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Wheat policy and economy-wide reform in Brazil

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Abstract

In recent years, the wheat sector in Brazil has moved from governmental protection and public intervention to a free market and privatization. In this study, those changes are analyzed through measures of governmental intervention on nominal rates of protection and on welfare of producers and consumers. Elasticities of demand and supply of wheat are estimated, and the effects of changes in policies are analyzed under official and shadow exchange rates. Welfare measures indicate that almost US\$ 8 billion were spent from 1970 until 1989 with policies to subsidize producers and consumers. The policy-induced stimulus to consumer demand exceeded the stimulus to domestic production, and self sufficiency in wheat declined. The reduction in wheat subsidies since 1989 was more than an isolated sector-specific policy. It was part of macroeconomic anti-inflation policy, and it coincided with other economy-wide changes such as real appreciation and a decline in international commodity prices. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Wheat; Governmental intervention; Welfare

1. Introduction

Production of wheat in Brazil started around 1530 and spread throughout the country with colonization (SEAB/DERAL, 1994). Through time, production became very concentrated in the Southern region, due to favorable weather conditions, but it was never enough to satisfy internal demand. The lack of self sufficiency pushed the Brazilian government into the market, whose Decree of 6 March 1918 was the first known policy intended to increase wheat production. This decree established prizes in farm machinery for increases in planted area (da Silva, 1992). From that

time onwards, the government has intervened continuously in the wheat market, supporting producers prices (since 1938), credit and input subsidies, being the only domestic buyer, importer, and seller (until 1989), and fixing prices at all market levels.

By 1967, the government had total control over the wheat market. Self sufficiency was always the goal and government intervention was justified on the basis of economic reasons such as foreign exchange savings, infant industry arguments, and counteracting subsidies by exporting countries, and political reasons such as heavy dependence on imports which could create problems at home in case of external shocks such as large increase in prices, wars, etc. A good review of those policies can be found in Calegar and Schuh (1988), da Silva (1992), and Maia (1996).

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On the consumption side, government intervention started in the early 1970s with a consumption subsidy to escape the effects of increases in world prices. Meant to be temporary to reduce domestic price inflation and maintain nutritional status of low-income groups, this policy lasted until 1990, expanding consumption faster than production, and preventing Brazil from reaching self sufficiency (McClain and Dusch, 1994). This conflict between self-sufficiency and subsidizing consumers started to change during the 1980s, due to the escalating budget costs of these policies, which forced the government to cut expenditures by gradually reducing the guaranteed producer price and consumer subsidy. Private sector imports were also legalized and by 1991 the wheat market was completely liberalized. During this period wheat consumption and production were influenced both by policies specific to the wheat sector and economy-wide policies (Valdes, 1996; Valdes and Gnaegy, 1996).

Policy reforms like these produce both costs and benefits to different segments of society and certainly producers' and consumers' welfare is affected by changes in production, consumption, trade flows, and prices. Although, a previous study by Calegar and Schuh (1988) carried out a cost/benefit analysis of wheat policies, it only included the period 1970/1982. The purpose of this paper is to update that study by capturing the recent changes in policies, and improve some methodological aspects of the analysis. Our paper extends the analysis through 1994, provides econometric estimates of supply and demand parameters, and uses an alternative method for calculating the real exchange rate. The second section describes briefly the recent evolution of production, consumption and imports of wheat in Brazil in light of the prevailing policies. In the third section, the methods and data used in the analysis are presented. The results are discussed in the fourth, and some conclusions are drawn in the last section.

2. The Brazilian wheat industry and policies

As Calegar and Schuh (1988) have shown, it was not until 1967 that cultivated area and production of wheat responded to the continuous support of the Brazilian Government. The establishment of experiment stations in the mid 1930s to develop technologies

suitable for Brazilian conditions helped some, but the poor soils, serious disease problems and difficult climatic conditions prevented large increases in production. Guaranteed producer prices were first used in 1938, and usually were set above the world free market price, at the prevailing exchange rate.

Quotas of domestic and imported wheat were assigned to millers in 1955. The obligation by millers to consume a more expensive domestic wheat, and the difference in prices between domestically produced and imported wheat generated market frauds known as 'paper wheat' and 'wheat nationalization'. In the former, there was an agreement between a miller and a producer for a pseudo-purchase of national wheat, which gave the miller the right to buy a corresponding quota of the cheaper imported product. The 'wheat nationalization' occurred when the low-priced imported wheat was sent to the farmer and returned 'nationalized' at a price as high as 150% above the import price (Maia, 1996). To end those frauds the Brazilian government named the Bank of Brazil in 1962 as the sole buyer of domestic wheat. Total control of the wheat industry by the government came through the Decree 210 on 27 February 1967. The alleged objectives of this Decree were to: (a) give priority to national wheat; (b) regulate marketing activities through the monopoly power of the government in buying domestic and imported wheat; (c) guarantee domestic supply and improve storage capacity; and (d) regulate the expansion of mills. Behind all these objectives there was always the major goal of self-sufficiency in production and, as can be noticed in Fig. 1, after 1967 there was some reduction in wheat import dependency.

Production of wheat during the 1970s was four times greater than that of the prior decade. According to McClain and Dusch (1994), production growth in the 1970s was almost entirely due to area expansion. The development of new varieties, and improved crop systems such as double cropping with soybeans, were responsible for the strong growth in yields of the 1980s, although they were still low if compared to other countries and highly variable. In 1987 production achieved 6.1 million metric tons (MMT), compared to the average of 2.2 MMT for the 1970s and of 270 thousand MT for the 1960s, and were just 1 MMT from the goal of self-sufficiency. Such an increase was possible based on programs of credit subsidies and

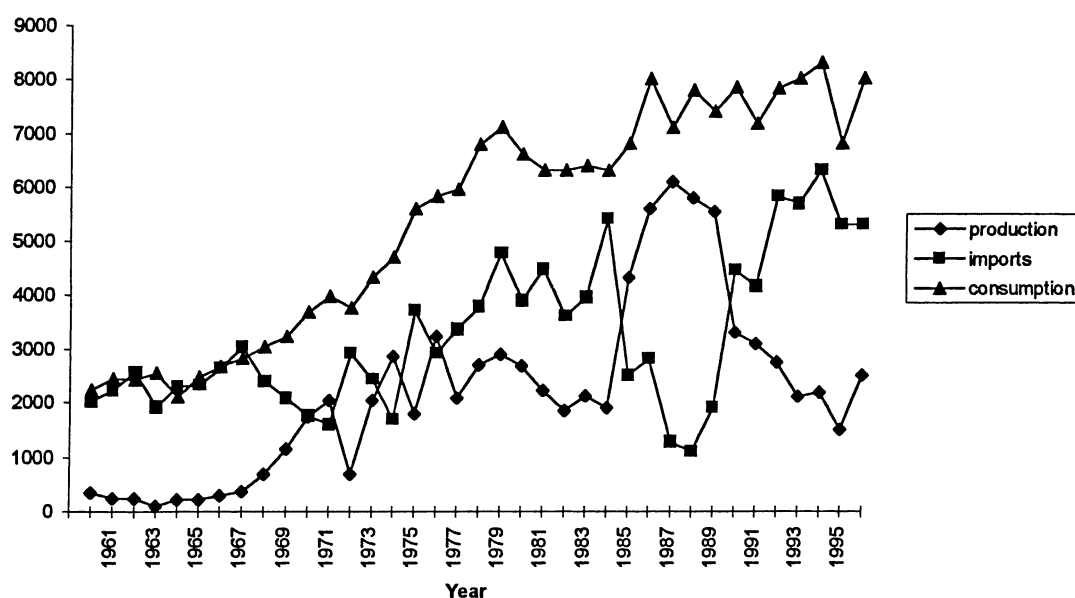


Fig. 1. Production, imports and consumption of wheat in Brazil. Period 1960/1995. 1000 MT.

price incentives. Wheat producers were allocated credit at subsidized interest rates to finance all or partial production costs. Real interest rates were sometimes negative due to high inflation rates.

The Brazilian Government began adjusting interest rates on farm credit for inflation in the mid-1980s. Under price incentives, the policy was one of supporting producers' price above the world free trade price, insulating producers from external price shocks. Besides being a guaranteed buyer, the government also procured wheat at storage points in production regions, providing an implicit transportation subsidy. The turning point for producer programs occurred in the 1986 crop year when producer prices reached their highest level (US\$ 236/MT). The budget costs forced reforms to the sector which started with the reduction of the guaranteed producers' price in the following years. Production has now dropped to the levels of late 1970s. The Brazilian Government still supports wheat producers through a minimum guaranteed price and production credit programs, but those have not been sufficient to maintain production levels in recent years.

On the consumption side, the policies for wheat are more recent. The explicit subsidy to consumption was introduced in 1972 and, according to Carvalho (1981) (in Calegar and Schuh, 1988), the main reason was to

reduce domestic inflation, and also to escape the effects of the increases in the world price of wheat in the mid-1970s. Concern was also expressed about maintaining the nutritional status of low-income groups who had wheat in the form of bread, macaroni, and wheat flour, as a staple in the consumer food basket ever since. By keeping the wheat products' price artificially low, the wheat consumer subsidy expanded consumption Per capita, from 30 kg in the 1960s to 60 kg in 1979, dropping again to 50 kg during the 1980s. Bread in Brazil is a relatively cheap staple and is generally price inelastic, but other wheat products such as pasta and cookies are more responsive to price and income changes, making consumption levels vary widely with price, subsidy and macroeconomic policies.

Fig. 2 shows that per capita consumption grew with the subsidy from 1972 until 1980, when it stabilized due to stagnant incomes and the gradual reduction of the subsidy in the late 1980s. The subsidy was permanently removed with the end of most price controls in late 1990. According to Calegar and Schuh (1988), most of the subsidy was captured by middle and upper income groups, and not by the targeted, low-income groups. Other studies have shown that imports were higher with the subsidy, than they would have been without, and that wheat prices were more unstable in

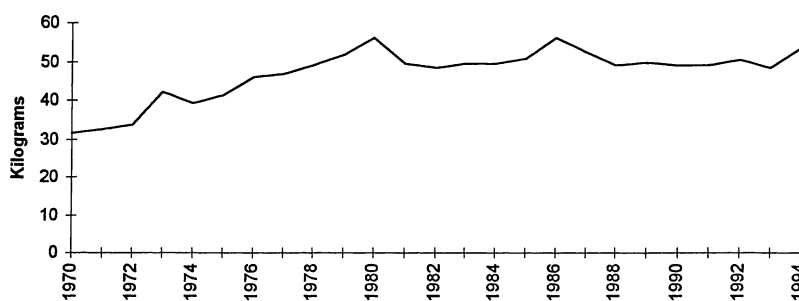


Fig. 2. Consumption per capita of wheat in Brazil. Period 1970–1995.

Brazil during that time, than they would have been under free trade (Calegar and Schuh, 1988; Braverman et al., 1992).

In between producers and consumers, there was another class of beneficiaries from Brazilian wheat policies: the milling industry. Since the early 1950s, quotas of national and imported wheat were assigned to millers, shielding the sector from market risks. Quotas were based on the government's projection of consumption in eight zones, and mills could apply for additional quotas according to regional demand conditions. New mills or expansion of the existing ones would require government approval. As the sole importer of wheat, the government ensured the purchase of the domestic crop by not distributing foreign wheat until mills had purchased their national quota. Also, the mill price for wheat was set below government acquisition costs, which after 1972, determined prices of flour and wheat products. Prices were set to guarantee a margin of return to the mill, while at the same time, guaranteeing that part of the subsidy was passed on to consumers. Financial constraints by the government, which in 1989 was not able to buy the entire crop in one parcel, increased support for privatization of the sector (McClain and Dusch, 1994). So, under pressure to cut government expenditures, the quota system ended in 1990. Private sector imports were legalized in 1991, and imported wheat was charged an import duty varying according to the origin, and with a declining schedule, where tariffs on imports from MERCOSUR (Mercado Comun del Cone Sul, a custom union formed by Argentina, Brazil, Paraguay and Uruguay, which became effective in January the first, 1995), were declining faster than those from non-MERCOSUR members.

What is apparent through time from the Brazilian wheat policies, is its contradiction with the economic and trade theory. If the goal were to increase production, a production subsidy would have been optimal. If fewer imports were the goal, a tariff (production subsidy + consumer tax) would have been optimal. The use of a tariff and a consumption subsidy are contradictory.

In general, Brazil's wheat programs have resulted in a large deadweight loss without satisfying the stated goals of reducing imports, redistributing income toward poorer consumers, and stabilizing wheat prices.

3. A model for welfare analysis

Standard partial equilibrium and comparative static analysis is used here in the same way Calegar and Schuh (1988) have used it. The concepts of economic surplus are derived from Fig. 3, which presents the multiple price system used by the Brazilian government. Brazil is assumed to be a price taker, facing world prices equal to P_w . The producer price (P_p) is the price set by the government, usually above the world prices. The difference between these two prices represents the producer subsidy. The consumer price (P_c) is the price at which the government sells wheat to millers, which is in general below the world price. That difference represents the consumption subsidy. SS and DD are domestic supply and demand assumed to have constant elasticities.

To evaluate these production and consumption policies, the following measures can be derived from Fig. 3.

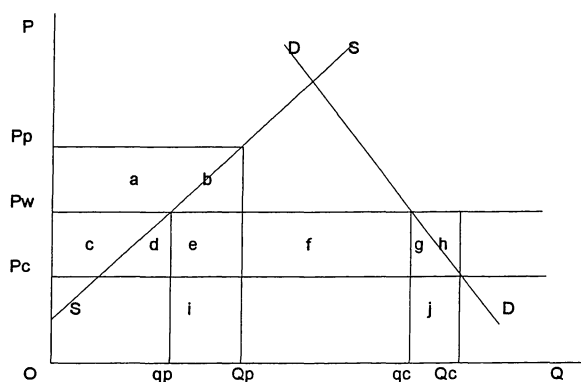


Fig. 3. Multiple price system for wheat in Brazil.

3.1. Production policy

TOP = treasury cost of the production policy subsidy (area a + b),

$$TOP = (P_p - P_w)Q_p \quad (1)$$

CPW = change in producers' welfare (area a),

$$CPW = \int_{P_w}^{P_p} aP^\varepsilon dP = [Q_p/(1 + \varepsilon)][P_p - (P_w/P_p)^\varepsilon P_w] \quad (2)$$

SCP = social costs in production (area b),

$$SCP = TOP - CPW \quad (3)$$

FEP = foreign exchange effect on production (area e + i),

$$FEP = P_w Q_p [1 - (P_w/P_p)^\varepsilon] \quad (4)$$

CQP = change in quantity produced ($Q_p - q_p$),

$$CQP = Q_p [1 - (P_w/P_p)^\varepsilon], \quad (5)$$

where, Q_p is the quantity produced at the subsidized price, q_p is the quantity produced at the world price, $q = aP^\varepsilon$, constant elasticity supply curve, a is the supply shifter, and ε is the domestic supply elasticity, P_p is producer price adjusted to the wholesale level, and P_w is the border price adjusted to the wholesale level.

3.2. Consumption policy

TCC = treasury cost of the consumption policy subsidy (areas c + d + e + f + g + h),

$$TCC = (P_w - P_c)Q_c, \quad (6)$$

CCW = change in consumers' welfare (areas c + d + e + f + g),

$$CCW = \int_{P_c}^{P_w} bP^{-\eta} dP = [Q_c/(1 - \eta)] \times [(P_c/P_w)^\eta P_w - P_c], \quad (7)$$

SCC = social cost of consumption policy (area h),

$$SCC = TCC - CCW, \quad (8)$$

FEC = foreign exchange effect on the consumption side (areas h + g + j),

$$FEC = P_w Q_c [1 - (P_c/P_w)^\eta], \quad (9)$$

CQC = change in quantity consumed ($Q_c - q_c$),

$$CQC = Q_c [1 - (P_c/P_w)^\eta], \quad (10)$$

where, P_c is the consumer price, $q = bP^\eta$, is a constant elasticity demand curve, b is the demand shifter, and η is the domestic demand elasticity, and all other variables are defined as before.

The joint effect of both policies can be expressed as:

$$TTC = TOP + TCC, \text{ total treasury cost} \quad (11)$$

CSW = CPW + CCW, the change in producer

plus consumer welfare (12)

$$TSC = SCP + SCC, \text{ total social cost} \quad (13)$$

$$NEF = FEP + FEC, \text{ total effect on foreign exchange} \quad (14)$$

Very important to the above measures are the way prices are computed. Producers' prices were obtained from CONAB (Companhia Nacional de Abastecimento, 1996) and represent the guaranteed price for wheat set by the government, in the beginning of each year. Those are farm gate prices, and marketing margins including all commercial expenditures from farm to the major wholesale market (such as: transportation costs, taxes, interest charges, insurance, bagging, packing and handling charges and grading storage) are added to it. From 1970 until 1982, the marketing margins used are those from Calegar and Schuh (1988) which averaged 17% of the farm gate price. From 1983 onwards, the margins were obtained from Braverman et al. (1992) and correspond to 18.5% over the farm gate price. Millers prices also were set

by the government up to 1991, and represent the consumers' price (P_c). From 1991 onwards, they represent free market prices. World prices (CIF) were also adjusted to the wholesale market using margins which included: foreign exchange brokerage, import registration fees, port authority charges, interest, storage and handling costs, insurance cost, domestic freight, value added tax, import taxes (when applicable), and all other domestic taxes. Those margins averaged 30% for the period 1983–1994. The basic data for calculations were obtained from EMBRAPA, Centro Nacional de Pesquisa de Trigo.

Fig. 4 shows the behavior of prices (in 1977 dollars) for the period 1970–1994. The Millers' price declined from 1970 until 1980 when it achieved its lowest value. Such a trend was largely a consequence of the explicit general wheat price consumption subsidy (Calegar and Schuh, 1988). After 1980, the government started to phase out the consumption subsidy and the Millers' price became much closer to the producer price. In 1991, the consumption subsidy was permanently eliminated with the end of most price controls. The pattern of the producers' price is much like that of world prices. They follow the same price variations of the international markets, as in 1974 and 1980, and in 1983/1984, with the appreciation of the US dollar, which drove commodity prices up. In 1985/1986 producers' price reached the highest value and set the turning point for producers' programs. From that time on they were gradually reduced. The Brazilian government still supports producer prices through the

minimum price program, which guarantees the purchase of domestic production should market prices fall below the minimum price (McClain and Dusch, 1994). However, as Fig. 4 shows, the recent reforms have reduced price differences at the three market levels.

Also important to the calculations above are the price elasticities of domestic demand and supply. However, there are no recent econometric estimates. The commonly used elasticities, are still those by Rojko et al. (1978) (supply = 0.75; demand = -0.25), and by Crocorno (1982) (supply = 0.359; demand = -0.46). The values used by USDA for the Swopsim model are: demand = -0.45 and supply = 0.495.

The cost of production and consumption policies during the period of analysis is calculated based on exchange rates evaluated at official and shadow price values. Calegar and Schuh (1988), calculated shadow exchange rates based on a shadow price of foreign exchange estimated by the World Bank at Cr\$ 61.50 per US\$ 1.00 for the year 1980. Given that the choice of a base year remains arbitrary, and under the assumption that the nominal rate fluctuates around a stable long term equilibrium path, the shadow rate is calculated in this study, using a methodology proposed by Lancieri (1996). Such methodology is based on the relative PPP doctrine (perfectly compensates for the inflation differential), and a concept of 'long term' exchange rate. For a period of t years, n different series of adjusted exchange rates would be obtained, taking

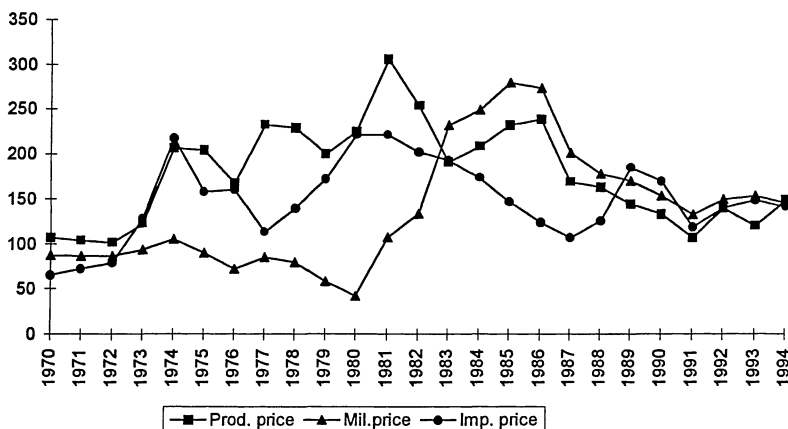


Fig. 4. Producers, millers and import prices of wheat in Brazil. Period 1970–1994.

as a base each nominal exchange rate, for $t = 1, 2, \dots, n$.

$$S_t^{A,B} = S_{t-1}(1 + P^A_t/1 + P^B_t) \quad (15)$$

where, S_t is the nominal exchange rate of A's currency with respect to B's, P_t is the j's consumer price index in period t . $j = A$ and B .

The 'central' value is calculated by taking an arithmetic average of the nominal rates in each year. Certainly, such a value need not coincide with any of the nominal exchange rates in a particular year.

Data for the nominal exchange rate and consumer price indexes are from the International Monetary Fund (1996), International Financial Statistics.

4. Results

In order to get elasticities of demand and supply for wheat in Brazil, during the period of analysis, different specifications for an aggregate domestic supply and a derived demand were estimated. Domestic production was expressed as a function of producers price, prices of fertilizer and soybeans, all in real cruzeiros of 1977, and a trend variable. Apparent consumption (production + imports) per capita was modeled as a function of millers (consumers) real price, gross domestic product per capita also in real cruzeiros, and a trend variable. A lagged consumption variable was also used in the derived demand equation to capture any permanent change which could have occurred at the millers level of the wheat market. The equations were estimated in log form, by OLS, since all explanatory variables are exogenous. Results obtained are presented in Table 1.

All coefficients presented have the expected signs. Autocorrelation was detected in some of the equations estimated and corrected using the Yule–Walker procedure. For those equations with a lagged-dependent variable, autocorrelation was tested using the Durbin-h statistic, and no problems were detected. In the supply equations, the coefficients for producers' price (supply elasticities) are most significant when lagged prices of wheat are used. The coefficients for price of fertilizer are negative as expected, and those for price of soybeans are positive in all equations, although not significant. Wheat in Brazil, is usually double-cropped

with soybeans, which reduces production costs for both crops, by spreading fixed costs over the two harvests. When correction of soil is done to plant soybeans, less fertilizer is needed on the following wheat crops. Also, soybeans naturally adds nitrogen to the soil. So, increases in the prices of soybeans would increase soybean's area, and consequently, increase wheat area and production.

The demand equations show that income (proxied by GDP per capita) is an important variable to explain changes in consumption of wheat. The coefficients for miller prices (demand elasticities) are significant, but have a small effect on the demand for wheat, ranging from -0.09 to -0.16 . The coefficients for lagged consumption are highly significant, as are those for a trend variable in all equations. This is an indication that they are capturing effects of other variables not included in the supply and demand functions.

The price elasticities of demand and supply to be used in calculating the welfare effects are 0.50 for supply, and -0.10 for demand. The supply and demand elasticities chosen are in the range of the values estimated, and the supply elasticity is very close to the value used by USDA. The small elasticities of demand obtained indicate that, changes in consumption policies would have a smaller effect on welfare than changes in production policies.

Official, shadow and real exchange rates are presented in Table 2. The shadow exchange rate is greater than the official for the periods 1974/1982 and 1989/1994¹. Real exchange rates (RER) were obtained as a ratio of nominal to shadow rates². As an annual average of nominal rates calculated from different years as a base year, the shadow rate does not coincide with any of the nominal exchange rates observed year by year, and so the real rate is never equal to one for an individual year. In Table 2, a value for RER greater than unity can be interpreted as a real devaluation of

¹Shadow or equilibrium exchange rates are based on purchasing power parity using the average nominal rate for the entire sample period as the base. One alternative is to use the elasticity approach (Brandao and Carvalho, 1991). Another is to define the real exchange as the relative price of tradables to non-tradables (Edwards, 1989; Ghura and Grennes, 1993).

²The real rate is $S \times P^*/P$ (where P and P^* are domestic and foreign prices, respectively), which is equal to S nominal divided by S shadow.

Table 1
Aggregate supply and derived demand for wheat in Brazil. Log form. OLS

Coefficient	Supply				Demand			
	S1	S2	S3	S4	D1	D2	D3	D4
Constant	5.92 (1.25)	-121.12 (-2.54)	5.61 (1.20)	-123.82 (-2.78)	-782.35 (-0.21)	-57.12 (-7.33)	-51.66 (-0.84)	-27.25 (-2.53)
Producer price	0.26 (0.67)	0.36 (1.00)	-	-	-	-	-	-
Lagged producer price	-	-	0.34 (1.00)	0.53 (1.97)	-	-	-	-
Price of soybeans	0.23 (0.54)	0.34 (0.68)	0.22 (0.53)	0.26 (0.58)	-	-	-	-
Price of fertilizer	-0.45 (1.42)	-0.13 (-0.32)	-0.44 (-1.61)	-0.09 (-0.30)	-	-	-	-
Trend	-	0.06 (2.84)	-	0.06 (3.10)	-	0.03 (6.84)	-	0.01 (2.49)
Miller price	-	-	-	-	-0.10 (-1.99)	-0.16 (-3.82)	-0.02 (-0.73)	-0.10 (-2.37)
Gross D. product	-	-	-	-	0.14 (1.32)	0.52 (4.36)	0.02 (0.33)	0.28 (2.38)
Lagged cons.	-	-	-	-	-	-	0.78 (7.83)	0.49 (3.42)
R^2	0.375	0.447	0.376	0.430	0.802	0.735	0.782	0.836
Adjusted R^2	0.097	0.218	0.130	0.309	0.164	0.696	0.749	0.801

Equations S1, S3 and D1 are corrected for autocorrelation. Durbin-h statistic for equations D3 and D4 are -1.160 and -1.329, respectively. t -statistics are in parentheses.

Table 2
Nominal and shadow price exchange rates. Cruzeiros/US Dollars

Year	Nominal	Shadow	Real
1970	4.59	4.31	1.065
1971	5.29	4.98	1.062
1972	5.93	5.63	1.053
1973	6.13	5.99	1.023
1974	6.79	7.07	0.960
1975	8.19	8.41	0.974
1976	10.67	11.49	0.928
1977	14.14	15.07	0.938
1978	18.07	19.61	0.921
1979	26.95	28.25	0.954
1980	52.71	49.24	1.070
1981	93.12	96.35	0.966
1982	179.51	184.68	0.972
1983	577.04	439.63	1.312
1984	1848.02	1287.01	1.436
1985	6200	4158.85	1.490
1986	13660	10110.16	1.351
1987	39230	32966.2	1.190
1988	262380	255814.44	1.025
1989	2830000	3542697.4	0.798
1990	68300000	107436551	0.635
1991	406610000	576397096	0.705
1992	4513000000	6374320000	0.708
1993	88449000000	98307000000	0.899
1994	1527100000000	2720000000000	0.561

Source: International financial statistics for nominal exchange rates.

the Cruzeiro relative to the United States dollar, while a value less than one for a given year can be interpreted as real appreciation. It can be noticed that for periods 1970/1973 and 1983/1988, there was a real depreciation of the cruzeiro against the dollar relative to its equilibrium value.

Nominal rates of protection for producers (NPP) and consumers (NPC) were calculated as percentages of the world price and are evaluated at official and shadow exchange rates. These are presented in Fig. 5 and Table 3. The producer subsidy was positive most of the time during the 1970s, although it was negative in some years. The reason used to explain this behavior was the instability of world prices, and the overvaluation of the Cruzeiro relative to US dollar (Calegar and Schuh, 1988). So, producers were taxed (negative subsidy) in those years when world prices were higher than the guaranteed price, such as in 1973/1974, 1976 and 1980. The overvaluation of the cruzeiro served as an implicit tax for producers, causing their prices to be lower and reducing the subsidy.

Beginning in 1982, the government placed the prices of wheat guaranteed in US dollars, with the explicit objective to protect producers' income from the higher inflation and exchange rate fluctuations. That policy increased protection for producers, which achieved its highest level in 1986 (production also reached its peak in 1986) and kept it positive until 1988 when the market started to be liberalized. The undervaluation of the Brazilian currency from 1983–1988 (Table 2), gave the wheat producers an additional protection. From 1989–1994, producers' protection has been negative. Nominal protection rates for producers of wheat are very similar to those calculated by Valdes (1996), during the period 1985–1995, although he did not take account of any misalignment of the exchange rate.

The explicit subsidy for consumers started in 1972 and was positive until around 1982. The government reduced the subsidy continuously until 1987, phased it out in 1988, and reinstated in 1989. Consumers were taxed from 1982 to 1989 due to the fact that world

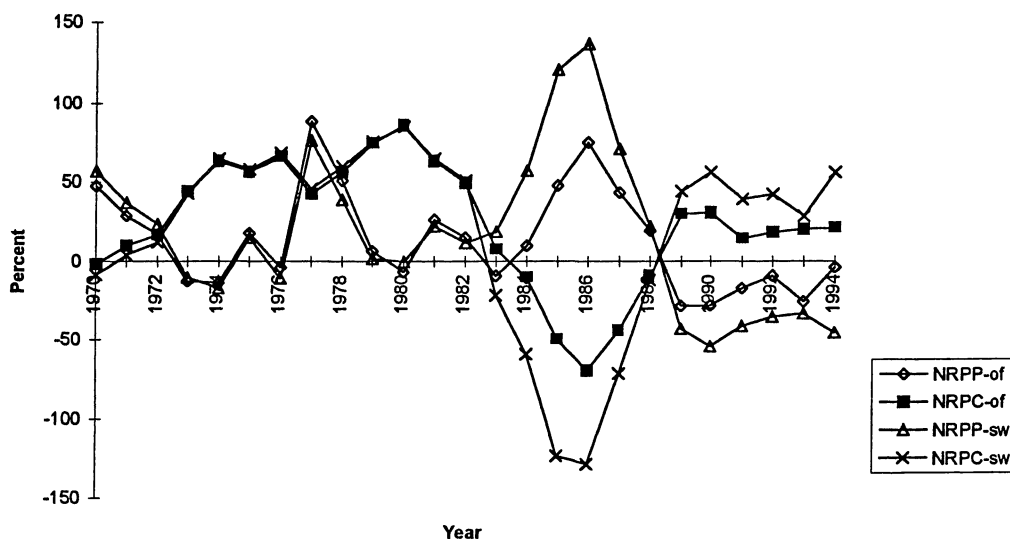


Fig. 5. Subsidy levels for wheat in Brazil. Official and shadow exchange rates. Period 1970–1994.

Table 3

Nominal rates of protection for producers and consumers of wheat in Brazil. Period 1970–1994. Official and shadow exchange rates. Percentage

Year	Producers exchange rates		Consumers exchange rates	
	Official	Shadow	Official	Shadow
1970	47.47	57.05	-2.07	-8.70
1971	29.06	37.09	9.16	3.51
1972	16.77	22.99	16.09	11.62
1973	-12.85	-10.81	43.82	42.51
1974	-13.77	-17.18	62.95	64.42
1975	17.66	14.58	56.37	57.51
1976	-4.41	-11.23	65.48	67.95
1977	87.53	75.96	42.13	45.71
1978	50.64	38.81	56.15	59.59
1979	6.21	1.32	73.96	75.16
1980	-7.33	-0.80	85.43	84.40
1981	26.26	22.03	62.93	64.17
1982	14.45	11.24	49.25	50.68
1983	-9.53	18.74	7.05	-22.00
1984	9.40	57.09	-10.71	-58.98
1985	47.88	120.46	-50.08	-123.74
1986	74.75	136.11	-69.35	-128.82
1987	43.24	70.46	-44.50	-71.95
1988	19.15	22.21	-9.54	-12.35
1989	-29.13	-43.39	29.31	43.53
1990	-28.19	-54.34	30.36	55.73
1991	-17.33	-41.68	13.95	39.29
1992	-9.21	-35.72	18.13	42.04
1993	-26.00	-33.42	20.48	28.45
1994	-4.12	-46.17	20.89	55.59

prices fell continuously at a rate greater than that of domestic prices. Since 1989 the nominal rate of protection for consumers has been positive. The overvalued currency worked as an implicit subsidy for most of the period, especially since 1989.

In order to discuss the costs and benefits of the Brazilian wheat policies, the total period was divided into three parts: one which goes from 1970 until 1982 and overlaps with Calegar and Schuh's study; another which goes from 1983 until 1989, and corresponds to the period of phasing out producers and consumers subsidy policies; and the last, from 1990 until 1994, represents a period of market liberalization. Results considering official and shadow exchange rates are presented separately for producers and consumers, and then they are combined to show a total effect of policies. Tables 4–6 in an appendix, show the same results, for a supply elasticity of 0.75, and a demand elasticity of -0.25. Those values can be compared to the results obtained by Calegar and Schuh (1988). The smaller the elasticity of demand, the smaller the effects of any policy on consumption and consequently on welfare. The greater the elasticity of supply, the greater the effects of policies on producer's welfare.

Table 7 shows the effects of the Brazilian wheat policy on producer welfare, social costs and foreign exchange saving. Producers were subsidized from

Table 4
Effects of the Brazilian wheat production policy. Official and shadow exchange rates. Real 1977 US\$ millions

Exchange rate	Total cost	Change in welfare	Social cost	Foreign exchange effect
<i>1970–1982</i>				
Official	732.95	599.87	133.08	316.83
Shadow	574.77	456.34	118.43	223.82
<i>1983–1989</i>				
Official	1424.66	1157.87	266.79	601.61
Shadow	2087.01	1491.29	595.71	522.75
<i>1970–1989</i>				
Official	2157.61	1757.74	399.87	918.61
Shadow	2661.78	1947.63	714.15	746.57
<i>1990–1994</i>				
Official	–243.12	–270.54	27.42	–230.66
Shadow	–755.77	–982.21	226.43	–963.09

Source: Calculated by the authors. A negative sign indicates a loss in foreign exchange.

$\varepsilon = 0.75$ and $\eta = -0.25$.

Table 5
Effects of the Brazilian wheat consumption policy. Official and shadow exchange rates. Real 1977 US\$ millions

Exchange rate	Total cost	Change in welfare	Social cost	Foreign exchange effect
<i>1970–1982</i>				
Official	7725.10	7815.46	90.32	–2811.36
Shadow	7389.43	7500.74	111.28	–2677.71
<i>1983–1989</i>				
Official	–1928.97	–2953.79	1024.82	383.21
Shadow	–1186.95	–1863.17	676.22	223.23
<i>1970–1989</i>				
Official	5796.13	4861.67	934.5	–2428.15
Shadow	6202.48	5637.57	564.90	–2454.41
<i>1990–1994</i>				
Official	809.95	1013.18	203.23	–222.34
Shadow	1100.23	1374.96	274.73	–303.77

Source: Calculated by the authors. A negative sign indicates a loss in foreign exchange.

$\varepsilon = 0.75$ and $\eta = -0.25$.

1970 until 1989, and taxed from 1990 until 1994. The gains in producer welfare from 1970–1989 correspond to 87% of the total cost, if evaluated at official exchange rates, and 81% if evaluated at shadow exchange rates. The social cost ranged from 13% to 19% of the total cost of the production policy until 1989.

With market liberalization after 1989 there were no direct subsidies to producers' price anymore, but a tariff schedule was set on imports of wheat. Wheat imported from MERCOSUR countries would pay a

tariff which would decline overtime faster than wheat originated in non-member countries, until 1994, when the tariff for MERCOSUR member countries would be completely eliminated. Brazilian imports from Argentina increased from 757 metric tons in 1989–3098 metric tons in 1994 (Silva and Grennes, 1997). This measure did reduce the cost of the production policy, but was not enough to compensate producers for the eliminated subsidies.

Producers' price fell below the import price, and what was a treasury cost before 1989, became a

Table 6

Combined effects of the Brazilian wheat policies. Official and shadow exchange rates. Real 1977 US\$ millions

Exchange rates	Total cost	Change in welfare	Social cost	Foreign exchange effect
<i>1970–1982</i>				
Official	8458.05	8415.33	42.76	–2494.36
Shadow	7964.20	7957.08	7.12	–2453.89
<i>1983–1989</i>				
Official	–504.31	–1795.92	1291.61	984.82
Shadow	900.06	–371.87	1271.93	745.99
<i>1970–1989</i>				
Official	7953.74	6619.41	1334.37	–1509.54
Shadow	8864.27	7585.21	1279.06	–1707.90
<i>1990–1994</i>				
Official	566.83	742.46	175.81	–453.00
Shadow	344.46	392.76	48.29	–1265.49

Source: Calculated by the authors. A negative sign indicates a loss in foreign exchange.

 $\varepsilon = 0.75$ and $\eta = -0.25$.

Table 7

Effects of the Brazilian wheat production policy. Official and shadow exchange rates. Real 1977 US\$ millions

Exchange rate	Total cost	Change in welfare	Social cost	Foreign exchange effect
<i>1970–1982</i>				
Official	732.95	641.59	91.36	229.43
Shadow	574.77	493.84	80.93	165.98
<i>1983–1989</i>				
Official	1424.66	1242.06	182.60	438.42
Shadow	2085.62	1676.16	410.57	426.95
<i>1970–1989</i>				
Official	2157.61	1883.64	273.97	667.85
Shadow	2660.02	2168.56	491.45	632.24
<i>1990–1994</i>				
Official	–243.12	–260.93	17.81	–148.28
Shadow	–755.77	–897.18	141.91	–590.51

Source: Calculated by the authors. A negative sign indicates a loss in foreign exchange.

‘treasury revenue’ after that. Producers welfare was reduced, and social cost would represent a deadweight loss from the wheat not produced in Brazil (imported). Domestic and international wheat prices became much closer, and the exchange rate was adjusted more frequently, reducing implicit costs, and their differences at official and shadow exchange rates. The foreign exchange saving was positive during the period 1970–1989, but negative after that at both exchange rates.

The consumer welfare effects of the consumption policy are shown in Table 8. Consumers were subsidized until 1982, and from 1990 until 1994, but taxed

from 1983 until 1989. The loss in consumers’ welfare from 1983 until 1989 was due to a reduction in consumption subsidies, and real depreciation of the Brazilian currency (Table 2). Prices to consumers which were lower than producer and import prices since 1970, became higher than import prices, and declining after 1986. The real exchange rate was always greater than one in that period, reinforcing the loss in consumer welfare. Imposition of tariffs on imports in 1990 changed some that situation, increasing costs and consumers’ welfare. Because of inelastic demand, social costs of the consumption policy were much smaller than those of the production policy,

Table 8
Effects of the Brazilian wheat consumption policy. Official and shadow exchange rates. Real 1977 US\$ millions

Exchange rate	Total cost	Change in welfare	Social cost	Foreign exchange effect
<i>1970–1982</i>				
Official	7725.10	7673.98	51.15	–1226.09
Shadow	7389.43	7350.91	38.52	–1166.35
<i>1983–1989</i>				
Official	–1928.97	–2267.02	338.04	146.18
Shadow	–1186.95	–1410.05	223.10	83.93
<i>1970–1989</i>				
Official	5796.13	5406.96	389.19	–1079.91
Shadow	6202.48	5940.86	261.62	–1082.42
<i>1990–1994</i>				
Official	809.95	877.24	67.28	–90.66
Shadow	1100.23	1191.16	90.93	–123.36

Source: Calculated by the authors. A negative sign indicates a loss in foreign exchange.

ranging from 0.5% to 7% of the total costs. However, the foreign exchange saving was large and negative for most of the 1970–1994 period. An exception occurred in the period 1983–1989 when higher prices to consumers reduced demand and imports, saving foreign exchange. Declining consumer prices during the 1990s increased consumption and imports, and had an negative effect on foreign exchange.

The combined effects of production and consumption policies are presented in Table 9. For the period of prevailing subsidy policies (1970–1989), the combined changes in consumer and producer welfare

corresponded to around 90% of the total cost, for both official and shadow exchange rates. The foreign exchange saving was negative and conflicted with one of the main objectives of those policies of increasing self-sufficiency. The reduction of subsidies to producers and consumers in the late 1980s, had a small effect in reducing welfare, and a large effect in saving foreign exchange, mainly if measured by shadow exchange rates. After 1989, producers were taxed and faced decreases in welfare, while consumers benefited by reduction in prices and real appreciation of the cruzeiro. However, there was a deadweight loss

Table 9
Combined effects of the Brazilian wheat policies. Official and shadow exchange rates. Real 1977 US\$ millions

Exchange rates	Total cost	Change in welfare	Social cost	Foreign exchange effect
<i>1970–1982</i>				
Official	8458.05	8315.57	142.51	–996.66
Shadow	7964.20	7844.75	119.45	–1000.37
<i>1983–1989</i>				
Official	–504.31	–1024.96	520.64	584.60
Shadow	898.67	266.11	632.56	510.88
<i>1970–1989</i>				
Official	7953.74	7290.60	663.15	–412.06
Shadow	8862.50	8109.42	753.07	–450.18
<i>1990–1994</i>				
Official	566.83	616.31	49.48	–238.94
Shadow	344.46	293.98	50.48	–713.87

Source: Calculated by the authors. A negative sign indicates a loss in foreign exchange.

associated with the consumption subsidy, as it cost US\$ 1.09 (at the official rate) and US\$ 1.17 (at the shadow rate) to transfer each US\$ 1.00 to the consumers.

Appendix of Table 10 presents estimates of the effects of the subsidy policies on quantities produced, consumed and imported of wheat for the entire period of the study, calculated at shadow exchange rates. The changes in each of the variables is a function of domestic (producer and consumers) and import prices, and also of production and consumption levels in each year. For most of the years until 1982, consumption increased at rates greater than production. During the period 1983/1989 production increased the most (the highest level of subsidy occurred in 1986), while consumption and imports declined, as a result of reduced subsidies on consumption. Without a direct

subsidy after 1989, production kept declining, while consumption and imports increased related to the fall in wheat prices.

After 1989 wheat policy was dominated by general economic reform in Brazil. Budgetary stringency brought about the elimination of producer and consumer subsidies. It also resulted in a sustained real appreciation of the Brazilian currency. It is another example of how economy-wide policies often dominate sector-specific policies (Valdes and Gnaegy, 1996).

5. Conclusion

In this study, the recent changes in the Brazilian wheat policies were analyzed through measures of governmental intervention on nominal rates of protection and on the welfare of producers and consumers. Elasticities of demand and supply of wheat in Brazil were calculated, and measures of shadow exchange rates were used in calculating monetary effects of changes in policies.

The nominal rates of protection, considered as the 'ad-valorem' equivalent of tariff and non-tariff barriers, showed the strong changes in direction of the wheat policies in Brazil in the last 15 years. Positive and high rates of protection for producers during the 1980s were offset by negative rates during the 1990s, although the wheat market has been almost completely liberalized. Negative and high rates of protection for consumers, were substituted for positive rates, during the same period. A negative rate signals that producers are being discriminated against relative to the prevailing border prices, while a positive rate signals that consumers are paying more for that product, relative to border prices. During the 1990s, those rates have been symmetrical with an average value of 45% if evaluated at a long term shadow exchange rate. Such values can represent marketing margins and possible distortions in that market, not necessarily related to border prices.

The price elasticities of supply and demand calculated indicated that Brazilian producers are more sensitive to price changes than consumers are. Consumption is, however, more responsive to changes in income. Increases in income can generate increases in the demand for wheat products such as cookies and

Table 10

Effects of the policies on quantities produced, consumed and imported (1970–1994, thousands of metric tons)

Year	Production	Changes in consumption	Imports ^a
1970	5181.7	-6.24	-
1971	418.26	30.71	-481.16
1972	90.30	58.76	-359.51
1973	-254.97	212.83	122.53
1974	-406.19	389.09	644.06
1975	215.51	353.17	759.36
1976	-125.73	511.07	295.56
1977	869.89	279.63	405.36
1978	829.90	447.57	-422.32
1979	151.97	767.66	-62.24
1980	-189.62	1191.88	1039.91
1981	419.70	576.09	765.71
1982	211.50	400.17	-19.52
1983	-198.18	46.63	-164.87
1984	157.75	-66.81	131.36
1985	1300.07	-283.34	-441.08
1986	2243.12	-419.24	-1719.31
1987	1666.45	-276.28	-2519.40
1988	837.51	-64.49	-1730.93
1989	-2016.55	249.39	-588.12
1990	-1072.82	260.73	2277.28
1991	-545.78	111.17	1183.99
1992	-249.04	155.27	701.05
1993	-692.52	172.64	421.68
1994	-80.84	198.14	890.67

Source: Calculated by the authors.

^aChange in imports were calculated as current consumption - lagged production.

pasta, and consequently increase total demand. Annual data for the period 1970/1994 were used to calculate a simple supply/demand relationship. Given the big changes in wheat policies in that period, which affected directly production and consumption, it is necessary to develop models which would capture such shocks, and improve the estimates of the elasticities.

Calculations of welfare measures indicated that until 1989 the cost of the production policy was 2.1 billion of 1977 real US dollars in official exchange rate, but US\$ 2.6 billion if shadow exchange rate is used. On the consumption side, there were spent 5.8 billion of 1977 real dollars in official, and 6.2 billion at shadow exchange rates. Around US\$ 667 million of foreign exchange were saved with the production policy, but US\$ 1.1 billion of additional foreign exchange was spent with the consumption policy.

The combined effect showed that almost US\$ 8 billion were spent from 1970 until 1989 with the production and consumption policies. The gains in production were smaller than increases in consumer expenditure on wheat. Self-sufficiency declined as an additional US\$ 450 million in foreign exchange was spent as a result of Brazilian wheat policy. The administrative costs of the wheat support programs were not considered in this study.

Reductions in wheat subsidies in late 1980s were not, however, an isolated event. Government budget constraints had forced reductions in support for the whole agricultural sector, as part of the macro-reforms to fight inflation. Talks between Brazil and Argentina about a process of regional integration during that time, also contributed to wheat market liberalization in Brazil, and ended up in an agreement by which Argentina would have preferences in Brazilian wheat markets and reduced import duties.

It is also important to notice, that the reform of the wheat sector in Brazil has coincided with a fall in the border prices, and with a real appreciation of the exchange rate, hurting producers of most importable commodities. Valdes (1996), reports a decrease of 34.9% in prices of importables (corn and wheat) in Brazil, for the period 1990–1993, and an appreciation in the real exchange rate of 62% from 1986 to 1995. Such a combination of effects seems to explain the increased pressure for more protection in Brazil, recently.

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