EVALUATION OF AN INCOME AND RURAL CREDIT GUARANTY PROGRAM FOR FAMILY AGRICULTURE

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Abstract

In this study we evaluate potential impacts of an income guaranty program (PGR) that could be established as an alternative use for funds from Brazil's National Family Agriculture Strengthening Program (PRONAF). Using Newbery and Stiglitz methodology, we analyze the effect of PGR upon the incomes of rice, maize [corn], bean, and cassava producers and on the supplies and prices of these commodities. This methodology is well adapted to our study, as we include an analysis of risk-aversion and credit financed capital investment. Our results show that family farmers producing rice, maize, beans and cassava would obtain income gains on average of 38%, 35%, 62%, and 49% for their respective crops. The income gains arise from an increase in the average prices received of 21%, 24%, 30%, and 29% and an increase in average production of 8%, 4%, 12%, and 4%. The results also show that consumers would be benefited by a resultant reduction in the these commodities average prices: 31% less for rice, 29% less for maize, 34% less for beans, and 32% less for cassava. It is found that over the last analyzed year, 1997, the total cost of PGR would have been R$

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1,634 million while the social cost would have been R$ 47.5 million, or 2.9% of the total Income Guaranty Program's total cost.

Key-Words: Rural credit, Income Guaranty Program, Family Farmers.

1. Introduction

Over the years, the Brazilian agricultural sector has been subjected to constant government interventions, justified by the great instability of a sector dependent on climate and variable market characteristics. The benefits of these interventions were not equally distributed.

Subsidized credit, an important Brazilian agricultural policy instrument in the mid 60s and early 70s, benefited large producers and export crops more than small farmers producing for the local market. These small producers did not possess the information needed to negotiate the financial institutions' credit application procedures nor did they have any actual guarantees to offer to these institutions. The subsidized credit policies of the 60s and 70s did little to alleviate the process of impoverishment affecting the segment responsible for more than 60% of Brazil's food production: family agriculture.

The economic and social importance of family agriculture was recognized in the 90s, which lead to the implementation of public policies to support it. In 1996, the government institutionalized the National Family Agriculture Strengthening Program (PRONAF). The objective of this Program was to strengthen the productive capacity of family agriculture and to contribute to employment opportunities, income generation, and quality of life improvements in both rural and urban areas.

However, PRONAF became a program offering rural credit and did not address many of the problems arising on small family farms. These family producers were also ill equipped to make use of the subsidized credit: they didn't have the tools needed to complete the procedures; they lacked the collateral to secure the loan; and they were unable to evaluate or accept the risks associated with borrowing. In order to increase the income level of the small family producer another type of government intervention is needed.

In this study, the implementation of an Income Guaranty Program (PGR) is suggested as an alternative for PRONAF improvement. The Program would act as an instrument for capitalization of the small family farmer by providing a guaranteed income from their products. The income transfer to the farmers would occur through payment of the difference between a target commodity price (determined by the average price over the last sixty months, after excluding the years with the highest and lowest average price received for the considered product) and the market price or a minimum price established by the government.

This paper analyzes the impacts of resources from the National Family Agriculture Strengthening Program (PRONAF) being used to fund subsidized credit both with and without the inclusion of the Income Guaranty Program (PGR) on the supply, prices, and the income earned by producers of rice, maize, beans and cassava. Specifically, it is proposed: a) to determine the benefits and the risk premium of PRONAF associated to PGR; b) to determine both producer and consumer surpluses that would be derived from the implementation of PGR; and c) to determine the social and total costs of PGR.

2. Methodology

The Newbery and Stiglitz Model

The model proposed by Newbery and Stiglitz (1981) is used to analyze the risks associated with an intervention policy that applies new resources to, a priori, provide protection to agents averse to risk.

If a producer receiving income $\tilde{Y}$ with average $\bar{Y}$ and Variation Coefficient, CV_{y0}, gets a direct subsidy coming from a government policy that consequently changes his income to $\tilde{Y}_1$ with average $\overline{Y}_1$ and Variation Coefficient CV_{y1}, the sum of money the producer would be disposed to pay so that the policy is introduced, B, could be found by optimizing the expected utility:

$$E[U(\tilde{Y}_0)] = E[U(\tilde{Y}_1 - B)] \quad (1)$$

By expanding the two sides of equation (01) in a Taylor series, the risk premium (B) is obtained as a fraction of the current average income:

$$\frac{B}{\overline{Y}} = \frac{\Delta\overline{Y}}{\overline{Y}} - \frac{1}{2} R \cdot \Delta\sigma_y^2, \quad (2)$$

where $\Delta\overline{Y}$ = variation between the average incomes; $\overline{Y}_0$ e $\overline{Y}_1$ = average incomes in both sceneries (post and prior intervention); R = Arrow-Pratt aversion coefficient, $R(\overline{Y}) = -YU''(\overline{Y})/U'(\overline{Y})$, and $\Delta\sigma^2_y$ = variation in the square income variation coefficient squares (Newbery and Stiglitz, 1981).

In equation (02), the first term on the right side ($\Delta\overline{Y}/\overline{Y}$), called Transference Benefit (BT), indicates the gain resulting from the change in average income that will occur independently from the risk behavior. The second term ($\frac{1}{2} R\, \Delta\sigma^2_y$) is the Efficiency Benefit (BE). It depends on extension of risk reduction (σ^2_y) and the extension of risk aversion (R) and represents the gains resulting from the increment of the economy's efficiency resulting from a risk reduction program.

Income Guaranty Program (PGR)

This study is an economic analysis of a hypothetical government supported Income Guaranty Program (PGR). PGR would guarantee the producer a "target price" (P_1) above either the competitive equilibrium price (P_0) or a fixed minimum price (P_m), whichever is higher. We posit that PGR will stimulate productive process efficiency. As shown in Figure 1, PGR would cause the production level to be adjusted to the supply curve up to level Q_1; the consumers would pay the prices (P_2), consistent with the demand of this new production level; and the government would pay the producer the difference between the "target price" and the price paid by consumer. The target-public for this policy would be small producers of basic foodstuffs (Kam-Chings and Teixeira, 1995).

Kam-Chings and Teixeira (1995) suggest that the target price could be calculated as the average of prices received over the last 60 months for the product of a considered activity on properties with a maximum area of 100 ha after excluding the years with the highest and lowest average real prices.

Economic Surpluses

Figure 1 was constructed to deduce the gain in economic surpluses directly related to the costs of the adoption of PGR. In the figure, net social cost is the area of triangle ABC; total cost of the policy (the difference between the market price and the target-price) is the area of P_1BCP_2; producer surplus is the area of P_1BAP_0; and consumer surplus is the area of P_0ACP_2. A restatement of the construction is found in expressions 03, 04, 05, and 06 (Wallace, 1962).

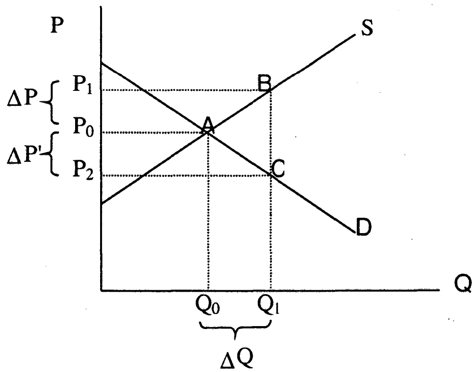

Figure 1. Effect of the Income Guaranty Program (PGR).

$$CS = \text{Área ABC} = \Delta Q \frac{(\Delta P + \Delta P')}{2} \tag{03}$$

$$CT = \text{Área } P_1BCP_2 = Q_1 (P_1 - P_2). \tag{04}$$

$$EP = \text{Área } P_1P_0AB = (Q_1 + Q_0)\frac{\Delta P}{2} \tag{05}$$

$$EC = \text{Área } P_0ACP_2 = BT - EP = CT - CS - EP. \tag{06}$$

As one can observe, at production level Q1, the consumers would be paying price P_2 and the producers would receive P_1. So, the Program would be generating surpluses to both consumers and producers.

It is worth emphasizing that the calculation of economic surpluses from Marshallian demand incorporates the income-effect existing in the price change, thus generating a distortion in the Program's cost.

Operationalization of the variables

The total production of each crop (Q_0) and the number of producers (n) were taken from the 1990 and 1996 Agricultural Censuses (Fundação Instituto Brasileiro De Geografia E Estatística - FIBGE - 1990, 1995/96) for groups of properties up to 100 hectares. Linear interpolation was used to provide data for the other years in our series of calculations. Prices were obtained from the ARIES databank system of the Getúlio Vargas Foundation (FGV) via the internet and were corrected using the IGP-DI [an inflation index] of November 1998 (Getúlio Vargas Foundation - FGV, 1998).

For determination of income using PRONAF resources, the annual amortization of the financing was calculated, applying an interest rate (i) of 5.75% yearly. This is in accordance with the Harvest Plan of 1998/1999 announced by the Brazilian Ministry of Agriculture. The value of R$ 2,500 was considered as the amount of PRONAF funded credit provided to each producer annually. This value was selected because it is close to the average value of the 1997 PRONAF contract (R$ 2,290.04) used in studies carried out by Veiga and Abramovay (1998).

For Brazil, the credit elasticity (ε_c) is estimated through an aggregated Cobb-Douglas production function.

The average monetary income from the use of resources via PRONAF (Y_0) is defined by

$$Y_0 = (P_0 \text{ x } Q_2) - C_A, \quad Q_2 = \Delta Q_2 + Q_0, \quad \Delta Q_2 = [(IVC \text{ x } E_c) \text{ x } Q_0], \quad C_A = {i}/{100} \text{ x } C_L \text{ x } n, \qquad (07)$$

where Y_0 =the average annual monetary income with PRONAF; P_0 = average annual market price of the each crop; Q_2 = total production given credit production elasticity (ε_c) and the credit variation index (IVC); Q_0 = marketed amount (the same as the amount produced); C_A = capital integrally amortized at the expiration of the debt; ΔQ_2 = variation in the total produced amount, given credit production elasticity (ε_c) and the credit variation index (ICV); C_L = capital or value liberated at the moment of business startup, equal to R$ 2.500,00 for each beneficiary producer; n = number of informers (beneficiaries) for each crop analyzed ; and i = interest rate (5.75%/yr.).

The value of the average income from the use of the resources via PRONAF funding of the Income Guaranty Program (PGR) is be defined by

$$Y_1 = [(P_1 \text{ x } Q_1) + (P_0 \text{ x } \Delta Q_2)] - C_A, \qquad (08)$$

where Y_1 = value of the average monetary income obtained through PRONAF via the PGR; P_1 = target price ; Q_1 = quantity produced given the price-elasticity of the supply ($\varepsilon_P{}^0$).

Credit production elasticity

For Brazil, the production function in the analyzed period is given by

$$PROD = A*TERRA\beta^{1}*CAP\beta^{2}*FIN\beta^{3}*TRAB\beta^{4}*e\mu^{1} \qquad (09)$$

By expressing it under logarithmic form, as it is used in this study, one obtains

$$logPROD_i = logA + \beta_1 logTERRA_i + \beta_2 logCAP_i + \beta_3 logFIN_i + \beta_4 logTRAB_i + \mu_i, \qquad (10)$$

where log $PROD_i$ is the natural logarithm of the total value of the aggregated production in the agricultural sector (animal and vegetable) measured in R$ (*Reais*); log $TERRA_i$ is the natural logarithm of the total land amount (permanent and temporary cropping) measured in hectares; log CAP_i is the natural logarithm of the total capital stock measured in R$; log FIN_i is the natural logarithm of the total financing flow that comprises all financing modalities measured in R$; log $TRAB_i$ is the natural logarithm of the service flows of the total work force converted into equivalent-man,; and i is the micro region (1, 2, 3, 4,..., 530).

All data were obtained from the 1995 Agricultural Census (FIBGE, 1995/96) for 530 homogeneous micro regions in 25 of the Brazilian Federation's units (states and the DF –Brasilia). The states of Acre and Pará, were excluded since some variables from these states were unavailable (FIBGE, 1998). In estimates, the ordinary least square method (MQO) was used by taking into account its basic presuppositions (Gujarati, 1995).

3. Results

In this study, the risk aversion coefficients R = 0.00, and R = 0.85 were used according to Binswanger (1981) in order to observe the producers' reaction to different risk aversion situations.

Tables 1 and 2 present the values of the total income obtained by producers coming from resources via PRONAF (Y_0) and resources via PRONAF associated to PGR (Y_1).

To determine the variation in the total produced amount (DQ_2) as a result of PRONAF resources, the credit elasticity estimated for Brazil by an aggregated production function of 0.073985, significant at 1%, was used.

As one can observe in Tables 1 and 2, PGR would make possible an almost consistent increment in total producer annual incomes obtained from the production of rice, maize, beans and cassava. The exceptions were 1991 for rice, 1994 for beans, and from 1995 to 1996 for cassava. This occurred when the market price for these commodities equaled or exceeded the target price. When a commodity's market price exceeds the government's target price, government's expenses for PGR would be null since market behavior would guarantee the producer's income.

Over the period from 1990 to 1997, the yearly average total income from the production of any of the considered commodities was higher if PRONAF is associated with PGR (Tables 1 & 2). Considering only PRONAF, the yearly average total incomes obtained for the production of rice, maize, beans and cassava from 1990-97 were R$ 586 million, R$ 1,723 million, R$ 926 million and R$ 462 million respectively. Over the same period, PRONAF associated with PGR resulted in yearly average total producer incomes of R$ 760 million for rice, R$ 2,299 million for corn, R$ 1,356 million for bean and R$ 596 million for cassava.

Table 1 – Total annual income for producers of rice, maize, beans and cassava: PRONAF without PGR, over the period from 1990 to 1997 - R$, Nov. 1998

Year	Rice	Maize	Beans	Cassava
1990	744,451,873	2,071,836,250	1,167,125,216	400,878,261
1991	919,332,320	2,197,696,714	1,117,711,196	481,147,298
1992	616,587,133	1,854,844,276	781,773,569	545,659,366
1993	596,645,516	1,980,704,740	1,053,843,055	521,739,156
1994	551,563,363	1,639,206,038	1,299,759,326	306,091,574
1995	412,200,394	1,298,722,639	645,362,161	493,313,140
1996	421,585,525	1,541,338,285	725,917,337	504,163,163
1997	428,877,262	1,202,039,405	614,526,347	441,075,772
Mean Income/Y	586,405,423	1,723,298,543	925,752,276	461,758,466

Source: Research data.

Table 2 – Total annual income for producers of rice, maize, beans and cassava: PRONAF associated with PGR, over the period from 1990 to 1997 - R$, Nov. 1998

Year	Rice	Maize	Beans	Cassava
1990	1,274,799,368	3,062,431,355	1,974,308,377	923,737,177
1991	919,332,320	2,609,504,582	1,782,154,073	792,446,816
1992	851,937,971	2,409,205,407	1,636,872,243	640,323,308
1993	744,629,153	2,252,963,442	1,204,357,626	590,356,986
1994	657,191,129	2,193,988,327	1,299,759,326	507,216,982
1995	661,877,835	2,153,340,497	1,257,186,137	493,313,140
1996	587,697,812	1,953,298,969	1,019,315,941	504,163,163
1997	490,028,740	1,760,298,397	903,760,856	453,245,645
Mean Income/Y	759,694,971	2,299,378,872	1,356,677,766	596,307,208

Source: Research data.

Tables 3 to 6 show that in study period the addition of PGR to PRONAF increased the yearly incomes of small (less than 100ha) family producers of rice, maize, bean, and cassava on average 38.23%, 35.38%, 62.08%, and 49.02% respectively. The distribution of gains among these producers would be based on their shares of total production.

Table 3 - Percent variations in producer income, prices to the producer, prices to the consumer, and the amount produced for RICE, Brazil, 1990-1997, PRONAF with PGR

Year	Rice			
	Producer Income (%)	Producer Prices (%)	Consumer Prices (%)	Amount Produced (%)
1990	71.24	38.71	-56.92	15.37
1991	-	-	-	-
1992	38.17	21.43	-31.51	8.51
1993	24.80	14.29	-21.01	5.67
1994	19.15	11.11	-16.34	4.41
1995	60.57	31.82	-46.78	12.63
1996	39.40	21.74	-31.96	8.63
1997	14.26	8.33	-12.25	3.31
Mean	38.23	21.06	-30.97	8.36

Source: Research data.

Table 4 - Percent variations in producer income, prices to the producer, prices to the consumer and amount produced for MAIZE, Brazil, 1990-1997, PRONAF with PGR

Year	Maize			
	Producer Income (%)	Producer Prices (%)	Consumer Prices (%)	Amount Produced (%)
1990	47.81	33.33	-40.00	6.00
1991	18.74	13.64	-16.36	2.45
1992	29.89	21.05	-25.26	3.79
1993	13.75	10.00	-12.00	1.80
1994	33.84	23.53	-28.24	4.24
1995	65.80	42.86	-51.43	7.71
1996	26.73	18.75	-22.50	3.38
1997	46.44	30.77	-36.92	5.54
Mean	35.38	24.24	-29.09	4.36

Source: Research data.

The annual variations in prices to the consumer were all negative. We found that if PGR were supported by PRONAF, there would be an annual consumer price reduction averaging 30.97%, 29.09%, 34.10% and 31.80% for rice, maize, beans and cassava respectively, .

Table 5 - Percentile variations in producer income, prices to producer, prices to consumer and the amount produced for BEANS, Brazil, 1990-1997, PRONAF with PGR

Year	Beans			
	Producer Income (%)	Producer Prices (%)	Consumer Prices (%)	Amount Produced (%)
1990	69.16	36.26	-40.53	13.78
1991	59.45	31.46	-35.16	11.96
1992	109.38	50.72	-56.69	19.28
1993	14.28	8.05	-8.99	3.06
1994	-	-	-	-
1995	94.80	43.55	-48.67	16.55
1996	40.42	20.59	-23.01	7.82
1997	47.07	22.95	-25.65	8.72
Mean	62.08	30.51	-34.10	11.59

Source: Research data.

The supply price-elasticities calculated for Brazil by Gomes et al. (1998) were used to calculate production variations due to PGR. These elasticities are 0.397, 0.180, 0.380, and 0.130 for rice, maize, beans and cassava respectively. Data presented in Tables 3 to 6 indicate that PGR brings about gains in the average yearly production of rice, maize, beans, and cassava of 8.36%, 4.36%, 11.59% and 3.82% respectively. It is observed that the price increments are much higher than the production increments, since the target price (p_1) is a good deal above the market price (p_0).

Table 6 - Percent variation in producer income, prices to the producer, prices to the consumer and the produced amount for CASSAVA, Brazil, 1990-1997, PRONAF associated with PGR

Year	Cassava			
	Producer Income (%)	Producer Prices (%)	Consumer Prices (%)	Amount Produced (%)
1990	130.43	74.95	-81.19	9.74
1991	64.70	41.03	-44.45	5.33
1992	17.35	11.83	-12.82	1.54
1993	13.15	8.97	-9.72	1.17
1994	65.71	37.48	-40.60	4.87
1995	-	-	-	-
1996	-	-	-	-
1997	2.76	1.88	-2.04	0.24
Mean	49.02	29.36	-31.80	3.82

Source: Research data.

Tables 7 and 8 show that from 1990 to 1997 the average annual effect of PGR on the prices received by producers would be increments that average R$ 0.05, R$ 0.04, R$ 0.20 per kg of rice, maize, and beans respectively, as well as R$ 19.27/ton for cassava. In percentile terms, this represents an average annual price received increment of about 21.06%, for rice 24.24%, for maize, and 30.51% for beans, and 29.36% for cassava. In those years in which the market prices were the same or superior to the target price, the producers receive the market price.

Table 7 - Variation in prices received by producers of RICE and MAIZE, Brazil, 1990-1997, Nov. /1998 R$

Year	Rice (per kg)			Maize (per kg)		
	(1)	(2)	(2-1)	(1)	(2)	(2-1)
1990	0.31	0.43	0.12	0.21	0.28	0.07
1991	0.38	0.34	0.00	0.22	0.25	0.03
1992	0.28	0.34	0.06	0.19	0.23	0.04
1993	0.28	0.32	0.04	0.20	0.22	0.02
1994	0.27	0.30	0.03	0.17	0.21	0.04
1995	0.22	0.29	0.07	0.14	0.20	0.06
1996	0.23	0.28	0.05	0.16	0.19	0.03
1997	0.24	0.26	0.02	0.13	0.17	0.04
Mean	0.28	0.32	0.05	0.18	0.22	0.04
Variation /Market Prices)[1]		21.06%				24.24%

Source: Research data.

[1] Percent average of the annual variations.

Table 8 - Variation in prices received by producers of BEANS and CASSAVA, Brazil, 1990-1997, Nov. /1998 R$

Year	Beans (per kg)			Cassava (per ton)		
	(1)	(2)	(2-1)	(1)	(2)	(2-1)
1990	0.91	1.24	0.33	61.95	108.38	46.43
1991	0.89	1.17	0.28	72.14	101.74	29.60
1992	0.69	1.04	0.35	81.23	90.84	9.61
1993	0.87	0.94	0.07	80.61	87.84	7.23
1994	1.04	0.89	0.00	56.73	77.99	21.26
1995	0.62	0.89	0.27	81.67	71.57	0.00
1996	0.68	0.82	0.14	85.53	77.99	0.00
1997	0.61	0.75	0.14	79.67	81.17	1.50
Mean	0.79	0.97	0.20	74.94	87.19	19.27
Variation /Market Prices)[1]			21.06%			29.36%

Source: Research data.

[1] Percent average of the annual variations.

The positive Transfer Benefit (BT) values shown in Tables 9 and 10 point out the increase in the family producers' average incomes brought about by PGR. The Transfer Benefit (BT) was null in very few years: 1991 for rice producers, 1994 bean producers, and 1995 and 1996 for cassava producers. In those years, the producer would just have efficiency benefits (BE).

It can also be seen that the Efficiency Benefit (BE) is reduced in the years with greater stabilization in the economy's prices. In those years, family producers receive their total benefit from BT, which represents the transfer of government resources to the producer.

The risk premium, column B, is the sum of the Transfer and Efficiency Benefits. The positive values of the risk premiums show that the family producers would be willing to sacrifice a part of their income as protection against price instability, as it makes it difficult for them to securely produce and market their products. The low values for efficiency benefits indicate the low risk associated to the production of the analyzed products, which makes the calculation of the surpluses to both producer and consumer possible.

Table 9 - Transfer Benefits (BT) & Efficiency Benefits (BE) to RICE and MAIZE producers, Brazil, 1990-1997

Year	Rice						Maize					
	R=0.00[1]			R=0.85[2]			R=0.00[1]			R=0.85[2]		
	B/Y_0	BT	BE	B/Y_0	BT	BE	B/Y_0	BT	BE	B/Y_0	BT	BE
1990	0.610	0.610	0.000	0.619	0.610	0.009	0.423	0.423	0.000	0.436	0.423	0.013
1991	0.000	0.000	0.000	0.008	0.000	0.008	0.167	0.167	0.000	0.168	0.167	0.001
1992	0.316	0.316	0.000	0.320	0.316	0.004	0.254	0.254	0.000	0.260	0.254	0.006
1993	0.209	0.209	0.000	0.214	0.209	0.005	0.121	0.121	0.000	0.126	0.121	0.004
1994	0.160	0.160	0.000	0.165	0.160	0.005	0.288	0.288	0.000	0.293	0.288	0.005
1995	0.485	0.485	0.000	0.491	0.485	0.007	0.540	0.540	0.000	0.543	0.540	0.003
1996	0.321	0.321	0.000	0.322	0.321	0.001	0.226	0.226	0.000	0.227	0.226	0.001
1997	0.120	0.120	0.000	0.121	0.120	0.001	0.382	0.382	0.000	0.383	0.382	0.001

Source: Research data.

[1] Risk-aversion coefficient R = 0.00 = risk-neutral producer.

[2] Risk-aversion coefficient R = 0.85 = risk-intermediate producer.

Table 10 - Transfer Benefits (BT) & Efficiency Benefits (BE) to BEAN and CASSAVA producers, Brazil, 1990-1997.

Year	Beans						Cassava					
	R=0.00[1]			R=0.85[2]			R=0.00[1]			R=0.85[2]		
	B/Y_0	BT	BE	B/Y_0	BT	BE	B/Y_0	BT	BE	B/Y_0	BT	BE
1990	0.553	0.553	0.000	0.563	0.553	0.010	0.920	0.920	0.000	0.933	0.920	0.014
1991	0.470	0.470	0.000	0.495	0.470	0.025	0.486	0.486	0.000	0.489	0.486	0.003
1992	0.796	0.796	0.000	0.812	0.796	0.016	0.136	0.136	0.000	0.138	0.136	0.003
1993	0.114	0.114	0.000	0.121	0.114	0.007	0.102	0.102	0.000	0.110	0.102	0.008
1994	0.000	0.000	0.000	0.042	0.000	0.042	0.442	0.442	0.000	0.459	0.442	0.017
1995	0.671	0.671	0.000	0.680	0.671	0.009	0.000	0.000	0.000	0.001	0.000	0.001
1996	0.300	0.300	0.000	0.301	0.300	0.001	0.000	0.000	0.000	0.001	0.000	0.001
1997	0.337	0.337	0.000	0.338	0.337	0.001	0.021	0.021	0.000	0.023	0.021	0.001

Source: Research data.

[1] Risk-aversion coefficient R = 0.00 = risk-neutral producer.

[2] Risk-aversion coefficient R = 0.85 = risk-intermediate producer.

Tables 11 and 12 present the possible total benefits generated by PGR for the analyzed products. Using the average degree of risk aversion (R=0.85), the total benefit related to rice was R$ 8,229 thousand in 1991 and R$ 538,493 thousand in 1990; the total benefit related to maize was R$ 281,395 thousand in 1993 and R$ 1,021,076 thousand in 1990; the total benefit related to beans was R$ 65,408 thousand in 1994 and R$ 871,839 thousand in 1992; and the total benefit related to cassava was R$ 324 thousand in 1995 and R$ 530,542 thousand in 1990. For rice in 1991, beans in 1994, and cassava in 1995 and 1996, the total program benefit would come only from efficiency gains, as the producer had been compensated by the market. PGR performance relative to the aforementioned crops would probably be neutral in those years.

It is also verified that the years generating the higher Efficiency Benefits, which represent uncertainty levels, were the ones presenting the highest risk premium values. This means that the risk averting family producer would spend much more to maintain the desired utility level in those years.

Table 11 - Total Benefits (B), Transfer Benefit (BT) and Efficiency Benefit (BE) to the RICE and MAIZE producer, 1990-1997, in thousand R$, Nov. /98 R$

Year	Rice						Maize					
	R=0.00[1]			R=0.85[2]			R=0.00[1]			R=0.85[2]		
	B	BT	BE	B	BT	BE	B	BT	BE	B	BT	BE
1990	530,347	530,347	-	538,493	530,347	8,145	990,595.10	990,595.10	-	1,021,076,19	990,595.10	30,481.08
1991	-	-	-	8,229	-	8,229	411,807.87	411,807.87	-	415,223.09	411,807.87	3,415.22
1992	235,350	235,350	-	238,001	235,350	2,650	554,361.13	554,361.13	-	567,533.54	554,361.13	13,172.41
1993	147,983	147,983	-	151,188	147,983	3,205	272,258.70	272,258.70	-	281,395.37	272,258.70	9,136.67
1994	105,627	105,627	-	108,694	105,627	3,066	554,782.29	554,782.29	-	563,660.09	554,782.29	8,877.80
1995	249,677	249,677	-	253,119	249,677	3,441	854,617.86	854,617.86	-	859,383.21	854,617.86	4,765.35
1996	166,112	166,112	-	166,567	166,112	455	411,960.68	411,960.68	-	413,073.28	411,960.68	1,112.60
1997	61,151	61,151	-	61,681	61,151	530	558,258.99	558,258.99	-	559,730.79	558,258.99	1,471.79

Source: Research data.

[1] Risk-aversion coefficient R = 0.00 = risk-neutral producer.

2 aversion coefficient to the risk R = 0.85 = risk-intermediate producer.

Table 12 - Total Benefits (B), Transfer Benefit (BT) and Efficiency Benefit (BE) to the BEAN and CASSAVA producer, 1990-1997, in thousand R$, Nov. /98 R$

Year	Beans						Cassava					
	R=0.00[1]			R=0.85[2]			R=0.00[1]			R=0.85[2]		
	B	BT	BE	B	BT	BE	B	BT	BE	B	BT	BE
1990	807,183	807,183	-	822,417	807,183	15,234	522,858	522,858	-	530,542	522,858	7,683
1991	664,442	664,442	-	699,283	664,442	34,840	311,299	311,299	-	313,348	311,299	2,049
1992	855,098	855,098	-	871,839	855,098	16,741	94,663	94,663	-	96,685	94,663	2,021
1993	150,514	150,514	-	159,677	150,514	9,162	68,617	68,617	-	73,870	68,617	5,252
1994	-	-	-	65,408	-	65,408	201,125	201,125	-	208,760	201,125	7,635
1995	611,823	611,823	-	619,813	611,823	7,989	-	-	-	324	-	324
1996	293,398	293,398	-	294,153	293,398	754	-	-	-	563	-	563
1997	289,234	289,234	-	290,257	289,234	1,022	12,169	12,169	-	12,904	12,169	734

Source: Research data.

[1] Risk-aversion coefficient R = 0.00 = risk-neutral producer.

[2] aversion coefficient to the risk R = 0.85 = risk-intermediate intermediary producer.

Tables 13 to16 present the change in social cost, total cost, and the values of producer and consumer surpluses arising from the inclusion of PGR in PRONAF.

The analysis of these results is conditioned by the hypothesis that all products are essentially destined for the domestic market, that is, a closed economy situation. However, maize and rice are marketed in both the foreign and domestic markets.

Table 13 - Change in Producer Surplus (EP), Consumer Surplus (EC), Social Cost (CS) and Total Cost (CT) caused by the Income Guaranty Program for RICE, 1990-1997, Nov./1998 R$

Year	Rice			
	(EP)	(EC)	(CS)	(CT)
1990	368,289,822	541,522,442	64,920,400	974,732,665
1991	-	-	-	-
1992	165,553,191	243,424,506	16,686,390	425,664,088
1993	104,683,589	153,923,648	7,131,143	265,738,382
1994	74,912,645	110,149,334	3,993,564	189,055,543
1995	174,255,676	256,220,384	25,573,290	456,049,351
1996	116,820,525	171,769,439	11,938,128	300,528,093
1997	43,468,114	63,914,227	1,747,378	109,129,720
Period average			18,855,756	388,699,692

Source: Research data.

Table 14 - Change in Producer Surplus (EP), Consumer Surplus (EC), Social Cost (CS) and Total Cost (CT) caused by the Income Guaranty Program for MAIZE, 1990-1997, Nov./1998 R$

Year	Maize			
	(EP)	(EC)	(CS)	(CT)
1990	822,833,030	987,399,636	52,725,223	1.862.957.890
1991	346,074,008	415,288,809	9,230,712	770.593.530
1992	463,804,300	556,565,160	18,973,812	1.039.343.272
1993	229,306,369	275,167,643	4,499,768	508.973.780
1994	463,475,482	556,170,579	21,144,734	1.040.790.796
1995	706,030,889	847,237,067	57,686,705	1.610.954.662
1996	345,139,048	414,166,858	12,600,651	771.906.558
1997	464,404,740	557,285,688	27,530,580	1.049.221.008
Period average			25,549,023	1,081,842,687

Source: Research data.

When analyzing the benefits in Tables 11 and 12 as producer surplus, it is clear that they are not directly comparable to those obtained using the percent variations in producer surplus found in Tables 3 to 5, since as Newbery and Stiglitz (1981) admitted the total benefits would be a composition of both transfer and efficiency benefits

Table 15 - Change in Producer Surplus (EP), Consumer Surplus (EC), Social Cost (CS), and Total Cost (CT) caused by the Income Guaranty Program for BEANS, 1990-1997, Nov./1998 R$

Year	Beans			
	(EP)	(EC)	(CS)	(CT)
1990	568,452,838	635,329,643	77,595,519	1,281,378,000
1991	469,580,788	524,825,587	56,088,230	1,050,494,607
1992	596,094,864	666,223,672	110,963,889	1,373,282,426
1993	108,335,658	121,081,030	3,454,366	232,871,055
1994	-	-	-	-
1995	428,634,350	479,061,921	69,365,140	977,061,412
1996	209,071,655	233,668,320	16,666,973	459,406,949
1997	205,728,143	229,931,454	18,203,809	453,863,407
Period average			50,333,990	832,622,551

Research data.

Table 16 - Change in Producer Surplus (EP), Consumer Surplus (EC), Social Cost (CS), and Total Cost (CT) due to the Income Guaranty Program for CASSAVA, 1990-1997, Nov./1998 R$.

Year	Cassava			
	(EP)	(EC)	(CS)	(CT)
1990	446,729,878	483,957,368	43,233,126	973,920,373
1991	270,084,501	292,591,542	14,616,935	577,292,979
1992	83,284,076	90,224,415	1,324,079	174,832,571
1993	60,453,967	65,491,798	729,998	126,675,763
1994	174,787,002	189,352,585	8,659,233	372,798,821
1995	-	-	-	-
1996	-	-	-	-
1997	10,759,673	11,656,313	27,399	22,443,385
Period average			11,431,795	374,660,649

Source: Research data.

It is observed that for all products affected by the PGR there were wide oscillations in the producer surplus (EP) between 1990 and 1995, especially for bean producers in 1991 and 1992 and cassava producers in 1991 and 1994. This occurred due to large differences, approximately 30% on average, between the target prices (P_1) and the market prices (P_0), as can be seen in Tables 7 and 8. This means that PGR would have a greater than normal effect in improving the producers' income.

The same observation can be made for the consumer surplus (EC). In those same years, there were high negative variations in these commodities' prices to the consumer (Tables 3 to 5), considerably increasing their real income and well-being.

It is also observed that for rice, maize, beans, and cassava the changes in consumer surpluses are greater than the changes in producer surpluses. This demonstrates that the results are in accordance with the theory, since supply price-elasticity is higher than demand price-elasticity for all products.

The Social Costs and Total Costs arising from implementation of the Income Guaranty Program are presented in Tables 13 to 16. The following price elasticities of demand (Gomes et al., 1998) were used to calculate these costs: rice, -0.270; maize, -0.150; beans, -0.340, and cassava, -0.120. The averages proportion of social cost in total cost over the analyzed period were 3.79%, 2.08%, 5.10% and 1.79% for rice, maize, beans, and cassava respectively. This generally means that the cost of the Income Guaranty Program to society would be low.

Part of the Total Cost would be amortized through the producer and the consumer surpluses; the rest would be Social Cost. In 1997, the Social Cost of PGR would have been R$ 47.5 million of a Total PGR Cost of R$ 1,634 million, only 2.9% of the Total Cost.

In synthesis, the results from this study showed PGR to be quite favorable for both producers and consumers. Producers would have a significant income gain, and consumer well-being would improve due to the reduction in product prices. Thus, it is confirmed that the association of PRONAF and PGR could stimulate the production of the analyzed products, thereby contributing to increase market supply, input demand, and employment. However, in order for this to occur, the State must participate more in the process by making new investments and improving basic infrastructure.

1. Conclusion

It is concluded that the implementation of PGR associated with PRONAF would bring significant gains to the incomes of small family producers of rice, maize, beans, and cassava and would improve the consumers' well-being by reducing the market prices of these commodities. The association of these two programs would stimulate family farm production and contribute to the generation of employment and income in rural and urban areas.

If these policy measures are to be successful, they should receive budget appropriations coherent with the original proposals and be held to high levels of administrative efficiency. This presents a problem. In the specific case of PRONAF, some banks, even the government's, are still reluctant to participate in the program since it does not generate significant financial profit. The banks lack of experience relative to programs supporting family agriculture also negatively affects efficient program implementation and direction.

This points out the need for an improved mechanism to allocate PRONAF resources to the Program's beneficiaries: family farmers. One option would be to involve Rural Credit Cooperatives (Credis) to act in the role of financial agents and possibly become important local catalysts for development.

It is suggested that funds from the ICMS (a value added tax) be used to agricultural income guaranty policies, since the ICMS has already proven itself to be a very efficient instrument for the transfer of agricultural income to the State.

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