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THE IMPACT OF PLANNING ON AGRICULTURAL DEVELOPMENT:
THE CASE OF BRAZIL

Marvin S. Anderson *

Introduction

What is the impact of formal planning on agricultural development? Is there really any substantive evidence to suggest that the planning process *per se* can promote the development of a country's agriculture? Or are all of these elaborate "plans" a political sham? This skepticism prompted the author to review the case of Brazil.¹

In an attempt to coordinate a multi-year investment program, the federal government in Brazil has formulated a considerable number of "plans" during the post-World War II period. Each plan has characteristically focused on capital-intensive targets over which the planning nuclei has had some control without specifying what the desired level of factor "x" was supposed to achieve. Structural objective-instrument linkages in the agricultural sector, in particular, have rarely been specified with any degree of rigour. Agricultural "planning" has generally involved 1) calculating an annual "food balance" for each agricultural commodity to identify "bottlenecks", and 2) assigning the traditional policy instruments to said "bottlenecks". It is estimated that between four and eight percent of direct federal investment has been channeled into the agricultural sector during the post-1955 period. Only rarely, however, has any policy-oriented research accompanied the respective plans.

Macro-economic models of the Brazilian economy have not been widely used by Brazilian policy-makers, presumably because very few regional or sectoral objective-instrument linkages have been identified in the respective models. Excellent studies by Smith², Netto *et.al.*³, Pastore⁴, the Getulio Vargas Foundation⁵, Herrmann⁶, Patrick⁷ and others are only now gaining some

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1. Anderson, Marvin S. (1972) The Planning and Development of Brazilian Agriculture: Some Quantitative Extensions, EASP Dissertation Series No.42 (Ithaca, N.Y.: Cornell University)
2. Smith, Gordon W. (1969) "Brazilian Agricultural Policy, 1950-1967" in Ellis, Howard S. (ed.), The Economy of Brazil, (Berkeley, California, University of California Press) pp.213-265.
3. Netto, Antônio D., Affonso Celso Pastore, e Eduardo Pereira de Carvalho. (1966) Agricultura e Desenvolvimento no Brasil, Estudos ANPES No.5, Versão Preliminar (São Paulo: IPE - Instituto de Pesquisa Econômica)
4. Pastore, Affonso Celso. (1968) A Resposta da Produção Agrícola dos Preços no Brasil, Buletin 55 (São Paulo: Faculdade de Ciências Econômicas e Administrativas, Universidade de São Paulo.
5. The Getulio Vargas Foundation (1968) Projections of Supply and Demand for Agricultural Products of Brazil Through 1975 (Washington, D.C.:USDA)
6. Herrmann, Louis F. (1972) Changes in Agricultural Production in Brazil, 1947-65, FAER No.79 (Washington, D.C.:ERS/USDA, June)
7. Patrick, George F. (1972) Desenvolvimento Agrícola do Nordeste, Pesquisa No.11 (Rio de Janeiro: IPEA/INPES)

currency in policy-making circles.

In short, there is still a general lack of "hard" macro-information regarding the *effectiveness* of alternative public policy-instruments potentially available to secure a specified (welfare) objective. An acute need to quantify what effect alternative policy instruments have on the objectives of the agricultural sector persists.

Objectives of Study

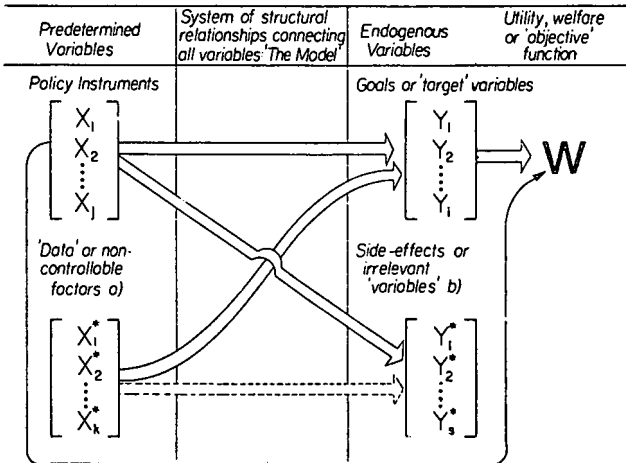
The primary objective of this study was to link quantitatively, where possible, the structural relationships which have historically prevailed between the agricultural objectives and the policy instruments initially identified in the study.

Essentially, we were simply asking; "Is it possible to identify quantitatively the direction and magnitude of structural linkages on a regional basis within the agricultural sector, given the secondary data which is currently available?"

Planners will immediately conceptualize these objectives in a Tinbergen framework, as illustrated in Figure 1.

FIGURE 1

The Theory of Economic Policy



a/ Not subject to control by the policy-maker or level of government that sets the goals and uses the policy-instruments in question.

b/ Variables which do not enter the welfare function, W .

Identification of Policy Objectives

An attempt was first made to identify the contemporary policy objectives of federal agricultural policy-makers in Brazil via three major sources: 1) current federal public planning documents, 2) miscellaneous federal public policy statements as reported in the national press or in quasi-official public documents, and 3) personal interviews with selected agricultural policy-makers currently identified with the planning infrastructure in Brazil.

These objectives were tentatively identified by the author as follows:

- I. Augment the rate of growth in agricultural production via:
 - (a) Increasing the rate of public and/or private investment in the agricultural sector,
 - (b) Increasing the rate of labor absorption into the agricultural sector, and/or,
 - (c) Increasing the rate of land colonization in the agricultural sector.
- II. Facilitate a more egalitarian income distribution (a) within agriculture and/or (b) between agriculture and other sectors of the economy.
- III. Promote economic stability within the agricultural sector.
- IV. Augment the rate of growth in agricultural exports to secure additional foreign exchange.

Are these really the contemporary objectives in Brazilian agriculture? Or, alternatively, is this a fairly inclusive list but one that includes a number of objectives which would obviously be "weighed" very differently by Brazilian planners in a medium-term (3-5 year) planning framework?

To provide a partial response to these questions, the author presented the above list of seven objectives (and some quantitative estimates to clarify the objectives so defined) to nineteen policy-makers and ask them to rank the objectives both ordinally and cardinally.¹ A summary of the results are provided in Table 1.

¹ The questionnaires were given to policy-makers with radically different degrees of professional competence in various federal ministries, *autarquias*, development agencies, and banking institutions. The interviews were conducted during the January - May period of 1971. No one introduced *additional* objectives into the discussion although each was given the opportunity to do so.

TABLE 1

*Subjective Preference Tabulations Based on a Non-Random Survey of
Nineteen Policy-Makers in Brazilian Agriculture, 1971*

Objective	Ordinal Ranking ^{a/}				Cardinal Ranking ^{b/}				
	Mean	Mode	Frequency	Rank ^{c/}	Mean	Standard Deviation	Coefficient of Variation	Rank ^{c/}	
I. (a)	1.84	1	12	1	26.53	11.68	44.03	1	
	(b)	4.11	5	5	4	13.68	10.59	77.41	3
	(c)	4.57	5	6	5	11.13	7.11	63.88	6
II. (a)	4.00	3	5	3	13.26	8.03	60.53	4	
	(b)	3.74	3	5	2	15.00	9.86	65.70	2
III.	4.84	7	7	6	11.53	14.10	122.29	5	
IV.	4.89	6	6	7	8.87	6.28	70.76	7	

^{a/} Each respondent ranked the seven pre-selected objectives from 1 to 7 with ties prohibited.

^{b/} Each respondent allocated an imaginary federal investment total of NCr\$ 100 billion/annum to (any) imaginary instruments to pursue the designated objectives.

^{c/} Based on the corresponding mean values.

The evidence presented in Table 1 strongly suggested that the desire to augment agricultural output via a capital-deepening process was the overwhelmingly important objective in Brazilian agriculture. Decidedly less unanimity prevailed with respect to all of the other objectives.¹

Identification of the Policy Instruments

Can we then perform a qualitative evaluation to determine which "candidates" have, in fact, traditionally qualified as truly national agricultural policy-instruments in the sense that statistically reliable objective-instrument linkages might be anticipated? To answer this question, an extensive analyses of all of the monetary and fiscal policy instruments was conducted. Particular attention was focused on the regional rural per-capita expenditure level characteristic of each policy instrument, a crude measure of the relative size of the programs in question. Nevertheless, the size and nature of many "candidates" made the measurement of their results, in the aggregate, impossible.

¹ Interpreting the coefficient of variation as a measure of a particular objective's political viability, one might further suggest that there would also be a considerably higher probability of implementing a program focused on Objective I. (a).

This "screening process" suggested that the policy instruments which were important included 1) agricultural credit, 2) direct regional agricultural investment, 3) direct subsidies for (agricultural) capital goods, and 4) direct investment to stimulate the production of particular crops. Simply focusing on the need to stimulate agricultural production irrespective of its origin introduced a number of other possible policy instruments, namely those affecting the area under cultivation (or the stock of animals). These policy instruments included 1) the agricultural credit program, 2) the minimum price program, 3) the crop diversification program(s) and production quotas, and 4) land colonization and land reform programs. These relationships are illustrated in Figure 2.

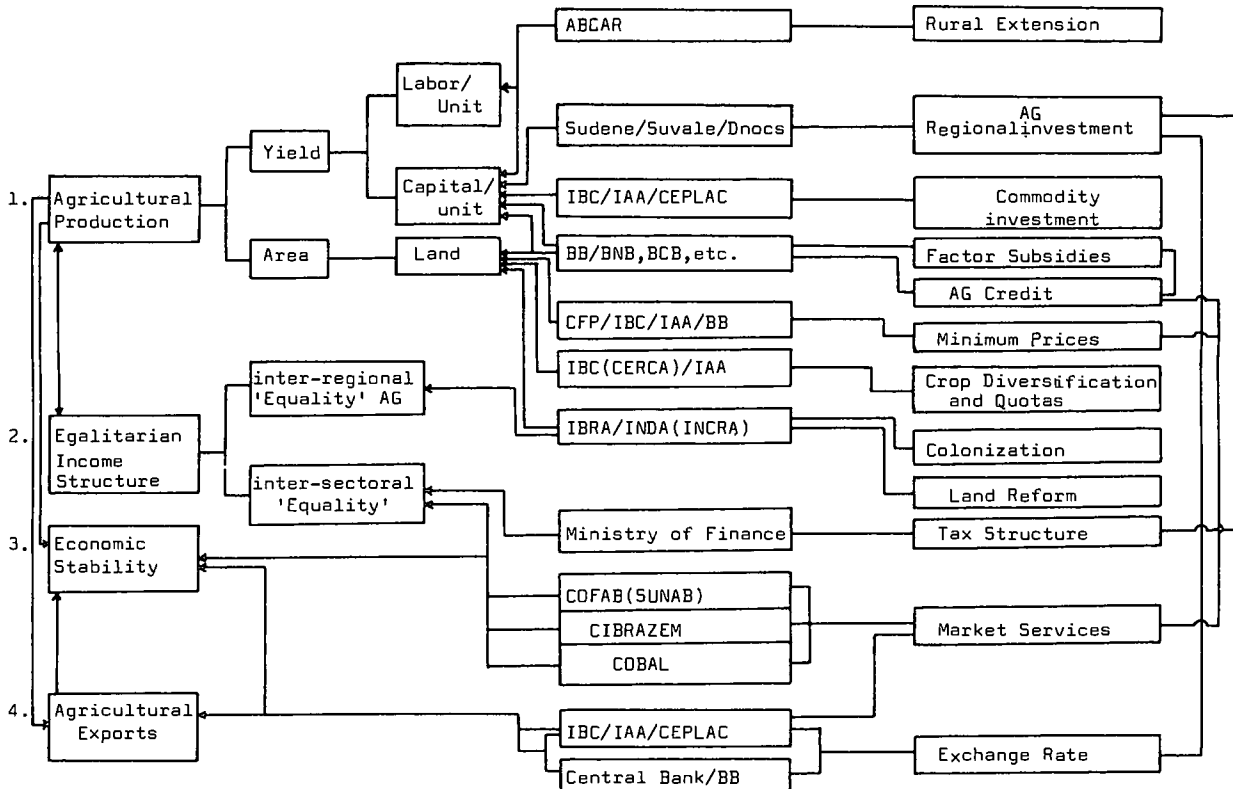
FIGURE 2

*A Partial Schema of Apparent Objective - Federal Agency - Policy
Instrument Linkages in Brazilian Agriculture During the Post -
1965 Period*

OBJECTIVES

FEDERAL AGENCIES

POLICY INSTRUMENTS



Analytical Procedure

The analysis below focuses solely on the first objective identified in the preceding, namely the desire to secure production increases in the agricultural sector. In this context, and following the lead of Netto *et. al.*¹, Pastore² and others, regional agricultural production in the crops sector, was initially viewed as being a function of two components: 1) the area under cultivation and 2) the corresponding yields registered. Alternatively, the "residual" crops were investigated by focusing on the total real value of production.

By region³, the following commodities were considered:

Region I (S): Corn, rice, beans, manioc, and other crops.

Region II (C-W): Corn, rice, beans, manioc, and other crops.

Region III (E/NE): Corn, rice, beans, manioc, coffee, sugar, cotton, cocoa, and other crops.

On a regional basis, the specific crops considered contributed in excess of 80% of the regional agricultural income generated by the crop sector during the 1966-1968 period.

The Area Under Cultivation. Regarding the area under cultivation for the j th product ($j = 1, \dots, 10$) in the i th region ($i = 1, 2, 3$), the maintained hypothesis was of the following general form;

$$Y_1 = f(X_1, X_2, X_3, X_4, X_5, X_6)$$

where, for the j th product in the i th region, the variables were generally defined as follows:

Y_1 = the current area under cultivation, in thousands of hectares;

X_1 = the area under cultivation, in thousands of hectares, lagged one year;

1 Netto, Antônio, D., Affonso Celso Pastore, e Eduardo Periera de Carvalho (1969), Agricultura e Desenvolvimento no Brasil, Estudos ANPES No.5, Versão preliminar (São Paulo: IPE - Instituto de Pesquisa Econômica.)

2 Pastore, Affonso Celso (1968), A Resposta da Produção Agrícola dos Preços no Brasil, Buletin 55 (São Paulo: Faculdade de Ciências Econômicas e Administrativas, Universidade de São Paulo.

3 The regions considered were as follows: *Region I* (South): São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul; *Region II* (Central-West): Mato Grosso, Goiás, and (after 1959), the Federal District, and; *Region III* (East/Northeast): Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, and Guanabara.

X_2 = the real¹ farm product price, lagged one year;

X_3 = the real "minimum price" designated for year t as a fraction of the real farm product price in year $t - 1$;²

X_4 = the real farm product price of the *principal* substitute product, lagged one year;

X_5 = the real "minimum price" for the principal substitute product designated for year t as a fraction of the real farm product price of the principal substitute in the year $t - 1$, and;

X_6 = the real quantity of production credit conceded to the respective enterprise in year $t - 1$.

A priori, it was hypothesized that a positive relationship prevailed between the dependent variable and X_1 , X_2 , X_3 and X_6 , while a negative relationship prevailed between the dependent variable and X_4 and X_5 . Annual data for the 1952-68 period was utilized. For estimation purposes, it was assumed that the functions were linear in natural numbers.

Yields Per Hectare Under Cultivation. Regarding the yield per hectare under cultivation for the j th product ($j = 1, \dots, 10$) in the i th region ($i = 1, 2, 3$), the maintained hypothesis was of the following general form:

$$X_2 = f(X_1, X_2, X_3, X_4)$$

where, for the j th product in the i th region, the variables are generally defined as follows:

Y_2 = the average yield per hectare under cultivation, in metric tons;

X_1 = the real average per hectare quantity of production credit conceded to the respective enterprise, in NCR\$ lagged one year;

X_2 = the real average per hectare regional or *autarquia* investment conceded to the respective region and/or enterprise, in NCR\$, lagged one year;

1 Unless otherwise designated all nominal prices and values were deflated utilizing FGV Column (48), the agricultural product price index (exclusive of coffee).

2 See Smith, Gordon, W., (1969) "Brazilian Agricultural Policy, 1950-1967", in Ellis, Howard S. (ed). The Economy of Brazil (Berkeley, California: University of California Press), pp.213-265. The numerator was deflated by the current year's deflator and the denominator was deflated by last year's deflator--which, regarding the "minimum price", assumes perfect foresight by the farmer at the time of planting regarding the rate of inflation during the up-coming year.

X_3 = the total annual precipitation, in thousands of millimeters, lagged six months, and;

X_4 = the total area under cultivation in the respective crop, in millions of hectares.

A priori, it was hypothesized that X_1 , X_2 , and X_3 would all bear a positive relationship to the dependent variable while X_4 and Y_1 would be negatively related to one another. The annual time series data utilized covered the 1952-68 period. Once again, it was also assumed that the functions were linear in natural numbers.

Empirical Results and Interpretation

Focusing solely on the production-instrument linkages implicit in the original regional commodity-specific area and yield functions, the viable "candidates" were 1) the quantity of credit allocated to the respective agricultural enterprises, 2) the real price of the respective commodities lagged one period, and 3) the guaranteed "minimum" price of the respective commodity. The empirical results associated with these apparent linkages are summarized in Table 2.

What do these parameter estimates imply? A crude interpretation would indicate that a 10 percent increase in the real quantity of institutional credit reaching the respective sectors (for production purposes), *ceterus paribus*, should prompt an increase in crop output of approximately 1.7, 1.1, and 1.4 percent in the South, Central-West, and East/Northeast respectively. This would translate into a national production increase of approximately 1.5 percent. Alternatively, if effective prices in the preceding year were to improve 10 percent over the prior year, crop production could be anticipated to increase 1.7, 1.3, and 0.3 percent in Regions I, II, and III respectively and this would translate into a national production increase of nearly 1.0 percent. In contrast, if "minimum" prices (in real terms) in the current year (relative to real effective prices in the preceding year) were all to increase 10 percent over their corresponding value in the preceding year, crop production could be anticipated to increase 1.1, 0.8, and -0.1 percent in the three regions respectively where, in this case, national crop production levels should increase, *ceterus paribus*, approximately 0.5 percent.

Interregionally, the parameter estimates indicate that the South is most responsive to price fluctuations while the East/Northeast is least responsive to price changes. Similarly, the short-run production increase is also sharper in the South than in the other Regions with respect to an expansion in the quantity of credit reaching the agricultural sector. However, in this case Region III is apparently more responsive to an expansionary agricultural credit policy than is Region II.

TABLE 2

The Estimated Aggregate Production-Instrument Elasticities,
by Enterprise and Region; 1952-1968

Enterprise	Real Credit			Effective Price		Real "Minimum" Price	
	Area Com- ponent ^a	Yield Com- ponent ^a	Net ^b	Area Com- ponent ^a	Net	Area Com- ponent ^a	Net ^b
Corn	.098	-.063	.059	.186	.231	.058	.070
Rice	.093	.106	.189	.037	.033	.127	.113
Beans	.249	-.061	.179	-.008	-.008	.046	.048
Manioc	.041	.002	.049	.014	.016	.001	.001
Coffee	.146	.029	.221	.005	.007	...	...
Sugar	.001	.039	.040	.034	.038	...	...
Cotton	.014	.014	.025	.295	.235	.065	.052
Wheat	.126	-.013	.044	.105	.048	.437	.198
Cocoa	.024	-.031	-.023	.040	.013	...	...
Other Crops	.183	.029 ^c	.179	...	...	...	...
Region I	.145	.002	.166	.153	.173	.094	.107
Region II	.101	.031	.110	.166	.130	.104	.081
Region III	.086	.050	.137	.035	.034	-.006	-.006
BRAZIL	.115	.025	.147	.099	.093	.054	.051

^a Aggregated across regions (and between regions) by simply weighting all of the respective elasticities (irrespective of sign) by the relative importance of the enterprises (regions) explicitly considered in the present study. I.e. the weights are based on relative average hectare estimates obtained, by region, for the 1950-68 period. These are *average* elasticities for the period analyzed and *no* adjustments were made for no-lag or 1 year lag distinctions that were sometimes utilized in the equations actually estimated.

^b The elasticity of crop production, Y , with respect to real credit, X_1 , is $e_{Y.X_1}$. Given the elasticity of the area with respect to credit, $e_{Y_1.X_1}$, the elasticity of yields with respect to credit, $e_{Y_2.X_1}$, and the elasticity of yields with respect to the area, $e_{Y_2.X_2}$, then $e_{Y.X_1} = e_{Y_2.X_1} + e_{Y_1.X_1}(1 + e_{Y_2.X_2})$. An analogous procedure was utilized with respect to the effective price and "minimum" price variables--except in these cases (by assumption) there is no direct yield component. (For further details see Tweeten, Luther G., and C. Leroy Quance (1969), "Positivist Measures of Aggregate Supply Elasticities," *American Journal of Agricultural Economics*, Vol. 51 (May 1969), p. 349.) Note that the aggregation procedure utilized in the present study to secure $e_{Y_2.X_2}$ was the same as that utilized to obtain the "national" elasticity estimates provided above.

^c The yield was here expressed in terms of the real value per hectare.

Summary and Implications

The preceding analysis indicates that the number of truly *national* policy instruments, in a historically measurable sense, has been very limited. The empirical evidence suggests that at the regional level, dis-aggregated by enterprise (commodity), only three identifiable policy instruments have been characterized by an empirically discernable impact on agricultural output. Those variables were 1) the real product price received by farmers, lagged one year, 2) the real "minimum" product price announced prior to planting by the respective federal or quasi-federal agency, and 3) the real quantity of credit made available to agriculture for production purposes via the federally-controlled banking system. The first of these was postulated to ~~affect primarily~~ the total land area under cultivation and is, of course, not a policy-instrument *per se* but is rather subject to other indirect policy-instruments. The second of these was also postulated to primarily affect hectare-adjustments on a commodity basis while the third instrument, the credit variable, was hypothesized to effect both yield levels and hectare changes.

The central issue which must be investigated in greater detail pivots on the *a priori* specification of the various functional relationships empiricized in this study. More specifically, we must further resolve; "How are the credit and "minimum" price policies *structurally* related to output levels?" For example, is credit a prerequisite to increasing output levels or is it simply a complementary input which follows an exogenous hectare-expansion into the hinterland? Similarly, is it really output or marketings which respond to changes in the respective "minimum" price programs? In the case of Brazil it is not at all apparent that the federal policy instruments utilized during the 1952-68 period can lay claim to being the *fonte* of the agricultural development which we have witnessed in that country.

At the same time, any attempt to link the macro-objectives to the policy instruments in the agricultural sector is handicapped by 1) the biological nature of agricultural production, 2) historical attributes such that a large percentage of the population is dependent upon agriculture and remains burdened with a heritage of commercially outmoded institutions, and 3) the small scale and dispersed nature of agricultural production.

But the absence of such research will imply that we will continue to

...rely ⁶exclusively on the tangible investment in projects unaware of their macro-economic implications or remain at the macro level unable to offer advice on specific policy implementation.¹

The absence of such research will also mean that formal macro-planning will continue to masquerade as the panacea of LDC's in development circles.

¹ Panagides, Stahis S. (1969), "Possibilities for Labor Reallocation in Brazilian Agriculture; New Lands, " draft (Rio de Janeiro: IPEA/Ministry of Planning, July 1969), p. 17.