DISTRIBUTION OF BENEFITS OF AGRICULTURAL PRICE STABILITY AMONG CONSUMERS[1]

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Abstract: Several studies have suggested that price stabilization distributes benefits among groups in society. This paper analyzes the distribution of benefits resulting from the stabilization of agricultural prices among consumers of the São Paulo metropolitan region resulting from the 1994 Real Plan. A measure of instability was made of the price series for 19 important agriculture products in food., between 1989 and 1998, to test the effectiveness of the Real Plan in stabilizing prices. To calculate the distribution of benefits of stabilization among consumers stratified according to income level, an estimate was first made of the coefficient of distribution of spending on food. Next, the coefficients of distribution were estimated for a set of nineteen agricultural products important in family diets. The data for family budgets were taken from the IBGE Family Budget Study for 1996, and the price series for agriculture products are from the Institute of Agricultural Economics (Instituto de Economia Agrícola). The results indicate that, in the aggregate, food price stabilization had greater benefits for lower income consumers. However, an individual examination of products suggests that the consumers of higher income strata benefit proportionally more from stabilization of prices of products with a high income-elasticity of demand.

Key words: agricultural price stabilization; distribution of benefits; income distribution.

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Introduction

Agricultural production has some characteristics that distinguish it from industrial production. In general, a long period separates planting decisions from harvest, and thus there is no knowledge of future prices, and production is widely dispersed and highly dependent on climatic conditions. Also, agricultural products are perishable and cannot be stored for long periods. Thus, the process of formation of agricultural prices is strongly linked to supply, which can be considered highly inelastic, at least in the short term.

The high instability of agricultural prices resulting from these factors would generate risks and uncertainties in the activity, blocking a more suitable allocation of resources. If the prices of a product are high at the time of planting, farmers tend to increase the area planted. At harvest time, the increase in supply drives prices down, which attests to an excessive investment of resources. Thus one can conclude that the market does not operate efficiently in terms of providing the information necessary to guide farmers. This proposition would justify intervention in agricultural markets to stabilize prices, benefiting both the sector and the rest of society.

This discussion was the motivation for the current paper, whose objective is to test the hypothesis that consumers benefited from reduction of agricultural price variability resulting from the economic stabilization in Brazil from July 1994 onwards with the Real Plan. This hypothesis will be tested in two stages:

a. a study of variance of prices for agricultural goods paid by consumers before and after the Real Plan;
b. estimation of the distributive effects of stabilization of agricultural prices between consumers.

The text is organized such that after this introduction there is a brief discussion of relations between agriculture and inflation. Next the methodology and description of data used are presented. The results and conclusions make up the last two sections.

1. Agriculture and inflation

In the literature there is a reasonable recognition of the advantages of the stabilization of agriculture prices in the allocation of resources. Even those that identify distortion in the implementation of policies with this objective, such as Lipsey & Steiner (1966), recognize the importance of the role of the state. From the distributive point of view, there is a great controversy in terms of the advantages and disadvantages of government intervention to stabilize agricultural prices.

Starting off a long tradition of analysis that considers linear suplly and demand functions and random additive disturbances, Waugh (1944). (parallel shifts), Waugh (1994) showed that the consumer benefits in a regime of floating prices, if the alternative is stabilization through arithmetic averages. Waugh's work assumed stochastic variations in supply, with stable demand. Later, Oi (1961) argued that instability is a virtue, and that with variations originating in demand, the producers operating in perfect competition also gain with the market functioning freely.

Massel (1969) integrated the two analyses in a single structure – that is, he considered fluctuations in supply and demand. His principal conclusion is that, if the marginal utility of the currency is constant in terms of the variations in price of the agricultural product analyzed, and demand is declining, the beneficiaries of the stabilization are defined by the source of the instability. If caused by changes in demand, consumers gain with stabilization, but if price variability is caused by random changes in supply, the producers increase their surplus with public intervention in the market.

Samuelson (1972) entered the debate criticizing Waugh (1944) and Oi (1961), and showing that their results cannot be examined at the same time. To defend stabilization of agricultural prices, he generalized Massel's (1969) model by introducing simultaneous variations in supply and demand.

More recent work, such as Turnovsky (1976), allow non-linear supply and demand functions and multiplicative stochastic disturbances, concluding that the distribution of benefits between consum-

ers and producers does not depend on the source of the instability, but on the elasticity of the supply and demand curves. If the demand is elastic and the supply inelastic, producers benefit from stability, and lose under inverse conditions. Just, Hueth & Schimitz (1982) address this problem in a closed economy in which demand is not linear and supply is linear, but varies randomly. In this case, depending on the degree of non-linearity of demand, the effect of stabilization could be negative for producers. Note that this result contradicts that obtained by Massel (1969).

The models for evaluating the distributive effects of price stabilization discussed above dealt with stable economies, in which there were visible differences between the behavior of agricultural prices and prices in other sectors, especially industrial. It could thus be said that in this case that the variability of agricultural prices is a localized problem.

What occurs with agricultural prices in chronically inflationary economies, as was the case with some Latin American economies until the end of the 1980s, and Brazil's in particular, until mid-1994, when the Real Plan was implemented?

From a theoretical point of view, it is models with a structuralist inspiration that relate inflation to agricultural prices. In the classical structuralist explanation, inflation results from unequal development of economic sectors – agriculture and urban activities. During the process of industrialization, the insufficient growth of agricultural production, which does not keep up with industrial production, puts pressure on the prices of raw materials, and especially of food, reducing the real salaries of urban workers. When they obtain nominal increases in salaries to compensate, even if partially, the losses suffered, the costs to the economy rise, with a resulting increase in the general price level. In this type of model the agricultural sector is considered competitive, while the industrial sector is oligopolized, operating with gains in productivity. The change in relative prices in a market structure in which there are rigid nominal prices would only produce significant and permanent increases in the general price level in the presence of a monetary system that does not permit the control

of means of payment and meet the demand for currency. In other words, in structuralist models, currency supply is endogenous.[4]

In chronically inflationary environments, whether price increases are caused by agriculture, as the structuralists would have it, or by the lack of monetary discipline of the government, as the monetarists generally argue, industrial and agricultural prices follow different dynamics. Sayad (1979) presents a model of inflation for Brazil, based on structuralist hypotheses, and observes that initially agricultural prices have a greater variability than industrial prices. The most important conclusion of the model, which analyzes data from 1948 to 1976, is that the terms of trade of agricultural prices/industrial prices have a cyclical behavior linked to variations in nominal income: when it grows, the terms of trade are favorable to agricultural, and vice versa. These results, according to the author, can be interpreted in two ways. The first says that when nominal income rises, agricultural prices respond more quickly than industrial prices, exactly because of the competitiveness of the sector, compared to the oligopolistic regime of industry. According to the second interpretation, agricultural price increases are exogenous, resulting from supply shocks, such as poor harvests, and the government expands the currency supply, sanctioning this increase. At any rate, there is a clear relation between agricultural prices and nominal income.

In another article, Sayad (1981) studies how the agricultural products commerce can affect general price indexes through increasing their margins and increasing or reducing the variability of consumer prices. An important conclusion of the study is that the increase in agricultural price variability, even without a clear direction, can increase inflation. In terms of the role of margins, the author points to the stabilization of consumer prices at the retail level, even at the cost of farm income. In general, intermediaries appear to have considerable power, since they can affect inflation by influencing the variance of retail agricultural prices, and even raise the margins for agribusiness.

[4] An interesting formalization of Latin American inflation from a structuralist perspective can be found in Oliveira (1964).

These studies suggest that there is a close relation between Brazilian inflation and agricultural prices, and that their variability is greater than that of prices of other economic sectors. It could be assumed, therefore, that a successful stabilization plan would have substantial impacts on the behavior of agricultural prices, especially in terms of reducing its instability.[5] This hypothesis appears even more likely if one considers that Brazil has for a long time had no effective policy of supporting agricultural prices,[6] and that the reasonable stability of agricultural prices in the recent period appear to be a byproduct of a broader economic stabilization plan – the Plano Real.[7]

2. Methodology and data

One could say that current price fluctuations are influenced by two causes: a monetary cause, y_1, resulting from fluctuations in currency purchasing power, and a specific cause, y_2, resulting from product market dynamics. Thus, $x = y_1 x y_2 x$, or more specifically

$$(1) \qquad \frac{P_1^i}{P_o^i} = \frac{I_1}{I_o} = \frac{R_1^i}{R_o^i}$$

where: P_o^i and P_1^i are the nominal prices of product *i* at moments 0 and 1, respectively, I_o and I_1 are general price indexes at 0 and 1, respectively, and R_o^i are the real prices of *i* at 0 and 1. According to Houck (1973, 1974), and Negri Neto *et al* (1996), the variability of a product can be broken down into the variability of its factors, according to the formula

$$(2) \qquad \text{Var}(y_1\, y_2) = M_1^2\, \text{Var}\,(y_1) + M_2^2\, \text{Var}\,(y_2) + 2\, M_1 M_2 = \text{Cov}\,(y_1\, y_2)$$

where and are the averages of factors 1 and 2, respectively.

[5] Carvalho & Silva (1994) show that the Brazilian stabilization plans, even though having short term results, had significant impacts on agricultural prices.

[6] Carvalho (1994) concluded that the Brazilian Guaranteed Minimum Prices Policy contributed little to stabilize prices in the sector.

[7] At the beginning of the Real Plan agricultural prices dropped substantially, which analysts explained in terms of the expression "green anchor", suggesting that the economic stabilization was being achieved at the cost of agriculture.

2.2. — Distribution of benefits of stabilization

A review of the literature on distribution of benefits of stabilization indicates that there is no consensus on the results. Along with the problems of specification of the functions and nature of disturbances, the idea of consumer surplus is questionable.[8] However, as Just (1977) argues in relation to this last point, this is no justification for not doing anything. He recommends that the rigorous empirical studies be carried out, addressing the specific characteristics of each case, to enable a precise evaluation of the results of agricultural price stabilization policies. Wright & Williams (1988) agree, and argue that what is important "…is not the measurement method. First, it is the fundamental specification of the nature of stabilization and identification of the crucial parameters of the model"[9] that count.

The concepts of consumer and producer surpluses, developed originally by Marshall (1890) and HICKS (1938), are traditionally used to evaluate the distributive effects of agricultural price stabilization policies.[10]

2.3. Coefficient of distribution

The benefits of price stabilization are produced by new equilibrium points resulting from the shifts in supply and/or demand of a product. This is called the market price effect.[11] The essence of the argument is that there is always a permanent reduction in the price of a good, the consumer surplus increases, wherever the supply and demand function take a conventional form.

This study starts from the hypothesis that the substantial and permanent fall of inflation indexes reduces the variability of agricul-

[8] See Dahlby (1981), Helms (1985 a), Helms (1985b) and Hallet (1986), for example.
[9] Wright & Williams (1988:624).
[10] A summary of the evolution of the concept and its limitations can be found in Silva (1995).
[11] See Pinstrup-Andersen (1979).

tural prices, even in the absence of an explicit and effective policy of intervention in the sector. But as well, the benefits of this stability may not reach consumers equally[12].

The distribution of benefits of reduction of price variability between consumers will be estimated by the coefficient of distribution α, presented by Pinstrip-Anderson (1977).[13] To obtain this value, a Lorenz curve was constructed which associates the accumulated percentage of population on the horizontal axis, stratified according to the income level, with the accumulated percentage of the share of each income strata in the overall benefits of the reduction in price variability of each product on the vertical axis. The coefficient α, a measure of inequality,[14] is defined as the quotient of the area above the Lorenz curve in relation to the area below this curve. Algebrically:

$$\alpha = \frac{1 - \int_0^1 f(n)dn}{\int_0^1 f(n)dn} \qquad (3)$$

where *f(n) dn* is the Lorenz curve.

If the product that is being examined has an $\alpha > 1$, this means that a greater amount of the benefits of agricultural price stabilization went to consumers with higher incomes. If $\alpha = 1$, the benefits of stabilization are distributed equitably among all income classes. And finally, $\alpha < 1$ indicates that poorer consumers had the greatest gains.

The coefficient α cannot be calculated empirically by formula (3) because there is no mathematical function that relates the accumulated percentage of the population with the accumulated percentage of the benefits. In practice, as the number of strata are finite and composed of intervals, only pairs of points that associate these two variables are available. To get around this problem PINSTRUP-

[12] Prior studies indicate that the distribution of benefits is proportional to the amount of the good consumed or to its share in total expenses of the family, according to Pinstrup-Andersen (1977) and Silva (1995a), respectively.

[13] Silva (1995a; 1995b) adapted the coefficient of distribution to assess the distributive effects of technological innovations in Brazilian agriculture among consumers and producers.

[14] For a discussion of the measures of inequality, see Hoffmann (1991), especially chapter 16.

ANDERSEN (1977) suggest the following formula, which can be used to estimate the coefficient of distribution based on the pairs of values of discrete variables:

$$(\alpha) \quad \hat{\alpha} = 2 - \frac{\sum_{i=1}^{m} (n_i - n_{i-1})(b_i + b_{i-1})}{\sum_{i=1}^{m} (n_i - n_{i-1})(b_i + b_{i-1})} \qquad (4)$$

Where n_i = accumulated proportion of consumers belonging to strata 0, 1, 2, ..., *i*;

b_i = accumulated proportion of total benefits going to strata 0, 1, 2,..., *i;*
m = number of strata;
$n_0 = 0$ and $b_0 = 0$.

2.4. Data considerations

The prices paid by consumers for 19 agricultural products that make up family diets in the São Paulo Metropolitan Region were obtained at the Institute of Agricultural Economics, for the period between January of 1989 and December of 1999. The products included are rice, beans, wheat flour, manioc flour, potatoes, carrots, sugar, tomatoes, onions, lettuce, bananas, oranges, apples, beef, pork, chicken, eggs, milk and coffee.

The data used to estimate the coefficients of distribution of the most important agricultural products in the diet of consumers were taken from the Family Budget Study (POF) conducted by the Brazilian Geography and Statistics Institute (IBGE) between October 1995 and September 1996, in the São Paulo Metropolitan Region (RMSP). The POF analyzes the structure of expenses, income and receipts of family units, and serves as the basis for establishing the weights of the National Consumer Price Index.

3. Results

Initially, the historical series of prices paid by consumers in the RMSP for the 19 products was divided into two sub-periods: January 1989 to June 1994, and July 1994 to December 1999. On the latter date, the last phase of the Real Plan was implemented. For each of these periods, formula (2) was used to assess whether price stability reduced the variability of real prices of the products examined. The results (Table 1) clearly show that the variability of price fluctuations for all products due to the market were reduced substantially after the Real Plan, Period 2, compared to the prior period, Period 1. These results indicate that the inflationary process contaminated the structures of the markets for these agricultural products.

Next, the distributive effect of the benefits of greater stability of agricultural markets were estimated for classes of consumers, stratified according to income level, using formula 4, in two stages. The first stage considered spending on the 19 products in relation to total family spending, with the objective of assessing the overall impact of stabilization of prices of this set of products on the welfare of the families. The result, 0.421, indicates a highly redistributive effect in favor of poorer families (Table 2).

Next the coefficient of distribution of each of the 19 products was estimated. The reason for this is that the products are not consumed in the same proportion by families of different income strata. It is expected that products with a high income elasticity are consumed more at the lower income strata. The results are presented in Table 2, which organizes the products in increasing order according to the redistributive impact. Thus, price stability for manioc flour overwhelmingly benefited low income consumers, since the estimate for the coefficient of distribution, along with being less than one, is the lowest of all, at 0.430. At the other extreme is apples, with the highest coefficient of distribution, at 1.505, which indicates that high income consumers benefited the most with price stability.

Conclusions

A review of the literature and the empirical results presented here permit at least two interesting conclusions. The first is that inflation in itself, at least in the Brazilian case, created a great instability in specific markets for agricultural products. Thus result confirms the conclusions of other authors who point to the perverse effects of great variability of prices on resource allocation.

The second result has to do with the benefits of stability to consumers. In general, stability benefits all, independently of income level. However, these gains are not distributed equitably, and vary according on the product considered. The reduction in price variability for the majority of products selected for this study would be of proportionally greater benefit to higher income consumers, since they have higher consumption levels in these income strata. This result, however, should be analyzed with care, for the following reason. The estimate of coefficients of distribution come from information exclusively about family food consumption – as if this item of consumption had the same importance for all income levels. If total consumer spending were considered, the weight of spending on food would be inversely proportional to income, as occurs with each product individually. Coefficients of distribution estimated based on this criterion might point to a greater distributive effect of economic stabilization, which was captured, at least in part, by the result of the set of products.

This solution, it turn, would not be completely satisfactory, since it wouldn't emphasize the fact that the stabilization of product prices might possibly be of greater benefit to families in higher income strata.

Table 1 – Decomposition of variability of nominal price of selected agricultural products

Product	Period	Decomposition			Total
		Inflation	Market	Interaction	
Sugar	1 (1)	0.0401	0.0423	-0.0016	0.0808
	2 (2)	0.0001	0.0019	-0.0002	0.0018
Lettuce	1	0.0401	0.0876	0.0259	0.1536
	2	0.0001	0.0565	-0.0009	0.0557
Manioc flour	1	0.0401	0.0122	0.0105	0.0628
	2	0.0001	0.0008	-0.0003	0.0007
Carrots	1	0.0401	0.0793	0.0079	0.1274
	2	0.0001	0.0163	0.0000	0.0164
Onions	1	0.0401	0.2596	-0.0157	0.2840
	2	0.0001	0.0114	-0.0004	0.0112
Pork	1	0.0401	0.0589	-0.0018	0.0972
	2	0.0001	0.0028	-0.0002	0.0027
Beans	1	0.0401	0.1290	-0.0144	0.1547
	2	0.0001	0.0078	-0.0002	0.0077
Tomatoes	1	0.0401	0.1540	-0.0149	0.1792
	2	0.0001	0.0274	0.0010	0.0286
Eggs	1	0.0401	0.0943	-0.0001	0.1344
	2	0.0001	0.0025	-0.0004	0.0022
Apples	1	0.0401	0.0485	-0.0060	0.0826
	2	0.0001	0.0062	-0.0003	0.0060
Milk type C	1	0.0401	0.0354	0.0036	0.0792
	2	0.0001	0.0010	-0.0002	0.0009
Oranges	1	0.0401	0.0649	0.0047	0.1097
	2	0.0001	0.0080	0.0006	0.0087
Chicken	1	0.0401	0.0467	-0.0057	0.0812
	2	0.0001	0.0021	0.0000	0.0022
Wheat flour	1	0.0401	0.2636	-0.0036	0.3001
	2	0.0001	0.0017	-0.0003	0.0015
Beef	1	0.0401	0.0573	0.0021	0.0996
	2	0.0001	0.0016	0.0000	0.0018
Coffee	1	0.0401	0.0484	0.0086	0.0971
	2	0.0001	0.0019	-0.0001	0.0020
Potatoes	1	0.0401	0.1217	-0.0033	0.1585
	2	0.0001	0.0086	0.0001	0.0089
Bananas	1	0.0401	0.0502	-0.0052	0.0851
	2	0.0001	0.0132	0.0004	0.0137
Rice	1	0.0401	0.0782	0.0073	0.1256
	2	0.0001	0.0014	-0.0003	0.0013

(1) January 1989 to June 1994. (2) July 1994 to December 1999.

Source: estimated by author based on basic data from IEA

Table 2 – Estimates of coefficients of distribution in the Metropolitan Region of São Paulo, 1995-1996

Product	Coefficient	Product	Coefficient
All Products	0,421	Onions	1.180
Manioc flour	0.430	Oranges	1.184
Beans	0.716	Potatoes	1.201
Rice	0.755	Bananas	1.232
Sugar	0.766	Pork	1.350
Coffee	0.856	Tomatoes	1.401
Milk	0.895	Lettuce	1.419
Eggs	0.938	Beef	1.423
Wheat flour	1.025	Carrots	1.488
Chicken	1.122	Apples	1.507

Source: estimated by author based on basic data from IBGE and IEA

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