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RESEARCH NOTES ON AGRICULTURAL CAPITAL FORMATION AND
TECHNOLOGICAL CHANGE

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These notes report on preliminary findings of a continuing research project. The data and conclusions are tentative and formal reference to them should be cleared with the author.

I - Objectives -

During the 1962/63 to 1970/71 period, Brazil quadrupled wheat production from 400 thousand to 1600 thousand metric tons through effective use of credit and marketing policies. This increased production has been responsible for rapid transformation in farms, agro-businesses and rural communities. The overall objective of this research project is to analyze these transformations in terms of capital formation. This paper reports on preliminary findings concerning the linkage between growth of production on farms and transformations occurring in farm input suppliers and related effects on rural communities.

II - Area Description -

Farm data were collected during the months of January and July, 1970 in the municipios of Lajeado, Não Me Toque, Carazinho and São Borja, in the state of Rio Grande do Sul. In February, 1971, each municipio was revisited to interview agronomists, bankers and farm input dealers. All data were

collected as part of a research contract with the Instituto de Estudos e Pesquisas Economicas, Universidade Federal do Rio Grande do Sul, and form part of a larger study on capital formation and technological change in agriculture.

The municipio of Lajeado is located approximately 100 kilometers northwest of Porto Alegre in the region known as Encosta Inferior do Nordeste which forms the transition zone between the coastal region and the central plateau. Over 45 percent of the 6500 rural properties have 10 hectares or less. Many farms have an average slope of 20 percent. Due to the small farm size and rough topography, agriculture is largely subsistence with corn, tobacco and dairying the primary activities.

Não Me Toque and Carazinho are located over 300 kilometers northwest of Porto Alegre in the central plain referred to as Planalto Médio. Altitude varies between 500-600 meters. Agrarian Reform Institute data for 1967 indicate that each has approximately 2,300 properties of which 25 percent have 10 hectares or less. They are highly mechanized municipios and this facilitates the widespread practice of double cropping wheat and soybeans. Rapid expansion of these two products has reduced the relative importance of livestock and corn.

São Borja with over 5,000 square kilometers is one of the largest municipios in the state. It is located on the western border with Argentina, and has a long tradition of cattle raising. During the past ten years, it has ranked among the state's top 7 or 8 rice producing municipios. Wheat, soybeans, and sunflowers are being rapidly introduced, but summer crops have severe restrictions because of irregular rainfall. 27 percent of the 2,500 farm properties were reported to have 10 hectares or under, but 25 percent had

between 100 and 1,000 hectares. Most farm inputs and commodities are transported by rail rather than truck as is common in the other three municipios.

III - Preliminary Findings -

The municipio-level interviews, from which the following findings were obtained, were undertaken to determine the nature of changes in farm input suppliers and rural communities due to increased wheat production, and how these changes facilitated the observed growth in farm output. In each municipio, most of the principal input suppliers were interviewed, and additional information and impressions were obtained from bankers, agronomists and other knowledgeable persons. Interviews were taken only in cities where municipal governments were located, but in all cases these are the only ones of real economic importance.

Number of dealers

The first noticeable change in these rural communities has been the increase in number of input dealers. Lime, fertilizer, insecticides, herbicides, tractors and other farm machinery are now available from at least one dealer in each city. The growth rate in dealers selling fertilizer and machinery has been so great that most major brands are now represented in each locality, except in Lajeado where topography, farm size, and traditional orientation of many farmers inhibits use of these two production inputs. (See Table 1).

TABLE 1. NUMBER OF FERTILIZER AND MACHINERY DEALERS IN EACH MUNICIPIO OF LAJEADO, NAO ME TOQUE, CARAZINHO, AND LAO BORJA, 1971

Município/Input	Number of Dealers ^{a/}	
	Before 1966	1970
Lajeado		
Fertilizer	0	2
Machinery	0	3
Não Me Toque		
Fertilizer	1	4
Machinery	<u>5</u> ^{b/}	8
Carazinho		
Fertilizer	2	6
Machinery	1	6
São Borja		
Fertilizer	0	8
Machinery	1	8
TOTAL	10	45

^{a/} There is some double counting because a few dealers handle both fertilizer and machinery

^{b/} Includes three dealers that manufacture farm implements.

Services offered by dealers

As competition increases among dealers, they begin offering a wider variety of services as a way of attracting business. Many now deliver the purchased input to the farm, and transportation costs may not be charged if the distance is not great. None of them rent equipment. Reasons given for not doing so included lack of capital required to introduce the service, limited farmer demand, and probable high maintenance cost. When bulk handling of fertilizer becomes common, however, some may try to improve their competitive

position by offering farm application. Some lime dealers are now considering this possibility.

Credit is offered by most dealers, and often as much as 50 percent of total sales are on time. It is probable that most of these types of sales are to the dealers' biggest customers. Many companies fix the proportion of sales sold on credit, but in spite of this restriction, there are unconfirmed reports that some dealers are rapidly accumulating overdue accounts. Interest rates range from 0 to 3 percent per month, and repayment periods vary from 6 months to a year. Machinery dealers tend to charge lower rates and require shorter repayment periods than fertilizer dealers. This would appear to be inconsistent with economic logic considering that income should be generated more quickly from fertilization than mechanization. Part of the explanation is that the latter is often financed only until bank credit is processed, while fertilizer is financed for the entire growing season.

Many farmers find this credit very important even though the Bank of Brasil has unlimited credit for agricultural loans. To prevent over-rapid expansion by farmers caught up in the "wheat fever", the Bank adopted guidelines restricting the amount lent per hectare and the increase in number of hectares financed from one year to the next. Farmers that want to expand area planted more rapidly than permitted by these regulations must find another method to finance those production inputs not covered by a loan.

Another important dealer service is that of assisting farmers to obtain bank loans. Dealers save farmers time by informing them of required documents, assisting in preparing loan applications, and recommending them to the bank.

All dealers assist in speeding adoption of new technology by informing farmers of types and recommended usage of purchased inputs. Fertilizer dealers often provide free soil analysis and help interpret the results. Machinery dealers conduct farm demonstrations on their products.

Growth in sales of farm inputs

In the five year period, 1966-1970, fertilizer sales rose ten-fold (Table 2). This increased demand undoubtedly explains the reason for the rapid increase in number of new dealerships. In order to test the importance of wheat in total fertilizer sales, dealers were asked to estimate the proportion of their 1970 sales which went into wheat and soybean production. Lajeado farmers have a relatively longer history of soybean production, so fertilizer use is more evenly balanced than in other municipios where 85-95 percent is applied to wheat. In other municipios soybeans are often double cropped with wheat, and farmers assume that the residual left from fertilizing wheat will suffice for soybeans.

Fertilizer dealers were asked to identify the major factors explaining increased demand. Increased total cultivated area including wheat was named most frequently, closely followed by government incentives and credit. These factors are highly correlated because government action in the price, credit, and marketing areas has been instrumental in providing financial resources and creating conditions conducive to expanding crop area.

Farm machinery sales have experienced a similar growth record (Table 3). Since machinery dealers generally serve a larger area than fertilizer dealers, total sales do not as closely represent purchases by farmers within the municipios. Likewise, there are dealers located elsewhere also making sales in these municipios. Another data problem is that dealers have incomplete sales records so sales appear to have grown slightly faster than may have been the case.

**TABLE 2. HISTORY OF FERTILIZER SALES FOR INTERVIEWED DEALERS AND ESTIMATED USE MADE OF 1970 SALES
MUNICIPIOS OF LAJEADO, NÃO ME TOQUE, CARAZINHO, SÃO BORJA, 1966-1970**

Município	Sales per year					Estimated Use of 1970 Sales	
	1966	1967	1968	1969	1970	Wheat	Soybeans
		Metric tons				Percent	
Lajeado ^{a/}	0	0 ^{b/}	20 ^{b/}	105	620	36	30
Não Me Toque	1600 ^{b/}	3190 ^{b/}	4300 ^{b/}	6000	10,300	97	3
Carazinho	2800 ^{b/}	4000 ^{b/}	3400 ^{b/}	4700 ^{b/}	20,800	84	16
São Borja	1700	3680	5500	9330	17,250	90	2

^{a/} Data do not include fertilizer provided tobacco growers by tobacco company. This is estimated at approximately 500 tons per year.

^{b/} Incomplete data for one dealer.

TABLE 3. HISTORY OF SALES OF SELECTED ITEMS OF FARM MACHINERY FOR INTERVIEWED DEALERS, 1966 to 1970
MUNICIPIOS OF LAJEADO, NÃO ME TOQUE, CARAZINHO AND SÃO BORJA, 1971

Município and item	Units sold per year				
	1966	1967	1968	1969	1970
LAJEADO:					
Sales:					
Micro-tractors		31 ^{b/}	26 ^{b/}	39 ^{b/}	54
Threshers		18 ^{b/}	74 ^{b/}	70 ^{b/}	116
NÃO ME TOQUE:					
Sales:					
Tractors	131	95	104	284	502
Self-propelled combines					4
Manufactured and sold:					
Plows	80	80	80	200	500
Light discs	12 ^{b/}	21 ^{b/}	31 ^{b/}	176	157
Heavy discs					48
Cultivators	43	52	69	139	228
CARAZINHO:					
Sales:					
Tractors				0 ^{b/}	64
Self-propelled combines ^{a/}				500	535
Manufactured and sold:					
Plows	133	75	160	180	480
Light discs			75	110	120
Cultivators	15	35	40	50	40
SÃO BORJA:					
Sales:					
Tractors	6	30	104	140	156
Self-propelled combines			8	24	48
Plows	10	N.R. ^{c/}	51 ^{b/}	105	232
Light discs	10	N.R. ^{c/}	39 ^{b/}	105	191

^{a/} One firm is the distributor for a brand of imported combines. Approximately 500 have been imported and sold in Brazil. During these two years, the dealer estimated that 22 went into the município of Carazinho, 5 or 6 into NãO Me Toque, and 23 into SãO Borja.

^{b/} One dealer provided incomplete data.

^{c/} Two dealers provided incomplete data.

Sales in Lajeado have been small because of limited potential for mechanization. Tractor sales in the general region of Nãõ Me Toque and Carazinho began in large scale in 1957 when an aggressive dealership for Massey Ferguson was established. Other dealerships were subsequently opened and annual sales in Nãõ Me Toque alone have grown from 100 units to 500. Many dealers reported they could have sold even more units if they would have been available. Because of limited supplies, some farmers had to accept tractors smaller than desired. Self-propelled combines have entered these municipios very rapidly, especially after 1969 when a regional office of an imported Belgian brand was opened. Sao Borja sales have increased but part of the mechanization needs of wheat have been met by machinery previously acquired for rice production. Increased mechanization has particularly benefited a small group of firms manufacturing and selling plows, discs, and cultivators in Nãõ Me Toque and Carazinho. They have developed implements well suited to local conditions, and could have expanded production even faster if they were not limited by lack of managerial talent and fear of debt.

Employment in farm supply firms

Rural communities have benefited from the expansion in number and size of firms. One noticeable way has been through employment creation. The number of full - and part - time employees of the interviewed firms has grown rapidly as can be seen in Table 4. Employment in 1970 was anywhere from two to four times greater than 1965, and nearly six times the number employed in 1960

TABLE 4. EMPLOYMENT GROWTH FOR INTERVIEWED FARM SUPPLY FIRMS, 1960, 1965, 1970
MUNICIPIOS OF LAJEADO, NÃO ME TOQUE, CARAZINHO AND SÃO BORJA, 1971

MUNICIPIO	NUMBER OF FULL- & PART - TIME PERSONS EMPLOYED BY FARM SUPPLY AND PRODUCT MARKETING FIRMS BY YEARS		
	1960	1965	1970
Lajeado	NA	NA	20 ^{a/}
NÃo Me Toque	33	60	191
Carazinho	94	125	291
SÃo Borja	1	49	210
Total	128	234	692

^{a/} Excluded from total

Capital investment by farm supply firms

Entry of new firms and expansion by existing ones has prompted capital investment in land, buildings, equipment and inventories. The survey results for this item are summarized in Table 5. Those firms operating in 1965 had total investments of over one million cruzeiros, measured in 1970 cruzeiros. The dealers' estimates of total value of investments in 1970 totaled nearly 15 million cruzeiros. Such a rapid rate of expansion, of course, is directly related to the relatively small number of firms operating in 1965. However, additional investments could have been made if firms would have reacted more quickly to increased demand.

TABLE 5. GROWTH OF INVESTED CAPITAL FOR INTERVIEWED FARM SUPPLY FIRMS, 1965-1970
MUNICIPIOS OF LAJEADO, NÃO ME TOQUE, CARAZINHO AND SÃO BORJA, 1971

MUNICIPIO	TOTAL CAPITAL INVESTED BY INTERVIEWED FARM SUPPLY FIRMS 1965 AND 1970		
	Capital invested in 1965	Additional capital invested by new and/or existing firms 1966-70 1970 Cruzeiros	Capital invested in 1970
Lajeado	N.A.	N.A.	Cr\$ 263,500 ^{a/}
NÃo Me Toque	Cr\$819,000	Cr\$5,050,500	Cr\$ 5,869,500
Carazinho	Cr\$373,355	Cr\$6,508,645	Cr\$ 6,882,000
SÃo Borja	Cr\$ 34,000	Cr\$2,174,000	Cr\$ 2,208,000
Total	Cr\$1,226,355	Cr\$13,733,145	Cr\$14,959,500

^{a/} Excluded from total

Area occupied in warehouse and office space is another indication of firm expansion and investment. As shown in Table 6, total area in 1970 is almost 2.5 times greater than 1965, and over three times greater than 1960. Not all this increase is new construction; sometimes old warehouses, houses and office buildings have been adapted to meet expanded needs.

TABLE 6. INCREASE IN AREA OCCUPIED BY INTERVIEWED FARM SUPPLY FIRMS, 1965-70 MUNICIPIOS OF LAJEADO, NÃO ME TOQUE, CARAZINHO, AND SÃO BORJA, 1971

MUNICIPIO	WAREHOUSE AND OFFICE AREAS OCCUPIED		
	1960	1965	1970
	Square Meters		
Lajeado	NA	246 ^{a/}	381 ^{a/}
NÃo Me Toque	5010	5918	9334
Carazinho	1848	2944	11746
SÃo Borja	12	1213	3104
Total	6870	10075	24184

^{a/} Excluded from total

Cash operating expenditures by farm supply firms

Rural communities feel the impact of these firms through their expenditure of operating costs within the municipio. As the data of Table 7 indicate, these expenditures totaled over Cr\$12,000,000 in 1970. The firms in NÃo Me Toque and Carazinho are especially important because the machinery manufacturing

TABLE 7. ANNUAL CASH OPERATING EXPENSES FOR INTERVIEWED FARM SUPPLY FIRMS MUNICIPIOS OF LAJEADO, NÃO ME TOQUE, CARAZINHO, AND SÃO BORJA, 1971

MUNICIPIO	ANNUAL CASH OPERATING EXPENSES FOR 1970					Total
	Rent	Wages	Utilities	Taxes	Other	
Lajeado ^{a/}	4,800	30,000	1,800	51,600	12,000	100,200
NÃo Me Toque	12,720	756,000	86,900	601,980	4,136,800	5,794,400
Carazinho	21,600	762,000	96,360	3,816,800	1,213,200	5,909,960
SÃo Borja	16,620	251,160	32,560	229,850	219,780	749,970
Total	55,740	1,799,160	217,620	4,700,230	5,581,780	12,554,530

^{a/} Includes only one firm

firms employ the largest number of people and pay the most taxes. Not all taxes remain within the municipios because the majority of the 17 percent value-added tax goes to the state government.

Motor vehicles sales

Much of the increased income generated in both the farm and non-farm sectors eventually finds its way into the consumption of consumer durables. With Brazil's rapid expansion of domestic motor vehicle manufacturing and truck transportation, it should be expected that motor vehicle sales would be affected in these municipios. The data in Table 8 summarize these sales.

Table 8. NEW MOTOR VEHICLE SALES OF INTERVIEWED DEALERS, 1965-1970^{a/}
MUNICIPIOS OF LAJEADO, NAO ME TOQUE, CARAZINHO AND SAO BORJA

MUNICIPIO	NUMBER OF NEW VEHICLES SOLD BY YEARS					
	1965	1966	1967	1968	1969	1970
Lajeado	NA	NA	NA	NA	NA	NA
Não Me Toque)	193	250	307	453	631	1002
Carazinho)						
São Borja	ND	ND	ND	ND	110	200
Total	193	250	307	453	741	1202

ND = No motor vehicle dealer was located in the municipio

^{a/} Motor vehicles include cars, trucks, pick-ups, jeeps and panel trucks.

Carazinho is a regional trading center where the number of dealers increased from four to six between 1965 and 1970. Annual sales increased from 200 vehicles to 1,000. São Borja has one dealer with sales of 200 vehicles last year, and an additional two dealerships will probably be established before the end of 1971.

All interviewed dealers admitted to a high linkage between the prosperity of wheat farmers and vehicle sales. Carazinho dealers estimated that farmers,

mainly wheat growers, account for 40 to 60 percent of sales. The São Borja dealer estimated that wheat farmers account for nearly 70 percent of his sales.

IV - Conclusions -

These data demonstrate the impact expanded wheat production has had on farm input dealers. The total number of dealers has expanded, sales have increased rapidly, and services have increased. These changes have obviously benefited farmers by providing a good supply of farm supplies close at hand. Technical advice provided by dealers has undoubtedly stimulated adoption of new inputs, thereby contributing to agricultural modernization and making possible the tremendous growth in agricultural production experienced in these municipios.

Rural communities have felt the effects of increased farm output and expansion in farm input suppliers through creation of employment opportunities; investment in land, buildings, equipment, and inventories by these dealers; and expenditure of cash operating expenses in the local economy. A major secondary effect of this economic activity has been a marked increase in motor vehicle.