PREMIUM FOR INSURANCE OF PRODUCTIVITY OF THE MOST SIGNIFICANT CULTURES FOR THE FINANCIAL RESULTS OF THE PROAGRO

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ABSTRACT

The objective of this work is to give some information about the risks of the cultures of larger weight in the determination of the results of the PROAGRO, calculating, for that, the premiums for insurance of productivity of those cultures. The methodology used is based in the theory of the demand of insurances and, presupposing lack of profit and worthless operational costs, as well as normal distribution for the productivity, allows to calculate the insurance premium to cover the risks of productivity of the cultures. The used data comes from the Statistical Annuals of Brazil, of FIBGE. Once obtained those prizes, it is tried to settle down a relationship among the value and the position that each culture has in the Program, in terms of their contribution for its financial results.

Key words: PROAGRO, premium, productivity.

1 Introduction

The need of special mechanisms for the reduction of the risks and uncertainties that feature the agricultural activities is justified, basically, by the intrinsic characteristics of this sector. By reason of those characteristics the agriculture has difficulties of adjusting quickly to the flotation of the markets and, besides that, is subject to the effects originated

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from climatic and environmental variations. Therfore, while the programs of minimum prices are destined to reduce the economic risks, the insurance programs seek, mainly, to reduce the losses due to unfavorable climatic conditions. Reducing the negative effects associated to the natural disasters, the insurance supplies the necessary environment so that the producers can make their decisions concerning production and investment (Biainain, 1997).

In Brazil, the agricultural insurance is made by the Companhia Seguradora do Estado de São Paulo - COSESP, by some cooperatives or associations of insurance and by the Programa de Garantia da Atividade Agropecuária - PROAGRO (Rossetti, 1999). COSESP, whose participation in the insurance of agricultural production is less expressive than PROAGRO, has been expanding its operations, initially restricted to the State of São Paulo, for States of Paraná, Mato Grosso and Goiás. As advantages in relation to PROAGRO, the COSESP secures a larger number of cultures, and covers more risks, including, besides the coverage of losses from waterspout, windstorm, hail and drought, the risks of fire and lightening bolts, of excessive rains, frost and excessive variation of temperature. Moreover, it has also larger acceptance for the financial agents, due to the agility for payment of the indemnities and to easiness of its operation (Silva, 1999). However, its main disadvantage resides in the high adhesion rates, which can, in some cases, erode the profit of the producer. Moreover, COSESP requests that the producer respects the cultivation norms established by the Secretaria da Agricultura e Abastecimento do Estado de São Paulo, being the same subject to the loss of the coverage offered by the insurance, in case he doesn't execute one of the technical requirements. The difference between COSESP and PROAGRO is summarized, basically, with respect to the number of covered events and the speed in the verification of the losses and in the payment of the coverages, with the first program exhibiting larger speed and covering larger number of events, being, however, more expensive than PROAGRO (Tsunechiro et al., 1997).

For being a program of national expression that, essentially, summarizes the larger attempts made for the development of the Brazilian agricultural insurance, this work is concentrated on PROAGRO, whose historical and evolution, extracted essentially of BANCO CENTRAL DO BRASIL (1999), is now synthesized.

Nevertheless the changes by which it has been passing recently, the PROAGRO presents a historical of deficient program, since its revenues, obtained from the additional collected, have been insufficient to cover the expenses associated to the indemnity of the producers whose plantations were affected by natural disasters. As Azevedo Filho et al. (1996) pointed out, the deficient position of PROAGRO is not a problem associated specifically with the execution of public programs of agricultural insurance in Brazil. In fact, such programs have caused high cost to the society in another countries, with estimations indicating that, in countries as Canada and United States, the farmers receive, on the average, twice more resources, through indemnities, that the value collected by means of the premiums paid to the insurance companies. As reason for the common problems to the public administration of those programs, as well as for the lack of interest of the private insurance companies in those operations, it is mentioned the difficulty, on the part of the insurance company, of distinguishing among the producers whose losses are, in fact, the result of natural disasters, of those for which the negligence to the suitable cultivation techniques is the main source of losses of the production. Moreover, a second cause is the lack of knowledge about the relative risk associated to a particular producer, being fact that those that seek the insurance have a higher relative risk than have the population of producers in general. From these two factors, results a classic case of asymmetry of information among the insurance company and the insured producer, which creates a sharply unfavorable situation to the first.

PROAGRO was instituted by the Law no. 5969, of 11.12.73, and was implemented in 01.01.75, with the attribution of discharging the rural producer of the payment of financial obligations associated to the

operations of rural credit, in the situations in that this payment can be made difficult by the occurrence of losses of the expected revenues, by virtue of natural phenomenons, plagues and diseases, affecting goods, flocks and plantations. With the Lei Agrícola (Law no. 8.171, of 17.01.91), PROAGRO had its initial rules modified, being denominated, after that, PROAGRO NOVO. Among the changes implemented, is the possibility of fitting also the not financed activities and the restriction of the fitting just to the costing operations, that is, with the exclusion of the investment operations. Moreover, it is determined that the resources for the Program should be, starting from then, obtained from the premium paid and from the financial results of the applications of the existent resources, with the participation of the National Treasure being limited to those cases in which its resources are not enough to pay the damages caused by the occurrence of widespread climatic disasters. To give consistency to those objectives, the premiums were raised, and the norms of the Program were simplified, as an attempt to reduce costs (BANCO CENTRAL DO BRASIL, 1999).

Nevertheless the alterations made in the Program, seeking to turn it self-sufficient, this objective was not reached, due, mainly, to the difficulties found in its financial administration, due to the absence of a system of information that allowed monitoring the behavior of the revenues and to control the assumed risks. The Resolution no. 2.103, approved by CMN in 31.08.94, constitutes another measure seeking to reach an equilibrium in the budget of the Program, instituting more efficient control mechanisms, being, among the made modifications, the insurance after the emergency of the plant, the need of analytic budget and of its integral fitting, the requirement of higher technical responsibility in the insured activities and the automation in the collection of revenues and in the registrations of the communication of losses, allowing better accompaniment and safety in the procedures.

On the other hand, it is necessary to mention that the efforts accomplished to promote an agricultural zoning have been producing some

positive results, reducing the climatic risks of cotton, rice, bean, apple, corn, soy and wheat (MINISTÉRIO DA AGRICULTURA E DO ABASTECIMENTO, 2000). The PROAGRO execution grants significant reduction in the premiums of the cultures inserted in the agricultural zoning. These reductions happen on the system of direct plantation as well as on the traditional system, being, however, more intense in the first system, and suffering a larger decrease in the irrigated cultivation. In the last, just the losses caused by hail, waterspout and windstorm are covered, what happens also for irrigated tillage, in which, however, are added the cases of drought and disease caused by fungus or plague without diffused method of combat, control or prophylaxis as disasters that can be covered by the Program. For wheat, is added to the mentioned events the losses caused by frost and rains in the crop (Ministério da Agricultura e do Abastecimento, 2000).

Furthermore, it is necessary to stand out that, in the present execution of PROAGRO, preferential and reduced aliquot is granted for the operations linked to the Programa Nacional de Fortalecimento da Agricultura Familiar - PRONAF and to the Fundos Constitucionais/ Programa da Terra. The special treatment granted to the family agriculture indicates the recognition of the special conditions of this segment, and it can be conceived as a progress in the sense of promoting its development, as pointed out by Buainain (1997).

Summarizing, it can be affirmed that, in spite of the alterations implemented in the execution of PROAGRO until the moment, its revenue has not been enough to cover the expenses with the granted coverages. Moreover, this Program is losing credibility, in the recent years, since the indemnities complained by the producers, with reason or not, have not been paid by the government (Buainain, 1997). In spite of its limitations, PROAGRO played an important role in the eighties, because, together with the Politics of Warranty of Minimum Prices, it avoided that the intense flotation in the production levels and agricultural income generated successive accumulations of debts.

The proposal of this work comes from the recognition of that problematic, that is, if PROAGRO is recognized as an instrument of importance for the development of the Brazilian agriculture, it is undeniable that this Program exhibits difficulties of execution not overcome until the moment. Thus, this work has the objective to provide information concerning the risks associated to the cultures of larger weight in the determination of the results of PROAGRO, since such information can contribute to the better understanding of the difficulties that have been affecting this instrument, as well as to make that the collected premiums be more consistent with the true risk condition that each culture has. In consistency with this objective, this work looks for, specifically, to calculate the premiums for the productivity insurance of those cultures.

2 Methodology

According to the theory of the demand of insurance, described by Varian (1992), the consumer's choice about what percentage of the losses he wants to cover is a problem of maximization of the expected utility, that is, of the expectancy of the utility of his income, which depends on the income levels associated to the presence or absence of the loss against which protection is looked for, as well as of the respective probabilities of incidence of the event that causes that loss.

Considering the situation of the agricultural insurance, supposing that the farmer is subject to a loss L of its initial income W, due to the occurrence of a disaster that happens with a probability p, and that he decides to buy an insurance that warrants him a coverage of value K, not necessarily equal to the value of the loss L. If the rate of the additional is γ, the amount spent in the purchase of an insurance that guarantees the coverage of K corresponds to γK. Thus, the income obtained by the farmer, in the occurrence of the catastrophe, would be the resultant of the initial income (W), added to the coverage granted by the insurance company (K), and subtracted from the loss (L) and of the cost of the

insurance (γK). In the absence of the disaster, the income obtained by the farmer would be equal to the initial income (W) minus the cost of acquisition of the insurance (γK). Therefore, the consumer's choice is a problem of maximization of the expected utility of the two events, whose solution will be achieved with the choice of the optimum level of coverage (K*), that is:

$$Max \quad pU(W + K - L - \gamma K) + (1 - p)U(W - \gamma K) \tag{1}$$

Solving this problem, it is achieved that K * needs to satisfy the expression:

$$\frac{U'[W - L + (1-\gamma)K^*]}{U'(W - \gamma K^*)} = \frac{(1-p)}{p} \cdot \frac{\gamma}{(1-\gamma)} \tag{2}$$

For the insurance company, whose analysis constitutes the main objective of this work, its expected profit is obtained by the sum of the profit associated to the occurrence of the catastrophe, equivalent to the difference among the additional collected (γK) and the coverage K, with the profit obtained in the absence of the catastrophe, which, in this case, is identical to the additional collected, γK. So, the expected profit of the insurance company can be described in the following way:

$$\Pi = (1 - p)\gamma K + p(\gamma K - K) \tag{3}$$

Being admitted that, by effect of the competition in the market of insurance, the profit of the insurance company is zero, it is obtained, from the expression (3), the relationship:

$$\gamma = p, \tag{4}$$

showing that, in a situation of free market, the rate of additional or premium

(γ) to be collected by the insurance company is equal to the probability (p) of occurrence of the event that causes the losses. Besides, substituting the condition (4) in the expression (2), and admitting that the utility function is strictly concave, it is deduced that the consumer should acquire an insurance that guarantees him the coverage of 100% of the loss, that is, K = L, in the hypothesis that the insurance company operates with zero profit.

Martins (1987), assuming the presupposition that the insurance company operates with zero profit, that its operational costs are worthless, and that the productivity follows normal distribution, calculates the insurance premium to cover the risk of productivity of the cultures, using the methodology described in the following, that was used in this work. The difference, in this case, consists of considering the medium indemnity by hectare insured as a proxy for the premium, instead of multiplying it by the index of losses, as done by the mentioned author, what would culminate in the reduction of the premium to the half, due to the presupposition of normal distribution of the productivity.

In relationship to the presupposition of normal distribution for the productivity, Martins (1987), that used this methodology for the State of São Paulo, argues that, if on one side the dispersion of the insured area of each culture in this State guarantees independence among the disasters, on the other the heterogeneity of the adopted technologies makes the distribution of the variable productivity be continuous, facts that, added to the great number of planted hectares of each culture, contribute to support the admitted presupposition.

Although used as justifications for acceptance of the hypothesis of normal distribution for the productivity, it is known that the condition of stochastic independence of the agricultural risks is not satisfied, since the losses suffered by the farmers are highly correlated to each other, emerging from that the condition of systemic risks. That is because, differently of what is verified in the insurance of another risks, the losses of crops are frequently caused by natural phenomenons that affect great number of

farmers, acting on a wide area[2]. Although the notion of probabilistically independent disasters can be sustained in other branches of insurance, where, for example in the life insurance, the death of a insured doesn't alter the probability of death of another one, in the agricultural activity that proposition cannot be maintained. Thus, events like diseases, drought, excessive rain, hail, frost, etc., don't happen with probabilistic independence, what one can understand considering the fact that the occurrence of a plague or disease in the farm of an insured become more probable if that same plague or disease already infests the neighboring area (Rossetti, 1999).

Thus, nevertheless the acceptance of the presupposition of productivity's normal distribution for States and cultures that will be analyzed here, it is recognized that it is based in the unreal hypothesis of independence of the disasters, what alerts for the need of reducing the pretension concerning the values of the premiums calculated with that methodology.

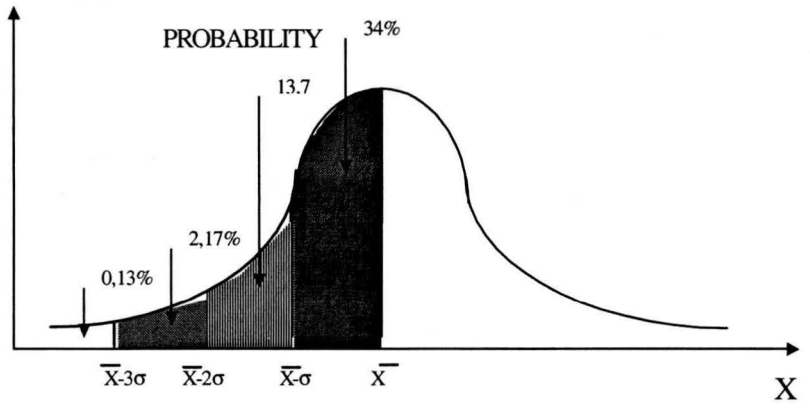
Assuming that the distribution of frequency of the productivity (X) is normal, with mean X and standard deviation s, and using the knowledge of the indemnity corresponding to each productivity obtained, it is easy to obtain the medium indemnity (K). So, assuming that an insurance upon the medium productivity is made, and that this warrants the total coverage of the loss, it means that:

- $K(X) = -(X-X)$, for values of X smaller than X, and
- $K(X) = 0$, for values of X greater than X.

that is to say, the coverage will be equal to the difference among the insured medium productivity and the observed productivity only in the cases in that the last one is smaller than the first since, otherwise, indemnity would not be necessary.

[2] To have an idea of the importance of this phenomenon, it is important to mention the work of Miranda and Glauber (1997), whose estimations allow to conclude that because of the presence of systemic risks, the portfolios of insurance in the United States are twenty to fifty times more risky than they would be in case the losses were independents between farmers.

The medium indemnity is calculated by summing the partial medium indemnities, associated to specific intervals of values assumed by the productivity (X), whose accumulated frequency of occurrence can be known due to the presupposition of normal distribution of X. The following illustration shows the intervals of the productivity, as well as the respective frequencies that characterizes each interval.



This situation can be summarized in the following way:

Interval	Probability	corresponding medium indemnity [1]
I) $0 < X < (\bar{X} - 3\sigma)$	0,13%	$(\bar{X}+3\sigma)/2$
II) $(\bar{X} - 3\sigma) < X < (\bar{X} - 2\sigma)$	2,17%	$5\sigma/2$
III) $(\bar{X} - 2\sigma) < X < (\bar{X} - \sigma)$	13,70%	$3\sigma/2$
IV) $(\bar{X} - \sigma) < X < \bar{X}$	34,00%	$\sigma/2$

Therefore, the medium indemnity by insured hectare will be given for:

$$\overline{K} = 0{,}0013\frac{(\overline{X}+3\sigma)}{2} + 0{,}0217\frac{(5\sigma)}{2} + 0{,}137\frac{(3\sigma)}{2} + 0{,}34\frac{(\sigma)}{2}$$

or

$$\overline{K} = 0{,}0006\,\overline{X} + 0{,}4317\sigma \tag{5}$$

which corresponds to the medium indemnity by insured hectare associated to the whole interval $(0,\overline{X})$ of variation of the productivity and that here will be used as proxy for the value of the collected premiums. To obtain the results in terms of percentage of the insured value, $\overline{X}$, we have:

$$\overline{K} = \frac{0{,}0006\,\overline{X} + 0{,}4317\sigma}{\overline{X}} \Rightarrow$$

$$\overline{K} = 0{,}0006 + 0{,}4317\frac{\sigma}{\overline{X}} = 0{,}0006 + 0{,}4317CV_{(X)} \tag{6}$$

where CV(x) is the coefficient of variation of the productivity.

The estimation of the coefficient of variation of the productivity, for each product and state, was obtained using the standard deviation and the average of the series of productivity of the respective product and

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[3] The indemnity of productivity loss K(X) is given by

$$K(X) = -(X - \overline{X}), \quad para \quad 0 < X < \overline{X}$$

Therefore, as an example interval I its indemnity is equal, at the extremity, of values:

$$K(X = 0) = -(0 - \overline{X}) = \overline{X}$$

$$K(X = \overline{X} - 3\sigma) = -(\overline{X} - 3\sigma - \overline{X}) = 3\sigma$$

Finally, the arithmetic average of the extreme values gives the medium indemnity of the first interval:

$$\overline{K}_I = (\overline{X} + 3\sigma) / 2$$

Using this same proceeding, the indemnities for the others intervals are obtained.

state. As a problem, this procedure results in an overestimation of the standard deviation, due to the elevation of the productivity happened along the time, what tends to magnify the value of the premiums to the products that experienced a great increase in their productivity in the analyzed period, and in the states in which that increase was more expressive.

On the other hand, contributing for a decrease in the value of the premiums, the productivity is expressed in relation to the harvested area, instead of the planted area, what doesn't allow to capture the real variation of the productivity due to losses, that it would be revealed by the comparison of the area planted with the obtained production. However, that is a limitation of the used data, since the information concerning the planted area are not available, for the whole period, in the source of the data used.

3 Data

The data used in this work, refers to the behavior of the productivity of the analyzed cultures, and in the most important states, were obtained from the Anuários Estatísticos do Brazil, embracing the period from 1973 to 1994. The selected products represent, at level of Brazil, 86,6% of the number of contracts of rural credit, 94,5% of the amount of coverages paid, and 93,8% of the total of adhesions to PROAGRO, in the period from 14.08.91 to 31.12.96. The analyzed states answer, in the mentioned period, for more than 90% of the total of adhesions, of the credit contracts, of the number of coverages paid and of the collected value of the additional. The admitted products are cotton, rice, potato, bean, corn and wheat, that are deficient, besides coffee, onion, tobacco, orange, cassava, soy and grape, in the list of products that contribute positively to the financial results of the Program. The Admitted states were Minas Gerais, Maranhão, Mato Grosso do Sul, São Paulo, Goiás, Bahia, Paraná, Roraima, Alagoas, Pará, Santa Catarina and Rio Grande do Sul.

4 Results

The premiums for insurance of the productivity, calculated for the States of larger importance in the determination of the financial results of PROAGRO, are presented in Table 1.

The calculated values indicate that the several cultures exhibit a highly distinct behavior among States, with relationship to the risk of fluctuation in the productivity, showed in the demanded premium. This was expected, due to the environmental or technological different conditions that characterize the cultivation of those products in each State.

By virtue of that situation, that is, of the absence of a more uniform pattern of the values of premiums for each culture, it becomes difficult to do some inference concerning the differences among cultures, that is, if there are, independently of the variations among Units of the Federation, cultures that are characteristically riskier than others.

To solve this problem, it was opted, for each culture, a pondered average of the premiums obtained for each state, in which the weights used were the relative participations of states in the total produced by the group of the analyzed states. In this case, it is necessary to say that the found solution is just an artifice, whose purpose is to permit the obtainment of some inference about the general behavior of the cultures in relation to the necessary premiums to cover their productivity losses, what does not mean that, in this work, the differences among areas are not recognized. Besides, it is recognized that the calculation of a medium premium for the several areas would be a very high generalization, because, even inside of a single State, the calculated premiums fail in the description of the different risk degrees that are present in it.

Table 1 - Values of the premium for the insurance of productivity, expressed in percentage of the medium productivity insured, 1973-94

Culture	States												
	RR	PA	MA	AL	BA	MG	SP	PR	SC	RS	MS	MT	GO
Cotton	-	6,89	21,54	16,83	14,74	12,24	6,91	6,52	-	-	6,32	7,08	10,66
Rice	16,39	4,11	12,41	12,55	12,89	9,21	10,77	9,61	11,79	6,00	14,26	5,74	8,45
Potato	-	-	-	0,00	17,98	11,59	7,65	7,36	6,07	7,39	-	-	25,27
Coffee	-	20,60	12,67	11,28	11,41	15,59	13,29	20,75	12,43	-	7,09	9,76	7,31
Onion	-	-	-	-	15,69	13,05	11,74	13,74	6,99	6,61	11,85	-	-
Bean	9,04	5,54	7,80	15,05	14,58	6,67	10,71	8,97	8,88	10,24	8,20	13,05	17,12
Tobacco	-	3,88	6,81	6,52	8,10	7,68	31,03	5,73	4,44	6,41	-	22,83	15,43
Orange	24,86	13,17	4,53	10,16	3,80	4,68	6,89	2,72	10,28	4,02	7,20	4,16	5,83
Manioc	7,57	4,18	3,68	4,40	5,50	5,49	3,74	3,14	4,33	9,31	3,90	6,04	1,74
Corn	10,01	7,30	11,86	9,25	21,24	8,82	5,61	8,45	8,63	12,09	9,93	10,13	11,99
Soy	-	-	13,87	-	17,71	8,75	5,40	6,06	9,54	9,81	7,52	9,03	9,96
Wheat	-	-	-	-	-	16,96	15,10	13,25	14,12	16,23	10,42	23,83	18,65
Grape	-	-	-	-	38,01	20,68	5,88	10,29	6,45	8,27	-	-	-

The results obtained by this process are presented in Table 2, that still exhibits the classification of the cultures according to the value of the calculated premium. Through the values exhibited in Table 2, it can be concluded that coffee and wheat are the cultures whose premiums are, in a general way, the highest, being the lowest premiums associated to tobacco, orange and cassava. In an intermediate position, with medium premiums of the order from 8 to 10%, are bean, grape, onion, corn, soy, potato, cotton and rice.

Table 2 – Medium premium for the insurance of productivity, expressed in percentage of the medium productivity insured

Culture	Medium premium	Classification
Cotton	8.34	9
Rice	7.99	10
Potato	8.58	8
Coffee	15.22	1
Onion	9.75	5
Bean	10.22	3
Tabacco	5.72	12
Orange	6.69	11
Manioc	4.69	13
Corn	9.62	6
Soy	8.65	7
Wheat	14.44	2
Grape	10.14	4

For coffee, the high premium obtained is due, probably, to the effect of many adverse factors that occurred in specific moments, mainly the frosts, resulting in high instability of the production in the analyzed period (1973-94). During that period, the production of coffee was subject to the occurrence of a strong frost in 1975, reaching 100% of the coffee plants in Paraná, 66% in São Paulo, 10% in Minas Gerais and 80% in Mato Grosso do Sul. This phenomenon occurred again in 1981, affecting

São Paulo, Paraná and Minas Gerais, and damaging about 50% of the following crop. The crops of 1986 and 1987 already suffered the negative effects of the presence, in 1985, of a great drought in all the areas of coffee production, as well as the negative impact of the attack of plagues and diseases (ANDRADE, 1995). This author still tells the occurrence of a strong frost in 1994, that, however, doesn't seem to have influenced substantially the results of the analysis, since its more disastrous effects were verified after 1995.

Finally, it is necessary to say that the premiums obtained in this work cannot serve, in an immediate way, as parameters for the determination of the rates of the additional collected by PROAGRO. So, while the calculated values correspond to the premium requested to insure the producer against production losses, the premiums for PROAGRO seek to obtain revenue enough to cover the resources (financed or own) that this producer expended in the costing operations, when the occurrence of natural disasters culminates in partial or total loss of its production.

5 Conclusion

The premiums calculated for insurance of the productivity shows, at first, that the analyzed cultures present a distinct behavior, in terms of their risk, among States. That is, a same culture can exhibit an elevated premium at certain place, being characterized as having high risk, at the same time that, in another area, the premium demanded for insurance of productivity of that same culture can be very small.

Such behavior, that is consistent with the environmental or technological differences inherent to each area, shows the importance of the efforts that have been made to extend the area covered by the agricultural zoning. Moreover, as pointed out by Buainain (1997), since the agricultural zoning not only identifies the suitable zones to produce certain culture, but also indicates the technical procedures requested for a rational production, to increase the productivity, to reduce the risks and

to protect the environment, it is believed that, at the end, the linkage between PROAGRO and agricultural zoning will result in other positive effects, besides the possible reduction in the costs of the Program.

Starting from the premiums calculated for States of larger expression in the determination of the results of PROAGRO, a medium premium associated to each culture was calculated. With those medium premiums, it was verified that coffee and wheat exhibit, in general, the riskiest behavior, requesting therefore the largest premiums, while tobacco, orange and manioc presented the lowest premiums. For the other cultures, it can just be affirmed that they occupy an intermediate position, with medium premiums varying from 8 to 10%, what doesn't allow a very clear distinction among them.

The obtained classification doesn't allow to establish a clear relationship between the values of the requested premiums and the situation of the cultures in PROAGRO, that is, its participation as causing a positive or a negative balance in this program. However, it is possible to verify that wheat, a product that answers for the largest portion of the deficit of the Program, demands an elevated premium for insurance of its productivity, being characterized as a culture of high risk. On the other hand, orange, tobacco and cassava, products characterized as having the lowest risk of productivity loss, have been contributing positively in the execution of PROAGRO. However, coffee, a product that contributes positively for the results of PROAGRO, requested a high premium for productivity insurance, what is due, probably, to the occurrence of disasters in some years of the series, mainly frosts, that affected in a severe way the production in States of larger expression in their production. Besides, it is necessary to consider that the methodology used admits as losses subject to the coverage every occurrence that results in a smaller productivity than the medium productivity of the product. For that reason, the premiums are elevated for those cultures whose production suffers constant oscillations, as occurs with coffee, although this oscillations are not considered, in terms of the insurance program, as losses caused by

natural disasters. Such fact helps to explain the discrepancy among the position occupied by the coffee in PROAGRO, since that its contribution for the results of this Program is positive, and the value of their calculated premium, one of the highest.

To conclude, it is necessary to point out that the results of this work are just indicative, that is, they only inform which cultures, between those analyzed, presented, along the period considered, larger relative risks of productivity loss than others, and therefore should be charged with a higher premium when inserted in an insurance program. That is because the position that these cultures occupy in PROAGRO cannot simply be inferred by the risk degree that they present, what is possible only with the comparison between the requested premium and the rate of the additional really collected, needing this last one to be consistent with the risk level offered by the culture, to guarantee that the collected value is enough to sustain the expenses with the coverages made by the Program. Such a relationship, however, cannot be obtained since the calculated premiums are not immediately comparable, in the form they are, with the collected aliquots of the additional.

Better results can be obtained through the calculation of the premium on the operational cost of each culture that theoretically would correspond to the Valor Básico de Custeio (VBC). For that, it would be necessary to calculate the insurance premium of the gross income of each culture, with its posterior conversion to the rate on the operational cost, with the use of the information about the operational markup of that culture. Even with a work of this nature, the results obtained by this process would not be comparable to the real premium for PROAGRO, because, in this case, besides the risk of reduction in the productivity, the variations in the gross income would also include the price risk, whose protection is not attributed to an insurance program, but to politics of warranty of prices.

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