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RESEARCH NOTES ON AGRICULTURAL CAPITAL FORMATION AND TECHNOLOGICAL CHANGE

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I - Introduction

The Brazilian government in recent years has developed a set of policies and programs to modernize and increase productivity of its agricultural sector. These policies, mainly credit subsidies and price supports, have fomented a rapid modernization of the agricultural sector. Farms have increased their production, productivity and use of non-farm inputs such as fertilizers, machinery, seeds and pesticides. This modernization has created new opportunities for product and input marketing firms in the community. The relationship between this agricultural modernization process, capital formation and the growth of agricultural infrastructure, especially in selected marketing firms in a region of São Paulo is the subject of this investigation.

II - The Problem

Agricultural development is a vast complex subject requiring not only the study of farmers but also of their economic environment before it can be more fully understood. Many studies have been completed on the "economic behavior" of farmers to assess the extent to which their "behavior" determines agricultural development. Such development however is not entirely determined by the farmers' behavior; it is also determined by the economic environment in which they operate. Much emphasis in the development literature has been given to analysis of the farm firm, yet little analysis of their economic environment has been completed.

Wharton calls this environment the "economizing setting"; it includes components which are physical-climatic, sociocultural and institutional in nature.[1/]

1/ Wharton,Jr., Clifton R. "The Infrastructure for Agricultural Growth", Chapter 4 in Agricultural Development and Economic Growth, Herman Southworth and Bruce Johnston, ed., Cornell University Press: Ithaca, 1967, p. 107

Agricultural infrastructure is one vitally important component of this "economizing setting". For our purposes we use Wharton's definition of agricultural infrastructure: "the physical capital and the institutions or organizations, both public and private, which provide economic services to and which have a significant effect, directly or indirectly, upon the economic functioning of the individual farm firm, but which are external to the separate, individual farm firm".[2/] In more general terms, Wharton describes agricultural infrastructure as those things outside the farm gate which are required by or affect the operation of economic processes within the farm fences. He classifies agricultural infrastructure as capital-intensive, capital-extensive, and institutional.

I. Capital-Intensive Infrastructure

A. Irrigation and public water facilities: dams, canals, distributaries, drainage systems;

B. Transport facilities: roads, railroads, bridges, boats, airplanes, ports, docks, harbors;

C. Storage facilities: silos, warehouses, go-downs;

D. Processing facilities: machinery, equipment, buildings;

E. Utilities: electricity and power, drinking water systems, gas.

II. Capital-Extensive Infrastructure

A. Extension education services, statistical reporting services;

B. Agricultural research and experiment facilities: laboratories, experiment stations;

C. Crop and animal protection, control, and grading services;

D. Soil conservation services;

E. Credit and financial institutions;

F. Education and health facilities: schools, hospitals.

2/ Ibid, p. 109

III. Institutional Infrastructure

Formal and informal institutions of a legal, political and socio-cultural nature.[3]

Commenting on research on infrastructure in developing countries, Wharton indicates that there is a need for ex post studies of infrastructural investment in the developing world to answer the general question of how do you determine how much is enough. In addition, he argues that more research is needed on the nature of sequences and linkages of alternative infrastructure investments since variations of the sequence may change its developmental impact.[4]

Mosher describes infrastructure in a farming locality as a service system which expedites the flow of goods, services and information between the individual farm and the society. His "Progressive Rural Structure" contains the following elements:

(1) Market towns containing outlets where farmers can purchase production supplies and equipment and markets where farmers can sell their products;

(2) Rural roads to expedite and reduce the cost of the flow of commodities, information and all sorts of rural services;

(3) Local verification trials that determine the best farm practices in the light of local conditions;

(4) An extension service through which farmers can learn about and learn how to use new technology; and

(5) Credit facilities to finance the use of production inputs.[5]

3/ Ibid, p. 110

4/ Ibid, pp. 127-128

5/ A. T. Mosher, Creating a Progressive Rural Structure (New York, N.Y.: Agricultural Development Council, Inc. 1969), p. x. Mosher's concept of a "Progressive Rural Structure" includes the rural circulatory system serving agriculture but does not include central facilities in major cities and ports.

What is the role of this infrastructure in agricultural development and capital formation? As agriculture evolves from the pure subsistence level to the modern, market oriented economy, the need for infrastructure increases. In pure subsistence agriculture where the farm family is entirely self-sufficient consuming all it produces and buying nothing, there is no infrastructure needed. The transition from subsistence to commercial agriculture is unquestionably linked to development of agricultural infrastructure. The farmer requires markets in which to sell his production and buy the industrial goods needed for production and home consumption. He now depends upon a market system external to his control whose efficiency is closely linked to agricultural development and capital formation. As Wharton states "we know that some level of infrastructure is a necessary condition to the development of agriculture; but we do not know what the level is. We know that without some minimum level of agricultural infrastructure, efforts to stimulate more rapid increases in agricultural output will be frustrated, but we do not know what the level is."6/ Thus infrastructure is essential to agricultural development and capital formation.

Product and input marketing infrastructure affects the rate of farm capital formation directly and indirectly. The required growth of infrastructure investments during the modernization process competes directly for the human and capital resources transferred between the agricultural and industrial sectors. Secondly, inefficient marketing firms reduce net farm incomes by increasing marginal costs or reducing marginal revenues and consequently reducing farm incomes and capital formation. Indirectly they influence farm capital formation via risk reduction which speeds adoption of new technology and increased production once farmers are assured of a satisfactory market outlet for this increased production. Finally inefficient marketing firms which weaken the signals of changing supply and demand may inhibit production or adjustments to production once again lowering farm incomes and capital formation.

The importance of exchange in the agricultural development process has been stated clearly by Wynn Owen in his interesting paper "The Double

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6/ Wharton, op.cit., p. 113

Developmental Squeeze on Agriculture":

> "... how can peasants be encouraged to produce a cumulative surplus of food and fibers over and above their own consumption, and how can this surplus largely be channeled to investment activity in the non-farm sector without requiring in exchange an equivalent transfer of productive value to the farm sector?"[7/]

Yet the development models of Arthur Lewis, Ranis and Fei, and Johnston and Mellor incorporate only the two sectors of agriculture and industry to analyze their interrelationships in the development process. They leave aside the marketing sector which links producer and ultimate consumer, and agriculture and industry in the transfer of resources between farm and non-farm sectors. Furthermore, these models assume that neither capital nor labor resources are absorbed in this transfer process.[8/]

Ruttan argues that macro-development literature tends to substantially underestimate the magnitude of the resources needed in product and factor markets during the development process.[9/] Generally the development literature has few studies of the role of marketing in economic development. Even development plans assume that these resources will somehow be provided automatically as the demand for marketing services grows during the development process.[10/]

Fortunately, some recent research studies have demonstrated the importance of product and factor markets during agricultural development.

7/ W.F. Owen, "The Double Developmental Squeeze on Agriculture", American Economic Review, Vol. LVI, March 1966, p. 44

8/ See Ruttan, Vernon W., "Agricultural Product and Factor Markets in Southeast Asia", Chapter 6 in Agricultural Cooperatives and Markets in Developing Countries, Kurt Anschel, Russell Brannon and Eldon Smith, eds., Frederick A. Praeger Inc., New York, 1969, p. 81

9/ Ruttan, op. cit., p. 80

10/ Collins, N.R. and Holton R.H., "Programming Changes in Marketing in Planned Economic Development", Kyklos, Vol. 16, p. 123, Jan. 1963.

Stevens' analysis of changes in consumption and demand for food during the development process is one of the first to demonstrate the implications of these changes for marketing and agriculture.[11/] Increasing urbanization and per capita incomes during the development process require that substantially larger quantities of food move from producers to urban consumers through the assembly, wholesale and retail market system. Even if marketing margins which frequently account for 1/3 to 1/2 of consumer expenditures for food remain constant, large amounts of resources are needed to transfer this increased food volume. Any tendency for marketing margins to increase in response to new demands for marketing services will require additional resources thereby reducing their availability for other economic activities, such as agriculture. Finally inefficient product markets with higher than necessary marketing margins reduce agricultural incomes and capital formation.

Factor markets are also closely linked to the capital formation process. In the transition from subsistence to commercial agriculture, farmers become highly dependent upon factor markets for the purchase of the modern inputs used in the production process. Modern agriculture requires this technology and depends upon the non-farm sector to organize a production-distribution network to fulfill this demand. Creation of such a network for this new technology requires large amounts of resources to build the facilities and finance the flow of commodities. Thus, new investment needs in factor markets compete directly for scarce capital resources of the economy. Subsistence agriculture which can provide human and some capital resources for the industrial sector demands nothing in return, but commercial agriculture in addition to providing resources also demands a counter-flow of resources from the industrial sector; a fact frequently ignored in development literature.

Factor markets which deliver the new technology to farmers in the appropriate quantities and qualities at the correct time and place for a reasonable price stimulate its adoption. Adoption of new technology affects the farm's capital structure in many ways; most importantly it may increase

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11/ Stevens, Robert D., Elasticity of Food Consumption Associated with Changes in Income in Developing Countries, FAER 23, 1965, Development and Trade Analysis Division, USDA/Economic Research Service, Washington, D.C.

productivity, farm income and the capacity to generate more capital.[12] Therefore efficient factor markets which stimulate adoption of new technology have a vital role in farm capital formation.

Reduction of market risks associated with the adoption of new technology or the marketing of increased production can have a decisive impact upon farm income and capital formation. This has already been observed in developed countries where reduction of market risk through contracts or minimum prices has demonstrated that producers are willing to expand output and adopt new technology. Removal of these market risks is important; a producer will be more reluctant to expand output a second time if he has already suffered one market failure.

In the developing countries the market risks are frequently greater than in developed countries. Morton Paglin observed that the:

> "... farmer with a relatively large holding can eke out a moderate income without the trouble of hiring a high percent of non-family labor, or the risk of borrowing additional working capital for other inputs associated with intensive cultivation; he frequently seems to prefer the low effort, low risk, low-output package to the higher-risk, higher-profit, higher-output combination."[13]

Reduction of market risks can therefore encourage the producer to adopt the higher-risk, higher-profit, higher-output combination which contributes to additional farm capital formation.

In sum, product and factor markets are closely linked to the farm capital formation process. They require and compete for large quantities of capital resources reducing the amount available for agricultural and industrial capital formation. Secondly, efficient markets can improve farm income by increasing the farmer's share of the consumer dollar and reducing

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12/ See Adams, Dale W., Rural Capital Formation and Technology: Concepts and Research Issues. Occasional Paper No 29, Department of Agricultural Economics and Rural Sociology, Ohio State University, Columbus, 1971.

13/ Morton Paglin, "Surplus Agricultural Labor and Development: Facts and Theories", American Economic Review, Vol. LV, Sept. 1965, p. 828.

the cost of purchased farm inputs which permits more savings and investment for increased capital formation. Finally, efficient markets promote adoption of new technologies through reduction of the risks associated with this technology.

III - Objectives

The overall objective of this research project is to examine the relationship between capital formation and modernization on farms with the development of marketing facilities at the community level.

More specifically the objectives are: (1) to describe and analyze the marketing system in a rapidly developing agricultural region, (2) to identify the historical development of the marketing system in that same region, (3) to study the importance of linkages between producing and marketing sectors in affecting speed and type of farm capital formation, and (4) to evaluate the impact of selected government policies upon the development of the marketing system.

IV - Hypotheses

Two major hypotheses will be tested in this study: first, marketing infrastructure in the Ribeirão Preto region of São Paulo developed rather quickly in response to farmer demands, in other words, its development occurred via a shortage of capacity rather than excess capacity. Secondly, satisfactory performance of marketing firms has greatly facilitated agricultural development and capital formation in that region.

V - Area Studied

This research project is part of a larger study of farm level capital formation in developing countries. The Ribeirão Preto region of São Paulo, Brazil, was selected for this larger study because it lies in the heartland of São Paulo agriculture. It is a highly diversified and rapidly modernizing agricultural region containing three types of farming: those farms specializing in 1) ranching, 2) annual crops, and 3) perennial

crops. The main enterprises of the region are beef cattle, corn, rice, cotton, soybeans, coffee, and sugar cane. Other crops such as fruits and vegetables can also be found in the region.

The ten municipios selected to represent these kinds of farming were Altinópolis, Barretos, Batatais, Colombia, Guaíra, Jardinópolis, Pontal, Ribeirão Preto, Sertãozinho, and Salles de Oliveira. A total of 383 farm level interviews was completed in those ten municipios during July 1970.[14/]

Given the importance of analyzing the relationship between farm and firm capital formation, this same area was a logical choice for the study of capital formation among product and input marketing firms. Hence, the same ten municipios were selected for the marketing study.

The population frame consisted of input and product marketing or manufacturing firms located in the selected municipios that sold inputs to farmers and/or bought agricultural products from farmers during the calendar year 1970. The population also included those firms who were local representatives or subsidiaries of firms with headquarters located outside the region. These firms are the farmers' first link to the marketing sector.

The population list was constructed utilizing four sources: (1) local "agronomos" from the extension office, (2) telephone books, (3) commercial associations, and (4) the business firms themselves. The completed list contained a total of 315 firms in the ten municipios; interviews were completed with 143 of these firms during September of 1971.

The firms, stratified according to major type of activity, such as fertilizers and pesticides, machinery and implements, grains, fruits and vegetables, etc., were randomly drawn from each stratum; replacements were also randomly drawn until the original objective of a 50% sample had been

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14/ A more complete discussion of the region's agriculture can be found in "Methodology and General Data Description: Farm Level Capital Formation in Brazil", Occasional Paper Nº 47 by Kelso L. Wessel and William C. Nelson, Dept. of Agric. Economics and Rural Sociology, Ohio State Univ., Columbus, Ohio, 1971.

achieved. Because of refusals to cooperate in the interviews, inability to locate the firm, change in the products and inputs handled during 1970, and firms which had already gone out of business, many replacements had to be drawn until sometimes the original list had been exausted. Thus, the number of completed interviews per stratum did not always fulfill the original objective.

VI - Inputs and Products Studied

Inputs for purposes of this study include those elements utilized in the production process which must be purchased in the marketplace. The categories of purchased farm inputs studied here include fertilizers, lime, machinery and implements, pesticides, veterinary products, feeds and seeds.

The products included in this study were annual crops such as corn, cotton, rice, and soybeans; perennial crops like coffee and sugarcane and fruit and vegetable crops. Livestock and livestock products were also included.

VII - Some Research Questions to Be Studied

1. What is the present structure and composition of the marketing system in the Ribeirão Preto region?
2. How has this system developed over time?
3. Are marketing firms an important source of agricultural credit?
4. What has been the economic performance of the marketing system in this region?
5. How has this performance facilitated capital formation and modernization on farms?