PRICE RELATIONSHIPS AND MARKET INTEGRATION: A NORTHEAST OF BRAZIL CASE STUDY

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entitled Price Relationships and Market Integration:

A Northeast of Brazil Case Study

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

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TABLE OF CONTENTS

TABLE OF CONTENTS--Continued

LIST OF TABLES

LIST OF ILLUSTRATIONS

ABSTRACT

This dissertation explores price interdependence among the wholesale tomato markets in Northeast Brazil. The markets for tomatoes have recently increased in importance both for producers in the Serra da Ibiapaba and for consumers in the capital cities of Fortaleza, Teresina, and Sao Luis.

The markets in these cities include a range of entrepreneurs from small and poorly capitalized middlemen to large truck owners and integrated urban wholesalers with various categories between these extremes. The inherent risk involved in vegetable markets due to price variations, perishable commodities and insufficient local infrastructure determine the behavioral strategies of farmers and intermediaries.

To determine whether prices in a specific market behave interdependently with prices in other markets, the Granger causality method was applied using weekly price data for wholesale markets in Fortaleza, Teresina and Sao Luis.

The results of this dissertation support, in general terms, the conclusion that prices in the wholesale markets of Fortaleza, Teresina and Sao Luis function as integrated

markets, implying a competitive nature of the Northeast tomato market. Statistical evidence suggests that Fortaleza operates as a central market "driving" the prices of Teresina and Sao Luis.

The lack of directly contemporaneous causality between Fortaleza and Sao Luis indicated the presence of imperfections in these markets. This results were expected due to the strategies of intermediaries who increase prices as a means to cover possible payment default in Sao Luis, and the lack of bargaining power of intermediaries in Fortaleza. Also, the longer distance that separates these markets may cause price adjustment in time periods different than contemporaneous.

Other studies suggest that governments have a role in promoting competition among markets and monitoring and implementing plans created to improve the marketing system. Market imperfections in the system can be reduced by adequate market information to diminish the risk associated with intermarket trade. In the tomato markets of Northeast Brazil policies promoting increased supply during the winter season and enforcing payment of the commodities commercialized in the CEASAs are needed simultaneously with technical measures to provide high quality seeds and facilitate storage.

CHAPTER 1

INTRODUCTION

In this dissertation, the Northeast of Brazil, one of the poorest regions of the world with accentuated economic and social problems, is studied. Specifically, the market for tomatoes, that has increased recently in importance both for producers in the Serra da Ibiapaba and for consumers in the cities of Fortaleza, Teresina and São Luís will be analyzed. Analysis of price relationships and market integration can be instrumental in understanding the performance of markets in the Northeast of Brazil, especially for perishable commodities like tomatoes. The Granger causality model, used in this study, provides econometric estimates of the nature of integration among spatial separated markets.

A literature review indicates a lack of market integration research for agricultural products in Northeast Brazil. Hence, a better understanding about the performance of wholesale markets for tomatoes can be useful for specific public policies, improvements in private trade as well as encouraging competition in the markets, evaluating alternative marketing channels,

improvement of transportation facilities, providing adequate market intelligence, promoting vertical integration, and the overall amelioration in the flow of tomatoes from Ibiapaba to Fortaleza, Teresina, and São Luís.

A close relationship between wholesale prices in different markets will indicate that the marketing system for tomatoes in Northeast Brazil is competitive. Otherwise, some market imperfections could exist. Empirically, hypotheses are needed about the degree of competitiveness of the markets to be study. First, the wholesale markets for tomatoes in Sao Luis, Teresina, and Fortaleza are closely integrated, that is, market prices reflect supply and demand by the competing markets. Second, there are no large regional price differences caused by collusion or speculative and monopolistic actions of traders. Third, price differences between markets larger than transfer costs may result from factors such as: inadequate public policies; poor development of physical infrastructure; transport bottlenecks and inadequate handling facilities; poor market intelligence among producer markets and between producer and consumer markets; poor regulation of marketing practices; uncertainties raising from basic imbalances in demand and supply; and poor implementation of standard weights and

measures. The model used in this study identifies the existence of market imperfections, but it does not indicate which of the above imperfections may be present.

Objectives

General Objective : To analyze the performance of the wholesale markets for tomatoes in the Northeast cities of Fortaleza, Sao Luis, and Teresina.

Specific Objectives:

1. To describe the production and marketing system for tomatoes in the Northeast States of Ceara, Maranhao and Piaui.
2. To analyze the level of market integration for tomatoes among the wholesale markets in the Northeast cities of Fortaleza, Sao Luis and Teresina.
3. To discuss the implications of this study for future research on other agricultural products in Northeast Brazil.

Economic Viewpoints on Marketing and Development

A well-functioning marketing system is essential for the coordination of production, distribution, and consumption of goods and services. From an economic perspective the marketing process can be divided into

various functions. The marketing functions are the principal specialized activities in the marketing process and may be classified as exchange functions (buying and selling), physical functions (storage, transportation, processing), and facilitating functions (standardization, financing, risk bearing, and market intelligence). The exchange functions are activities relating to the transfer of property rights involving important social processes, particularly in less developed societies where markets play an important role in social interchange. Physical functions are activities involving the physical handling and transportation of products, and are the most important and usually the most costly components of agricultural marketing. The facilitating functions smooth performance of the exchange and physical functions. These activities are indirectly involved in the exchange of title and physical handling of products. They have been called the grease that makes the wheels of the marketing machine go round. (Kohls and Uhl, 1985, chapter 2).

Most aspects of marketing have been given relatively little attention by economists oriented to the workings of the perfectly competitive market model (USDA,1974, pp. 25-43). Marketing is incorrectly considered by these economic planners and most farmers as an accessory to production. The marketing process is supposed to adjust

automatically to the kinds and quantities of commodities produced. The supplying of farm inputs and price guarantee programs for farm outputs can be seen as production promoting policies. Agricultural planning to promote agricultural development, therefore, is usually focused on the production process. Hence, public investment has been concentrated in fertilizer plants, price support programs, and irrigation systems, rather than in positive actions by governmental agencies to provide basic services and the creation of an adequate environment for private marketing firm expansion. By means of these positive actions, marketing also can perform an active role in economic progress by shifting demand and cost functions in agriculture and manufacturing as well. Lele, (1976, pp.488- 517) argued that improving competition along different channels of marketing can potentially have a positive impact on pricing efficiency.

Another aspect to be considered, is the stereotype of existing marketing systems in low income countries as pointed out by Mellor, (1970):

> It is generally believed that indigenous marketing systems, are exploitive, collusive, economically inefficient, and operating with high profit margins... my position is that, in general, the stereotype position regarding the indigenous marketing system is incorrect and misleading in its policy implications... incorrect stereotypes

> concerning the way marketing channels operate have led to incorrect policies designed to deal with a wrongly diagnosed situation (p.12).

According to Mellor (1970), the role of government policy therefore, should be that of facilitating the operation of the marketing system through three principal ways. First, removing existing governmental constraints on the operation of the private marketing sector. Second, introducing appropriate measures for motivating increased competition. Third, promoting measures for motivating technological changes and raising private investment in the marketing sector (Mellor, (1970, pp.13-15).

Finan (1981, p.323), reinforces Mellor's general evaluation by noting that in Ibiapaba (State of Ceara in Northeast Brazil), the marketing functions for vegetables in both wholesale and retail sectors are accomplished efficiently by the middlemen. Their dedication and ingenious approaches to market problems as well as their willingness to confront long uncomfortable hours without paid holidays, made the private middlemen much more effective than the public bureaucrat representing an official entity. However, the author also recognizes the role of the public sector in the shaping of market policy, especially in facilitating transactions and in providing

market information.

Lele (1976, p.493) recognizes that, contrary to the popular view, the margins incurred by official and parastatal agencies are normally higher than those incurred by traditional middlemen, because the former often operate with high overhead costs and poor management.

Stressing the difficulties of maintaining a consistent policy of agricultural marketing, Fenn (1978, pp.365-367) claims that economic development can be retarded due to political instability introduced by sudden changes in official attitudes toward the private sector . In a state of political uncertainty, capital is more likely to be directed to rapid short-run profits from enterprises that leave no lasting benefits to the economy. A related problem is the lack of continuity in the administration of government policies through changes of staff. As a result, professional experience and talent is wasted and the standards of public administration are unavoidable lowered. Agricultural and food prices are evidently an element of immediate interest to government, but the type of governmental interventions may have a positive or negative effect on the efficiency of trade and on future investments and improvements.

Fenn (1978) accentuating some key points in

government marketing policies in the less developed countries (LDCs) made the following observations:

1- Price stability and lower marketing margins can be assisted by official measures to promote and maintain effective competition within the marketing system. The laissez-faire attitude does not necessarily allow effective competition to survive and flourish. There is likely to be unequal access to capital, and various social and political privileges may be exercised. These imperfections in the market for the factors of production, plus the scarcity of good entrepreneurs in underdeveloped countries, greatly increase the risk of monopoly situations.

2- Governments must have a continually active policy to reduce unjustified privileges and market imperfections... but government action can be decisive in numerous other ways, for example, in widening access to credit, in breaking up traders' rings, improving market transparency and helping the spread of improved technology... the government should always be ready to act as a countervailing power against big business trust and monopolies and to sustain effective competition in the market.

3- It sometimes happens that more efficient technology and organization lead rapidly toward monopoly instead of toward perfect competition. This is when such large investments and operations are needed that the market is too small to support more than one or few separate enterprises. Then, unless the government is directly involved in the operations, it must have powers to ensure that facilities are used in the public interest and that the enterprise fits in with the wider development of marketing services.

4- The supporting services and aids such as credit, advice, farm inputs, market research and grading are important.

5- Education and training facilities are also of fundamental importance.

> 6- A special need of new marketing enterprises is obviously a supply of managers and staff with technical training in such matters as accountancy, engineering, refrigeration, food technology and retail management. In a developing economy, the supply of such skills normally lags behind the demand, and local enterprises are at a disadvantage in competing for staff with larger international companies.
>
> 7- In practice, government administrative and technical staffs sometimes seem to maintain an attitude of indifference or even hostility toward entrepreneurs and their activities, regarding them rather as the natural opponents of the public sector in marketing. In this atmosphere, much can be lost through unnecessary obstructions that damage confidence and understanding. Conversely businessmen often lack a proper understanding of government needs and responsibilities and fail to recognize their own social obligations to cooperate in national policies (p.366).

Reinforcing partially the Fenn point of view, Adams and Graham (1984,pp.313-328) argued that in traditional agricultural credit projects with subsidized credit to agriculture usually involving negative real rates of interests on loans and, consequently, low rates of interest on rural savings deposits, can generate significant inflationary pressures because of excess demand caused by additional money supply. Also, the subsidization, by taking away resources from priority areas like basic infrastructure (to reduce the costs and risks of marketing), agricultural research, and amelioration of rural education, has been obstacle to reaching development goals.

Lele (1976, pp.488-517), in discussing optimum pricing and marketing strategies in rural development, argues that setting prices for a large number of crops is neither necessary nor desirable. Also, she emphasizes the need for developing the domestic professional and institutional capability to determine appropriate price levels. Besides, the author stresses the need for developing the capability to reach the government goals in pricing and marketing and to make the investments indispensable to improve that capability. Finally, she stresses the central role that the traditional trading sector can play in performing the pricing and marketing functions through the motivation and improvement of the cooperative sector.

Fox (1979), stressing the impact of Brazil's minimum price policy on the agricultural sector of Northeast Brazil, concludes that trying to stabilize producer incomes by stabilizing prices can be only partially effective because random variations in output contribute significantly to income variations. Also, the author adds that basic staple crops such as beans, corn and manioc are in need of special attention because of their significant price risks, their importance in small-scale production and in the diets of the poor, as well as the insignificant participation of these crops in the program in the past.

Finally, he emphasizes that in a market, such as Brazil's, where market forces operate within governmental direction, minimum prices can be important in conducting production credit programs, storage loan programs, and official purchases for the objective of regulating stocks.

Abbott (1978 pp.323-324), emphasizing the basic conditions for agricultural development, has recognized three essential conditions for market demand to perform its full incentive effect on production:

1. Reasonably stable prices for agricultural products at a remunerative level.
2. Adequate marketing facilities.
3. A satisfactory system of land tenure.

According to Abbott, farmers are going to be motivated to increase production or improve its quality only if they have assurance that prices will bear some minimum relationship to costs. Also, the marketing system should insure that increasing urban demand, stabile prices, and differentials for quality at the processing or consuming level are represented in cash receipts of the producer and are not lost in the marketing channel. Furthermore, farmers will be unwilling to increase and improve production unless they have reasonable security of tenure (Abbott, 1978 pp.324-329).

The seasonal concentration of output, difficulties in adjusting production to demand, because of the

uncertainties of weather and yields, and the relatively low price elasticities of demand for basic farm food products cause a strong tendency towards price instability in the marketing of agricultural products. As argued by Abbott (1967, pp.6-8), price fluctuations are severe in LDCs countries because most producers are forced to sell at once or even before the harvest to meet basic living expenses or to repay debts.

Government attitudes toward agricultural marketing often emphasize marketing efficiency in terms of cost-reduction mechanisms or improvement of physical distribution facilities without attention to the extent to which externalities affect the marketing process. The marketing firm is influenced critically by organizational, operational, and institutional changes among its sellers as well as buyers. Changes in the economic structure of its suppliers or customers may have important implications for the individual marketing firm. Identically, the structure and conduct of competing marketing firms can be an significant factor determining actions of individual marketers. Also, the actions of public sector have an significant external effect on all sectors of an economy. Particularly, public policies about the terms of exchange, the regulation of competition, and marketing infrastructure are essential external factors affecting

the whole organization of the marketing system. The crucial need is for a set of development strategies which recognize and utilize such externalities in creating a chain reaction in the marketing system which is going to lead to the kind of organizational, operational and institutional improvements among marketing operators that will contribute to general economic growth (Collins and Holton, 1964, pp. 363-366).

According to Farrel (1970,p.57), the marketing firm is critically influenced by organizational aspects of the marketing system, the nature or structure of the market, the nature of competition, and a large number of institutional factors. Market organization is a general term comprising market structure, conduct and performance, three generally recognized components of market organization.

Evaluating Performance in Marketing

There are several methods for measuring performance of a marketing system. A micro measure of performance, to determine how well a marketing firm, is functioning, may be relatively simple and quantifiable. For instance, in a transportation firm performance might be measured by the cost per ton mile of moving a specific commodity from the farmer to the wholesaler. As better roads and more

adequate trucks are introduced with improved on and off loading arrangements, ton mile costs can be reduced, and it should be possible to measure the improved performance. Other factors affecting transportation charges besides the operating costs of a firm are government policies which restrict importation of additional trucks or local tax collections on trucking (USDA, (1974).

In a macro-measure of marketing performance, one looks at the whole marketing system instead of the activities of a specific firm or group of them. The macro view considers the performance of all business activities involved in the forward flow of food and fiber from farm producers to consumers. Assemblers, processors, wholesalers, and retailers collaborate with farmers in the flow of goods from farm producers to consumers. Value is added at each stage. The functional approach helps to see what must be done as well as simplifies a complex economy and shows some similarities between institutional and functional approaches. Groups such as retailers, and processors are each involved in buying and selling. Further, each group faces the physical problems of storage and transportation and the facilitating problems of financing and risk bearing, (Rhodes, 1987, pp.8-9, and USDA, 1974).

Usually, societal and firm objectives are in

conflict. For instance, a farmer or a retailer selling tomatoes may view the system for tomatoes marketing differently from government officials who are concerned with consumer nutrition or consumer income.

Two common measures used to evaluate marketing performance are: first, the farmer's share of the consumer's food expenditure, and second, the gross marketing margin. The gross marketing margin may be low because marketing activities are being execute at low cost. But, the margin also may be low because the marketing system is supplying few services. It also is possible for farmer's share to remain constant while prices paid by consumers and services provided are rising. Thus, objective measurements of prices and margin as reflections of costs become extremely important inputs in marketing efficiency considerations. The costs of performing particular marketing activities must be evaluated in terms of the prices of the inputs, such as labor, containers, raw materials, etc. Profits in excess of opportunity costs, i.e., in excess of what could be earned in their next best alternative, are extra normal. They are a source of inefficiency in the marketing system because they restrain the flow of scarce resources, and are regressive since the price of the commodity in consideration is artificially raised. Hence, more consumer

income is spent for the good than would be the case in the absence of the extra normal profits, and total consumer satisfaction is less because other goods desired cannot be purchased with a reduce income.

Efficient marketing can be defined as optimization of the technical input-output coefficients ratio. Each marketing firm or organization of firms such as, a meat processor, a commission man, or organization of firms are using as an input resources that are costly and scarce. Each attempts to develop and adopt new technology and different organization that may be cost reducing. Each hopes to find a satisfactory solution as to how to combine these inputs to secure a satisfactory output. Savings in inputs such as labor, materials, or equipment needed per unit of ouput as consequence of improved marketing methods might be possible by larger volume of operations. However, scale economies often refer to implementing similar methods on a larger scale rather than scale economies due to technical change. According to Weiss (1971,p.52), scale economies in food marketing in LDCs refer specifically to more efficient information gathering and transportation with larger vehicles. For instance, small marketing firms often use pickups for lack of capital where trucks are more efficient. Larger firms also also cover wider areas, reducing volume of trade uncertainty as

well as using fixed resources more efficiently. Vertical integration, in the sense that intermediaries are eliminated because of more direct purchasing, reduces the number of small inefficient firms and fosters innovations. In short, pricing or economic efficiency is concerned with improving the operation of the buying, selling, and pricing aspects of the marketing process. The best measure of the satisfaction consumers obtain from the marketing system's output is what they are willing to pay for it in the market place.

The commercialization functions, which transfer commodities and ownership from producers to consumers, involve the essential role of efficient price formation as a result of the interaction of supply and demand. In this communication process, prices are constituted and these prices change up and down in reaction to moves in the underlying supply and demand forces. In this sense, prices, as expression of desires of consumers and producers, become the main barometer of economic activity (Bressler and King, 1970).

Market prices, reflecting space, form, and time defferences (assuming competitive market structure, rational preferences, homogeneous commodities, perfect knowledge and no barriers inhibiting trade) differ between regions because of the transfer costs involved in the

movement of goods and services. If markets are poerating efficiently, prices of a commodity will be related over apace, and time, and among forms. For example, the prices of a product in different regions will move toward each other until they differ by no more than the cost of transfer, which includes loading, handling and transportation charges. In short, closer movement of prices between markets implies close integration between them (Tomek and Robinson, 1981, and Stigler and Sherwin, 1985).

Knowledge about the Northeast agricultural sector jointly with government actions directed to improved the marketing system are important for a better understanding of how these markets work. Differences between Northeast and the rest of Brazil wil be study to visualize regional and national differences with some socio-economic implications.

Plan of the Study

Chapter 2 outlines the regional setting and analyzes some regional differences between the Northeast and Brazil as a whole. Also, it describes marketing policies and programs on a regional level. The information in Chapter 2 is included seeking a better understanding of the Northeast region as well as to outline the government's

role in creating institutions with specific functions directed to improve the marketing system in the region. The brief review of the regional programs shows the government's focus on the needs of the low income population and to what extend these programs have supported the marketing systems. Chapter 3 gives an overview of the marketing system in the Micro-Region of Ibiapaba. General characteristics of the small and large markets are discussed. The marketing flows from Ibiapaba to the regional wholesale markets are delineated. Finally, specific local public policies are discussed. Chapter 4 presents the economic theory of market integration and traders' performance. Also, the Granger causality approach to testing market integration among markets is presented. Chapter 5 contains the empirical analysis of the wholesale markets' performance. Chapter 6 relates the results of the study of the Northeast of Brazil's tomato market. Chapter 6 concludes with recommendations for improving the degree of competition of the Northeast private marketing sector using the results of this dissertation and secondary information.

CHAPTER 2

REGIONAL CHARACTERISTICS AND MARKETING AGENCIES IN NORTHEAST BRAZIL

The Regional Setting

The Northeast region, according to the geographic division of Brazil established by Brazilian Institute of Geography and Statistics (IBGE, 1968]), includes nine States of the Union: Maranhao, Piaui, Ceara, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas, Sergipe, Bahia, and the island Territory of Fernando de Noronha (Figure 1). In area, the Northeast is more than five times as large as the State of Arizona with 1.6 million Km^2 or 18.2 percent of the country's overall land area. Three-fifths of the region is situated in the Semi-Arid zone (IBGE, 1968).

Some 35 million people or 29 percent of Brazil's total population, live in the Northeast and the average population density of the region was 23 inhabitants per square kilometer in 1977, about 65 percent higher than that of the country as a whole. The Northeast population is equally distribute between the rural and urban areas, and according to IBGE Census (1980] the rural population with the exception of Maranhao, decreased between census

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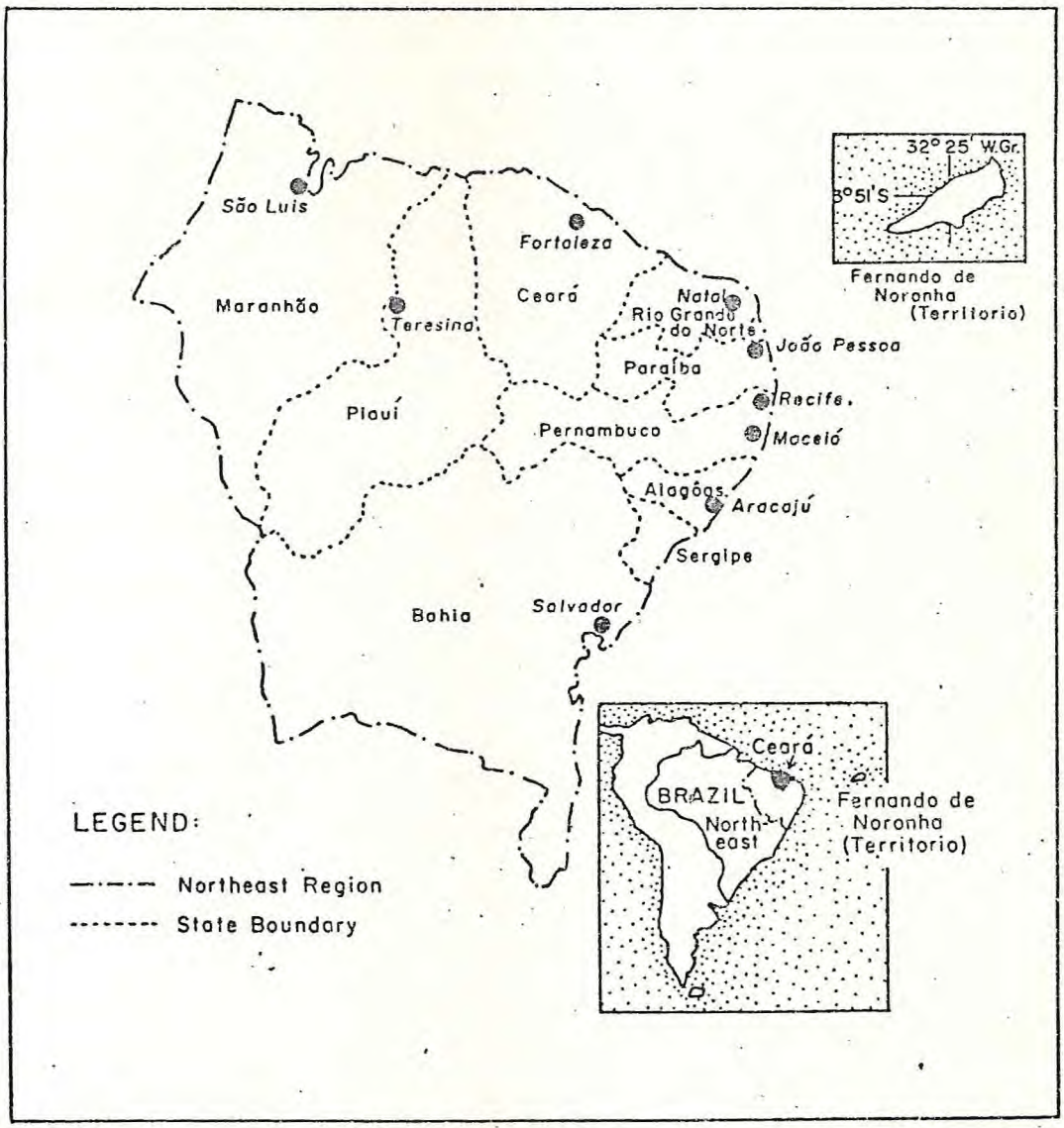

Figure 1. The Northeast Region.

periods for the first time in history. This decrease is explained, at less in part, by the rural exodus during the 1970s when the grow of the economically active population in the agricultural sector was only 0.75 percent per year while the industrial and services sectors grew at a rate of 6.8 percent and 5.5 percent respectively. On the other hand, urban population growth is notable in all the Northeastern States. The rural migration is often due to drought pressures, inter-regional and intra-regional seasonal migration, and insecure land tenure situations. The direction of the migratory flows is frequently toward the cities in the Northeast, Southeast or on the agricultural frontiers of Maranhao and Mato Grosso.

The Northeast is heterogeneous in topography, climate, vegetation and socioeconomic characteristics. Though there are areas of fertile soils throughout the region, generally the soils are poor in nutrients essential for highly productive agriculture. Climatic conditions are complex due to the uneven distribution of rainfall and duration of the dry period. (World Bank, 1983 p. 14-16).

The Agricultural Sector

The Northeast of Brazil rural structure has latifundia-minifundia characteristics. Half of the 80 million hectares of agricultural land is concentrated in farms larger than 500 hectares. Basically, 99 percent of the labor force does not have entrepreneural access to nearly 70 percent of the agricultural land. The smallest farms (less than fifty hectares), produce up to 100 times more output per hectare than the largest. Small farms apply twenty-five times as much labor per hectare as the largest and obtain higher productivity levels (Kutcher and Scandizzo, 1981).

Crops account for the greater part of agricultural production in the Northeast, and 47 percent are represented by rice, corn, beans and manioc (Table 1). Cotton and perennial or tree crops such as sugar, cocoa, babacu, and carnauba (varieties of palm) are exported and contribute about 38 percent of the value of crop output; the remaining 15 percent is constituted of fruits and vegetables that are perishable and have high income elasticities but restricted markets within the Northeast.

The composition of crop production gives the first insight about the stagnation of Northeastern agriculture. The export crops face marketing problems; for instance,

Table 1. Northeast (NE) and Rest of Brasil (BR): Cultivated Area, Production and Yield, selected crops, 1980.

Crop	Area (ha) (1,000)		Production (t) (1,000)		Yield (kg/ha)	
Basic Crops	NE	BR	NE	BR	NE	BR
Beans	1,791	14,643	501	1,968	280	423
Corn (grain)	2,760	12,601	1,133	21,865	411	1,735
Manioc	1,293	2,016	13,324	23,466	10,305	11,640
Rice	1,568	6,016	1,977	9,718	1,261	1,615
Industrial Export/Crops						
Cocoa (nuts)	438	483	302	319	690	661
Cotton (1)	2,073	2,073	243	243	117	117
Sugar Cane	1,026	2,608	47,935	148,651	46,726	57,006
Babacu (nuts)			207	251 (2)		
Carnauba (wax)			19	19 (3)		
Vegetables						
Tomato	12	50	279	1,535	23,681	30,643

-Source: Instituto Brasileiro de Geografia e Estatistica-IBGE, 1983.

(1) Tree-like.

(2) Production value (Cr.$1000) Northeast 3,203,824; Brazil 3,938,404.

(3) Production value (Cr.$1000) Northeast 1,070,486; Brazil 1,070,486.

cotton because it compete with synthetics, sugar because of international marketing barriers and strong competition from more efficient southern Brazilian farmers, and cocoa because of inelastic world demand. The subsistence crops are inferior goods, produced for home-consumption on the farms or for the local market because their quality is inadequate for exportation. Vegetables, like tomatoes, are perishable and consequently present high risk to marketers (Kutcher and Scandizzo, 1981).

Regional Differences

Furtado (1963, p.265), Baer (1965, pp.150-191) and others argued that the Northeast had to be treated as an integral part of Brazil and its deteriorating economy as part of a national, rather than regional problem. These authors recognized that the Northeastern economy, dependent on sugar and cotton exports to foreign markets as well as foods imports from the Center-South, had been disadvantaged by overvalued exchange rates so that the cruzeiro yield of Northeast's exports did not rise as fast as the cost of its imports and high rates of inflation, a combination that led to a severe deterioration in the interregional terms of trade. This led to underinvestment in Northeastern agriculture and a steady capital outflow to the more dynamic regions.

According to the World Bank (1983), the Northeast lagged behind the rest of the country in a number of development indicators, as can be seen in **Table 2.** In 1979, the per capita income of the Northeasterns was around 40 percent of the national average and over 70 percent of the families in the region were considered poor. Further, almost 1/2 of the Northeasterns with more than 5 years of age neither know how to write and read nor have access to any kind of sanitary device.

Government Regional And National Marketing Agencies in the Northeast

Many regional and national government agencies, directly or indirectly, are involved in the marketing system of the Northeast. To deal with single commodities there are, for instance, the Sugar and Alcohol Institute and the Coffee Institute. There are other agencies to perform a single marketing functions. For example, the National Supply Superintendency (SUNAB) was created to deal with the supply of agricultural products. Similarly, other agencies concerned with supply of agricultural goods were created as subordinate to SUNAB but normally function as independent agencies. Among these are the Brazilian Warehousing Company (CIBRAZEM), which deals with storage; the National Agricultural Market Information Service

Table 2. Northeast and Rest of Brazil: Some Socioeconomic Indicators 1979 or 1980

Indicator	Northeast	Rest of Brazil
Land Area %	18	82
Population %	29	71
Per Capita gross domestic product (current US$ 1979)	793	2002 (a)
Infant Mortality (b) 1978-74	122	89 (a)
Poverty Families (c) (% total families) 1979	74	42
Literacy (% population> 5 years) 1980	48	77
Access to (d) sanitation (% total population) 1980	48	87
Adequate Diet (e) (% total population) 1974-75	21	38

a-Data refer to national average.
b-Deaths of infants aged 0-12 months per 1000 live births.
c-Families earning the equivalent of two or less minimun wages per month, including income in kind.
d-Population of homes with any sanitary device (latrine, septic, tank, etc.)
e-Diet satisfying FAO/who low calorie requirements

Source: World Bank [1983] Brazil. An Interin Assessment of Rural Development Programs for the Northeast. Washington,D.C.

(SIMA); the Production Finance Company (CFP) administers the minimum price program; and the Brazilian Food Company (COBAL), a subsidiary parastatal company, has shifted its emphasis from direct participation in the retail marketing of agricultural products in competition with the private sector to one of support to small private operators. According to the World Bank (1982, p.50), in 1972 COBAL was made the executive agency for the establishment and coordination of National System of Supply Centers (SINAC). This network consists of several state-level Supply Centers (CEASAS), nonprofit corporations jointly owned by COBAL and similar agencies of the state and municipal authorities. CEASAs are basically central wholesaling establishments that function as a connection between rural and urban marketing agents as well as providing sales stalls, weighing and grading services, packing materials, and collection and distribution points for pricing of fruits and vegetables from other markets. Private wholesalers and retailers pay a fee to cover the costs of the services received; the overhead, however, is financed by government transfer.

The wholesale and retail market centers are linked to rural producer markets (MEPROS) located in horticultural producing areas. The producer markets were constructed where marketing infrastructure has been a major bottleneck

interfering both with quality and quantity of production. Technical assistance on grading and packaging is given to producers and price information from other markets is provided. Thus, both the CEASAS and MEPROS have been contributing to the creation of marketing standards, price information, and competition among middleman and merchants to benefit producers and consumers. The CEASAS also accomplish the task of assisting retailers in poor neighborhoods furnish staple goods at low cost and selling under COBAL's own brand name, SOMAR (World Bank, 1982,p.51).

The Northeast Development Superintendency (SUDENE) was established in 1959 to fulfill the need for technical guidance for a number of development activities in the Northeast. SUDENE is theoretically involved in activities that influence marketing across many programs. In practice, however, SUDENE has assumed a more limited view of its role in marketing, restricting its preoccupation to the agricultural production sector. SUDENE's division of supply has the general responsibility for organizing and instituting programs in agricultural marketing as well as the distribution of modern agricultural inputs to farmers and the organization of producer cooperatives for the sale of agricultural commodities and purchase of modern farm inputs (Slater et. al,1969, pp.2-29).

The two agencies most prominent in Northeast marketing have been SUDENE and SUNAB. However, the fact that SUDENE's 34/18 funds (system of fiscal incentives which enable Brazilian corporations to reduce their tax liabilities by up to 50 percent by making deposits in a special fund used for private investment in the Northeast in projects approved by SUDENE) are not available to urban food marketing firms suggests that not enough importance has been given to the real urban consumer income that might be generated by promoting enlargements in scale and improvements in the efficiency of urban distribution enterprises.

SUNAB, on the other hand, deals with problems in the marketing sector, primarily the regulation of prices at retail and wholesale levels, motivated by anti-inflationary and political considerations (Slater et. al, 1969, pp. 2-33). Empirical evidence, indicates that firms which have been able to enlarge the scale and efficiency of their operations have maintained consistently lower prices than have enterprises without similar management or access to investment capital.

Both SUDENE and SUNAB, through the Production Finance Company (CFP), have been trying to enlarge the number of agricultural products covered by the minimum price support program for Northeast producers. One

important point, however, is whether price controls at the wholesale level are preferable to direct promotion, including the provision of official financing of more efficient wholesale operations.

Concluding Observations

In Northeast Brazil, which has a population of about 35 million of whom 50 percent live in rural areas, agricultural productivity is relatively low and rural per capita incomes are considerably lower than the regional average (Kutcher and Scandizzo, 1981) Generally, poor soils, periodic droughts, and highly unequal distribution of land add to the difficulty encountered in efforts to reduce the high degree of poverty still existing in the region. Socioeconomic indicators emphasize clearly the disadvantaged position of the Northeast with respect to Brazil as a whole.

While the Government, in setting its agricultural policies, is pursuing multiple objectives, increasing emphasis is being placed on raising income levels of the rural poor. In the process, there has grown up over time a complex and ever-changing myriad of specialized government agencies, semi-autonomous institutions and enterprises to administer a vast number of programs involving an even

greater array of specific market interventions with frequent changes in both mode and direction.

Considering the marketing of agricultural products as an important part of regional development, it is crucial to obtain, through a more programmatic approach to sectoral policies, agencies and programs, a more efficient performance of Northeast marketers at several levels.

In the next chapter marketing system in the micro-region of Ibiapaba, the growth of production and marketing, and changes in organizational structures are discussed.

CHAPTER 3

THE VEGETABLE MARKETING SYSTEM IN IBIAPABA, CEARA

The Development of Ibiapaba Agriculture

This chapter focuses on the vegetable production and marketing system of the Ibiapaba microregion, situated in the Northwestern part of Ceara, along the border of the State of Piaui. The region includes seven municipalities (Carnaubal, Guaraciaba do Norte, Ibiapina, Sao Benedito, Tiangua, Ubajara, and Vicosa do Ceara), which in total cover about 4,800 square Km or 3 percent of the state's territory. Ibiapaba is one of the priority regions within the federal Development Program for Integrated Areas in the Northeast (POLONORDESTE). It is a highland plateau that extends about 100 Km in a north-south direction and about 50 Km east-west. Temperatures average about 26 °C in the lower areas and 22 °C in the higher areas with little fluctuation during the year. Annual rainfall levels average from 1,000 mm to 1,900 mm in the more humid eastern side. Most rainfall (90 percent) occurs during the period December to June. Soils in the area are variable, but in general of moderate to low quality. Deep and light sandy soils with low water and nutrient retention capacity

and relative high acidity predominate. As a result of these three factors, the micro region can be divided into three agricultural zones: the western part (Carrasco) corresponding to about 70 percent of the area, and having moderate to poor agricultural potential; the central part comprised of humid and subhumid zones, covers about 20 percent of the area and has generally good agricultural potential; and the lower part (sertao), east of the escarpment, accounts for approximately 10 percent of the area and has limited agricultural potential (World Bank, 1977, pp.4-5 and Centro de Treinamento em Desenvolvimento Economico Regional-CETREDE, 1976).

According to Finan (1981, p.62), in the beginning of this century, minimal improvements in transportation infrastructure and the penetration of market forces into the Serra da Ibiapaba motivated the growth of a money economy and a merchant capitalist class. Fontenelle (1969) suggests that the capitalist elements introduced by the early development in the agricultural system of Ibiapaba interacted with the pre-capitalist base to create a hybrid system of production and distribution. Within the same economy there coexisted a capitalized coffee agriculture, a strong merchant class, absentee landlordism, along with sharecropper relationships, strong patron-client ties, and a poorly capitalized subsistence farming class. The

reduction in the physical isolation of the region increased the participation of the peasant producer in a market system, a regional trade network was established with the sertao in which the highland fruits, brown sugar blocks (rapadura), sugar cane rum (cachaca), manioc flour (farinha), were sent to the sertao in exchange for cowpeas, beans, manure, squash, cattle, and smaller livestock.

The Serra da Ibiapaba micro-region is located strategically with respect to the largest consumption centers of the Northeast. The main highway BR 222 (National) links the North and Northeast. Also, the paved State road CE-75 crosses the plateau from south to north. Besides, there are several gravel feeder roads linking, at least in summer season, several municipios as showed in Figure 2.

In 1976, the population of the micro region was estimated at 194,000 with a population density of about 40 per square km. Approximately 80 percent of the population is concentrated in rural area. Of more than 9,000 landholdings, more than 5,000 are less than 10 hectares, more than 3,000 are between 10 and 50 hectares, while the rest are more than 50 hectares (World Bank, 1977, Annex 1,p.5).

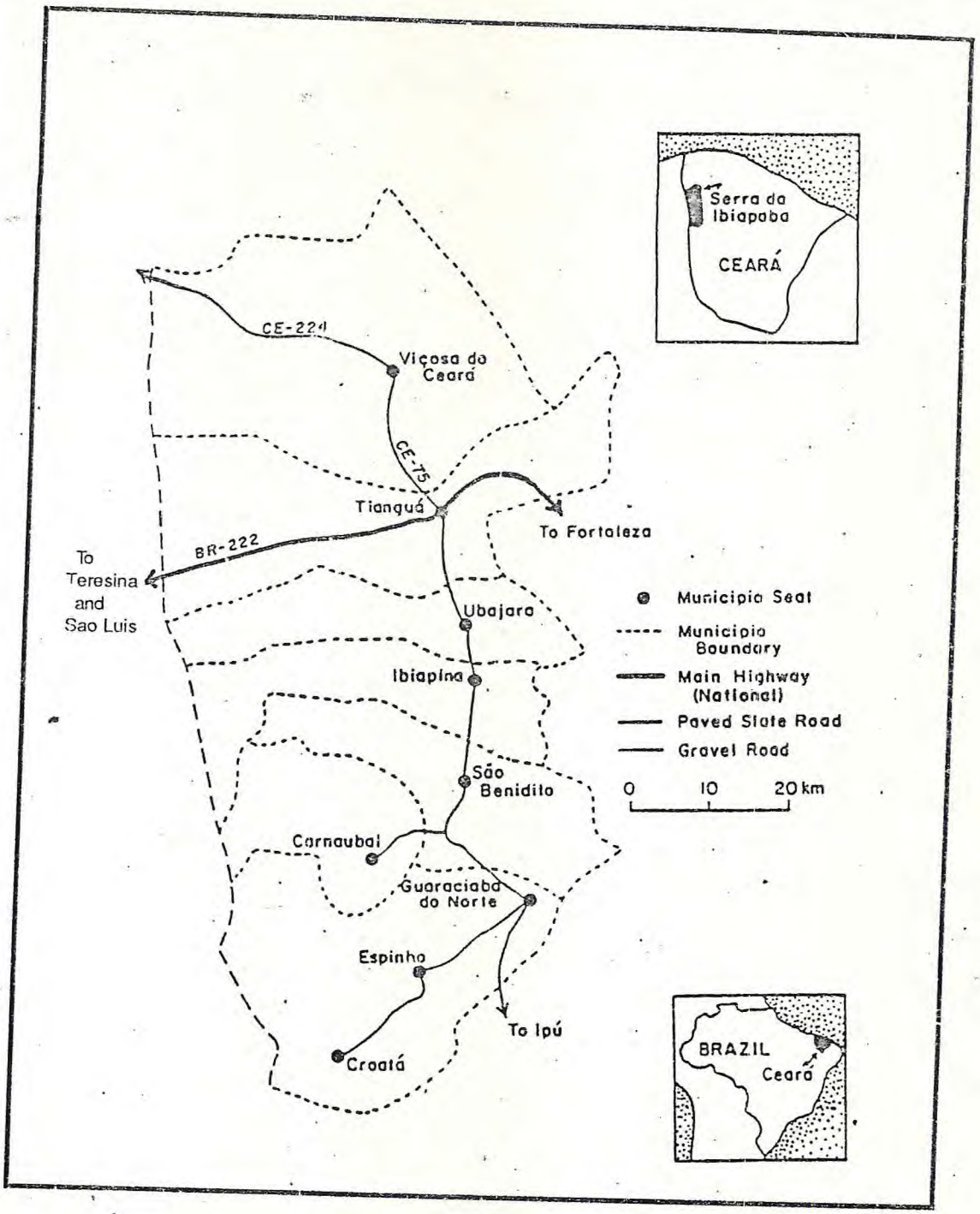

Figure 2. The Serra da Ibiapaba.

Ibiapaba has a minifundia structure of land ownership due to immigration from the sertao during times of severe drought. This phenomenon increased the Serra population and the pressure for land. Also, the fragmentation of land due to inheritance rules furthered the tendency toward small properties. For this reason, the producers of Ibiapaba were motivated to adopt intensive agriculture such as that which accompanied the introduction of vegetable crops during the 1960s.

Around 1965, the rural extension agency in the Serra da Ibiapaba began to promote the production of commercial vegetable crops in the humid zone. A small number of landowners began moderate experiments in growing tomatoes for the urban market of Teresina, capital of the state of Piaui. By 1978, annual production in Ibiapaba had reached 15,000 metric tons of tomatoes, mostly from small farms. This production supplied the urban markets of Teresina, Sao Luis, Fortaleza, and Belem as well as other smaller urban centers throughout the region. Vegetable growing diversified, and the Serra region became a principal supplier of green peppers, carrots, cabbage, chuchu, beets, and passion fruit (maracuja, passiflora).

Although tomatoes can be cultivated throughout the year, the dry season is more favorable because of better water control and a lower incidence of insects and

diseases. During the dry season, the producers grow the tomatoes in the lowlands using available streams for irrigation. In winter, tomatoes are grown on a smaller scale, primarily in the higher lands to avoid over watering from strong winter rains. As a consequence, the supply of tomato varies in a seasonal pattern, reaching its peak in the summer dry period and decreasing during winter season due to technical difficulties of production (CEASA-CE, 1979).

The introduction of vegetable crops in the Serra da Ibiapaba has intensified the use of land and the application of modern inputs such as chemical fertilizers and pesticides. The introduction of an intensive culture in the region has also increased the need for production credit to finance input costs. At the same time, vegetable production has involved the producer in problems of marketing. Given the high seasonality and perishability of most vegetable products, tomato producers face a instable marketing system, characterized by high risks associated with supply variability.

The Development of the Vegetable Market

Based on Finan's (1981) study, the municipios of Guaraciaba, Tiangua, Ibiapina, Ubajara, and Sao Benedito are the principal suppliers of tomatoes. Vegetable

production began around 1965 in the municipios of Ubajara and Tiangua. In the initial stages, there was no existing distribution system for the marketing of the first harvests of tomatoes. The major long-distance market contacts of that time were to Teresina, the capital of the State of Piaui. Small-volume middlemen, called "maloqueiros", transported rapadura, cachaca, and various fruits, distributing them in several retail public markets (mercados publicos) around Teresina. These maloqueiros first responded to the marketing needs of the Serra vegetable farmers. Due to the small-volume nature of transactions, the unspecialized enterprises, and the competitive structure of the public market retail system in Teresina, few modifications in the traditional structure were required. The supply of tomatoes in Ibiapaba expanded quickly,and middlemen began to try other markets such as Sao Luis and Fortaleza.

The Fortaleza tomato market had been supplied from the Serra de Baturite, nearby highland region the Serra de Baturite, during the summer, and from faraway Sao Paulo during the rainy season. The Sao Luis tomato market had been furnished in part by a meager local production and partially from Sao Paulo. The need to deal with large wholesalers from the South favored the emergence of similar large volume marketers in Fortaleza and Sao Luis.

Official efforts in the marketing sector also contributed to development of the Ibiapaba market system. Beginning in 1972, the network of CEASA's was inaugurated in the urban centers of Fortaleza, Sao Luis, Belem, and Teresina. These central wholesale markets, in theory, were designed to concentrate the whole process of the wholesale distribution of fruits and vegetables in a single point. The traditional vegetable wholesalers who operated in several public markets around each city were forced to relocate in CEASAs and to adhere to CEASA regulations.

Policy-makers felt that the centralization of wholesale activities would help to improve competition among intermediaries and merchants, keeping wholesale margins at a reasonable level, and benefiting both farmers and consumers in the vicinity. Such competition also would help coordinate the flow of fruits and vegetables throughout the entire Northeast, since improved market information among urban centers would channel produce to the CEASA reporting the maximal prices.

Official efforts in the marketing sector also extended out into the Serra. In 1977, the Ibiapaba farmers' market (MEPRO) was inaugurated in Tiangua. The MEPRO was administered from the CEASA in the capital city of Fortaleza and tried to concentrate and guide rural assembly activities by offering farmers and intermediaries

a physical location where public prices and market assistance were available to all users.

Ibiapaba Market Structure

Vegetables from the Serra da Ibiapaba are marketed in several directions, principally to the states of Ceara, Piaui, Maranhao, and Para. The other Northeast states are supplied principally by two other big areas of production, one located in the State of Paraiba, and the other between the States of Pernambuco and Bahia. Tomato production and consumption markets in Northeast are outlined in Figure 3.

The vegetable marketing system in the Serra da Ibiapaba is comprised of an intricate network of middlemen, farmer-merchants, and truckers, each one generally specialized in specific crops and specific markets.

The annual volume of tomatoes commercialized in the CEASAs and the percentual share of Ibiapaba production region in these wholesale markets is presented in Table 3. These wholesale markets are the principal selling centers of tomatoes produced in the Serra da Ibiapaba. However, there are other areas in the Northeast region as well as several states of the Center-South supplying these urban populations.

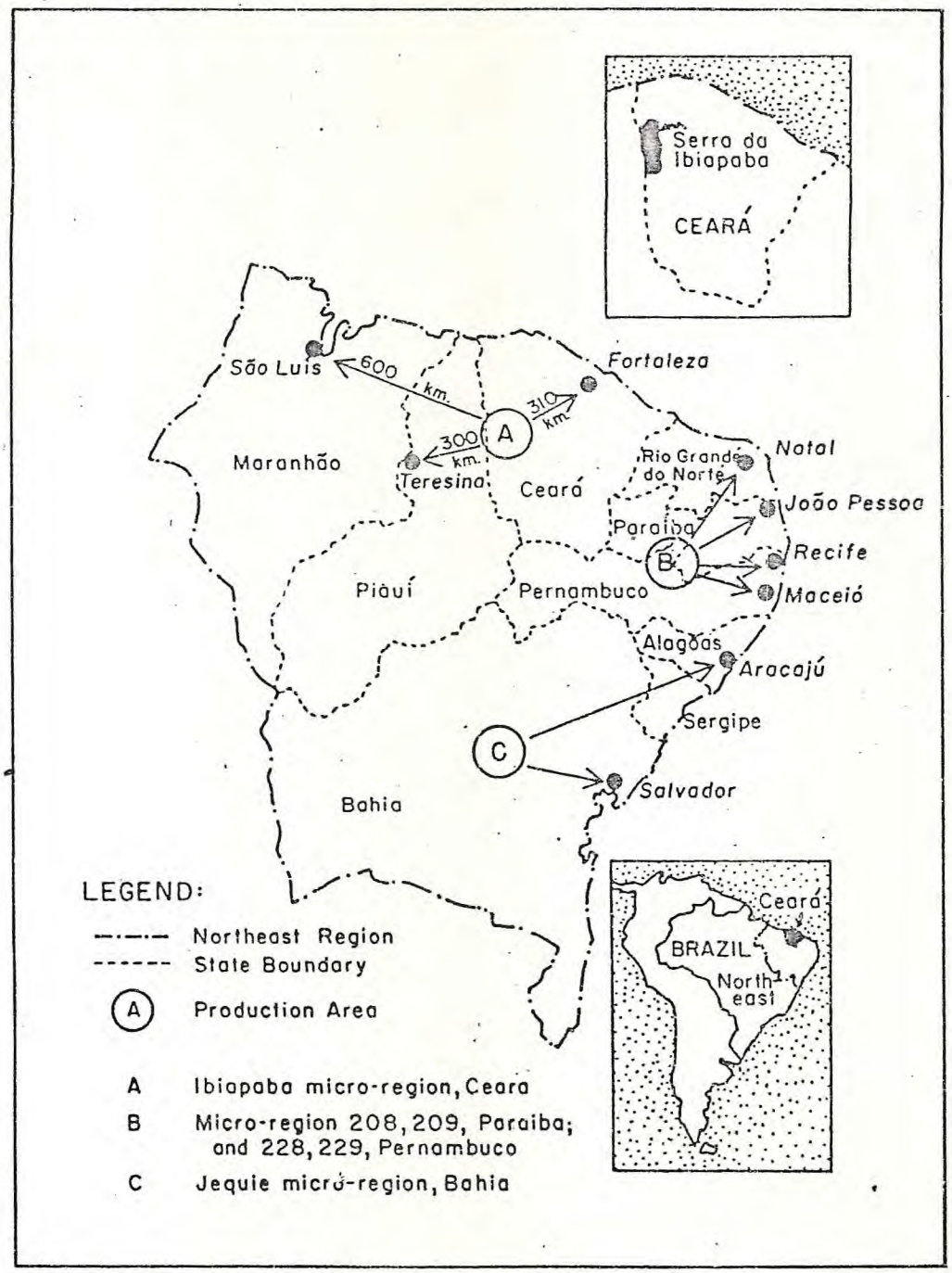

Figure 3. Production of Tomato Areas and Consumption Markets in Northeast, Brazil.

Table 3. Estimated Annual Volume of Tomatoes, in Metric Tons, Commercialized in the CEASAs of Teresina, Sao Luis, Fortaleza, and Belem and the percent (in parenthesis) Share of Ibiapaba Production Region in these Wholesale Markets.

year	Teresina	Sao Luis	Fortaleza	Belem
1974	1,302	618	1,181	474
	(92)	(54)	(19)	(14)
1975	1,327	604	2,441	984
	(96)	(67)	(34)	(19)
1976	1,870	760	6,352	2,098
	(98)	(74)	(68)	(32)
1977	1,869	971	6,444	966
	(92)	(75)	(72)	(13)
1978	2,080	2,541	9,240	1,870
	-	-	-	-
1979	2,625	2,826	10,220	2,003
	-	-	-	-
1980	2,139	2,029	7,749	3,842
	-	-	-	-
1981	2,750	3,317	12,297	11,389
	-	-	-	-
1982	3,288	4,597	13,814	10,954

Source: Weber et al. (1978) and Departamento Nacional de Obras Contra as Secas-DNOCS (1981-82).

Note: Data to calculate percentage share not available for the years 1978-82.

The principal market for Ibiapaba tomatoes is Fortaleza, followed by Teresina, Sao Luis, and Belem. Fortaleza and Belem markets had substantial market shares in 1981-82, but all the markets presented a positive consumption trend. The average monthly consumption of tomatoes in Teresina for 1982 was more than 274 metric tons; 384 in Sao Luis; 1,151 in Fortaleza; and 913 in Belem.

Description of Regional Production and Marketing Characteristics

In the humid and sub-humid zones in Ibiapaba, the production of vegetables and coffee represents more than half of the total production value of the region. Vegetables are produced on medium and small farm and coffee production is localized on relatively large farms. In 1976, about 1,600 vegetable farmers produced around 6,360 tons of products of which tomatoes constituted about half. To the tenants and small producers, vegetables product represents about 80 to 90 percent of total farm revenues. Therefore, the price and market conditions for tomatoes and other vegetables are important variables in determining the farm income levels (World Bank, 1977, and Weber et al. 1978).

The sections that follows provide a general delineation of the type of market organization which distribute Ibiapaba product to the alternative urban markets.

Marketing Flow from Ibiapaba to Teresina

Teresina, capital city of the State of Piaui, had an estimated population of 323,688 inhabitants in 1977, and is situated a distance of 300 Km from the Ibiapaba micro-region. The flow of vegetables from the Serra da Ibiapaba to Teresina has more traditional characteristics than the other markets under study. Small-volume maloqueiros still supply this market. The middlemen perform several market functions: look for plantings, bargain with the farmer, control the loading of the truck, escort the load to Teresina, sell to retailers at CEASA, and furnish short-term credit to their numerous retail customers.

The maloqueiros de mil quilos (small intermediaries of one thousand kilos) buy directly from the producer at the farmgate or in MEPRO. Because of the Ibiapaba farmers' small scale of operation, the middlemen rent truck space. Thus, several maloqueiros travel together in the same truck, their loads separated and identified with marked crates. The truck owners also market their own product, in

small amounts like their colleagues, preferring to rent out the rest of the space for freight fees.

The maloqueiros travel to the Teresina market twice a week, once at the beginning and once at the end. On the day before the journey, the marketers in Ibiapaba collect their vegetables and pack them in crating materials at a pre-determined place. The amount of time needed to ready the vehicles is generally more than one afternoon. At night, the truck is readied for travel, and the journey to Teresina begins. On arrival at CEASA, each maloqueiro's cargo is unloaded and set up for resale. At four o'clock in the morning, the gates are opened and a mass of retailers hurry forward to make their purchases. By mid-morning, that market day is concluded.

Despite official efforts to establish a strong wholesale sector in Teresina's CEASA, the results have not succeeded. The physical facility keeps space for wholesaling activities. The occupants are called "wholesalers", but in fact they function as retailers, selling most of their commodities to Teresina consumers. The Teresina wholesaler does not have enough capital to buy a complete truckload nor can he satisfactorily compete with the Serra middlemen for retailer buyers.

'Perhaps, the lack of a wholesale sector in Teresina's CEASA is due to an atomistic retail sector as well the low

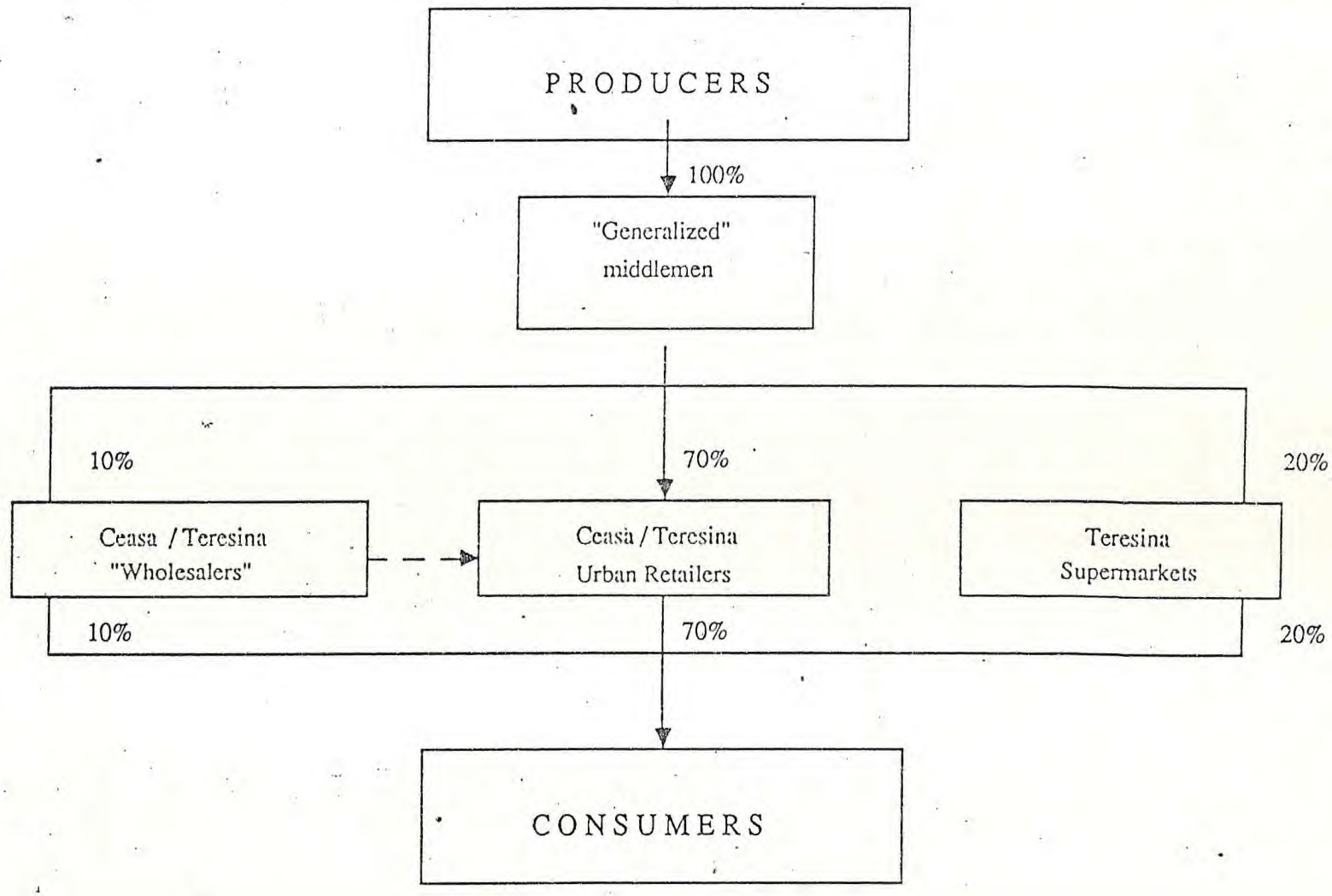

Figure 4: Marketing Channel: Ibiapaba to Teresina, Piaui.
Legend:----Occasional flow of products.

Source: Finan (1981

purchasing power of its customers. Because of inadequate conditions of storage and small volume of individual transactions, the retailers in the public markets and at neighborhood vegetable and fruit stands (quitandas) prefer to renew their stocks daily but in small quantities.

Ibiapaba maloqueiros usually sell their products on credit. At the end of the day the middlemen must go to their buyers to collect their money. Because retailers do not settle their debts until the product has been sold to consumers, the collection process generally takes more than one day. Hence, the maloqueiros need to wait at least one night in the city.

As can be seen in Figure 4, the market flow from Ibiapaba producers to Teresina consumers is quite direct given the few number of vertical links. Because the Ibiapaba middlemen carry out most of the marketing functions (from rural bulking to urban wholesale), fewer vertical transactions occur. The large number of buyers and sellers and free entry fulfill the principal conditions for a theoretical model of perfect competition.

The supermarket chain controls around 20 percent of the total supply of the city. As in the whole Northeast, the supermarkets are located in the more affluent neighborhoods to serve a middle and upper class clientele. The intermediaries who supply the Teresina supermarket

system operate at a higher scale and are more capitalized than their colleagues who sell exclusively in CEASA.

Marketing flow from Ibiapaba to Sao Luis

Sao Luis, capital city of the State of Maranhao, with an estimated population of 434,459 inhabitants in 1977, is situated at 600 Km from the Serra da Ibiapaba. Wholesalers in the Sao Luis CEASA commercialized a monthly average of 388 metric tons of tomatoes during 1982. The Sao Luis market consumed in 1982 for about 14 percent of the total Ibiapaba production moving through the CEASA system. Almost all of the green peppers, chuchu, carrots, cucumber, and cabbage consumed in Sao Luis also come from Ibiapaba. The middlemen who supply Sao Luis marketed a larger average volume than the Teresina maloqueiros, the standard volume being the truckload.

The middlemen travel to Sao Luis once a week. The relative large volume commercialized, the larger distance between Ibiapaba and Sao Luis, and the fact that buyers in Sao Luis pay their suppliers only one or two days later, make travel to Sao Luis more than once a week impossible.

The intermediaries to Sao Luis also travel at night after preparing their load during the same day. In contrast with Teresina middlemen, Sao Luis middlemen, do not buy directly from the farmers but rather from other

Serra intermediaries specialized in rural bulking and assembly. The emergence of the specialized rural assembler represented a principal organizational change in marketing behavior, because it increased the possibility of access to new sources of supply in other municipios. Consequently, larger intermediaries to urban centers did not need wide knowledge of production patterns in each supply area.

In Guaraciaba do Norte as well as in Tiangua, rural assemblers own private warehouses, sell to various transporting middlemen, and prepare the load for them. After the Ibiapaba middlemen arrive in the Sao Luis CEASA around dawn, they deliver their product to a wholesaler or, usually, sell part of the load to supermarket agents (about 20 percent of the total Sao Luis volume) and other retailers. The Sao Luis market channel is complex when compared with Teresina market channel (Figure 5). There are at least five transactions separating the Ibiapaba farmer from Sao Luis consumer.

Marketing Flow from Ibiapaba to Fortaleza

Fortaleza, capital city of the State of Ceara, with an estimated population of 1,307,611 in 1980, is situated 310 Km from the Ibiapaba micro-region. The Fortaleza market accounted in 1982 for about 42 percent of the Serra

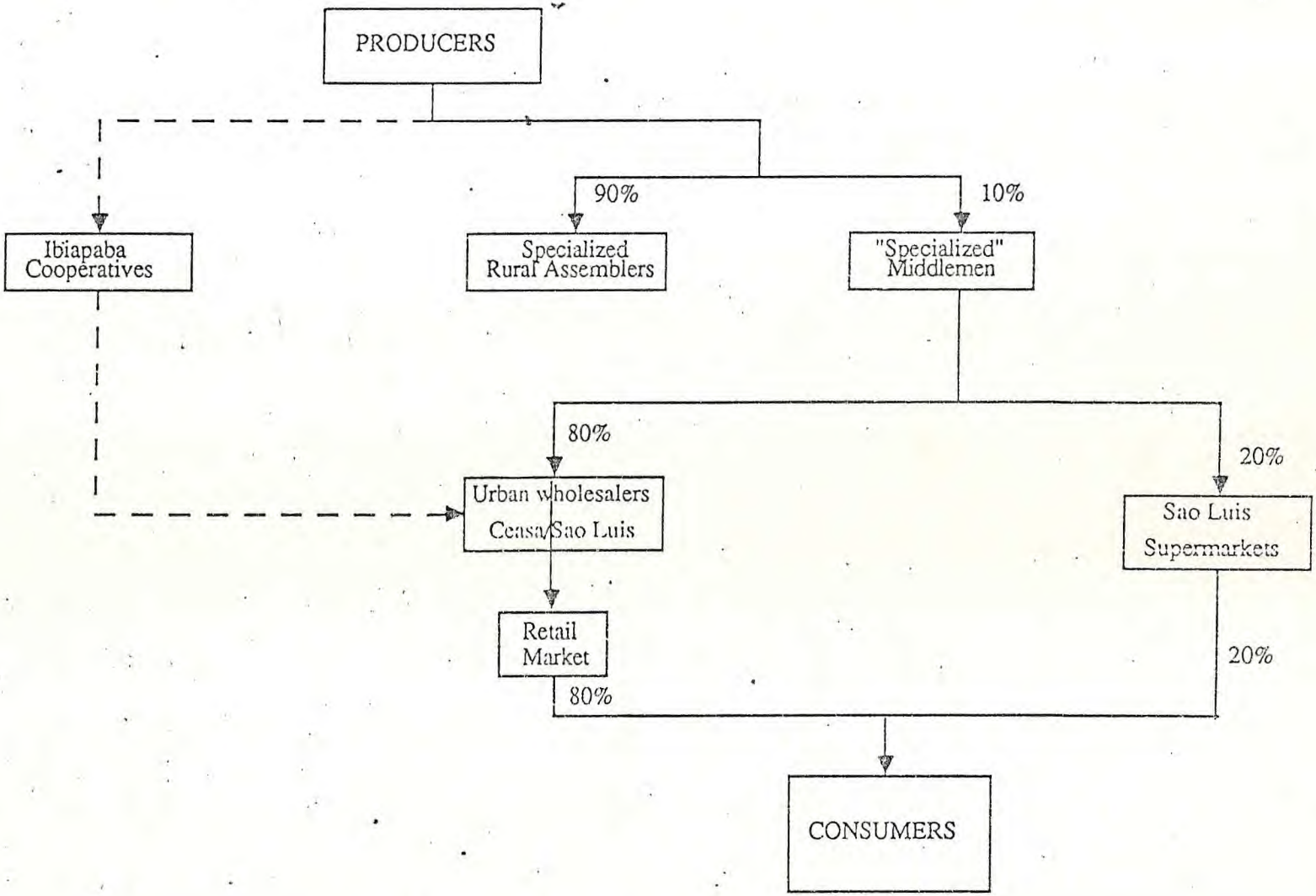

FIGURE 5. Marketing Channel: Ibiapaba to Sao Luis, Maranhao.
Legend: - - - - -Occasional flow of products.

Source: Finan (1981)

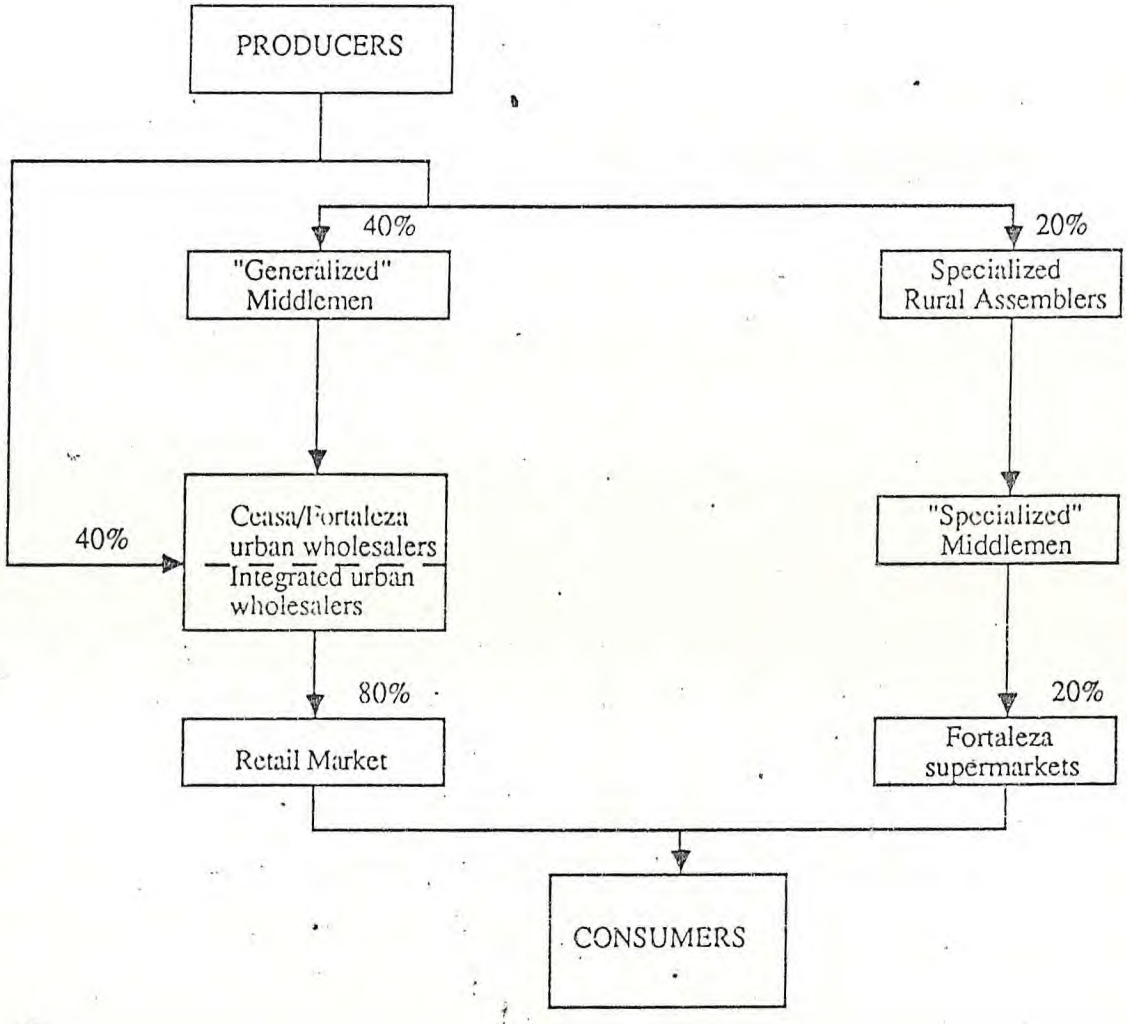

FIGURE 6. Marketing Channel: Ibiapaba to Fortaleza, Ceara.

Source: Finan (1981).

vegetables marketed through the CEASA wholesale system. The average monthly consumption of tomatoes in Fortaleza for 1982 was more than 1,151 metric tons. Ibiapaba also furnishes most of green pepper, cucumber, cauliflower, and passion fruit consumed in Fortaleza and its vicinities.

Approximately thirty Ibiapaba intermediaries operate in the Fortaleza market. Each Fortaleza middleman travels to the Fortaleza market twice a week. The Fortaleza middlemen also travel at night to arrive in the CEASA early in the morning. In contrast to other markets, the Fortaleza middlemen receive payment directly after the close of market activities, hence, the middlemen can return to the Serra on the same day.

There are three different market channels separating Ibiapaba producers from Fortaleza consumers (Figure 6). Vegetables, and particularly tomatoes, come from all the producing municipios in Ibiapaba, but arrive at the CEASA through different structural arrangements. According to Finan (1981, p.85), approximately forty percent of the total supply of tomatoes is furnished by urban wholesalers who have backwardly integrated marketing and production activities. These commercial agents, the integrated wholesalers in the CEASA of Fortaleza, are specialized only in tomatoes produced in the municipio of Guaraciaba do Norte, where they maintain extensive plantings and

finance the production of others. These vertically integrated wholesalers perform the rural assembly, grading and packing, transportation, and debulking of the product. In terms of capital invested, scale, and access to information, they constituted the most powerful participants in the system.

Another forty percent of the total supply of tomatoes is furnished by Ibiapaba middlemen, who buy from farmers and sell to the non-integrated wholesalers in CEASA. These middlemen tend not only to diversify their product but also tend to operate at a higher volume and level of capitalization than their Teresina colleagues.

Fortaleza's supermarket chain accounts for around twenty percent of the vegetables sold in the city. The supermarkets are supplied by middlemen from Ibiapaba, who have demonstrated that can provide vegetables regularly. The transaction is covered by informal contracts.

Fortaleza's retail system, includes large public markets, a daily street market (feira livre), many fruit and vegetable shops, and a relatively well developed supermarket chain. Different levels of income determine the nature of the consumers in each retail subsystem.

The Fortaleza vegetable market is the most integrated structure; three transactions separate the producer from the consumer. In the channel that includes Ibiapaba

middlemen and urban (non-integrated) wholesalers, the number of links increases to four.

Concluding Observations

The marketing organization in Ibiapaba is characterized, in general terms, by similar systems found elsewhere and some of which are typical to the region. The Ibiapaba middlemen extend significant amounts of credit to buyers in Teresina and Sao Luis markets. The collection of the money usually takes more than one day in Teresina and Sao Luis making more frequent trips to these markets organizationally infeasible. Frequently, the credits are not honored by the buyers implying losses to middlemen. Consequently, the intermediary covers the uncertainty that involves the marketing of vegetables to Teresina and Sao Luis with higher prices when compared with Fortaleza prices. Thus, the market integration of these three markets could be not perfect due, in part, to market imperfections in Teresina and Sao Luis.

In the next chapter, the theoretical economic foundations on which the research is based, such as market organization, market efficiency, market integration, transfer costs and market boundary are presented. To determine whether prices in a particular market behave or not independently of prices in other markets the Granger

causality approach is used. Given its simplicity and general acceptance among researchers compared with other methods, the Granger approach is ideal for this study.

CHAPTER 4

ECONOMIC THEORY,METHODS, AND DATA

An efficiently integrated market system should be positive correlated over time among prices at different market places. Correlation coefficients measure how closely prices of a commodity move together in different market locations. Usually, they are used to examine the hypothesis that markets in LDCs are not integrated, and consequently not efficient. While prices in an efficient market tend to move together, they may do so, for other reasons such as common price trends or common seasonality. Analogously, a monopoly or price fixing by an official institution can produce a coefficient near to one as in a competitive market. Then, correlation coefficients are not unequivocal indicators of market conditions and questions about their interpretation began to appear in the literature (Heytens, P.J. 1986). Recently, a substantial literature has evolved concerning market integration. The construction of bivariate time series models and Granger-causal ordering have received much attention from researches over the last decade.

Theory

Market Organization. An important concern of the economics of a free-enterprise economy is how well private markets perform. Every market has a structure, a pattern of behavior, and a set of performance results. Market organization includes a body of concepts about how these three parts are related. Using them, we can evaluate the degree of competition in real markets (Bain and Qualls, 1987).

Market organization, in general terms, concerns all aspects of a particular marketing system, and is composed of many integrated components including market structure, conduct and performance. First, market structure, includes the characteristics of the organization of a market that influence the nature of competition and pricing within the market (Bain,1968, p.7). Dimensions of market structure usually stressed in the literature are buyer and seller concentration, product differentiation and barriers to entry (Helmberger, et. al 1981, p.514). The degree of seller concentration is delineated by the number and the size distribution of sellers in the market who compete in the sale of a given commodity. The degree of buyer concentration is defined in an analogous form where buyers respond to prices of differentiated products. The degree of product differentiation, refering to the outputs of

the various sellers in the extent to which their outputs, though similar, are recognized as nonidentical by buyers. The circumstances of entry to the market, which defines the relative ease or difficult with which new sellers may enter the market, are determined usually by the advantages which established sellers have over potential entrants. In terms of market structure, further approximation often demands consideration of the degree of vertical integration of a firm and the legal form of business organization of firms.

Second, market conduct alludes to the behavior of firms under a given market structure and, specifically, to the types of decisions that managers can make under changing market structures. Bain has captured the essence of market conduct concept in the following manner:

> Market conduct refers mainly to two closely interrelated phases of the business enterprise behavior. For the firms in any industry acting as sellers, these are:
> 1. The manner in which, the different sellers in the industry coordinate their intrinsically rivalrous decisions and actions, adapt them to each other, or succeed in making them mutually consistent as they react to demands for their product in a common market.
> 2. The character of pricing policies and related market policies that sellers in the industry adopt, assessed in terms of the individual or collective aims or goals that they pursue as they determine their selling prices, their sales-promotion outlays, the designs and qualities of their products, and so forth (1968, pp. 302-303).

Market conduct considers essentially all human decision making within business organization as well as households. Hence, systematic explanation of market conduct requires several social sciences in addition to economics.

Third, market performance refers to the concrete impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output. Performance is an essential element in this classification scheme as it describes a market's efficiency. It is admitted that performance is more complex to study than descriptive structure. Nevertheless, at least two major dimensions can be studied effectively in most agricultural markets. These two dimensions are pricing efficiency and productive efficiency (Bressler and King,1970,p.409).

Pricing or Economic Efficiency. Pricing or economic efficiency is concerned with the purchasing, selling, and pricing aspects of the marketing process so that it will remain responsive to consumer direction. In the words of a U.S. Department of Agriculture report:

> The best measure of the satisfaction consumers obtain from the marketing system's output is what they are willing to pay for it in the

> market-place...the reliability of this measure depends upon three conditions: first, consumers are provided with viable alternatives in the market-place from which to choose; second, prices on the alternatives adequately reflect the costs of providing them; and third, business firms are relatively free to enter or leave the given marketing activity in response to profits or losses based on the prices bid in the market-place (USDA,1974, p.48).

Price differentials between markets habitually are defined by the cost of transportation from one market to another. If prices move outside of the expected level it is usually because of a breakdown or deficiency in the transportation facilities, poor market information, monopoly profits or some other institutional or structural weakness. In other words, if markets are operating efficiently, prices of a given item will be related over space, time, and among forms. Prices would differ only between regions of a country by transportation costs from one point to another. The price of a storable product at one point in time should not exceed price in a previous period of time by more than the cost of storage (USDA,1970,p.13).

Consequently, pricing or economy efficiency relates to functional deficiencies and/or to the range of competitive economic power which exists within the marketing system. In the case of monopoly, laws may need

to be proclaimed which could confer responsibility to an official agency to examine the number of firms serving the market and the capacity of firms to enter the market, to insure and augment effective competition, and to monitor market conduct by forbidding collusion or other inequitable practices which might injure competitive performance as well as consumers interests (Bressler and King,1970 and USDA,1974).

Productive Efficiency. Operational or technical efficiency assumes that the output of goods and services are given and focuses on reducing the costs of supplying them. Often the gains obtained from the improved technical activity and/or productivity add up to society in the form of economies of scale and lower total unit costs. These may be extended to consumers in the form of lower unit prices and/or shared with producers. Marketing firms, operating in a competitive environment, will strengthen their total profit position; but, because of the technical and pricing efficiencies in force, consumers and producers also gain because profits are only normal ones, and efficiencies have been passed on. The area of technical efficiency is one in which research as well as operational assistance can make significant contributions to marketing amelioration. (USDA,1974).

Market Integration. Following Monke (1984), integrated markets can be defined as markets in which prices of differentiated products do not behave independently. Ravallion (1986) claims that if trade takes place at all between any two places, the price in the exporting place will add on the unit transport cost incurred by moving commodities between the two places. If this holds, then the markets can be viewed as spatially integrated. Stigler and Sherwin (1985) argue that the parts of the market will be more closely integrated the closer the movement of their prices. Spinks argues that:

> Stereotyped thinking about the various markets for agricultural commodities in developing countries tends to created the impression that they operate in a vacuum, that they are not related (1978,p.356).

Spinks (1978) also recognizes that there are few studies on market integration, though in some countries empirical evidences exists to infer that one large urban market may be an essential mechanism for setting prices for certain goods. In addition, he says that many people believe that markets in LDCs are not integrated because at first view there seems to be no clear order in the system. Careful survey, particularly of transport facilities, will show that the markets, and especially

those where interregional movement is significant, are integrated. In this context, Chuchart and Tongpan (1965 p.53) found that in Thailand, rice prices in rural areas were closely related to those in Bangkok wholesale markets. Price changes in Bangkok seem to dominate the rest of the country.

Cummings (1968) analyzed pricing effectiveness in one private wholesale wheat market in North India by comparing average seasonal and spatial price differences with estimated storage and transport costs. The author found that correspondence between average price movements and average cost differences was moderately close. Also, Khanna prices were dominated by other markets; local supply and demand factors as shown by monthly volumes of arrivals, dispatches, and the level on stocks seemed to have little independent influence. Although Khanna middlemen can profit from seasonal price changes if they guess correctly, these traders do not seem to be able independently to influence seasonal prices. This fact shows that the task of government is to improve information and transportation linkages and to provide some consistency in policy.

Lele (1967) studied sorghum prices in Western India and analyzed the prevailing view in LDCs that there exist large regional price differences that are caused by

speculative elements in trade. The analysis accentuates the high degree of interdependence between wholesale markets in the process of price formation. Also, the author argues that price discrepancies often result from differences in varieties or quality of the product traded.

Lele (1967), also argues that regional price differences larger than transport costs may result from factors such as transport bottlenecks and official control on the transportation of commodities. Finally, the author concludes that the regional differences could be reduced by creating competitive conditions by means of better transportation facilities, improved market information, and overall improvement in the flow of merchandise.

Delgado (1986) developed a variance components methodology for joint test of time series of prices for seasonal differences in food grain prices in Northern Nigeria. The author found forceful evidence for seasonal differences in market integration. Delgado defined market integration as stable price spreads among markets in a specific season in spite of ample price changes. His results suggest the need to look assiduously at marketing behavior that varies through seasons. According, to the author, "research should focus on explaining the distinctive bump in prices that occurs in the middle of the harvest season in some years, since it appears likely

that this is associated with the finding of lower market integration at that time" (Delgado,1986, p.979). In this context, Benson and Faminow (1988, p.46) argue that if meaningful price interdependence prevails between two spatially unrelated sales places for a specific good then they should be viewed to belong to the same competitive geographic market for antitrust purposes.

The above studies suggest that measurement of market integration can be used as basic information for a better understanding of how specific markets work.

Transfer Costs. Transfer costs usually are considered the most important single variable determining spatial price relationship. Tomek and Robinson (1981) say that transfer costs must include not only the average transportation rate, but also a fixed charge, independent of the distance traveled and usually related with loading or unloading, plus a variable charge associated with distance covered in transportation of the commodity. These authors argue, and it is generally recognized, that transportation costs per mile increase less than proportionately with distance, that is, transportation costs per unit of product increases but at a decreasing rate.

Stigler and Sherwin (1985) affirm that prices in two

regions seldom differ by exactly the transportation costs because of the influence of other transaction costs such as: size of shipments and backhauls; distortion in market prices; differences in quality (quality of the commodity is not homogeneous); prices change owing to volume of transaction; and finally, prices changes through time. Following the same line of thinking, Lele (1967), in her work on market integration of sorghum prices in Western India, has demonstrated that correlation among prices in different markets are expected to be less than perfect for several reasons including transport costs, transport bottlenecks and associated uncertainty. It is therefore essential to discover whether the apparent lack of integration came from factors beyond the control of the middlemen, such as transport bottlenecks, or was a result of speculative and monopolistic action of intermediaries.

Market Boundaries. In the case of firms selling to spatially dispersed consumers, the boundary between service areas may be determined by the price of the good in each market plus the transfer cost of the commodity from producers to consumers. At this point, consumers are indifferent to acquire their goods from one market or another. Alternatively, the distance at which producers are indifferent to deliver their products to one market or

another also is defined to be the market boundary. According to Benson:

> "...part of the supply and demand forces which determine product price for a specific firm and its customers originate in distant firms' service areas. When this occurs the firms are in the same competitive market even though they do not, and cannot, compete for the same costumers. This occurs when distance is costly-that is, when the firm charges a deliver price, or when a consumer differentiates between firms on the basis of relative locational convenience because the consumer must travel to the firm to make a purchase" (1980, p.731-32).

The effect of changes in relative market prices and transfer costs on the location of a boundary point between hypothetical firms is illustrated in **Figure 7.** Hypothetical delivered price schedules between two firms, A and B, are analyzed where:

AB = Total distance between the firms A and B

P_A, P_B= Initial prices charged by the two firms

$P_A + t_u$ = Consumers pay to firm A this price plus the cost of transportation

$P_B + t_u$ = Consumers pay to firm B this price plus the cost of transportation

t_u = t constitutes the transport rate and u is the number of units of distance a consumer's location is from the firm's location

ΔP = change in price P_A

Therefore, when the prices are P_A and P_B, the

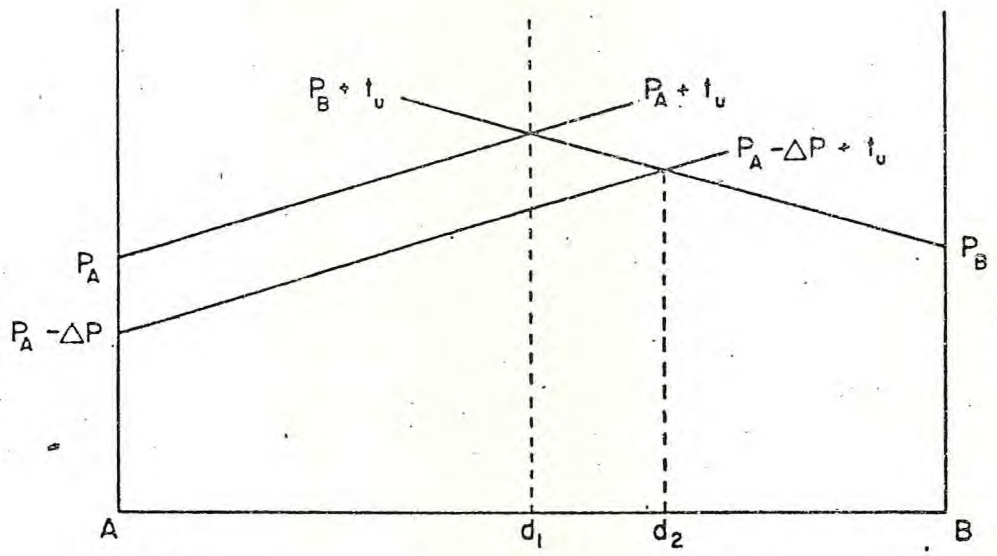

Figure 7. Effect of Changes in Market Prices and Transfer Costs on the Boundary between Markets, 1978-79.

boundary between the firms's service area is d_1, because the consumers buy from the firm with the lowest delivered prices. However, when firm A lowers its price by P, its delivered price schedule shifts down, and the service area boundary shifts to d_2. Consequently, A has taken customers away from B (from d_1 to d_2). Firm B can respond to the competitive actions of firm A in the same way, i.e., lower its prices to regain lost sales. The above analysis implies that if all firms in the area are producing a homogeneous product, they are going to respond to the competitive pressure initiated by firm A as established by the spatial theory of competition (Benson and Faminow, 1985, and Faminow and Benson,1985).

According Benson (1980; p.743), "the only way to really determine whether or not two firms are in the same geographic market is examination of reactions by one firm to price changes of another." Conversely, Elzinga and Hogarty (1973) analyzing the geographic market delineation stated that the only data required to estimate market areas (at least in most cases) are shipment data by origin and destination in physical terms (e.g., barrels) and recognized that plant shipments data will probably not be as difficult secure as the various area consumption statistics. The authors conclude that "these procedures have the advantage of being usually consistent with

economic analysis, reasonably applicable by antitrust practitioners, designed independently of any need to support a particular case, and analytically far superior to the eclectic methods now being used." (1973,p.81).

According to Werden (1981, p.720), shipment data are useful but insufficient to define markets because they are inaccurate and may produce erroneous conclusions.

Perhaps the best way to determine whether or not two firms are in the same geographic market is through an empirical assessment of the velocity of the market adjustment to spatial price reaction by one firm to price changes of another.

Modeling Spatial Market Structure

Empirically, we cannot always determine excess or scarcity of a commodity between markets that permit exportation or importation of goods in order to keep the equilibrium in the markets. Therefore, the knowledge of spatial equilibrium models is useful in order to asses price relationships and trading patterns between markets. The usual principles involved in developing interregional trade models can be illustrated by diagrams (Figure 8) showing supply and demand functions for two hypothetical regions (Tomek and Robinson,1981).

If no transfer costs exist between the regions A and B, the deficit of region B can be compensated through

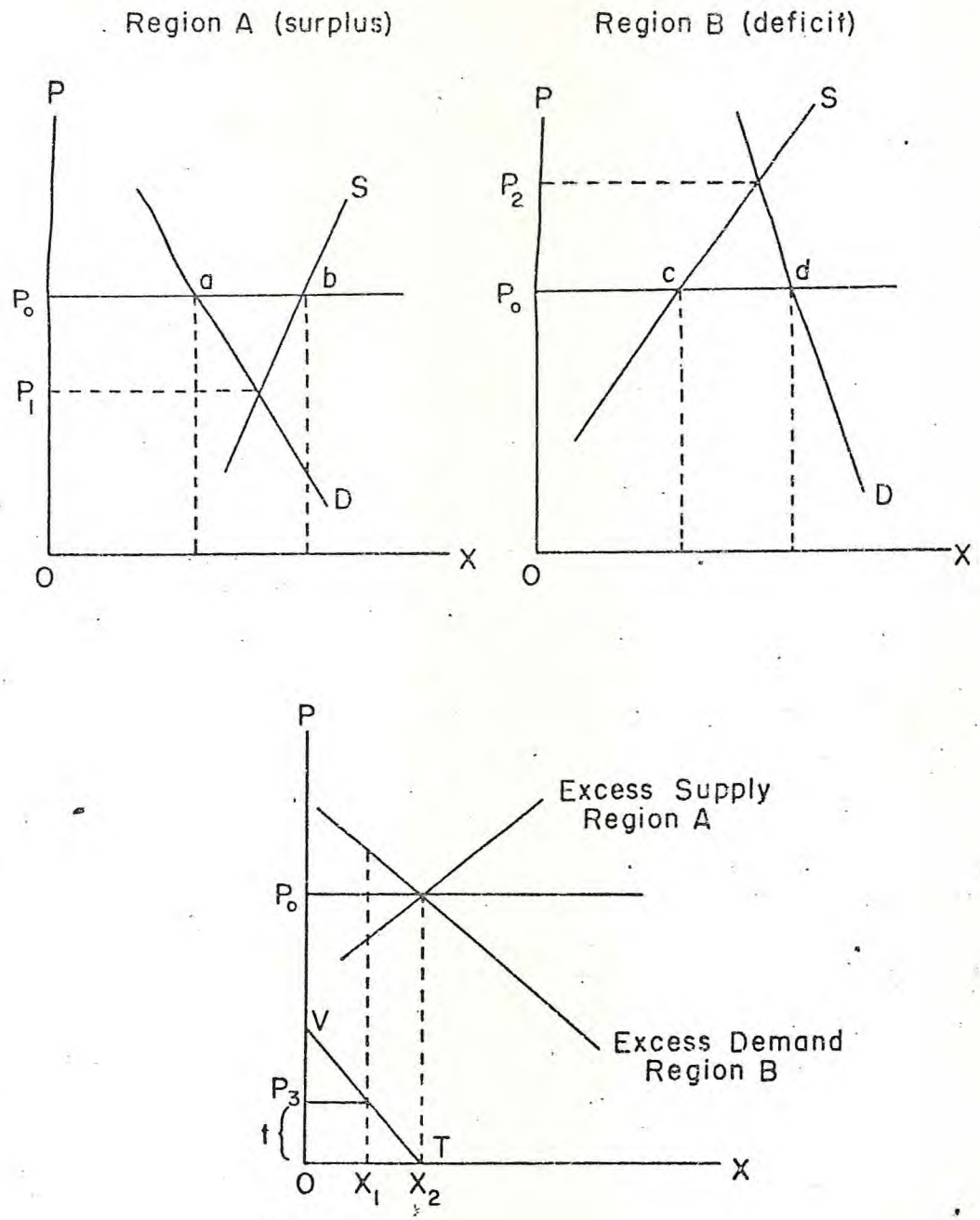

Figure 8. Two-Regions Spatial Equilibrium Model.

trade by the surplus of region A ($ab = cd = ox_2$). The volume of the trade between these two regions decreases with the introduction of transfer costs. No trade would occur if it cost more than P_2 to transfer a unit of a product from region A to region B, that is, transfer costs ov plus OP_1 greater than OP_2. The "volume of trade" line, which is shown as the diagonal line VT, illustrates the effect of changes in transfer cost on the amount shipped between regions. The vertical intercept of the volume of trade line OV shows the transfer cost per unit. The number of units transferred is illustrated by the point at which the line indicating transfer costs t intersects the volume of trade line. For example, at a transfer cost of P_3, the total amount transferred would be X_1 units. Given this information, the prices expected in each region could be established and will depend on the slopes of demand and supply schedules in both regions.

Empirical Model

To determine whether prices in a particular market behave independently of prices in other markets, the Granger causality approach commonly is used. Bishop, working with the construction and use of Granger causality test, affirms:

> Granger has provided a definition of causality that lends itself to empirical testing procedures , and that allows the researcher to examine the underlying causal structure among economic time series (1979, p.2).

Bishop (1979, p.1) assumes that the variables being tested result from stochastic (rather than deterministic) processes; the series are stationary (a stationary series can be defined as one in which the stochastic properties as well as the variance are invariant with time); and the future cannot cause the past.

In this context, the set of two variables X_t and Y_t has as possible temporal ordering :

(1) X_t causes Y_t (X_t => Y_t);

(2) Y_t causes X_t (Y_t => X_t);

(3) X_t and Y_t cause each other "bidirectionally"
(X_t <=> Y_t);

(4) Instantaneous causality between X_t and Y_t exists
(X_t:Y_t);

(5) no causal relationship exists.

The conventional definition of Granger causality essentially states that the stochastic variable X_t causes Y_t (X_t => Y_t), if the present Y_t can be predicted better by using past values of X_t than by not doing so, other relevant information (including past values of Y_t) being used in either case (Klein et al.1985, p.111).

In the same context Benson and Faminow assert that the Granger technique can be used to test for:

> (1) instantaneous price response ; (2) lagged price response ; and (3) feedback. A lack of spatial price response implied independent geographic markets as predicted by spatial price discrimination , given constant marginal cost . Under a competitive f.o.b. pricing system (or competitive price discrimination with upsloping marginal costs) the data should indicate instantaneous and lagged geographic price interdependence, along with feedback. This is indicative of rivalrous behavior between firms located in the respective regions. Organized oligopoly (basing point or other cartelized regimes) would be indicated by lagged and/or instantaneous price response, but no evidence of feedback should be observed. The feedback implications for the nature of the spatial interdependence (rivalrous or collusive) are a secondary benefit of using this methodology, however (1988, p.30).

The principal interest of the theoretical analysis is directed to the geographic market delineation as suggested by spatial price interdependence. The above authors affirm that for the objective of economic market description this test of price interdependence is adequate To obtain a solution for spatial market structure where many regions are involved. It is assumed that in the Northeast region of Brazil, there are a group of rural markets and several urban markets in which the trade with the urban market dominates rural price formation (Ravallion, 1986 and Bessler and Brandt, 1982). Following the Granger method, cited by Bessler and Brandt (1982), which directly

utilizes ordinary least squares regression on levels of the series to test causality, one can use the following specification:

$$Y(w_1)_t = A_{10} + \sum_{j=1}^{n} A_{1j}\, Y(w_1)_{t-j} + E_{1t} \qquad (1)$$

$$Y(w_{1,2})_t = A_{20} + \sum_{j=1}^{n} A_{2j}\, Y(w_1)_{t-j} + \sum_{k=1}^{m} B_{2k}\, X(w_2)_{t-k} + E_{2t} \qquad (2)$$

Where E_{1t} and E_{2t} are white noise residuals. $Y(w_1)_t$ and $Y(w_{1,2})_t$ refer to the variables Y in the wholesale market 1 in time t in the former, and wholesale markets 1 and 2 in time t in the latter ; j and k are lags ($j=1,2,\ldots,n$); ($k=1,2,\ldots,m$). The A_{1j} and A_{2j} are parameters of the lagged dependent variables $Y(w)_{t-j}$. The B_{2k} are parameters of the lagged independent variables $X(w)_{t-k}$.

The Granger method makes possible a direct test of one-way causality from X to Y (X => Y) based on equations (1) and (2), which is comparable to testing the null hypothesis:

$$B_{21} = B_{22} = \ldots = B_{2m} = 0$$

The null hypothesis can be tested by using the well-known joint F statistic:

$$F = \frac{SSE_1 - SSE_2}{m} \Big/ \frac{SSE_2}{N - n - m - 1}$$

where SSE_1 and SSE_2 are related to the sum of square errors from ordinary least squares regressions in equations (1) and (2), respectively, N is the number of time series observations on $Y(w)_t$. Considering the null hypothesis, F has the same distribution of F with (m, N-n-m-1) degrees of freedom. For large values of F, the hypothesis that $X(w_2)_t$ does not cause $Y(w_1)_t$ is rejected.

The lack of one-way causality from Y to X (Y => X) can be tested utilizing the same data and **modus operandi**. In this causal ordering, $X(w)_t$ is specified as the dependent variable and first regressed as a function of its own past (equation (1)) and also as a function of its own Y_t's past values. To test for the lack of instantaneous causality ($B_{30}=0$) between Y and X, the residuals of equation (2) are used along with those of the following equation:

$$Y(w_{1,2})_t = A_{30} + \sum_{j=1}^{n} A_{3j}\, Y(w_1)_{t-j} + \sum_{k=0}^{m} B_{3k}\, X(w_2)_{t-k} + E_{3t} \quad (3)$$

where E_{3t} are white noise residuals; A_{3j} and B_{3k} are

parameters relating $Y(w)_t$ and $X(w)_t$ and its lagged values in the urban markets (w_1, w_2).

The F-test has F=(1,N-n-m-2) degrees of freedom. A significant F-statistic indicates rejection of the null hypothesis of no instantaneous causality. When autocorrelation is present the hypothesis tests are not valid. The Ljung-Box [1978] Q-test generally is used to test autocorrelation in Granger causality analysis and can be express in the following manner:

$$Q=N \sum_{k=1}^{k} r_k^2$$

where N is the number of observations; r^2_k is the sample autocorrelation coefficient for lag k, and k is the number of lags. This statistic is distributed as chi-square with k degrees of freedom.

The Data

Daily price data for tomatoes were collected from August 1978 to July 1979 for a total of 243 daily observation in the wholesale markets (CEASA's) of Fortaleza, Teresina and Sao Luis. Average weekly prices (Table A.1 in Appendix A) were chosen for the analysis because they are less prone to be serially correlated and allow for price adjustments as a function of supply-demand relations (used to smooth out the potential

volatility of daily price fluctuations). It was not possible to obtain more recent daily price data, because the CEASA's in the above cited places have terminated the monitoring and publishing of this kind of price information.

CHAPTER 5

MODEL APPLICATION, RESULTS AND ANALYSIS

Granger causality tests are applied to 1978/79 weekly price data from the Northeast tomato markets of Fortaleza, Teresina, and Sao Luis. Bivariate relationships are studied for lagged prices relations of tomatoes in each market with equation (1), presented in Chapter 4. Lagged prices of tomatoes in each market are tested against alternative markets with equation (2) and (3), also presented in Chapter 4.

Several steps were carried out in the development of the modeling procedure. The first step includes identification and verification of the data for stationarity and autocorrelation. An estimated sample autocorrelation function was computed for each market using ordinary least squares procedure, corresponding to equation (1) in Chapter 4. The three raw data series corresponding to the markets of Fortaleza, Teresina, and Sao Luis showed evidence of nonstationarity. Second, the first differences of the three raw data series were calculated, as commonly done in the Granger causality approach, to transform the series. Stationarity can be

achieved by first differencing of raw data, creating a new time series which displays price changes from period to period. First difference data allow for the quantification of the impact of a one period change in the price based on lagged prices. The third step, involves analysis of the length of significant lagged price relations and the decision on the number of lags to be adopted in the model. Empirical knowledge about the production process also is considered (Finan, 1981). Since tomatoes are highly perishable commodities and very difficult to store, short lags should be encountered. Also, mechanical procedures were applied, as suggested by Bessler and Brandt, (1982). Two, four and six period lags were tentatively chosen, considering the requirement for non-autocorrelation in the data to prohibit overvalued (F) statistics. The Ljun-Box (Q) statistic was used to test regression residuals for autocorrelation for the above number of lags.

Two period lags of first difference price relationships were sufficient to remove most autocorrelation from the residuals in the estimated equations. The data series were composed of 48 weekly observations for each market. As can be viewed in Figure 9, the wholesale markets of Fortaleza, Teresina and Sao Luis have similar patterns of seasonal variation in

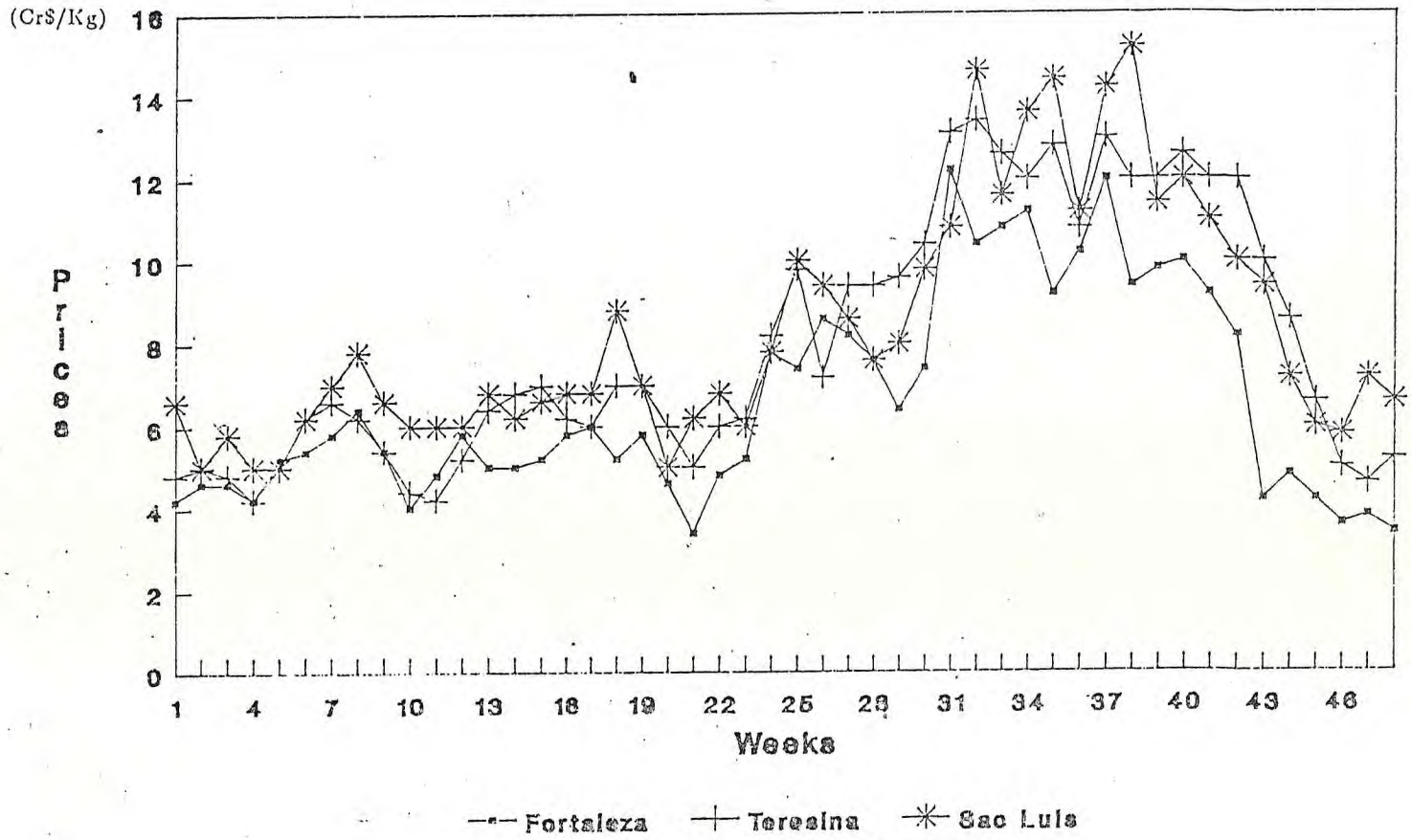

Figure 9. Average Weekly Prices for Tomatoes Three Northeast of Brazil Markets, 1978-79.

prices. From February to July, the prices go up because of decrease in supply owing to difficult production during the winter season. From August to January, the prices go down due to the summer season, as a consequence of increases in supply owing to more appropriate climatic conditions and easier water control.

Instantaneous causality testing was carried out for the data set. Weekly price data were chosen because they represent an appropriate time length in which to monitor a market that is assumed to be well-behaved in its price adjustment. Also, daily data are more prone to be serially correlated, whereas weekly averages of daily data allow for price adjustments as a function of supply-demand relations (used to smooth out the potential volatility of daily price fluctuations). It should be recalled that with a weekly adjustment there may exist disguised unmeasurable lagged effects that occurred daily. Also, since the available data were transformed on a weekly basis, instantaneous causality in the data suggest that adjustment normally occurs within one week. The estimated autocorrelations (as seen in Tables B.1 trough B.4 in Appendix B), suggested that first differencing was appropriate to change the raw data into a stationary series (Figure C.1 in Appendix C).

The results of the tests for one way and

Table 4. One-Way Granger Causality Tests on Tomato Prices. Weeks, 1-48. (1978-79).

Direction (a)	F-Statistic (b)	Q-statistic (c)
SL=>F	4.15*	11.89
T=>F	1.65	7.52
T=>SL	2.35**	17.65
F=>SL	16.56*	13.91
SL=>T	0.01	16.88
F=>T	4.78*	17.76

(a) Market abbreviations are: SL(Sao Luis), F(Fortaleza), and T(Teresina).
(b) F-test; H_0: Independent variables are equal to zero as a group. $F_{.05}$ (2,40), critical value 3.23.
(c) Q-test; H_0: No autocorrelation in residual of regression. $Q_{.05}$ (18), critical value 28.87.
* Statistically significant at 95% confidence level.
** Statistically significant at 85% confidence level.

Table 5. Instantaneous Granger Causality Tests on Tomato Prices. Weeks 1-48 (1978-79).

Relation (a)	F-Statistic (b)	Q-Statistic (c)
SL : F	2.18	8.56
T : F	4.63*	21.83
T : SL	5.46*	17.60
F : SL	2.18	21.56
SL : T	5.46*	12.51
F : T	4.63*	5.74

(a) Market abbreviations are: SL(Sao Luis), F(Fortaleza), and T(Teresina).
(c) F-test; H_0: Independent variables are equal to zero as a group. $F_{.05}$ (1,39), critical value 4.08.
(d) Q-test; H_0: No autocorrelation in residual of regression. $Q_{.05}$ (18), critical value 28.87.
* Statistically significant at 95% confidence level.

instantaneous causality are summarized in Tables 4 and 5, along with the Q-statistics and critical values of F for each equation. The regression equations for bivariate causality tests are presented in Table 6, and the regression coefficients for bivariate causality tests are presented in Table 7 with the F and Q statistics reported. The arrows display the direction of causality in each regression equation (Tables 4, 6 and 7). The colon indicates the instantaneous relationship between markets (Table 5). In Table 7, the Q-statistics indicated no remaining auto-correlation at the 95 percent confidence levels. For Teresina to Fortaleza and Sao Luis to Teresina all, the coefficients are not significantly different from zero. While for the other equations, the coefficients proved to be significant at least in one of the lag models, which has implications in testing unidirectional and bidirectional causality. In Table 4, the F-statistics indicate that in two cases we fail to reject the null hypothesis of no lagged one-way causality, i.e., the cases where there was no distributed lagged pricing process.

Notice that in the case of Teresina to Sao Luis, which are significant at 85 percent confidence level, the lagged coefficients are significant for one and three time periods. This suggests one-way lagged price interdependence between the two cities. In the other four

Table 6. Regression Equations for Bivariate Causality Tests (1).

2.1	T=>F	$P_t^{f}=A_1P_{t-1}^{f} + A_2P_{t-2}^{f} + B_1P_{t-1}^{t} + B_2P_{t-2}^{t}$
2.2	SL=>F	$P_t^{f}=A_1P_{t-1}^{f} + A_2P_{t-2}^{f} + B_1P_{t-1}^{sl} + B_2P_{t-2}^{sl}$
3.3	T=>F	$P_t^{f}=A_1P_{t-1}^{f} + A_2P_{t-2}^{f} + B_0P_t^{t} + B_1P_{t-1}^{t} + B_2P_{t-2}^{t}$
3.4	SL=>F	$P_t^{f}=A_1P_{t-1}^{f} + A_2P_{t-2}^{f} + B_0P_t^{sl} + B_1P_{t-1}^{sl} + B_2P_{t-2}^{sl}$
2.5	F=>T	$P_t^{t}=A_1P_{t-1}^{t} + A_2P_{t-2}^{t} + B_1P_{t-1}^{f} + B_2P_{t-2}^{f}$
2.6	Sl=>T	$P_t^{t}=A_1P_{t-1}^{t} + A_2P_{t-2}^{t} + B_1P_{t-1}^{sl} + B_2P_{t-2}^{sl}$
3.7	F=>T	$P_t^{t}=A_1P_{t-1}^{t} + A_2P_{t-2}^{t} + B_0P_t^{f} + B_1P_{t-1}^{f} + B_2P_{t-2}^{f}$
3.8	SL=>T	$P_t^{t}=A_1P_{t-1}^{t} + A_2P_{t-2}^{t} + B_0P_t^{sl} + B_1P_{t-1}^{sl} + B_2P_{t-2}^{sl}$
2.9	F=>SL	$P_t^{sl}=A_1P_{t-1}^{sl} + A_2P_{t-2}^{sl} + B_1P_{t-1}^{f} + B_2P_{t-2}^{f}$
2.10	T=>SL	$P_t^{sl}=A_1P_{t-1}^{sl} + A_2P_{t-2}^{sl} + B_1P_{t-1}^{t} + B_2P_{t-2}^{t}$
3.11	F=>SL	$P_t^{sl}=A_1P_{t-1}^{sl} + A_2P_{t-2}^{sl} + B_0P_t^{f} + B_1P_{t-1}^{f} + B_2P_{t-2}^{f}$
3.12	T=>SL	$P_t^{sl}=A_1P_{t-1}^{sl} + A_2P_{t-2}^{sl} + B_0P_t^{t} + B_1P_{t-1}^{t} + B_2P_{t-2}^{t}$

(1) For instance, 2.1 corresponds to equations 2 presented in Chapter 4, and 1 presented in Table 7.

Table 7. Regression Results for Bivariate Causality Tests. Weeks 1-48 (1978-79).

Equation Number(1)		A_1	A_2	B_0	B1	B2	R^2 (Adjusted)	Q
2.1	T => F	-0.203	-0.309		0.146	0.353	0.02	7.52
		(0.178)	(0.195)		(0.225)	(0.197)		
2.2	SL => F	-0.230	-0.394*		0.348*	0.336*	0.12	11.89
		(0.146)	(0.190)		(0.171)	(0.132)		
3.3	T => F	-0.445*	-0.255	0.629*	0.235	0.246	0.26	21.83
		(0.168)	(0.170)	(0.169)	(0.198)	(0.174)		
3.4	SL => F	-0.546*	-0.432*	0.422*	0.484*	0.443*	0.23	8.55
		(0.185)	(0.179)	(0.165)	(0.169)	(0.130)		
2.5	F => T	-0.142	0.171		0.385*	-0.086	0.12	17.76
		(0.184)	(0.161)		(0.145)	(0.159)		
2.6	SL => T	0.025	0.089		-0.015	0.008	-0.09	16.88
		(0.184)	(0.192)		(0.149)	(0.147)		
3.7	F => T	-0.202	0.024	0.417	0.470*	0.043	0.33	5.74
		(0.161)	(0.145)	(0.112)	(0.128)	(0.143)		
3.8	SL => T	-0.192	0.052	0.453*	0.179	0.124	0.21	12.51
		(0.166)	(0.164)	(0.112)	(0.136)	(0.128)		
2.9	F => SL	-0.324*	-0.255*		0.749*	0.089	0.44	13.91
		(0.153)	(0.118)		(0.131)	(0.171)		
2.10	T => SL	-0.428*	-0.255		0.480*	0.078	0.09	17.65
		(0.179)	(0.177)		(0.221)	(0.231)		
3.11	F => SL	-0.443*	-0.369*	0.340*	0.827*	0.223	0.51	21.56
		(0.151)	(0.119)	(0.133)	(0.127)	(0.169)		
3.12	T => SL	-0.419*	-0.261	0.653*	0.464*	0.021	0.33	17.60
		(0.152)	(0.150)	(0.161)	(0.188)	(0.197)		

T-test; H_0: Coeficient is equal to zero. Asterisk (*) indicates regection of H_0 at 95% confidence level. Standard error of coeficients in parentheses.
Q-test; H_0: No autocorrelation in residual of regression. $Q_{.05}$ (18), critical value 28.82
(1) See Table 6 for identification the variables in each equation.

cases, SL=>F; T=>SL; F=>SL; F=>T, we reject the null hypothesis of no lagged one-way causality, implying support for the alternative hypothesis that there is one-way causality between Fortaleza and Teresina and Teresina and Sao Luis and bidirectional price adjustments (feedback) between Fortaleza and Sao Luis.

In short, pricing adjustment in terms of markets reacting to each other is high between Sao Luis and Fortaleza, showing feedback response to changes in prices in these two markets. Fortaleza appears to be operating as the leading market, due to its high volume of trade and its efficient marketing payment system by comparison with the other markets. Figures C.2 and C.3 in Appendix C illustrate the role of Fortaleza as a central market. The prices in Fortaleza in time t are compared with the prices in Teresina and Sao Luis one week later (time t+1). The adjustment of prices in Teresina and Sao Luis markets, one week later, with the prices of Fortaleza market is accentuated during the Winter season, when prices are high due to reduced supply of tomatoes from Ibiapaba production area.

Turning to the instantaneous causality results, for four cases in Table 5 the null hypothesis of no instantaneous causality is rejected, implying support for the alternative hypothesis that there is instantaneous

causality. These results show that the city pairs are interrelated significantly suggesting that prices in these markets are determined interdependently. Instantaneous interdependence is considered the most important explanation of the spatial price formulation process. Two cases, SL:F and F:SL, are non-significantly interrelated in an instantaneous fashion as the F-statistics are non-significant at the 95 percent confidence level. Thus, the data in these cases suggest that price changes in each city are not interrelated instantaneously.

Empirical evidence suggests that the lack of substantial adjustment to price changes between Sao Luis and Fortaleza is likely related to the long distance that separates these markets and consequently high transportation costs when compared with the other markets.

According to the logic of Uri and Rifkin (1985), under a competitive f.o.b. oligopoly system, price changes are partially reflected by changes in other markets. As suggest by instantaneous causality test in Table 5, for the markets of Teresina:Fortaleza; Teresina:Sao Luis; Sao Luis:Teresina; and Fortaleza:Teresina price movements in one city are immediately matched by price movements in other city within the same week. Strong instantaneous causality indicates fast and efficient movement of information among these markets (Adamowicz et al.1984).

Empirical evidence suggests that these contemporaneous adjustments can be explain also for the smaller distance that separates these markets and consequently low transportation costs when compared with the other markets. Hidden lag effects can be occurring daily, yet there is statistical evidence of lagged adjustments lasting several weeks. Besides, coefficient values in most cases decrease as the order of lag increases, suggesting that the lagged effects of price changes progressively diminish as longer order lags are estimated. The regression coefficients for the equations (considering directional or instantaneous relationships) have significant lagged coefficients for at least one time period, (see Table 7).

The R^2 (adjusted) values for various city pairs are low, indicating that price adjustment between some cities are less explained in the bivariate regressions than prices in other cities. In this study there were only two models which, based on the F-statistic, proved to be not statistically different from zero and they are associated with insignificant one-way lagged price response between the secondary markets toward the direction of the leading market. This is to be expected since prices are efficiently responsive to movements in the dominant and large market of Fortaleza (i.e., price adjustment is instantaneous between the secondary markets F<=>T<=>SL and

therefore, we would not expect the reverse lag SL->T or T->F to introduced relevant price signaling).

According to Heytens, " examination of price relations that could be supplemented with observation of trading activity have proved to be useful tests of the hypothesis." (1986, pp.25). Hence, empirical evidence about the amount of tomatoes commercialized, the low prices when compared with other markets, the vertically integrated and specialized marketing of urban wholesalers, the middlemen's operation at a higher scale and more highly capitalized when compared to their Teresina and Sao Luis colleagues suggest that Fortaleza operates as a central market for tomatoes in the study region. If so, the Fortaleza wholesale market defines the regional price of tomatoes. In other words, Fortaleza appears as a market that "drives" the price of tomatoes in Teresina and Sao Luis wholesale markets (Fortaleza, in most of the cases, has the higher R^2-adjusted implying it is a leading market).

As expected, closer markets interact more closely with price changes in proximate markets relative to more distant ones. To the extent that cross-correlation coefficients can measure price relations between markets, a cross-correlation matrix (Table B.5 in appendix B) shows strong associations between tomato prices (raw data) in

the three markets. There is an obvious decline in the intensity of the correlation indices with increasing distance (Fortaleza to Sao Luis), as compared with Fortaleza to Teresina, and Teresina to Sao Luis.

These results are consistent with the Granger Causality tests, which are considered as an effective and efficient approach that suggests causal processes in inter-regional price adjustments and provides a measure of the relative strength (and speed of price response) of market interdependence in the testing of uni-or bi-directional price relationships (Benson and Faminow, 1987). According to Adamowicz et. al (1984, p.464), strong instantaneous causality suggests fast and efficient movement of information between markets. They state that, as a basic rule, the most efficient price system would be characterized by instantaneous causality followed by less efficient directional systems (feedback, one-way causality and no causal structure). The results of this dissertation suggest (Table 5) that the flow of information and pricing adjustment are more efficient among the markets of Teresina:Fortaleza; Teresina:Sao Luis; Sao Luis:Teresina; and Fortaleza:Teresina than the markets of Sao Luis:Fortaleza; and Fortaleza:Sao Luis.

Instantaneous price adjustments in these markets probably are due to the shorter distance that separate

these cities as compared with the long way that separate Fortaleza and Sao Luis. Although, Sao Luis and Fortaleza did not show instantaneous price response to changes in prices, they shown two-way lagged price interdependence in terms of markets reacting directionally to each other.

According to Finan (1981, p.307) the competitive forces in the Ibiapaba tomatoes market are conditioned not so much by structural criteria as by behavioral strategies which participants devise to meet system exigencies. For instance, in evaluating CEASA's achievements Finan (1981) argues that Ibiapaba middlemen trade bargaining power for security of sale. Then, entry into the market becomes limited for aspiring wholesalers as well as new suppliers, since even the offer of more provocative prices will not break up the established relationships.

Also, Finan (1981,p.326-7) in analyzing the SIMA goal to use price as a tool for motivating the efficient allocation of product among alternative markets, found little possibility of success because of current strategies which define middlemen behavior. The supplier of an urban market to be prosperous must identify over all honest buyers. To enter a market on the basis of price considerations alone is considered by the middlemen to be silly behavior. These market imperfections suggest that low prices in the Fortaleza wholesale market might be

attributable to a more efficient payment system (less time consuming and probably less payment default), which is of less risk to traders in comparison to Teresina and Sao Luis wholesale markets. Besides, the Fortaleza wholesale market has a more accentuated oligopolistic organization with few wholesalers as compared with the wholesale markets of Teresina and Sao Luis. This particularity of Fortaleza wholesale market strengthens its bargaining power with producers and merchants. The merchants prefer to sell their products in Fortaleza even at a price below the Teresina market prices (notice that Teresina is a little closer than Fortaleza from the Ibiapaba production area), and obviously merchants are more likely to market their goods in Fortaleza than in Sao Luis given the greater distance that separate Sao Luis from the Ibiapaba region (Figures 3 and 9).

In general terms, the results of this dissertation show that prices in the wholesale markets of Fortaleza, Teresina, and Sao Luis perform efficiently, implying efficiency in the allocation of resources required by traders in the market which is reflected in the supply and demand relations of competing markets. The Fortaleza wholesale market operates as a leader market for tomatoes when compared with other markets. The graphical representation of the results in Tables 4 and 5 is

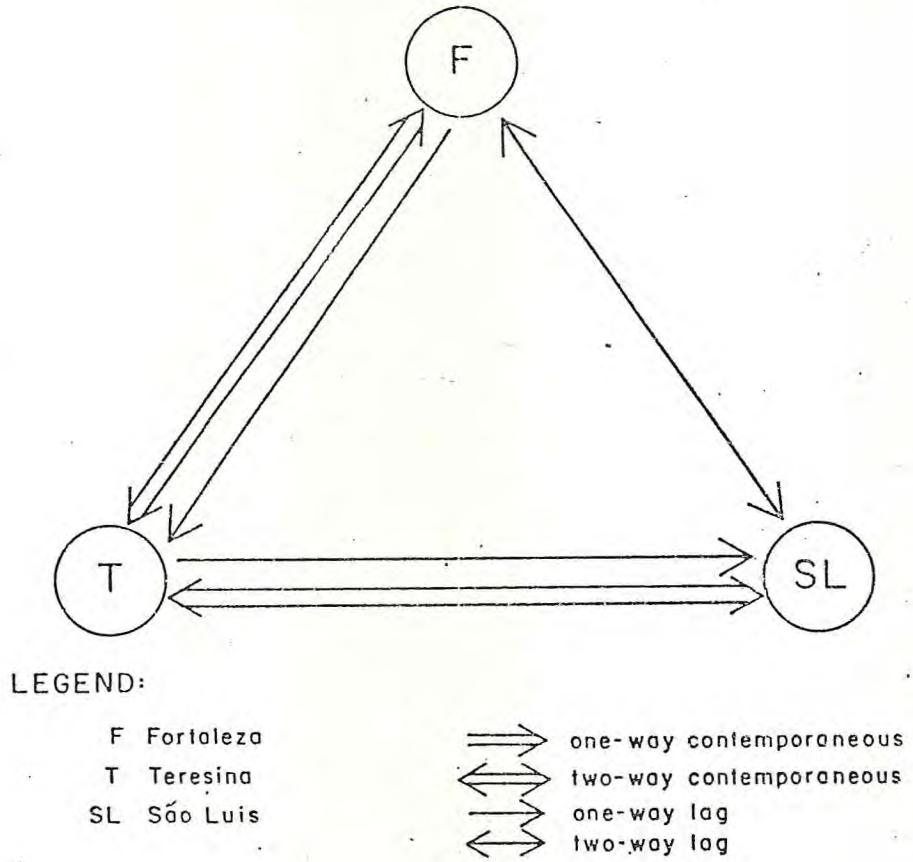

Figure 10. Graphic Representation of Causality.

presented in Figure 10. The graph of causality testing illustrates the following points:

1. a strong interdependence in price movements among the markets examined, as evidenced by the two-way contemporaneous nature of price response in two of three possible directions;

2. a tendency for prices to follow a leading or central market (in this case Fortaleza), linking all markets instantaneously through Teresina;

3. significant lagged price reactions which emanate from the leading market (a price echoing effect which unidirectionally parallels the two-way contemporaneous price structure and filters back through the weaker linked or secondary market of Sao Luis);

4. the presence of price feedback in both an instantaneous and lagged sense.

The lack of contemporaneous price relationship between the secondary market of Sao Luis and the leader market of Fortaleza suggests the existence of some imperfections probably due to the distance that separates the markets. Perhaps, a more adequate market intelligence should provide price and market supply information useful to producers and intermediaries in order to decrease the risk associated with intermarket trade.

Empirical evidences suggest that efforts are needed to

increase supply during the winter season as well as provide more adequate policy protecting payment and compelling standards of product, weighs and hygiene.

This study can be the beginning of future research about market integration of other agricultural products in regional and inter-regional markets in Brazil. Knowledge about regional and inter-regional market integration is an important subsidy in the shaping of market policy in order to promote competitive conditions through such measures as better transportation facilities, adequate market intelligence, and overall improvement in the flow of commodities.

CHAPTER 6

SUMMARY AND CONCLUSIONS

Efficient allocation of resources requires that normal profits are made by traders in the market. Competition drives allocations toward efficient conditions. Monopoly powers distort this outcome. When price data are reasonably accurate, considerable insight can be obtained from them concerning the efficiency with which a marketing system is performing its essential function of allocating scarce resources over time and space. This dissertation employs information about the wholesale prices of tomatoes in Fortaleza, Teresina and Sao Luis to reveal some prominent characteristics of the organization of tomato markets in these cities of Northeast Brazil.

The Granger causality test was used to investigate temporal ordering in the time series data. Although causality is not explicitly defined between the variables, the interpretation of the results provides important insights about market performance. It is argued **a priori** that the wholesale markets of Fortaleza, Teresina and Sao Luis perform efficiently. Pricing efficiencies in these

three markets were assessed by examining the relationship among prices and their movement over time.

The results indicated that in four cases, SL=>F; T=>SL; F=>SL; and F=>T, high levels of pricing efficiency, in terms of market price reacting directionally, are statistically evident. Fortaleza appears as the central market, perhaps due to the quantity marketed, its relatively low price level in comparison with the other markets, and its less time consuming payment system in comparison to Sao Luis and Teresina. In four cases, T:F; T:SL; SL:T; F:T, there was evidence of instantaneous causality, suggesting that these markets behave interdependently. The instantaneous relationship observed in these markets suggests that each market absorbs new information as it becomes available. As expected, closer markets interact more quickly to price changes. Fortaleza and Sao Luis markets do not show evidence of instantaneous price response, but do show strong evidences of directionality.

Jones (1968, p.110), in an attempt to form an idea about spatial integration in Nigerian markets, calculated simple bivariate coefficients of correlation of prices for each commodity in every pair of markets. Reinforcing Jones point of view, Stigler and Sherwin (1985) argued that closely parallel price series identified by correlation

analysis, suggest that two selling sites should be included in the same market. Delgado (1986, p.975), using a variance approach to test market integration in Northern Nigeria, argues that same seasonal price trends across different markets can be a test of market integration. To the extent that correlation coefficients can measure integration among markets (Harris, 1979), the wholesale markets of Fortaleza, Teresina, and Sao Luis seem well integrated (Tables B.2, B.3 and B.5 in Appendix B, and Figure 9 in Chapter 5).

According to Uri and Rifkin (1985), under a competitive f.o.b. oligopoly system, price changes in one market are reflected by price changes in the other market, but they need not be perfectly reflected. It might be expected that markets located in closer proximity to each other will interact more closely. Following the results of this dissertation the conclusion is reached that, in general terms, the prices in Fortaleza, Teresina and Sao Luis wholesale markets are established efficiently, implying a competitive invironment in the Northeast tomato markets. Fortaleza operates as a leading market. Empirical evidence suggests that Fortaleza is a leading market due to the amount of tomatoes commercialized, the low prices when compared with Teresina and Sao Luis, the vertically integrated marketing of urban wholesalers, the higher

scale of operation and capitalization.

Some imperfections in the system (lack of contemporaneous causality between Fortaleza and Sao Luis) could be diminished, based in empirical knowledge, by public effort in improving and providing feeder roads to reach isolated producers and facilitate middlemen tasks. Also, official effort have to be made to expand market intelligence with additional information toward farmers and middlemen in order to be useful. As Weber et al. (1978) and Finan (1981) argue, efforts are needed to increase supply during the winter season as well as provide a more adequate policy protecting payment and compelling standards of product, weighs and hygiene. Public effort also is important in monitoring and implementation of projects. Past experience in Brazil and other LDCs about marketing problems have to be considered in decision making.

Appendix A

Data

Table A.1 Average Weekly Data Series for Three Wholesale Markets.

Period	Fortaleza	Teresina	Sao Luis
1	4.2	4.8	6.6
2	4.6	5.0	5.0
3	4.6	4.8	5.8
4	4.2	4.2	5.0
5	5.2	5.0	5.0
6	5.4	6.2	6.2
7	5.8	6.6	7.0
8	6.4	6.2	7.8
9	5.4	5.4	6.6
10	4.0	4.4	6.0
11	4.8	4.2	6.0
12	5.8	5.2	6.0
13	5.0	6.4	6.8
14	5.0	6.8	6.8
15	5.2	7.0	6.6
16	5.8	6.2	6.8
17	6.0	6.0	6.8
18	5.2	7.0	8.8
19	5.8	7.0	7.0
20	4.6	6.0	5.0
21	3.4	5.0	6.2
22	4.8	6.0	6.8
23	5.2	6.2	6.0
24	7.8	8.2	7.8
25	7.4	9.8	10.0
26	8.6	7.2	9.4
27	8.2	9.4	8.6
28	7.6	9.4	7.6
29	6.4	9.6	8.0
30	7.4	10.4	9.8
31	12.2	13.1	10.8
32	10.4	13.4	14.6
33	10.8	12.6	11.6
34	11.2	12.0	13.6
35	9.2	12.8	14.4
36	10.2	10.8	11.2
37	12.0	13.0	14.2
38	9.4	12.0	15.2
39	9.8	12.0	11.4
40	10.0	12.6	12.0
41	9.2	12.0	11.0
42	8.2	12.0	10.0
43	4.2	10.0	9.4
44	4.8	8.6	7.2

Table A.1--Continued

45	4.2	6.6	6.6
46	3.6	5.0	5.8
47	3.8	4.6	7.2
48	3.4	5.2	6.6

Sources: CEASAs of Fortaleza, Teresina, and Sao Luis (1978-79).

Appendix B

Correlation Analysis Results

Table B.1 Autocorrelation Coefficients of Northeast Tomato Price Data for 12 Lags.

Lags	Fortaleza	Teresina	Sao Luis
1	.8220	.8814	.8452
2	.6852	.7906	.7349
3	.5868	.6894	.6717
4	.4495	.5936	.5191
5	.3688	.5428	.4629
6	.3029	.4935	.4028
7	.2443	.4231	.3065
8	.1826	.3427	.2283
9	.0861	.2587	.1301
10	-.0339	.1827	.0594
11	-.0977	.0946	-.0273
12	-.1757	.1018	-.0873

Table B.2 Partial Autocorrelation Coefficients of Northeast Tomato Price Data for 12 Lags.

Lags	Fortaleza	Teresina	Sao Luis
1	.8220	.8814	.8452
2	.0293	.0614	.0718
3	.0493	-.0846	.1212
4	-.1596	-.0436	-.3123
5	.0774	.1494	.2293
6	-.0084	.0114	-.1003
7	.0186	-.1460	-.0053
8	-.0746	-.1142	-.1972
9	-.1491	-.0361	-.0418
10	-.1791	-.0117	.0162
11	.0554	-.1545	-.1484
12	-.0991	-.1045	.0873

Table B.3 Autocorrelation Coefficients of First Difference Northeast Tomato Price Data for 12 Lags.

Lags	Fortaleza	Teresina	Sao Luis
1	-.1310	.0159	-.1960
2	-.1030	.0890	-.1420
3	.1388	.0110	.3058
4	-.1796	-.0949	-.2886
5	.1096	-.0305	.0418
6	.0262	.1215	.1491
7	.0580	.1322	-.0322
8	.0789	-.0515	.0386
9	.0222	-.0673	-.0418
10	-.0608	.1856	.0379
11	.0077	-.1419	-.1367
12	-.2149	.0480	-.0966

Table B.4 Partial Autocorrelation Coefficients for First Differences of Northeast Tomato Price Data for 12 Lags.

Lags	Fortaleza	Teresina	Sao Luis
1	-.1310	.0160	-.1960
2	-.1223	.0888	-.1876
3	.1111	.0084	.2544
4	-.1646	-.1039	-.2310
5	.1007	-.0299	.0469
6	.1353	.1422	.1618
7	.1353	.1422	.1618
8	.0523	-.0957	-.0127
9	.1024	-.1159	-.0469
10	-.0702	.2453	.0481
11	.0279	-.0917	-.1532
12	-.2791	-.0353	-.1231

Table B.5 Cross Correlation Coefficients of Raw Price Data for Fortaleza, Teresina and Sao Luis.

	Fortaleza	Teresina	Sao Luis
Fortaleza	1.0000		
Teresina	.8877	1.0000	
Sao Luis	.8674	.9100	1.0000

Appendix C

Plots of Price Data

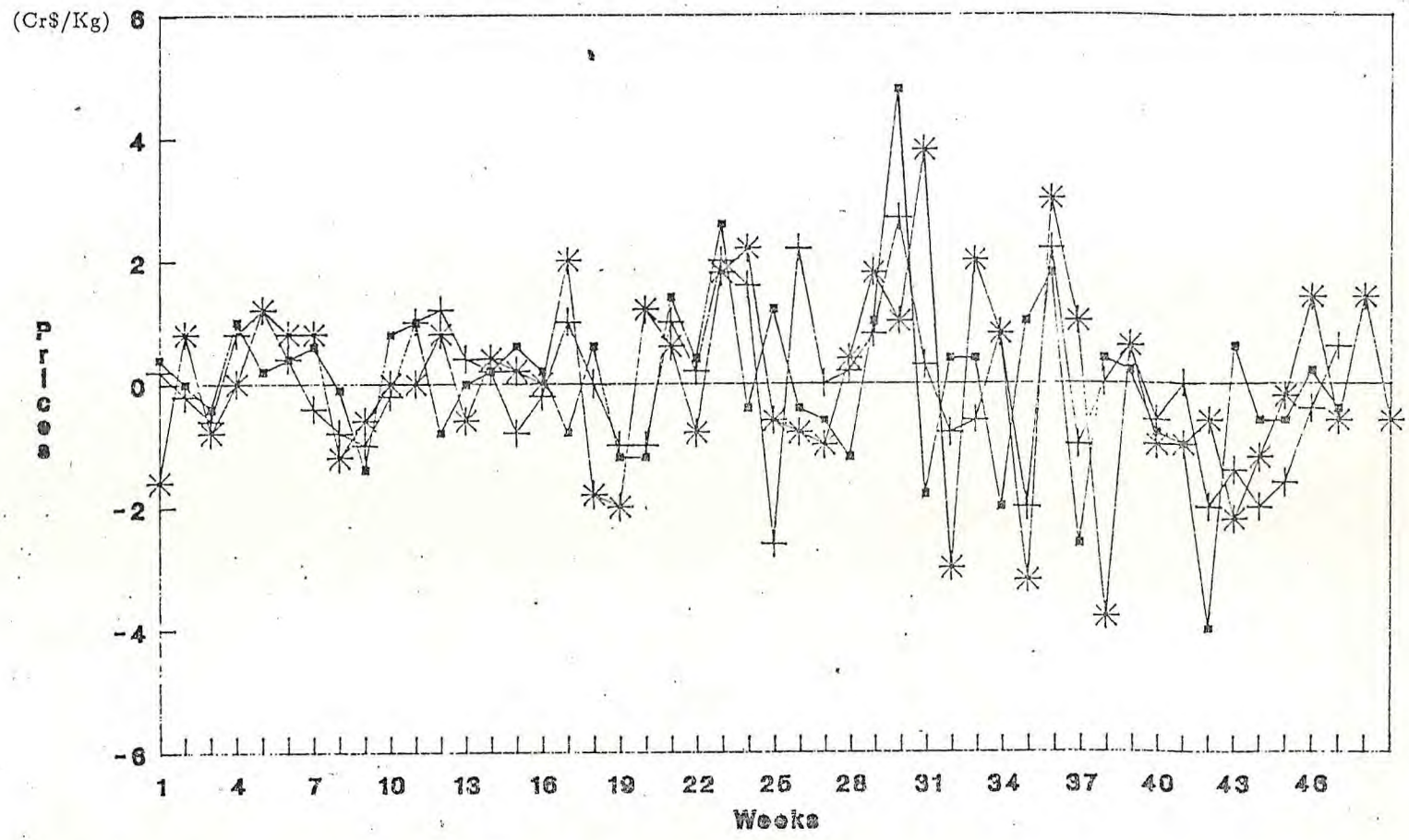

Figure C.1 First Differences of Average Weekly Prices for Tomatoes, Three Northeast of Brazil Markets, 1978-79.

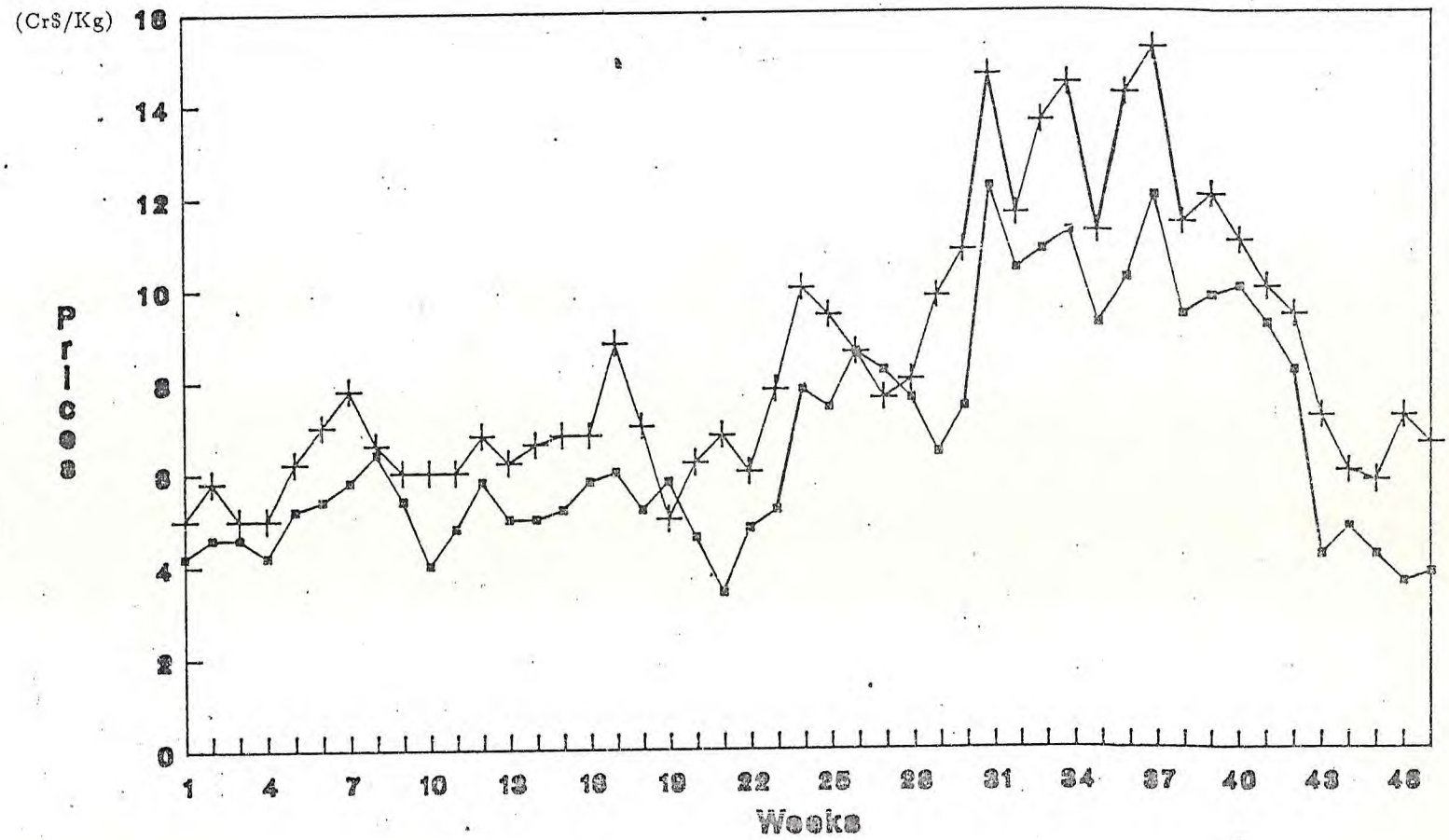

Figure C.2 Prices in Fortaleza in Week t Compared with Prices in Sao Luis in Week t+1.

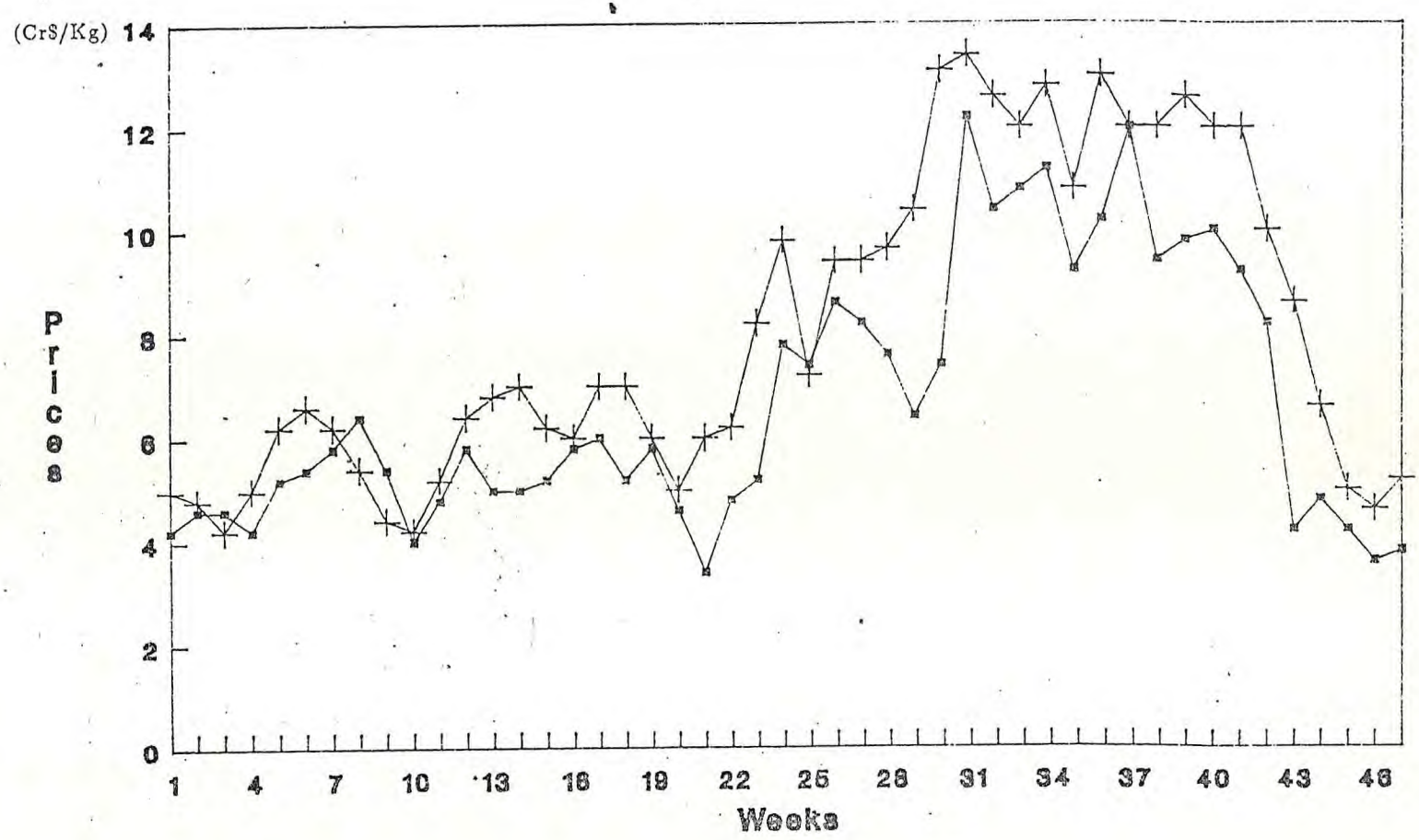

Figure C.3 Prices in Fortaleza in Week t Compared with Prices in Teresina in Week t+1.

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