means of the dependent and independent variables used in the analysis. At one extreme was cocoa, the crop with the smallest share of area and the smallest number of producers, yet the highest degree of geographical concentration and the highest price. At the other extreme was corn, with the largest share of area and the greatest number of producers. As indicated by the Herfindahl concentration index, the production of corn was spread fairly equally throughout the country.

The lower portion of Table 4 presents the correlation between the variables. Columns 2 and 3 reveal that most of the variables exhibited correlation of the expected sign with the share of credit and the share of subsidy. There was a high correlation between the share of credit obtained by crops, the share of subsidy (.60), and the share of area (.59). Crops produced by large farms tended to get more credit (.32), and crops with greater access to credit institutions tended to borrow more (.31). The crop value variable was the only one that had an unexpected sign ($-.30$), indicating that high value crops tended to borrow less. It will be important to explore whether this is carried over to the multivariate analysis. The two proxies for the ease of organizing by crop provided little support for the Olsonian lobbying hypothesis. The number of producers was essentially uncorrelated with the credit (.01) and subsidy ($-.06$) variables, and the geographical concentration of production exhibited a negative correlation with the two variables ($-.28$ and $-.20$), implying that the higher the degree of spatial concentration the lower the quantity of credit and subsidies that producers received.

Table 4. Descriptive Statistics

	Credit	Subsidy	Area	500–	Access	Crop value	Producers	Concentration
			Share			1996 US$/t	1000s	Herf. Index
Mean								
Cocoa	0.01	0.02	0.01	0.11	0.08	2,093	82	0.85
Cassava	0.02	0.04	0.05	0.03	0.03	72	1,509	0.08
Beans	0.04	0.05	0.11	0.05	0.05	752	2,657	0.11
Wheat	0.06	0.12	0.06	0.16	0.34	281	194	0.46
Sugarcane	0.07	0.10	0.06	0.50	0.06	15	354	0.25
Cotton	0.09	0.07	0.08	0.12	0.18	574	566	0.25
Coffee	0.10	0.14	0.06	0.12	0.21	1,037	467	0.28
Corn	0.11	0.11	0.27	0.10	0.07	163	3,279	0.15
Rice	0.13	0.12	0.13	0.26	0.07	284	1,646	0.14
Soybeans	0.20	0.17	0.16	0.24	0.21	277	427	0.31
Correlation								
Credit	1.00							
Subsidy	0.60	1.00						
Area	0.59	0.33	1.00					
500–	0.32	0.25	0.02	1.00				
Access	0.31	0.35	−0.03	0.03	1.00			
Crop value	−0.30	−0.27	−0.38	−0.27	0.02	1.00		
Producers	0.01	−0.06	0.65	−0.35	−0.41	−0.26	1.00	
Concentration	−0.28	−0.20	−0.48	−0.01	0.13	0.64	−0.60	1.00

Notes: See text for details.

Tables 5 and 6 report the results of pooled time-series cross-section regressions that seek to explain the share of credit (Table 5) and the share of subsidies (Table 6) obtained by each crop in each year. With ten crops and twenty-two years, there are a total of 220 observations on the dependent variable. With the exception of the dummies and the regional production shares, all variables are in logs so that the coefficients can be interpreted as elasticities.[12] Differences in the scale of crops could generate heteroscedasticity, and thus a Lagrange multiplier test for groupwise heteroscedasticity was performed for all of the models in Tables 5 and 6.[13] The tests rejected the null hypothesis of a common variance across commodities at the 1 per cent level in all cases, and the models were re-estimated without this restriction. The existence of excluded factors that affected all of the crops simultaneously, such as stabilization plans or international oil price increases, suggested the possibility of allowing for contemporaneous correlation across crops. A Lagrange multiplier test for contemporaneous correlation was conducted for the regressions using credit and those using subsidies as the dependent variable, and in both cases the null hypothesis of no contemporaneous correlation was soundly rejected for all specifications at the 1 per cent level of significance. Finally, an analysis of the Q-statistic together with the autocorrelation and partial autocorrelation functions suggested first order serial correlation of the regression errors. Thus, the pooled crop data were estimated with an error structure that accounted for contemporaneous correlation, heteroscedasticity, and first order autocorrelation. The errors from these models were no longer serially correlated, according to the Q-statistic, and seemed to behave like white noise.

The results from six different model specifications are shown in Table 5. The first five models include the regional production shares.[14] Sequentially, they show the results with no interest group or farm size variables, with each one included individually, and with all three simultaneously. The final model excluded the regional production shares and included the three interest group and farm size variables.

The first row in Table 5 shows that the area share variable is significant at the 1 per cent level and consistently large in all of the models. Controlling for other factors, a 1 per cent increase in a crop's share of harvested area was associated with approximately a 0.4 per cent increase in its share of credit. This is consistent with the high correlation shown in Table 4 and suggests that the allocation of credit was rooted in the structure of the agricultural

12. Since not all crops are produced in all regions, implying that some of the shares are equal to zero, the log transformation could not be used for this variable.
13. The tests performed in this section follow Greene (1993: Ch.16).
14. Since the five regional shares sum to one, one region had to be dropped to avoid perfect colinearity. The Southeast was arbitrarily removed. The results were not sensitive to this choice.

Table 5. Pooled Regression Results for Share of Credit by Crop (1969–90)

	(1)	(2)	(3)	(4)	(5)	(6)
Area share	0.40**	0.39**	0.40**	0.41**	0.32**	0.40**
	(0.06)	(0.06)	(0.02)	(0.06)	(0.05)	(0.05)
Access	0.25**	0.27**	0.22**	0.20**	0.26**	0.26**
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Crop value	0.08**	0.07*	−0.14**	0.13**	0.05′	0.09**
	(0.03)	(0.03)	(0.01)	(0.03)	(0.03)	(0.03)
Non-tradeables dummy	−0.31′	−0.44′	−2.30	−0.21′	−0.44**	−0.68**
	(0.19)	(0.23)	(4.38)	(0.13)	(0.15)	(0.17)
Perennials dummy	−1.30**	−1.07**	−9.50	−0.72**	−0.23	−0.37′
	(0.29)	(0.27)	(18.10)	(0.24)	(0.16)	(0.20)
Regional prod. shares						
North	1.55	0.94	8.68**	2.26*	1.57′	
	(1.01)	(1.01)	(0.58)	(0.90)	(0.89)	
Northeast	−0.57**	−0.43**	−1.43**	−0.83**	−0.94**	
	(0.15)	(0.16)	(0.12)	(0.14)	(0.17)	
South	−0.02	0.00	−0.05	−0.03	0.21′	
	(0.12)	(0.13)	(0.04)	(0.12)	(0.12)	
Centre-West	−0.84*	−0.59′	−1.41**	−1.52**	−1.42**	
	(0.34)	(0.34)	(0.18)	(0.35)	(0.35)	
Number of producers		0.15			0.26*	0.37**
		(0.15)			(0.11)	(0.10)
Herfindahl conc. index			−0.30**		−0.26**	0.02
			(0.02)		(0.07)	(0.05)
500- share				0.35**	0.52**	0.25*
				(0.11)	(0.10)	(0.10)
Intercept	−1.16**	−3.10	−0.45	−0.82**	−3.99**	−5.85**
	(0.28)	(1.98)	(2.53)	(0.30)	(1.42)	(1.35)
Adjusted R^2	0.95	0.95	0.93	0.94	0.95	0.95

Notes:
Standard errors are shown in parentheses.
′ = Significant at the 10% level.
* = Significant at the 5% level.
** = Significant at the 1% level.

sector. The question remains: why did some crops receive more credit than their share of area?

Differences across crops in access to credit institutions provide a partial answer. The coefficient on this variable is significant at the 1 per cent level in all six models. The average of the six coefficients is roughly 0.25, suggesting that a 1 per cent increase in the share of farms with access to credit institutions translated into a 0.25 per cent increase in the crop's share of credit. This result underscores the importance of facilitating access — especially for small farmers — to credit institutions. It also highlights the importance of conducting additional research to uncover which farmers' attributes, institutional variables, and other factors contribute to increased access.

Differences in the value of crops also contribute to an explanation of why some crops received more credit than their share of area in the sector. This

variable was positive and significant at least at the 10 per cent level in five of the six specifications.[15] Thus, contrary to the negative correlation identified in Table 4, most of the results indicate that, once other factors are controlled for, higher priced crops tend to take more credit.

The inclusion of dummies for perennial crops (cocoa and coffee) and non-tradeables (cassava, beans, corn, and rice) implies that the intercept term can differ for these two groups relative to the tradeable annual crops (soybeans, wheat, cotton and sugarcane). As hypothesized, due to lower credit requirements for perennials and policy discrimination against crops that cannot generate foreign exchange, the coefficients on these dummies are negative in all six models and significant at least at the 10 per cent level in most cases. Controlling for the other factors in the models, the policy discrimination against the non-tradeables implied by the average of the five significant coefficients was in the order of about 18 per cent.[16] The fact that the policy bias was not even larger could reflect the fact that although these crops were non-tradeables in the sense that their prices were largely determined by domestic supply and demand, and Brazil was essentially self-sufficient in them in most years, a poor harvest for an important food crop could represent a significant foreign exchange cost and was thus worth trying to avoid by ensuring that adequate credit volumes were provided.

The standard view of regional biases in the allocation of agricultural credit in Brazil stems from analyses based on the total volume of credit flowing to each region, the total number of loans, and their growth over time (see, for example, Fagundes, 1987). Correlation coefficients between credit and regional production shares capture this information. They reveal an apparent bias against production in the North (-0.41) and Northeast (-0.65), neutrality for the Southeast (0.08), and relative favouritism of production in the South (0.43) and Centre-West (0.62). The results in Table 5, however, indicate that when other factors are accounted for, several of these results are reversed. The most striking reversal concerns the Centre-West. The high correlation between a crop's share of credit and the percentage of production located in the Centre-West must be due to the other variables in the model, not to a bias in favour of the Centre-West.[17] For the principal crops in the Centre-West — rice, soybeans, and corn — it is likely that the

15. The third model conforms the least to the other five for the variables crop value, the two dummies, and the regional share for the North. In addition to the curious sign reversal for crop value, the coefficients on the dummies and the North's share seem implausibly large. These coefficients should be viewed with caution.
16. This result is consistent with information provided in Anderson (1986). She shows that credit limits for soybeans and cotton in the early 1980s, a time when food production was ostensibly given a high priority, were a larger share of operating costs than the limits for beans, corn, and rice. It is not clear, however, if this was always the case.
17. One policy that was biased in favour of the Centre-West was support prices. See Goldin and Rezende (1990), and Helfand (1999).

share of area is the key variable producing the high simple correlation. There is weak evidence for a bias in favour of the North that is not explained by the other variables in the model. This could reflect the military government's use of credit to subsidize the occupation of the Amazon region in the 1970s and early 1980s.

Once all of the factors discussed above were accounted for, the interest group and farm size variables were introduced. The results in Table 5 do not provide support for an explanation of the distribution of agricultural credit that relies on interest groups of the Olsonian genre. Whereas the collective action hypothesis would suggest a negative coefficient on group size and a positive coefficient on geographical concentration, these variables both have the 'wrong' sign twice, and are not significantly different from zero once. Apparently, large dispersed groups succeeded in securing more credit than small geographically concentrated groups. Farm size, in contrast, is positive and significant at least at the 5 per cent level in all three instances. The magnitude of the elasticity, with an average of 0.37, is similar to the area share variable, suggesting that this is one of the key determinants of the distribution of credit. As discussed above, this variable is consistent with alternative interpretations. While a definitive conclusion will require additional research, the most plausible interpretations rely on reduced transaction costs in lending, and interest groups that lobby by farm size rather than by crop.

The dependent variable in Table 6 is the share of subsidy obtained by each crop. The explanatory power of the regressions reported in this Table, as measured by the adjusted R^2, is lower than the regressions of Table 5. This could partly be due to the fact that crop subsidies depend on the mix of production, marketing, and investment credit that each crop takes, with different amounts of subsidy in each line. Clearly, this is a more complicated phenomenon to explain. Nevertheless, even though the magnitude of some of the coefficients changed, the most important results remain. The farm size variable is positive and significant, the two interest group variables are insignificant or significant of the 'wrong' sign, and the area share and access variables are always significant at the 1 per cent level with relatively high elasticities. In contrast to Table 5, the crop value variable is consistently positive and significant at least at the 5 per cent level. With subsidies as the dependent variable, production in the South now appears to be a negative factor. This is likely to be the result of more marketing credit being taken in the South, which was the least subsidized line of credit.

A number of tests were conducted to gauge the robustness of the results to alternative specifications. In all cases, while the magnitude of some coefficients changed, the important qualitative results remained unchanged. The tests included the following. First, the sample period was altered to exclude the last, and the last two years. There were important political and institutional changes in 1990 brought about by the first directly-elected civilian president to take office since the early 1960s. This was also the

Table 6. Pooled Regression Results for Share of Subsidy by Crop (1969–90)

	(1)	(2)	(3)	(4)	(5)	(6)
Area share	0.51**	0.44**	0.51**	0.54**	0.50**	0.37**
	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)
Access	0.13**	0.12**	0.13**	0.15**	0.15**	0.17**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Crop value	0.10**	0.10**	0.10**	0.09*	0.09*	0.16**
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Non-tradeables dummy	−0.19′	−0.47*	−0.19′	−0.03	−0.06	−0.72**
	(0.10)	(0.19)	(0.10)	(0.11)	(0.20)	(0.17)
Perennials dummy	−0.54**	−0.50**	−0.54**	−0.16	−0.09	−0.35
	(0.19)	(0.19)	(0.19)	(0.21)	(0.22)	(0.24)
Regional production shares						
North	−0.45	−1.16	−0.54**	1.05	1.16	
	(1.06)	(1.02)	(1.12)	(1.11)	(1.16)	
Northeast	−0.40′	−0.05	−0.40′	−0.66**	−0.72*	
	(0.21)	(0.21)	(0.21)	(0.22)	(0.28)	
South	−0.66**	−0.61**	−0.66**	−0.73**	−0.67**	
	(0.12)	(0.11)	(0.15)	(0.13)	(0.15)	
Centre-West	−0.28	−0.10	−0.28	−0.96*	−1.11**	
	(0.36)	(0.36)	(0.36)	(0.41)	(0.43)	
Number of producers		0.23′			0.03	0.40**
		(0.13)			(0.15)	(0.14)
Herfindahl conc. index			0.00		−0.10	−0.01
			(0.09)		(0.10)	(0.7)
500- share				0.31**	0.35**	0.35**
				(0.08)	(0.10)	(0.11)
Intercept	−0.97**	−4.28*	−0.97**	−0.21	−0.74	−6.55**
	(0.26)	(1.84)	(0.36)	(0.31)	(1.99)	(1.90)
Adjusted R^2	0.65	0.64	0.64	0.66	0.65	0.65

Notes:
Standard errors are shown in parentheses.
′ = Significant at the 10% level.
* = Significant at the 5% level.
** = Significant at the 1% level.

beginning of a period of considerable trade liberalization and agricultural policy reform. Second, time dummies were included to differentiate sub-periods, such as the credit-constrained 1983–90 period. Third, the farm size variable was defined as less than 50 ha, rather than greater than 500. Fourth, value per ha was used instead of price per ton. Finally, area concentration was used instead of production concentration. No important conclusions were altered in any of these cases.

CONCLUSIONS

This article has analysed the subsidized rural credit programme in Brazil from 1969 to 1990. The policy of charging negative real interest rates on agricultural loans during most of this period led to massive subsidies for the

approximately 15 per cent of farmers who had access to formal credit institutions. Total subsidies were estimated to exceed 44 bn (1996) dollars during this period. At their peak in 1979, the subsidies implicit in the loans represented nearly a third of the credit borrowed by the sector and more than a fifth of the value of agricultural production. The fact that subsidies disproportionately benefited large farmers, however, implies that credit was not an appropriate instrument for compensating the sector for the other forms of policy discrimination to which it was subject.

In addition to the inequitable distribution by farm size, credit and subsidies were not distributed equally across crops. Among the ten most important crops in the agricultural sector, the average annual amount borrowed by the largest and smallest users of credit differed by a factor of twenty. The average subsidy differed by a factor of ten. These discrepancies were attributable, in part, to differences in the amount of land used by each crop. The analysis showed, in addition, that crops which were produced on large farms, by farmers who had superior access to credit institutions, which were tradeable, had high prices, and were not perennials, benefited disproportionately from credit subsidies. Conversely, there was a bias against small producers not only because access to formal credit was more difficult for them, but because they were concentrated in the production of non-tradeable food crops that tended to have lower prices. Once other factors were controlled for, crops produced in the Northeast and Centre-West received less credit than crops produced in others regions.

Several proxies were introduced in order to test a commodity-based collective action explanation of credit policy. Group size and geographical concentration, two factors that have frequently been associated with the ability of commodity-based interest groups to organize and influence price and trade policy, were shown not to be significant of the expected signs. This lends support to the view that collective action by crop was not an important determinant of credit policy. It also suggests that caution should be used in specifying a dependent variable for studies of interest groups and political economy because the results can depend crucially on this choice. A bias toward large producers, in contrast, was clearly demonstrated. Sorting out the degree to which this was due to the influence of organizations that represent the interests of large producers, the desire of bankers to lower transaction costs in lending, or other factors, will require additional research in the future.

Two issues that have yet to be resolved by policy-makers in Brazil also warrant further study. The first relates to the volume of credit available for agricultural production. A vibrant and growing agricultural sector does not require credit subsidies, but it does need an adequate and timely supply of credit. The volume of real credit in the early 1990s was roughly equivalent to the levels observed in the early 1970s and was even lower than that period as a share of the value of agricultural production. Traditional sources of credit, including the Treasury and required lending to the agricultural sector

by commercial banks, have diminished in importance. A much higher percentage of credit is being provided voluntarily. The NRCS, however, was created in the 1960s in part due to an inadequate supply of credit by the private sector. This re-emerged as an important issue in the 1990s. In addition, the bias toward high priced tradable crops is likely to continue. Commodity funds, for example, which are supplying an increasing percentage of agricultural credit, are designed to finance export crops only.[18]

The second issue concerns the distribution of credit across farm sizes and, in particular, access to credit by small farmers. The Brazilian government has attempted in recent years to improve access to credit by small farms through the programme PRONAF. It is still too soon to evaluate the results. Given the volume of subsidies transferred to agricultural producers in the 1970s and 1980s, it is surprising that only about 15 to 20 per cent of farms actually borrowed from formal sources. It is clear that large producers were more able and likely to borrow than small producers, and that they borrowed a larger share of total credit. A more in-depth analysis of the determinants of access to credit by farm size seems warranted, especially since one of the original objectives of the NRCS when it was created in the 1960s was to assist mini and small producers. This type of study could then provide a benchmark for analysing how access to formal credit has changed in recent years.

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