EFFECTS OF ALTERNATIVE POLICIES ON THE LEVEL AND VARIATION OF INCOME AND ON RESOURCE USE AND OUTPUT: NORTHEAST BRAZIL

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Introduction

The Brazilian northeast covers an area of over 1.5 million sqaure kilometres and has more than 35 million people. Approximately 60 percent of the population lives in the semi-arid areas with generally infertile soils. These areas are subject to periodic, devastating droughts with accompanying high risks to farmers. Landownership is highly concentrated in large units and many of the rural poor are landless, hired labourers, or sharecroppers (Ferreira, 1978b). In 1975, the northeast had 47 percent of all farms and 63 percent of the farms with less than 10 hectares. The number of farms in the northeast with under 10 hectares increased from 837,124 to over 1.6 million between 1960 and 1975. Although these farms comprised 70 percent of the farms in the northeast in 1975, they contained only 5 percent of the land. The farms of 1,000 hectares or more accounted for less than 4 percent of the farms, but contained 29 percent of the total area (Fundação).

When differences in soil fertility and stock of fixed capital are taken into account, the distribution of wealth is even more unequal than the distribution of land. Also, the distribution of income of landowners is as unequal as the distribution of land. The degree of inequality in the distribution of resources and income increased between 1970 and 1975. The most severe poverty levels are found among persons who own no land and comprise over 70 percent of the rural labour force (SUDENE).

The government has tried several times to reduce the degree of income inequality between the northeast and southern states, especially through industrialization (promoted by fiscal and monetary policies) and various social programmes. The results of these attempts were very limited, especially in the agricultural sector, because the social and economic structures were not properly considered.

Unfortunately, with few exceptions, agricultural economics research in Brazil has traditionally been used on data obtained from medium and large landowners. As a result, our understanding of the problems arising from the poverty that exists is incomplete and probably biased (Schuh). Only recently has research included analysis of data obtained from sharecroppers and other low income groups in agriculture (EMBRAPA; and Patrick and Carvalho).

Objectives and Methodology

The study focussed on small owner operated farms and large farms on which sharecroppers were employed in the semi-arid areas of northeast Brazil. The objectives were to determine the potential effects of selected policies on level and variation in farm incomes, output, and employment. The policies considered were: (1) an increase in the price received for cotton, (2) elimination of cotton as an activity, (3) elimination of sharecropping on large farms, and (4) a reduction in credit.

The federal government is attempting to induce farmers to grow more Moco cotton (perennial tree type) that is not crossbred with lower grade cotton. An increase of 15 percent in the price of cotton was programmed. Changes in the socioeconomic structure could reduce the supply of labour if new alternatives are offered to landless farm workers and if the political and economic power of large landowners declines. A reduction in labour supply would probably reduce or eliminate cotton production which is very labour intensive. Thus programming

analyses were run with no cotton on the small and large farms and without sharecroppers on the large farm.

Agricultural credit policy in Brazil has been characterized by an abundant supply of loans in the last two decades (Patrick). However, implementation of the policy has been criticized in recent years. As a reaction, credit supplies are being reduced. To test the effects of reductions in credit, programmes were run with 50 percent and 75 percent reductions. Reductions of 50 percent had no important effects on farm plans; thus only the results of a 75 percent reduction are presented.

Linear and quadratic programming models were developed and used. Relations between sharecroppers and landowners (such as production activities on owner operated and sharecropper parts of the farms), sharecroppers' share of production, sharecropper labour (sujeição), and sharecropper consumption were determined (Ferreira, 1980). The model first optimized the sharecropper operation which was then considered as one of the activities available to the landowner. Risk was estimated by means of a variance-covariance matrix in which time series data for prices and yields were used.

The objectives were achieved by simulating existing farming systems and then introducing the policy changes and examining the effects on the utilization of resources, production, and level and variability of income. This methodology could be readily used to determine the effects of other policies. Data used to develop the existing farming systems were taken from the sample survey conducted in the SUDENE-World Bank project (Scandizzo and Kutcher) and 1973 prices were used (at that time Cr$6.13 were equal to US$1.00).

Results

Small Farm

Results of the analysis of the small farm operated by the owner's family are given in tables 1 and 2. Each system was programmed for very low expected income and risk levels to the maximum expected or linear programmed (LP) income. To save space, only five solutions are presented.

Data in column 2 of the basic model in tables 1 and 2 represent the actual farm operation. That the expected income and standard deviation were lower than the maximum in the LP plan indicates the degree of risk aversion on the small farm. Expected income increased at a decreasing rate with respect to risk; or, risk increased at an increasing rate with respect to income. Increases in income and risk were associated with increases in employment of hired labour, and, for family labour, on-farm employment increased and off-farm work decreased.

The 15-percent increase in price of cotton had negligible effects on income, risk, output, and resource use. Output may be inferred from crop and animal units, as yields were assumed to be constant. When cotton was eliminated, the maximum expected income in the LP plan was reduced by 12.4 percent. Below this level there was little effect on income and risk. However, farm activities were reduced to rice for on-farm consumption and cattle for market. Employment was reduced by 23 days with incomes near the existing level but potential employment (LP solutions) was reduced by 83 days or 25 percent. The only effect of the credit reduction was a small decrease in cattle and income in the LP solutions.

Table 1. Income, Risk, and Economic Activities, Small Farm, Northeast Brazil

Item and Unit	Quadratic Programming Solutions				LP Solutions
	1	2	3	4	5
	Basic Model (existing system)				
Expected income (Cr$)	5,050	5,482	5,930	6,276	6,403
Standard deviation (Cr$)	835	967	1,132	1,282	1,474
Cotton (ha)	0.28	1.68	1.69	1.58	0
Rice (ha)	0.86	0.86	0.86	0.86	0.86
Cotton-beans-maize (ha)	0.31	0.56	0.73	1.17	2.75
Cotton-beans (ha)	0.14	0.37	0.33	0	0
Cattle (animal unit)	9.91	9.91	12.25	14.20	14.20
	Cotton Price Increase				
Expected income (Cr$)	5,160	5,700	6,000	6,400	6,540
Standard deviation (Cr$)	857	1,005	1,126	1,305	1,492
Cotton (ha)	0.47	1.70	1.64	1.56	0
Rice (ha)	0.86	0.86	0.86	0.86	0.86
Cotton-beans-maize (ha)	0	0.60	0.70	1.19	2.75
Cotton-beans (ha)	0.19	0.45	0.41	0	0
Cattle (animal unit)	9.91	9.91	11.77	14.20	14.20
	No Cotton				
Expected income (Cr$)	4,900	5,500			5,608
Standard deviation (Cr$)	798	1,040			1,096
Rice (ha)	0.86	0.86			0.86
Cattle (animal unit)	9.91	13.40			14.20
	Credit Reduced 75 Percent				
Expected income (Cr$)	5,050	5,482	5,900	6,100	6,101
Standard deviation (Cr$)	835	967	1,132	1,325	1,326
Cotton (ha)	0.28	1.68	1.69	0.30	0
Rice (ha)	0.86	0.86	0.86	0.86	0.86
Cotton-beans-maize (ha)	0.31	0.56	0.74	2.45	2.75
Cotton-beans (ha)	0.14	0.37	0.33	0	0
Cattle (animal unit)	9.91	9.91	12.25	12.41	12.27

In summary, the simulated changes had relatively minor effects on the small farm. In the absence of technological change, new economic activities, or both, policies are not likely to have major impacts on farms of this size. However, the labour earnings rate, after adjustment for differences in capital, were substantially higher and risk lower for the small farm operator than for the sharecropper. Earning rates for sharecroppers were somewhat higher than for hired workers.

Table 2. Annual Employment in Labour Days, Small Farm, Northeast Brazil

Item and Unit	Quadratic Programming Solutions				LP Solutions
	1	2	3	4	5
	Basic Model (existing system)				
Family labour, total	212	216	216	217	216
On-farm	138	176	206	208	124
Off-farm	174	40	10	9	2
Hired labour	13	41	51	79	114
Total employed	225	257	267	296	330
	Cotton Price Increased 15 Percent				
Family labour, total	217	217	217	217	217
On-farm	144	180	204	208	215
Off-farm	73	37	13	9	2
Hired labour	29	57	66	106	143
Total employed	246	274	283	323	360
	No Cotton				
Family labour, total	217	217			217
On-farm	122	168			172
Off-farm	95	50			45
Hired labour	9	17			30
Total employed	226	234			247
	Credit Reduced 75 Percent				
Family labour, total	212	216	217	217	217
On-farm	138	176	206	213	215
Off-farm	74	40	11	4	2
Hired labour	13	41	60	108	115
Total employed	225	257	277	325	332

Table 3. Income, Risk, and Economic Activities, Large Farm with Sharecroppers, Northeast Brazil

Item and Unit	Quadratic Programming Solutions				LP Solutions
	1	2	3	4	5
	Basic Model (existing system)				
Expected income (Cr$)	9,720	11,883	15,261	20,456	20,685
Standard deviation (Cr$)	1,859	2,929	4,905	8,725	9,412
Owner-operated:					
Cotton (ha)	3.07	5.44	4.89	0.59	15.02
Rice (ha)	1.07	1.07	1.07	1.07	1.07
Cotton-beans-maize (ha)	1.59	2.73	4.93	5.63	0
Cotton-beans (ha)	0.74	1.28	0	0	0
Cattle (animal unit)	11.60	18.40	35.01	69.85	69.07
Sharecropped:					
Cassava (ha)	0.61	0.49	0.44	0.44	0.32
Cotton-beans-maize (ha)	41.29	33.51	29.76	30.16	21.48
	Cotton Price Increased 15 Percent				
Expected income (Cr$)	9,400	11,500	15,300	19,800	22,177
Standard deviation (Cr$)	1,081	2,069	4,135	7,383	9,591
Owner-operated:					
Cotton (ha)	2.00	2.89	4.83	3.36	15.02
Rice (ha)	1.07	1.07	1.07	1.07	1.07
Cotton-beans-maize (ha)	0.94	1.81	3.83	5.01	0
Cotton-beans (ha)	0.74	0.74	0.54	0	0
Cattle (animal units)	5.28	12.99	28.28	56.99	69.85
Sharecropped:					
Cassava (ha)	0.71	0.64	0.47	0.45	0.32
Cotton-beans-maize (ha)	48.09	43.76	32.03	30.35	21.48
	No Cotton				
Expected income (Cr$)	9,300	11,200	15,496		15,496
Standard deviation (Cr$)	4,015	5,327	8,454		8,454
Owner-operated:					
Rice (ha)	1.07	1.07	1.07		1.07
Cattle (animal unit)	32.77	43.74	69.85		69.85
	No Sharecroppers				
Expected income (Cr$)	9,700	11,500	15,500		17,685
Standard deviation (Cr$)	3,705	4,712	7,640		9,414
Owner-operated:					
Cotton (ha)	7.06	9.50	11.34		15.52
Rice (ha)	1.07	1.07	1.07		0
Cotton-beans-maize (ha)	2.27	1.24	0		0
Beans (ha)	0	0	0		1.07
Cattle (animal units)	25.30	32.93	57.10		69.85

Large Farm

Data from the analysis of the large farm with sharecroppers are given in tables 3 and 4. The actual farm operation was similar to column 4 in the basic model of tables 3 and 4. There are only negligible differences between the actual operation and the optimum (LP) solution with the exception of the share of the cotton produced by sharecroppers and the associated difference in risk. As risk increased at an increasing rate with respect to income, there is no evidence that the large farmers were risk averse as was found in the case of the smaller farmer. As income and risk increased, the share of cotton (with beans and maize) produced by sharecroppers decreased, and cattle production increased. Thus the employment of sharecroppers was associated with risk reduction.

An increase in the price of cotton had little effect on the LP solution with the exception of a 7-percent increase in expected income and a 2-percent increase in the standard deviation. At all levels of equal income, the risk was reduced. At lower levels of income and risk, there were increases in cotton production and decreases in cattle.

The elimination of cotton had substantial effects: (1) potential expected income was reduced from Cr$20,685 to Cr$15,496, which is 24 percent below actual income; (2) the standard deviations for given income levels were approximately doubled, a substantial increase in risk; (3) rice for on-farm consumption and cattle for market were the only activities; (4) sharecroppers were eliminated; and (5) there was a substantial reduction in employment.

With sharecroppers eliminated, compared with the basic model, potential income was reduced (but not to the level of no cotton), risk with respect to expected income was increased, and cotton production was reduced substantially. Hired labour was substituted for sharecroppers.

Table 4. Annual Employment in Labour Days, Large Farm with Sharecroppers, Northeast Brazil

Item and Unit	Quadratic Programming Solutions				LP Solutions
	1	2	3	4	5
	Basic Model (existing system)				
Family	197	197	197	197	197
Hired	31	109	219	331	510
Sharecropper	291	333	342	350	250
Total employed	519	640	758	878	957
Sharecroppers (number)	4.2	3.4	3.0	3.1	2.2
	Cotton Price Increased 15 Percent				
Family	197	197	197	197	197
Hired	31	62	154	353	509
Sharecropper	272	324	353	353	250
Total employed	500	584	704	903	956
Sharecroppers (number)	4.9	4.4	3.2	3.1	2.2
	No Cotton				
Family	197	197	197		197
Hired	128	191	340		340
Total employed	325	388	537		537
	No Sharecroppers				
Family	197	197	197		197
Hired	413	465	584		692
Total employed	610	663	781		889

A 75-percent reduction in credit constrained the maximum expected income to Cr$13,916, far below the existing level, and limited production and employment to the levels associated with this income level. Below this income level, there were little or no effects.

In summary, sharecropping appears to offer a better alternative than working as a hired labourer; but it is an alternative that is less remunerative than that of small farm operator. To the landowner, sharecroppers are a means of lowering risk with respect to income level or vice versa. Macro level policies had major effects on the income, risk, output, and employment on the large farm.

The methodology illustrated in this paper can be used as an effective tool in evaluating the effects of macro policies on economic units at the micro level. The opportunities to reduce risk, to increase expected income levels, or both by merely reallocating resources appear to be very limited. Thus implementation of government policies and programmes aimed at improving the productivity and increasing income levels of low income agricultural groups would be a better means of reducing inequalities.

Note

[1]Instituto de Planejamento Economico e Social (IPEA)/Instituto de Pesquisas (INPES), and Food and Resource Economics Department, University of Florida, respectively. Based on Ferreira's doctoral dissertation. Details of methodology and additional results are in Ferreira (1978a). The authors express their appreciation for assistance from M. R. Langham and W. G. Tyler, University of Florida, and G. Zepp, U.S. Department of Agriculture, in the initial study.

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