# AN ANALYSIS OF MARKET INTEGRATION IN THE PIG MARKETING SYSTEM IN THAILAND: 1969-1979

by

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DEDICATION

To Thai Pig Farmers

# DECLARATION

Except where otherwise indicated, this sub-thesis is my own work.

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# ABSTRACT

This study describes the pig and pork marketing system in Thailand and attempts to choose an appropriate technique to analyse pig market integration for the period 1969-1979.

Many economists who have studied agricultural markets in low income countries have concluded that the marketing systems in those countries are relatively inefficient, whereas anthropologists often conclude the opposite. This study attempts to show how the concept of market integration is useful and can be a proxy to indicate market efficiency especially in low income countries. Because of the unavailability and unreliability of data and the existence of parallel informal and illegal markets, correlation analysis using prices series data only is used in this analysis instead of regression/margins analysis which is normally used in high income countries.

Regression analysis was at first used to investigate market integration but was rejected due to the need to specify the direction of causal relationship and because of multicollinearity problems. Absolute and first difference values of price data were then analysed using correlation analysis. Owing to biases caused by trend and seasonal influences in those values, this method was also rejected and the residual value from which the trend and seasonal influences have been removed was then used.

Government intervention caused a structural change in the market during the study period. The 'unrestricted area' period and the 'restricted area' period were therefore analysed separately.

The results showed that during the period of 'unrestricted area' there was a high degree of market integration in the live pig wholesale markets between the North, Northeast and Bangkok regions. The wholesale market for pork carcass in the North and the Northeast region are also highly integrated in the wholesale market of live pigs in Bangkok. During the period of area restriction the results showed that the government intervention was very effective because there was no market integration between upcountry markets (the North and Northeast region) and Bangkok for live pig or pork carcasses, while the markets between the North and Northeast regions were highly integrated. The possible explanations are outlined.

These results of high market integration imply that (at least when not subject to government intervention) the Thai pork marketing system is quite efficient. Recommendations for marketing and data improvements and further study are finally discussed.

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# CHAPTER 1

# INTRODUCTION

Most farms in Thailand are no longer purely subsistence and there is a general tendency for Thai farmers to commercialize their farms and most farm households are now engaged in producing rice and various kinds of upland crops. Most farm households also raise livestock, such as cattle, buffaloes, pigs and poultry: farming and raising livestock simultaneously is thus a way of life of rural Thai people.

Livestock can be used as labour and as a food on the farm. Pork is the favourite diet of a large segment of the Thai people not only in the rural areas but also in the city. The average consumption of fish and meat together amounted to about 38 kilograms per head in 1978 of which about half was fish, one-quarter pork and one-eighth each of poultry and beef (Office of Agricultural Economics, 1978). In 1978 about 6.3 million pigs were slaughtered for consumption in Thailand. During 1968-1977 the domestic consumption of pig increased from 4,033,700 heads in 1968 to 5,049,000 heads in 1977 or increased at the average rate of 2.5 per cent per year (Office of Agricultural Economics, 1978).

The Bangkok metropolitan market is the largest final consumption market in the country with a high consumer demand for red meats.

A survey conducted in 1964 by the Division of Agriculture Economics, Ministry of Agriculture and Cooperative, showed that approximately 85 per cent of pigs from farms in the Northeast region flowed through shippers to the Bangkok consumption market. We would expect that prices in these two markets should be closely related to each other and highly integrated.

It is the purpose of this thesis to study the relationship between the upcountry and Bangkok live pig and pork markets using the concept of market integration. But before discussing the concept of market integration, it is worth discussing the concepts of market and marketing.

## 1.1 Why Study Markets?

As economic development and urbanization take place, the role of marketing becomes more important and as agriculture becomes more commercialised the need for the development of an efficient marketing system becomes crucial.

When farming was purely subsistence, producers and consumers, if not the same individuals lived close to each other. Today, as more and more farmers produce in excess of their family needs, and specialize in the production of marketable output, an increasing proportion of their production is moving into the market. Markets have, therefore, developed to facilitate the exchange of surplus between rural and urban areas. This is the beginning of formal marketing functions and of the people who specialize in its performance.

Emlen (1958:70) suggested that "production may be the door to the economic growth of the underdeveloped countries, but marketing is the key that turns the lock". The essentials for a satisfactory evolution of the development process are therefore improvement in production and the proper functioning of marketing: marketing is therefore an instrument of economic growth and development.

Marketing performs various economic functions (Meier, 1977:788):

(1) The market rations supplies of consumer goods among consumers; this rationing is steered by the consumers' willingness to pay, and provided the distribution of income is acceptable it is a socially efficient process.

(2) The market directs the allocation of production between commodities, according to the criterion of maximizing profit which corresponds to social usefulness. (In the absence of externalities and marketing power).

(3) The market allocates the different factors of production among their various uses, according to the criterion of maximizing their income.

(4) The market governs the relative quantities of specific types of labour and capital equipment made available.

(5) The market distributes income between the factor of production and between individuals. So it solves all economic problems of allocation of scarce means between alternative ends.

These functions are static functions; but the market also serves to stimulate both economic efficiency and economic growth. Johnson (1962:156) stated that:

> The availability of goods through the market stimulates the consumer to seek to increase his income; and access to the market provides an opportunity for inventors of new goods and technical improvements to profit from their exploitation. Moreover, the market serves particularly to provide an incentive to the accumulation of capital of all kinds: first to the accumulation of personal capital in the form of trained skill, since such skill earns a higher reward; and second to the accumulation of material capital, since such capital earns an income.

In the Thai economy, markets are important economic institutions. They are a main link in the distribution system for a wide range of commodities in growing, assembling, processing, storing, transporting and manufacturing. They are the largest retail outlet for all types of goods. Kenneth (1976:3) mentioned that:

> Markets also serve as collection and distribution points for non-retail transactions at many different levels. For example, individual small-scale producers often travel to markets or to retail merchants who have stalls in the

> market. On a bigger scale, some markets are central collection points for large shipments of produce that have been accumulated by middlemen from many producers in a given area, often at some distance from the market.

At this point we may say that the market may be thought of as a bridge which links producers to consumers. It is both the physical distribution and an economic bridge designed to facilitate the movement and the exchange of commodities from the farm to the consumers. Furthermore, markets also have an important role in capital formation, the development of the society's economic infrastructure, and training of entrepreneurial talent (Kenneth, 1976).

Studying markets is therefore very important, especially in a country such as Thailand where agriculture is a main sector in the economy. As higher consumption levels for marketed food are brought about by rising incomes, rapid urbanization and industrialization, many developing countries become aware of how inadequate their marketing systems are. Improvements in markets and marketing systems can have an important effect both on producers and consumers in the sense of increasing farm incomes and reducing food costs to consumers. Thus, it is important to assess and improve performance of markets in developing countries.

## 1.2 Definitions of Market and Marketing

Markets are variously conceived. Webster's dictionary gives eight different meanings of the word, the first six of which are:

(1) A meeting together of people at a stated time and place, for the purpose of traffic (as in cattle, provision, wares, etc.) by private purchase and sale, and usually, not by auction; also, the people assembled at such a meeting; as a market is held in the town every week.

(2) A public place (as in a town), or a large building, where a market is held; a market place; especially a place where provisions are sold; as a city market, fish market.

(3) Buying and selling, or either of the two, as an act or occupation; marketing; a sale or purchase; a bargain.

(4) The region in which any commodity can be sold; the geographical or economic extent of commercial demand.

(5) Opportunity for selling or buying of commodities; or the rate of price offered for them, also the phase or course of commercial activity by which the exchange of commodities is effected; as the market is dull, active.

(6) A body or group of men associated in, or organized for, the buying and selling of goods. Market may be used with reference to goods in general, or of a particular class of goods, expressed or implied, or of those dealing in them; as the stock market; the beef market.

Economists themselves use the word with several different meanings. Larson (1951:33-4) gave the following definitions of a "market":

The market may mean -

(1) The place where buying and selling take place, such as the public market, the retail store, or the vegetable market in a city. Again, it may be thought of as

(2) an area in which a good is sold, such as the United States market, the European market, or the world market. The market may be thought of as

(3) a group of people carrying on buying or selling. This group may be: (a) unorganized (for example, ladies selling cake at a church bazaar); or (b) organized (for example, board of trade). Too, the market may be

(4) the commodity traded, such as the corn market, the cotton market, or the livestock market. The market is also defined with respect to

(5) time (for example, the cash market and the futures market).

More general definitions include the concept that the market is the opportunity to exchange, buy or sell. By this definition, a market exists whenever two or more people are in communication with each other. Hibbard's (1921:13) definition is "a market is the sphere within which price - determining forces operate". Kohl and Uhl (1972:9) defines a market as "an arena for organizing and facilitating business activities and for answering the basic economic questions: what to produce, how much to produce, how to produce, and how to distribute production". In his view a market may be defined by a location, a product, a time or a level of the market.

The choice of markets' definition, therefore, depends on the problem to be analyzed.

Marketing also means different things to different people. To the consumer, marketing may refer to the weekly food shopping trip to the supermarket. The farmers may associate marketing with the loading of hogs into the pickup for the trip to market. The middlemen such as retailers, wholesalers and processors may view marketing as a process for gaining competitive advantage over market rivals, improving sales and profits, and satisfying consumers. Shepherd (1958) states that in physical terms, agricultural marketing begins when the farm products are loaded at the farm gate and ends when the good reaches the consumer's table. It is concerned with such physical things as trucks and refrigerated cars and packing plants, and with technological development in preservation and packaging. But in the economics of marketing it deals with the consumers' demand for farm products, with the price system that reflects these demands back to distributors and producers, and with the methods or practices used in

exchanging title and getting the physical product from the producer to the consumer in the form and at the time and place desired.

Kohls and Uhl (1972:8) define marketing as "the performance of all business activities involved in the flow of goods and services from the point of initial agricultural production until they are in the hands of the ultimate consumers". Beckman and Davidson (1962:4) define marketing as "the performance of all activities necessary for ascertaining the needs and wants of markets, planning product availability, effecting transfers in ownership of products, providing for their physical distribution, and facilitating the entire marketing process". Hence, marketing consists of the activities of buying, selling, transporting, processing and storing goods and also includes those business activities involved in the flow of goods and services between producers and consumers.

## 1.3 Outline of the Study

The questions of market integration in the Thai pork sector are approached in this study with the view that useful conclusion can be derived from an analysis of the existing pork marketing system largely utilising price data. The introductory chapter describes the role and importance of markets and marketing, and states the objective of the study and sources of data including examples of studies of livestock marketing in low and high income countries which are used to illustrate the considerable data requirements and modelling complexity of many existing methods. The concept of market integration is then discussed.

The second chapter describes the characteristics of the Thai pork sector in terms of production and consumption and discusses the relationship between Bangkok and provincial prices and price movements.

The third chapter outlines the main institutional features of pig marketing in Thailand, including the role and effects of government

intervention and regulation. Examples of marketing costs and marketing margins are also presented and discussed.

The analysis of market integration in live pig and pork carcass markets between the North, Northeast and Bangkok regions during the period of unrestricted and restricted area by the government are the domain of Chapter 4. Various methods of analysis utilising regression and correlation methods are used and each method evaluated. The results from the most appropriate and powerful approach are then presented. This approach used correlation analysis of the residual value of the absolute values of monthly price movements in each market after correction for trend and seasonality.

The final chapter discusses the conclusions drawn from this study and makes recommendations for the development of the Thai pork marketing system.

## 1.4 Objectives of the Study

There seems to be a general assumption that markets in developing countries are inefficient and poorly integrated because at first glance there appears to be little or no order in the system. This view is often based on hasty studies of price data for various markets which show variations not explained by transportation and other costs. Further study will often reveal that the market where interregional movement is important, are very much related. Spinks (1972:4) stated that "It is suggested that examination of markets in most developing countries will show considerable integration and that prices are formed competitively".

The major objective of this study is to present a possible useful way of analysing the relative efficiency of marketing channels by using the concept of market integration. Lele (1972:257) defined market integration as "the interrelationship between price movements in two markets".

If two markets are highly integrated, i.e. price movements in each market are highly correlated, then there is a high probability that the transfer of the commodities from one market to the other is relatively efficient.

## 1.5 Sources of Data

Very commonly, data is rarely available in low income countries for adequate market efficiency studies. The statistics are often based upon inaccurate information, or at best on legendary half-truths accepted without question. The complexity of the marketing systems including informal markets also causes unreliable data. For example, the livestock population in Thailand is always underestimated due to illegal slaughtering which can not be recorded. Generally, price data is the only reliable data available to investigate markets and market efficiency.

Another problem in Thailand is that not every government office collects every kind of data. For example, pork carcass wholesale price and retail prices can be obtained only from the Division of Commercial Economics whereas farm prices and live pig wholesale price can be obtained only from the Division of Agricultural Economics. These figures may be collected on different bases and often do not correspond to each other and, therefore, lead to ambiguous or incorrect data.

Secondary price data and other data used in this study were collected from available statistical reports and other pertinent sources, namely, the publications of the Department of Business Economics, Ministry of Commerce, Division of Agricultural Economics, Ministry of Agriculture and Cooperatives, National Statistic Office, National Economics and Social Development Board research papers and other Thai Government publications.

The basic data used for the analysis consists of 132 monthly price observations covering the period of January 1969 to December 1979

in the Bangkok, North and Northeastern region of Thailand for the live and carcass wholesale pig and pork markets.

1.6 Studies of Agricultural Marketing in Low and High Income Countries

Market studies in high-income countries have generally emphasised margin analysis. This method analizes the price of a product at various marketing stages from producer to consumer, and may include comparisons with cost components of those price differentials. Some examples of such studies are set out below in detail to show the complexity of such analysis, the amount and type of data they require and inconclusive nature of some of their results.

Griffith (1974) has provided some empirical evidence on the forces determining the relationship between the auction, wholesale and retail prices of the meat market in the Sydney area in Australia, utilising price data from the Division of Marketing and Economics of the N.S.W. Department of Agriculture. Retail and wholesale margin models are considered separately, each containing four equations for beef, lamb, mutton and pork. Two-stage least square and three-stage least squares estimation techniques were used. All preferred equations were tested for autocorrelation using the simultaneous equation version of the Durbin-Watson statistic and no evidence of significant autocorrelation was found in any model. Those equations are as follows:

Wholesale Margins

$$MW_b = f(PA_b, CW_b, LPA_b, MW_l, MW_m, MW_p, T_b)$$

$$MW_l = f(PA_l, CW_s, LPA_l, MW_b, MW_m, MW_p, T_l)$$

$$MW_m = f(PA_m, CW_s, LPA_m, MW_b, MW_l, MW_p, T_m)$$

$$MW_p = f(PA_p, CW_p, LPA_p, MW_b, MW_l, MW_m, T_p)$$

Retail Margins

$MR_b = f(PW_b, CR, LPW_b, MR_l, MR_m, MT_p, T_b)$

$MR_l = f(PW_l, CR, LPW_l, MR_b, MR_m, MR_p, T_l)$

$MR_m = f(PW_m, CR, LPW_m, MR_b, MR_l, MR_p, T_m)$

$MR_p = f(PW_p, CR, LPW_p, MR_b, MR_l, MR_m, T_p)$

Variable definitions are as follows:

PA = Monthly estimated dressed auction carcass price, in cents/kg, of composite beef, lamb, mutton and pork carcasses sold at Homebush saleyards and adjusted for shrinkage.

PW = Monthly wholesale price, in cents/kg, of composite beef, lamb, mutton and pork carcasses sold in the Homebush meat halls and adjusted for shrinkage.

MW = Monthly wholesale margin, in cents/kg, between adjusted wholesale price and adjusted auction carcasses price.

LPA = Monthly weighted average of past adjusted auction carcass prices in cents/kg. The preferred weighting factors used were:

$$LPA_t = 0.5\ PA_{t-1} + 0.33\ PA_{t-2} + 0.17\ PA_{t-3}$$

CW = An index of monthly wholesale marketing costs. Slaughtering fees comprise some 60 per cent of wholesale operating costs, so slaughtering fees charged at Homebush abattoir were used as a proxy for all wholesale costs. The base period was January, 1971 = 100.00.

T = Monthly throughput of local and interstate beef and veal, lamb, mutton and pork carcasses at Homebush meat halls, in thousands. Retail throughput (or consumption) is not available in monthly terms, so wholesale throughput was

used as a proxy in preference to interpolating quarterly consumption figures.

MR = Monthly retail margin, in cents/kg, between composite retail prices of beef, lamb, mutton and pork at selected retail outlets in Sydney and adjusted wholesale prices.

LPW = Monthly weighted average of past adjusted wholesale prices, in cents/kg. The preferred weights used were again:

$$LPW_t = 0.5\ PW_{t-1} + 0.33\ PW_{t-2} + 0.17\ PW_{t-3}$$

CR = An index of monthly retail marketing costs. Since wages contribute 52 per cent of retail operating expenses, the weekly wage rate for a New South Wales general butcher shopman under the Federal Meat Industry Interim Award was used as a proxy for all retailing costs. The base was January, 1971 = 100.00.

Griffith concluded that at both aggregate wholesale and retail levels, the transmission of supply and demand conditions to the auction level is distorted to some extent during the shortrun (periods up to 1 month) but that over longer periods retail and wholesale prices are quite responsive to changes in auction prices. The hypothesis of absence of price levelling is totally rejected in the shortrun at both wholesale and retail levels, while the hypothesis relating to the absence of price averaging is rejected for all meats except mutton at wholesale and for all except mutton and pork at retail. Griffith said that price levelling and price averaging are generally the most important in causing distortions in the pricing mechanism.

Griffith also found that the cost of providing market services were a significant determinant of all retail margins while wholesale costs

were significant in only the beef and pork equations. All wholesale margins except mutton were significantly influenced by turnover but this was not the case at retail level. When Griffith tried to illuminate differences in retail margin behaviour between supermarkets and traditional butchers and between high and low income locations, no overall consistent pattern was discerned. There is some evidence that butcher shops tend to practice price levelling more than supermarkets; that high income outlets average the margins between meats more, and that the two outlets in low-income locations are more influenced by the costs of providing retail services. Griffith's results can only give a rough idea of the relative importance of the various influences in each sector and on each meat type considered and the results may be used in conjunction with other models of the livestock and meat sectors.

Hogan and Todd (1979) examined some aspects of the efficiency of pricing in the livestock auction system, using readily available data. Two studies are reported in this article. The first is a comparison of reported average cattle prices within pairs of major auction centres in the Australian States of Victoria and New South Wales to determine whether unexplained price differences and potential imperfections occur. The model used was as follows:

$$P_{ct} - P_{mt} = d_t$$

where $P_{ct}$ = price of cattle type at the country centre in week t,

$P_{mt}$ = price of the corresponding cattle type at metropolitan centre in week t, less transport costs between the centres in week t,

$d_t$ = difference between country and metropolitan prices not attributable to transport costs in week t.

To examine whether the average prices are equal at any pair of auction centres after adjustment for transport costs, the specific statistical hypothesis required to hold is:

$$Ho_1 : d_t = 0$$
$$Ha_1 : d_t \neq 0$$

In three out of the four comparisons, the hypothesis that average cattle prices are equal after adjustment for transfer cost, was rejected. Factors not accounted for such as lot size, the degree of buyer competition and the accuracy of reported prices, were suggested as factors that could influence the relationship between reported prices in the pairs of centres examined.

The second part of Hogan and Todd's study is an examination, through the use of a case study, of whether lot size, number of buyers and saleyard size have an impact on price formation within centres and price differences between centres. The study was conducted for two auction centres in New South Wales (one large and one small) less than 50 kilometres apart. The hypotheses detailed and the models employed were as follows:

$Ho_2$ : There is no significant difference in the level of cattle prices at the small and large centres, after allowance for time, weight, transport costs and lot size.

Price: f [time (weeks), weight, lot size, centre size].

$Ho_3$ : Average cattle prices within a centre are not influenced by lot size, after allowance for time, weight, and number of buyers; and

$Ho_4$ : Average cattle prices within a centre are not influenced by the number of buyers attending an auction sale, after allowance for time, weight and lot size.

Price: f [time (weeks), weight, lot size, number of buyers].

$Ho_5$ : There is no difference in the level of auction sale price variability between the small and large selling centres.

$Ho_5 : \sigma^2_{sc} \leq \sigma^2_{lc}$ ,

$Ha_5 : \sigma^2_{sc} > \sigma^2_{lc}$ .

where

$\sigma^2_{sc}$ = the price variance at the small centre

$\sigma^2_{lc}$ = the price variance at the large centre

The major factor explaining the price differences between the two auction centres was found to be lot size. This factor also influenced price variation within auctions. The number of buyers purchasing cattle did not affect price levels.

Naughtin and Quilkey (1979) consider the degree of pricing efficiency achieved in the retail meat market in the Melbourne area (Australia). The approach adopted is to develop an economic model of the pricing behaviour of retail butchers, to postulate a behavioural model consistent with the economic model, and to test this model using the weekly total revenue and weekly wholesale meat expenditure figures of the three retail butchers in the Melbourne area. The aggregate margin and aggregate wholesale meat expenditure series were examined for seasonality using analysis of variance models. The null hypothesis of the absence of seasonality was accepted using the F-test, so that the statistical model was not modified to account for seasonality.

Naughtin and Quilkey advance an economic model of the pricing behaviour of retail butchers which incorporates the kinked demand curve hypothesis of Parish (1967). A behavioural model was postulated and

specified in terms of the aggregate variables that butchers were found to record as a guide to pricing decisions. That model was expressed as:

$$M = B_0 + B_1.W,$$

where $M$ = desired aggregate margin in the long run,

$W$ = aggregate wholesale meat expenditure in the long run,

$B_0, B_1$ = parameters.

$$E(m) = b_0 + b_1 E(w),$$

where $E(m)$ = expected value of the desired aggregate margin expressed in short-run terms,

$E(w)$ = expected value of the aggregate wholesale meat expenditure expressed in short-run terms.

$b_0, b_1$ = parameters.

The results indicate that price levelling (the practice of retailers holding selling prices stable while wholesale prices fluctuate) and averaging (the practice of setting higher margins on some types of meat to off-set lower margin on other types of meat) practices were not confined to the current planning horizon (approximately one quarter).

Only limited conclusions can be drawn from the empirical results that the demand curves are not kinked and that butchers are satisficing with respect to short-run profits and maximizing when the costs of information collection, etc. are taken into account. Such information costs arise because of the complexity of pricing to maximize profit in a multi-product environment. There is a possibility that the deleterious effects of price levelling and averaging practices on pricing efficiency may have been understated in earlier empirical studies. Naughtin and Quilkey suggest that further research is required to re-assess the extent

of the problem in retail meat market pricing efficiency which should be based on an explicit link between the pricing behaviour of the individual firm and the formation of a marketing margin.

Todd and Cowell (1980) examined price variation within cattle and carcass auctions to gain an insight into whether there is a substantial random variation in prices, or whether the price variations perceived by producers can be accounted for by factors which influence quality variation. On the basis of the technical and economic research, Todd and Cowell postulated a model to examine livestock price variation at cattle and carcass auctions. An analysis of covariance using regression was employed. The models developed were as follows:

$$P = f(W,S,F,A,B,D,H,LS,T),$$

where P = lot price ($/head, c/kg);

W = cold carcass weight including internal fats (hot carcass weight less 2 per cent shrinkage);

S = sex, either heifer ($S_0$) or castrate ($S_1$);

F = cold carcass measurement (mm) at the 12th - 13th rib interface;

A = dummy variables for the number of permanent incisors ($A_0 < 2$, $A_1 \geq 2$);

B = dummy variables for breed; Shorthorn ($B_0$), Hereford ($B_1$), Angus ($B_2$), other ($B_3$);

D = dummy variables for district of origin: Adelaide Hills ($D_0$), Upper South-East ($D_1$), Mid-North ($D_2$), Peninsular (Eyre, York)($D_3$), Far North ($D_4$);

H = dummy variable for horned ($H_0$), hornless ($H_1$) and mixed lots ($H_2$);

LS = number of cattle within a sale lot; and

T = time of sale in terms of pen numbers within the sale, the sale being split into four periods.

The results show that a substantial element of the perceived price variation in livestock auctions is due to variation in cattle type. The results do not support the criticism that price variation at auctions is excessive. Of the nine factors included in the model, seven were found to be significant. Time of sale, breed, district of origin of cattle, sex, carcass weight, fatness and lot size were found to influence significantly price variation within the auction. Mixed results were found with respect to age whilst the horns factor was not significant.

The model of carcass auction analysis was as follows:

$$P = f(T,W,S,F,A,BR),$$

where T = the specific auction sale; and

BR = bruising as a numerical score.

The results were similar to those of the livestock auction, with a positive price - fat relationship and buyers paying a premium on steers over heifers. Weight was not a significant factor in explaining unit price variation. This is attributed to the smaller weight variation at the carcass auction sales than at the livestock auction. Age was found not to influence within sale price variation.

These studies on livestock marketing in a high income country are included in such detail here to illustrate the complexity of the analytical methods frequently used as well as the type of data required. To be done adequately, a considerable amount of dependable data is necessary, and the cost of data collection (if not already available) is very high.

Such studies also assume little or no informal or illegal market. Such an assumption is unrealistic for most third world markets. In low income countries many problems also occur either because of the unavailability or unreliability of data. Firstly, data for adequate margins and market efficiency analysis is rarely available. Secondly, there are usually parallel informal and illegal markets for which data is difficult or impossible to collect.

Nevertheless, many agricultural marketing studies in low income countries have used this type of analysis. Given the data problems noted above, it is unlikely that this method will produce very conclusive results.

Chiewsakul (1977) studied pork marketing margins in Thailand in January - February 1977. Sampling was done in four provinces in the Northeast where pig raising is very popular: Nakorn Ratchasima, Ubonratchathani, Udornthani and Khon Kaen and markets in Bangkok. The study showed that the cost of production was high. For 100 kilograms weight of live pig, variable costs were 1,464.95 baht and fixed costs were 95.25 baht. Total cost of production was 1,560.20 baht or 15.60 baht per kilogram. Pork carcass retail price was 24.35 baht per kilogram.

Margins at different levels of market were calculated. The producers' margin was 8.24 per cent, wholesalers' margin was 10.13 per cent and retailers' margin was 8.75 per cent. Chiewsakul concluded that these margins were not excessive given production and marketing costs and concluded that profits were also not excessive. He also concluded that there should not be any increase in the controlled price of pork at that time but that pig raising should be promoted to get improvements in both quantity and quality. Techniques aimed at decreasing production costs should also be encouraged.

Although Chiewsakul calculated these margins, and presented useful data he did not analyse them in relation to marketing costs.

Harthamart et al (1976) also tried to study livestock marketing systems in Thailand by using pricing efficiency and gross marketing margins analysis. This study examined how well the present livestock (cattle, buffalo and pig) marketing system in Thailand performs. They tested three general hypotheses:

(1) There is a shortage of cattle and buffalo supply in Thailand.

(2) The livestock marketing system is not performing efficiently and effectively.

(3) The present livestock marketing system is not suitable for an increasing commercial and large livestock industry.

Special attention was paid to the provinces in the Northeast which is the largest livestock raising region of the country especially cattle and buffalo. Large numbers of livestock from these provinces are regularly shipped to Bangkok, the terminal market. One hundred and ten cattle - buffalo dealers and 56 pig dealers were selected at random from all 12 provinces. Within the Bangkok consumer market, 91 beef and buffalo meat retailers in 28 retail markets, and 147 pork retailers in 33 retail markets were selected. In addition, 28 slaughterhouses from those 12 provinces were chosen at random to study their slaughtering activities. The study starts by describing the characteristic of livestock raising, which is predominantly small-scale throughout all regions although there are some large-scale livestock farms producing high quality meat for domestic and export markets.

There are at least three levels of livestock markets in Thailand: the local assembly livestock market, the central assembly livestock market,

and the final consumption market. These markets overlap in their functions. (The institutional aspects of the Thai pork market is discussed in detail in Chapter 3 of this thesis.)

Several marketing intermediaries perform various activities at various levels within the marketing system. The marketing channels are also numerous. Most slaughterhouses, except two modern ones, not only lack important facilities but are in poor condition and not very hygienic. They generally operate below maximum slaughtering capacity because most cattle, buffaloes and pigs are slaughtered by illegal or unauthorized slaughterhouses.

To test the pricing efficiency of the livestock marketing system, Hartamart et al utilised a "spatial price differential model". Harthamart defines pricing efficiency as concerned with improving the operations of selling, buying and pricing aspects of the marketing process in accordance with consumer preference. The model equations are:

$$P_{ibu} = P_{wb} - (H_{cub} + T_{cub}) ,$$

where $P_{ibu}$ = ideal price of 1 kilogram of live animals, i.e. cattle and buffalo, and pig, delivered to meat wholesalers in the Bangkok terminal market (subscript "b") in relation to the Ubon Ratchathani supplying market (subscript "u"), expressed in baht.

$P_{wb}$ = actual wholesale price of kilogram of live animals paid by meat wholesalers at Bangkok market, expressed in baht.

$H_{cub}$ = all handling charges incurred in shipping 1 kilogram of live animals from the "u" market to "b" market, expressed in baht.

$T_{eub}$ = actual transportation costs for moving 1 kilogram of live animals from the "u" market to the "b" market, expressed in baht.

The results showed that the price spread for the cattle, buffalo and pig markets were not equal to zero between Ubon Ratchathani supplying market and the Bangkok receiving market, implying that there are imperfections and inefficiencies in the pricing of the livestock marketing system in Thailand.

The gross marketing margin model for cattle, buffalo and pig was expressed by the following equations:

$$P_r = P_f + (H_c + T_c + C_m)$$
$$P_f = P_r - (H_c + T_c + C_m)$$

where $P_r$ = retail consumer prices for red meats and by-products of cattle, buffalo and pigs in the Bangkok retail market expressed in bahts per head of livestock.

$P_f$ = farmer's price for cattle, buffalo and pigs at the farm gate, expressed in bahts per head of livestock.

$H_c$ = all handling charges or marketing costs, except transportation costs and commissions, incurred in performing marketing activities along the flow channels, expressed in baht per head of livestock.

$T_c$ = actual transportation costs along the flow channels, expressed in bahts per head of livestock.

$C_m$ = actual commissions charged by all levels of marketing intermediaries along the flow channels, expressed in bahts per head of livestock.

$P_r - P_f$ = gross marketing margins or the farm retail price spread, expressed in bahts per head of livestock.

The findings showed that gross marketing margins as a percentage of the consumer prices for pig is the highest (31.59%) as compared to cattle (21.04%) and buffalo (27.32%). It resulted from high commissions at 24.77 per cent of the consumer baht against 13.94 per cent for cattle and 19.74 per cent for buffalo. It was asserted that the major portions of total gross marketing margins belonged to dealers as their commission and the smaller portions were marketing costs. The commission per head of pig marketing was the highest of all (78.41%). As percentages of marketing margins, marketing cost per head of cattle was the highest (33.75%) and this is also the case of farmer's shares of consumers (78.96%) but gross marketing margins' shares for pig marketing was the highest (78.41%). This study concluded that the livestock marketing system in Thailand was not performing efficiently in the sense that there were excessive margins at most or all stages in the marketing chain over actual costs involved in carrying out each marketing function and it was concluded, therefore, that that consumer prices may be higher than necessary and returns to pig raisers less.

Illegal slaughter and the charges to truckers or livestock shippers illegally made by the highway patrol police were identified in this study as not only important "non-price" factors, but problems which obstruct the development of the livestock industry and marketing system. Many recommendations were made in this study both in government policies and marketing systems.

One problem of margins analysis of this type is that if important variables are ignored or omitted, it will make margins look excessive.

For example, illegal payments to officials may be a necessary cost to an intermediary, but ignoring them inflates his profitability and leads to the conclusion that the system is inefficient. One important variable omitted in the above study is the cost of capital (or cost of borrowing) which is usually a significant cost in buying/selling operations. Also, such a study relies heavily on how well the survey is designed and conducted, as well as the response of the intermediaries. Marketing systems are very complex and it is easy to ignore or omit some costs, whereas the gross return of each intermediary is easier to determine by multiplying sales by price. It is possible that these results are biased toward concluding that third world markets are inefficient.

Monkoltananont (1977) also considered marketing margins in her study. She examined and investigated the pig cycle in the Thai pig industry and estimated the extent to which the cycle affects the consumers as well as the producers. Her main aim was to propose possible stabilization schemes to try to solve the instability in the pig industry and to achieve welfare gains for both producers and consumers.

Some general information on the pig industry is presented in her study. The expansion of the pig industry has been fairly slow even though a rapid improvement in pig breeding leading to a larger litter size and improved feeding occurred during the last two decades. The slow rate of growth is largely due to low returns to producers caused by the low price of pork. Past governments have controlled pork's price without considering the long-run effects.

The data used in Monkoltananont's analysis were secondary data estimated and collected by the Division of Agricultural Economics, Ministry of Agriculture on a quarterly basis during 1961-1975. Monkoltananont

suggested that the marketing margins between producers and consumers are rather high in view of the relatively few and simple services provided. Such relatively high margins may be the result of having several groups of middlemen between the producers and the consumers operating at small scale levels. Standard econometric techniques were applied to analyse the supply and demand response of the pig industry in order to determine the pig cycle. The lack of a single agency with clear authority and precise functions is a major determinant of the unavailability of reliable information relating to pig production and consumption.

The models used were:

(1) Demand equation:

$$PP_t = a_1 + a_2 Q_t + a_3 PBF_t + a_4 T \quad ,$$

$$PPC_t = a_1 + a_2 Q_t + a_3 PBF_t + a_4 T \quad .$$

(2) Supply equation:

$$Q_t = b_1 + b_2 PP_{t-i} + b_3 Q_{t-j} + b_4 PR_{t-i} + b_5 T$$

$$Q_t = b_1 + b_2 PPR_{t-i} + b_3 Q_{t-j} + b_4 PR_{t-i} + b_5 T$$

$$Q_t = b_1 + b_2 PPB_{t-i} + b_3 Q_{t-j} + b_4 PR_{t-i} + b_5 T$$

where $PP_t$ = average wholesale price of pork in Bangkok-Thonburi expressed as unit of baht per kilogram,

$Q_t$ = number of slaughtering expressed as number of head divided by 1,000,

$PBF_t$ = average wholesale price of beef in Bangkok-Thonburi expressed as unit of baht per kilogram,

$PPC_t$ = the relative price of average wholesale price of pork and Consumer Price Index of food ($PP_t$ deflated by CPI) multiplied by 100,

$T$ = linear time trend,

$PPR_t$ = the relative price of average wholesale price of pork and average wholesale price of rice bran,

$PPB_t$ = the relative price of average wholesale price of pork and average wholesale price of broken rice,

$PR_t$ = average wholesale price of rice bran in Bangkok-Thonburi,

$i,j$ = number of time period (month or quarter).

Her supply analysis suggests that the time lag between prices and quantity is longer than 1 year, which implies that the pig cycle in Thailand is longer than 4 years. The stability test indicates that there has been no structural change in the pig industry between the period prior to 1969 and the period 1969 to 1975.

Stabilization schemes and government policies were proposed to develop the Thai pork sector.

Even though there are many studies on marketing in Thailand, studies related to the analysis of marketing efficiency by utilizing the market integration concept are particularly scant. Some examples of those studies are as follows:

Kenneth (1976) examined the Thai marketplace in relation to its socio-cultural and economic environment. He used a comparative framework, with research conducted in markets throughout Thailand, in both urban and rural settings over one year in 1974-75. Both quanitative and quantitative methods were used, with data gathered from observation and from several hundred structured and unstructured interviews and conservations conducted with merchants, customers, wholesalers, and market administrators.

The initial part of the study described the Thai marketplace dealing with market cycles; physical environment; the collection and

distribution net; and the specific capital requirements and expenses involved in selling in the market. The major participants in the marketplace, merchants and customers, are also profiled, and their places in the daily market operation is described. Then the study moves into an examination of the interaction that takes place there among customers, merchants, and wholesalers.

There was evidence that a considerable degree of competition in the marketplace exists not only between and among merchants, but also between merchants and customers. This is clearly manifested in haggling over price which offers an excellent example of the interdependence between socio-cultural and economic factors in the market.

Another section discusses capital formation in the marketplace such as sales, profits, credit, method of borrowing, and interest rates, the influence of ethnicity and kinship on success in the market, with special attention paid to the differences between ethnic Thai and ethnic Chinese business practices. Quantitative analysis of data on profits shows the advantage given to ethnic Chinese merchants due to assistance from their families that is both more effective and more readily available than that for ethnic Thai merchants.

The final part deals with the marketplace in society. Kenneth examined the marketplace as it fitted into Thai society. It was both a basic economic institution and an important part of the socio-cultural system, and as such, was a major source of integration and change. The role of the government in the marketplace was discussed, as are the possible consequences this involvement may have for the developmental process in Thailand.

Kenneth's study is a good example of the different conclusions on market efficiency obtained by economists and anthropologists. Many

economists have found that markets in low income countries operate inefficiently whereas the anthropological approach which consider the different factors affecting the marketing system often conclude that markets in those countries are relatively or highly efficient.

Pollak (1974) studied the production, the domestic demand and marketing of oilseeds, and Thailand's trade in these crops, using publicly available data. In the first part, production and supply of oilseeds are examined. Lack of technical knowledge about the production, poor quality of seeds and lack of cash resources to buy the needed inputs for growing oilseeds were considered to be the major constraints in their oilseed production. The model equations used are as follows:

$$AP_t = f(PBK_t, PBK_{t-1}, QBK_{t-1}, PABK_t, T)$$

where $AP_t$ = area planted oilseed crops in period t, in thousand rai,

$PBK_t$ = price of oilseed crops in the Bangkok wholesale market in period t, in baht per 100 kilograms,

$QBK_{t-1}$ = quantity of oilseed produced in period t-1, in thousand metric ton,

$PABK_t$ = price of alternative crops in the Bangkok wholesale market in period t, in baht per 100 kilograms,

T = linear trend.

The analysis of production and supply response of Thai oilseeds revealed that the growth of this sector was tightly linked to the expansion of agricultural land. Market prices and crop yields seem to have only a minor role. Thai farmers, it appears, respond positively to higher prices for oilseeds by increasing the production of these crops.

In the second part, Pollak's study shows that the marketing pattern at the farm level is heavily influenced by the relationship of farmers to

landlords, merchants and money lenders. The crops then move quickly from provincial markets into the Bangkok wholesale market where two types of traders operate, wholesale merchants and brokers. Prices in the international oilseed markets are also transmitted through the export sector into the Bangkok wholesale market. In analysing price linkage models, simple linear regression is used to measure the influence of one market on the other. Prices in upcountry markets are chosen as the dependent variable because of the fact that Bangkok wholesale prices determine to a large extent price levels in upcountry markets. The equation was:

Upcountry market price = f (Bangkok wholesale price)

Pollak suggested that oilseed prices in upcountry markets are tied closely to their wholesale prices in Bangkok and that in Thailand oilseed markets are competitive. Monopolistic markets might exist, particularly in more remote regions where alternative marketing outlets are limited.

In the last part of his study Pollak shows that the bulk of the oilseed harvest moves into the Bangkok wholesale market. Four groups of buyers compete for available supplies: oilseed crushers, the food processing industry, retail merchants and exporters. Market surveys showed that roughly one-fourth of the soybean, peanut and sesame production has been exported during the past two decades. Estimation for the domestic demand and the exports of the four selected oilseeds was done based on ordinary least squares. Due to the biasness in the OLS method, two-stage least squares (2 SLS) and three-stage least squares (3 SLS) have been used to estimate the structural parameters of the demand and export models. The

model equations were as follows:

$$Q_D = f\ (P,PS,PCY,X)$$

where QD = quantity demanded of some oilseed crop, in thousand metric tons,

P = price of this oilseed crop, in baht per 100 kilograms,

PS = set of prices for substitutes, in baht per 100 kilograms,

PCY = income level,

X = other factors that influence demand,

and

$$Q_x = f\ (P_x,P_{xs},T)$$

where $Q_x$ = quantity exported of oilseed crop, in thousand metric tons,

$P_x$ = price exported of oilseed crops, in baht per 100 kilograms,

$P_{xs}$ = price exported for substitutes, in baht per 100 kilograms,

T = linear trend.

In most cases the signs of the estimated coefficients are not consistent with expectations based on economic theory. Therefore, the specification of each model was derived from extensive preliminary research.

## 1.7 Examples of Market Integration Studies

A search of the literature on market efficiency in agricultural markets in low income countries showed that not many studies have been done on market integration, and no such studies were found for any agricultural market in Thailand. Presented here are examples of studies on market integration, one done in India and the other in Ghana.

Lele (1972) considered the high degree of interdependence between various jowar markets in India in the process of price formation. Jowar prices in a market are influenced by price movements in other markets.

She then defined market integration as the interrelationship between price movements in two markets. She analysed the correlation between weekly wholesale prices of jowar in the seven markets of Sholapur District, Barsi, which are Akkalkot, Pandharpur, Mohol, Kurduwadi, Kilhapur and Bombay where the last two markets are terminal markets and the remainder are primary markets. The correlation coefficients between prices were high and show close relationship between price in various markets. The primary markets were a little more closely related to Kolhapur than to Bombay because of the costs of shipment from the primary markets to Bombay are 20 to 40 per cent higher than those from the primary markets to Kolhapur. The correlation between primary market prices and the Bombay price was low due to the fact that Bombay is a much larger market than Kolhapur, therefore, its price is influenced by the relative supply situation in the various parts of the country rather than being very closely related to any particular primary market. Lele concluded that the high correlation between prices generally supports the hypothesis that agricultural markets are fairly competitive in this part of the country and that price movements in a single market are influenced by prices in other markets.

Southworth et al (1979) studied food crop marketing in a major agricultural district in Central Ghana. The central theme was a search for the existence or absence of significant imperfections in the marketing system for food crops in Atebubu District. In the absence of complete data on marketing margins and on the rate of return to capital invested in the several marketing functions, an alternative approach was taken to identify inefficiencies in marketing and their consequences. Price data was then analyzed to determine how closely seasonal price rose corresponding with costs of storage and to measure the extent of integration of the principal Ghanaian markets for commodities produced in Atebubu.

The marketing system for food crops in Atebubu District was not perfect, but it was sufficiently competitive to prevent traders from reaping excess margins. There was a large number of buyer and seller participants, but none was able to control large supplies. Knowledge of prices and requirements on the part of all participants was adequate to obviate collusion. Entry was free and traders from outside Atebubu were very active. Seasonal price increases of maize and yams were high, as they must be to cover large costs of storage, but there is no evidence that traders were able to manipulate prices. Atebubu markets were integrated with the national system and their efficiency is enchaned by intermarket movements of traders and information.

Southworth et al, obtained their results by examining the extent to which price in various market towns were related. The analysis presented in their study depended on wholesale prices reported from June 1965 to September 1974 for the 16 market towns with the most complete records.

A test of spatial arbitrage was employed, and the correlation over time of wholesale prices in pairs of markets was indicative of a high level of market integration, although there was no statistical test of significance of these results. The poorer spatial integration of yam markets than of those for maize and rice was due to the relatively higher cost of moving yams. Maize did show more correlations of 0.80 or greater than did yams and it also showed a tightly integrated system with all towns except Bimbila, Swedra and Tamale included at $r = 0.90$ (Tamale and Swedra were correlated with most other towns at $r = 0.80$). Atebubu prices were correlated at $r = 0.90$ or higher with six other markets and at $r = 0.85$ with all markets except Bimbila.

Atebubu merchants and farmers performed their roles in the economic order remarkably effectively and did an efficient job of providing food for the people of Ghana in the face of numerous obstacles which limit the capacity of the system such as barriers to expansion including shortages and irregularity in the availability of transport, inadequacies in financial resources, meagre wholesale market facilities and frequent congestion, risk of intervention by state trading organizations and general mistrust and suspicion of traders by the public. The authors, thus, suggested that a helpful program of government interventions which provided infrastructure, market facilities and expansion of credit to traders can lower the cost of the services performed by farmers and traders.

Marketing studies in low income countries have tended to use the same methodology as the ones used in high income countries such as that by Harthamart (1976) which uses pricing efficiency and gross margin analysis. To do this type of survey and analysis well is expensive and difficult since much of the data must be collected by the researchers themselves.

The complexity of third world markets is perhaps even greater than in the high income countries because of the co-existence of formal, informal and even illegal markets. Marketing channels may be more complex and less well documented and understood. Data in low income countries are unreliable and irregularly available and often incorrectly recorded. Other data, such as the quantities, prices, costs and profits in informal or illegal markets are usually unavailable.

There are different conclusions drawn by economists and anthropologists/sociologists in studying markets in the low income countries because each discipline has its own conceptual framework and asks a different set of questions. The anthropologists have emphasized spatial

considerations in the organization of markets and the relations between economic organization and other aspects of culture. They deal with broader factors than the economists who generally look at only the economic factors of price, costs and quantity.

This brief discussion of selected marketing studies outlines some of the problems created in using margins analysis of the type commonly used in high income countries. It is the object of this thesis to show how the concept of market integration, which requires much less data, is useful in analysing agricultural markets in low income countries.

# CHAPTER 2

# CHARACTERISTICS OF THAI PORK SECTOR

This chapter discusses the characteristics and status of the pig industry in Thailand. It then moves on to the pig and pork price movements to provide the background for further discussion and analysis in the next chapter.

## 2.1 Production

### 2.1.1 Area of Production

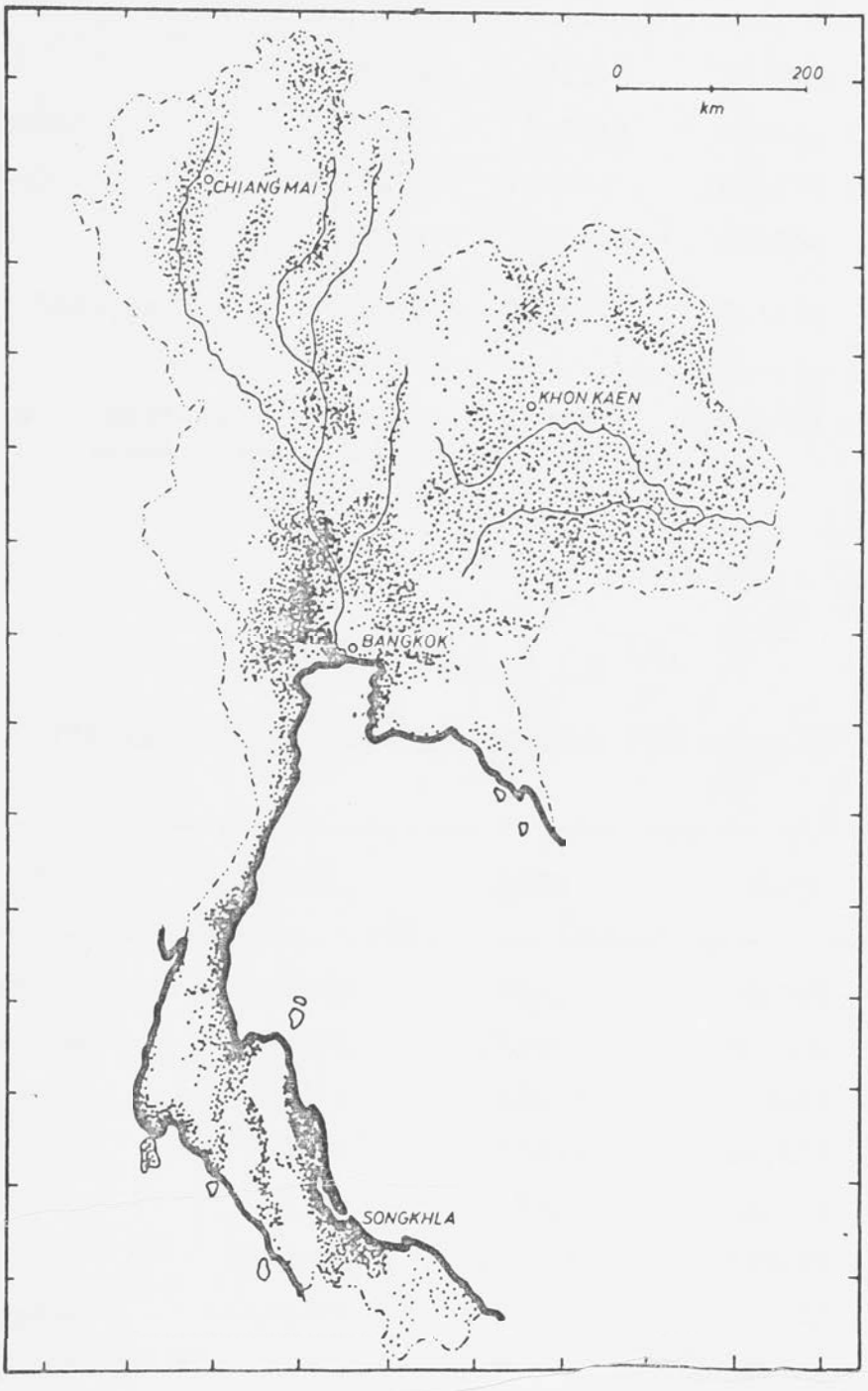
Pig raising in Thailand is small-scale and scattered around the kingdom especially in the provinces of the central region around the Bangkok metropolitan areas which is the most important market for pork. The majority of pig raisers in the central area are in Nakorn Pathom, Ratchaburi, Supan Buri, Chon Buri and Chachoengsao. In the north region are Lampang, Chiang Mai and Chiang Rai. In the northeast region are Nakhon Ratchasima, Buri Rum and in the south region are Surat Thani and Nakhon Si Thammarat (Figure 2.1). Table 2.1 shows the total number of pigs in Thailand by region. Provinces in the central region are the main production areas supplying pigs to Metropolitan Bangkok. The pig farms in this region especially in Nakhon Pathom and Ratchaburi are generally large, and pig production in this area on the average accounted for 23 per cent of total pigs raised in the whole kingdom (Table 2.2).

### 2.1.2 Type of Farm Management

Two types of management systems are common in the Thai pig industry: traditional and commercial farms.

FIGURE 2.1

DISTRIBUTION OF PIGS IN THAILAND




Source: Donner (1978)

TABLE 2.1

NUMBER OF PIGS BY REGION IN THAILAND

1973-1976

(Unit: heads)

| Region \ Year | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|
| North | 986444 | 821143 | 497050 | 852729 |
| Northeast | 1477912 | 948132 | 778411 | 736867 |
| Central | 1466250 | 1245581 | 1054271 | 987537 |
| South | 529766 | 500703 | 481680 | 469354 |
| Whole Kingdom | 4460372 | 3515559 | 3211412 | 3019487 |

Source: Department of Economic Commerce, Ministry of Commerce, Report Paper, September, 1977, p.7.

TABLE 2.2

PIG RAISING IN THE FIVE CENTRAL PROVINCES OF THAILAND

(Unit: heads)

| Provinces \ Year | 1973 | 1974 | 1975 | 1976 |
|---|---|---|---|---|
| Ratchaburi | 200980 | 133910 | 80565 | 81301 |
| Nakorn Pathom | 399971 | 369583 | 369234 | 285546 |
| Supan Buri | 96025 | 46527 | 76043 | 102750 |
| Chachoengsao | 238866 | 229903 | 169828 | 169260 |
| Cholburi | 47348 | 63296 | 40101 | 43673 |
| Total | 983190 | 843219 | 735771 | 682530 |
| Whole Kingdom | 4460372 | 3515559 | 3211412 | 3019487 |
| Number of pigs in 5 provinces as a percentage of whole kingdom | 22.04 | 23.99 | 22.91 | 22.61 |

Source: Department of Economic Commerce, Ministry of Commerce, Report Paper, September, 1977, p.8.

(a) Traditional Farms

Most pig farms are of a traditional type accounting for approximately 95 per cent of aggregate farms raising pigs. The majority of these farmers maintained other agricultural production such as rice, vegetable gardening and upland crops as their main occupations. Some are also traders or labourers. Pig raising is just a supplementary enterprise with each farm raising only 2-3 pigs. This farm type is typical all over the country and does not demand a large amount of capital except for buying the piglets in the first instance. Local breeds have been popular in this type of farm for a long time but now they are being replaced by cross-breeds. The cost of production is generally low. The pig sties are built from pieces of wood, the pigs are left in the yard and are fed with rice bran, broken rice, banana stem, food scraps and vegetable from the local area or the farm. Members of the family are used as labour input without payment. In this type of farm pigs are often viewed as a form of saving to be sold when money is required.

(b) Commercial Farms

Commercial farms are large farms which raise more than 100 pigs with virtually all production sold on the market. Some large farms raise over 1,000 pigs such as in Nakhon Pathom and Ratchaburi. This type of farm needs a large amount of capital for pig housing, complete feed, veterinary expenses, breeding stock and technicians. Foreign breeds such as Durox Jersey, Large White and American Landrace are the most common. The farmers will normally buy piglets from breeding centres promoted by the Department of Livestock Services or from private

commercial enterprises. Some firms have developed 'pig villages' in which small-holders are provided with inputs and services including credit for initial investments and working capital. They will return all the weaner gilts and a fraction of selected weaned male piglets to the firms at a predetermined price. The firms will sell these animals to commercial pig producers. The capital required under this system is about 1 million baht for each unit of 40 sows. Repayments to the commercial banks are made by the firms over a 10 year period. The technical assistance requirement for this production type if high, with one extension/supervision agent for about 30 contract raisers.

Intensive pig production in independent commercial units has developed mainly within a radius of about 70 kilometres from Bangkok. Most of these enterprises have integrated weaner production/fattening operations. The average number of sows is about 200 which would indicate an annual production of about 3,000 pigs for marketing. The independent commercial pig producers rely on the vertically integrated firms for the supply of essential inputs.

Intensive pig production development has also been attempted with public sector support under the joint Department of Cooperative Promotion, Kasetsart University and the Bank for Agriculture and Agricultural Cooperatives (BAAC). The objective of this program was to provide income opportunities for small farmers as a counterbalance to the vertically integrated firms and the independent large-scale commercial producers. In 1977, 74 pig producers' cooperatives were established in the Kingdom's 72 provinces. Those started are so far still in the initial stage.

### 2.1.3 Production Situation

From the survey conducted by Division of Agricultural Economics (D.A.E.) for the past few years (Division of Agricultural Economics, 1978), it was found that the quantity of pigs raised fluctuates, depending on market demand and the supply response of farmers. Consequently, there is a hog cycle in production and live pig prices. A general explanation of cyclical characteristics of the production system is known as the 'cobweb theorem'. Monkoltananont (1977:15) stated that:

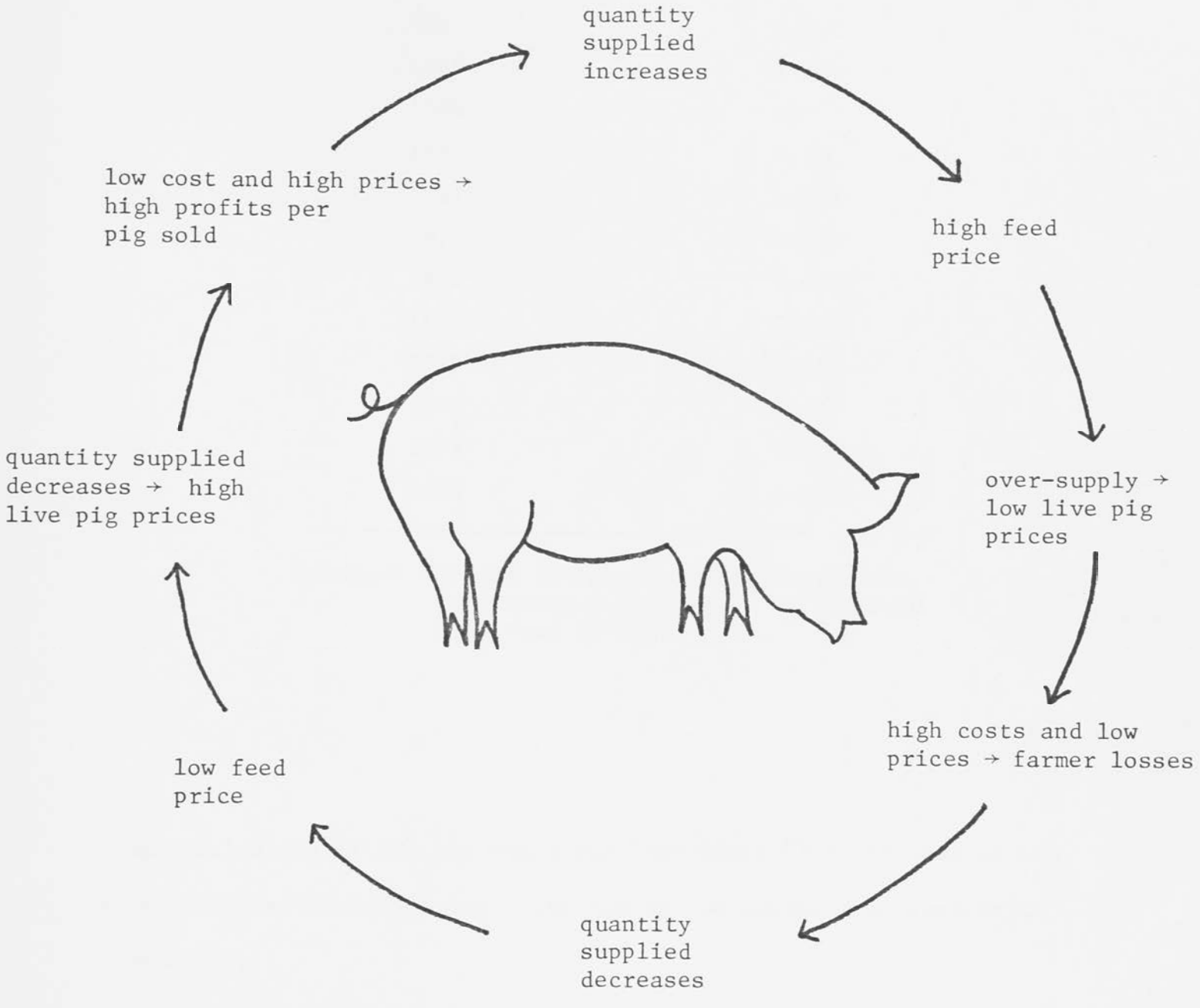
> It explains in the manner of price and lagged output (Waugh, 1964) or in the manner of supply and demand curves, initial position and lags, i.e. current pig prices reflect current pig production; while current pig production is influenced by previous pig prices.

On the average the complete hog cycle takes around 32 months (Figure 2.2), 16 months for the high price and another 16 months for the low price. For example in July 1972 - October 1973 when there were a considerable supply of pigs, the live pig price decreased but later on in November 1973 - March 1975 when the supply decreased owing to the low price in the previous period, the raisers reduced the number of pigs being raised which caused the increase in price.

Table 2.3 shows the number of pigs surveyed in each year conducted by Division of Agricultural Economics. Pig production started declining since 1974 because the cost of production outstripped returns especially during the period of low price. The main cost is feed which accounts for 62 per cent of total cost, followed by breeding stocks which are 28 per cent of total cost. Therefore, the changes in feed price have crucial effect on the raisers' revenue. From the Division of Agricultural

FIGURE 2.2

HOG-CYCLE IN THAILAND




Source: Agricultural Economic News, July 1982, p.15.

TABLE 2.3

NUMBER OF PIGS IN THAILAND

| Year | Number of Pigs (mil. head) |
|---|---|
| 1967 | 4.422 |
| 1968 | 4.503 |
| 1969 | 4.807 |
| 1970 | 5.132 |
| 1971 | 4.621 |
| 1972 | 4.527 |
| 1973 | 4.460 |
| 1974 | 3.516 |
| 1975 | 3.211 |
| 1976 | 3.019 |
| 1977 | 4.126 |
| 1978 | 5.363 |

Source: Centre for Agricultural Statistics, Agricultural Statistics of Thailand Crop Year 1979/80, p.69.

Economics' study (1978), it was found that since 1972 the cost of pig production had an increasing trend due to the increase in feed price (Table 2.4).

Shepherd (1959) investigating pig production in the U.S.A. reported that pig supply to market depended not only on live pig price in the market but also the feed price which is based on the changes in corn price because corn is 95 per cent of total mixed feed. So the variation in corn price affects pig enterprises the most. Shepherd also analysed the Hog-Corn Price

TABLE 2.4

FEED PRICE, HOG PRICE AND HOG FEED RATIO IN THAILAND 1972-1979

(Unit: Baht)

| Year | Items | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Feed Price/kg | 1.50 | 1.46 | 1.45 | 1.53 | 1.53 | 1.53 | 1.73 | 1.76 | 1.74 | 1.90 | 1.97 | 2.01 | 1.67 |
| 1972 | Hog Price/kg | 7.32 | 7.32 | 7.32 | 8.25 | 8.00 | 8.30 | 8.24 | 8.24 | 8.19 | 9.00 | 8.75 | 9.05 | 8.17 |
| | Hog Feed Ratio | 4.88 | 5.01 | 5.05 | 5.39 | 5.23 | 5.42 | 4.76 | 4.68 | 4.71 | 4.74 | 4.45 | 4.50 | 4.90 |
| | Feed Price/kg | 1.92 | 2.24 | 2.19 | 2.20 | 2.33 | 2.52 | 2.88 | 2.83 | 2.98 | 2.90 | 2.68 | 2.63 | 2.51 |
| 1973 | Hog Price/kg | 9.00 | 9.00 | 9.00 | 10.18 | 11.19 | 11.10 | 10.68 | 10.68 | 10.25 | 11.62 | 13.00 | 13.00 | 10.73 |
| | Hog Feed Ratio | 4.69 | 4.02 | 4.11 | 4.63 | 4.80 | 4.40 | 3.71 | 3.77 | 3.44 | 4.01 | 4.85 | 4.94 | 4.28 |
| | Feed Price/kg | 2.53 | 2.66 | 2.82 | 2.91 | 2.72 | 2.69 | 2.88 | 3.00 | 3.32 | 3.39 | 3.43 | 2.98 | 2.93 |
| 1974 | Hog Price/kg | 14.47 | 14.47 | 14.47 | 14.75 | 16.00 | 18.50 | 17.72 | 17.33 | 17.14 | 16.94 | 16.00 | 15.00 | 16.07 |
| | Hog Feed Ratio | 5.72 | 5.44 | 5.13 | 5.07 | 5.88 | 6.88 | 6.15 | 5.78 | 5.16 | 5.00 | 4.66 | 5.03 | 5.49 |
| | Feed Price/kg | 3.23 | 3.17 | 3.08 | 3.08 | 3.23 | 3.22 | 3.23 | 3.27 | 3.33 | 3.34 | 3.36 | 3.16 | 3.22 |
| 1975 | Hog Price/kg | 15.87 | 15.18 | 14.50 | 14.17 | 15.50 | 13.00 | 13.36 | 13.72 | 14.00 | 13.50 | 14.25 | 14.00 | 14.25 |
| | Hog Feed Ratio | 4.91 | 4.79 | 4.71 | 4.60 | 4.80 | 4.04 | 4.14 | 4.20 | 4.20 | 4.04 | 4.24 | 4.43 | 4.42 |
| | Feed Price/kg | 3.20 | 3.11 | 3.07 | 3.01 | 3.03 | 3.02 | 3.07 | 3.02 | 3.12 | 3.11 | 3.08 | 3.17 | 3.09 |
| 1976 | Hog Price/kg | 14.75 | 14.70 | 14.50 | 15.25 | 14.25 | 13.00 | 14.50 | 14.00 | 15.50 | 16.36 | 16.88 | 17.50 | 15.10 |
| | Hog Feed Ratio | 4.61 | 4.73 | 4.72 | 5.07 | 4.70 | 4.30 | 4.72 | 4.64 | 4.97 | 5.26 | 5.48 | 5.52 | 4.89 |
| | Feed Price/kg | 4.32 | 4.53 | 4.74 | 4.12 | 4.21 | 4.22 | 4.83 | 4.36 | 3.61 | 4.80 | 4.74 | 4.15 | 4.39 |
| 1977 | Hog Price/kg | 18.11 | 18.77 | 18.90 | 19.32 | 19.85 | 19.62 | 19.82 | 19.00 | 18.05 | 17.58 | 17.12 | 16.32 | 18.54 |
| | Hog Feed Ratio | 4.19 | 4.14 | 3.99 | 4.69 | 4.71 | 4.65 | 4.10 | 4.36 | 5.00 | 3.66 | 3.61 | 3.93 | 4.22 |
| | Feed Price/kg | 3.75 | 3.84 | 3.43 | 4.12 | 4.53 | 4.35 | 4.33 | 4.42 | 4.03 | 4.53 | 4.39 | 3.83 | 4.13 |
| 1978 | Hog Price/kg | 15.88 | 14.59 | 13.88 | 13.88 | 14.38 | 13.50 | 12.83 | 12.98 | 15.33 | 16.02 | 15.50 | 15.32 | 14.51 |
| | Hog Feed Ratio | 4.23 | 3.80 | 4.05 | 3.37 | 3.17 | 3.10 | 2.96 | 2.94 | 3.80 | 3.54 | 3.53 | 4.00 | 3.51 |
| | Feed Price/kg | 3.17 | 3.06 | 3.33 | 3.25 | 3.61 | 3.46 | 3.48 | 3.33 | 3.03 | 3.28 | 3.30 | 3.51 | 3.32 |
| 1979 | Hog Price/kg | 17.80 | 17.87 | 16.04 | 16.52 | 17.25 | 17.19 | 19.08 | 20.32 | 20.59 | 21.25 | 22.04 | 23.78 | 19.15 |
| | Hog Feed Ratio | 5.62 | 5.84 | 4.82 | 5.08 | 4.78 | 4.97 | 5.48 | 6.10 | 6.80 | 6.48 | 6.68 | 6.77 | 5.77 |

Source: Agricultural Economic News, July, 1981, pp.22-3.

Ratio and calculated that pig raising would make a lot of profits when Hog-Corn Price Ratio was high, the quantity produced and the breedings would increase at a high rate when Hog-Corn Price Ratio was low, the quantity produced would decrease because of the high production cost. The raisers had no profit or loss in the business.

In Thailand pig raising has a similar aspect. Rice bran is the most important feed. An increase in rice bran price will substantially affect pig enterprises. The Division of Agricultural Economics (1978) analysed the ratio of live pig price and rice bran price in order to determine a standard ratio to help in predicting the production in the future. The results of that study can be summarized as follows:

1974 Pig production was generally normal because the rice bran price was low and the live pig price was high enough to cover the production cost. In this year the average ratio of live pig price and rice bran price was 5.49.

1975 During January-April the average ratio was 4.75 and at the beginning of the year the raisers were still not in trouble. In the later period during May-December this ratio had a decreasing trend from 4.80 to 4.43. At the same time, the live pig price was very low which caused difficulties for the raisers.

1976 At the beginning of the year, during January-March the raisers still faced the low price but during April-December the ratio had increased. It ranged between 5.25-5.33. The difficulty faced by the raisers was reduced and production volume returned to normal.

1977 From January until August the live pig price and rice bran price ratio was high and the production condition was

quite bright. Therefore, the supply increased and rice bran price also increased. Subsequently, the ratio's trend started declining to be lower than 5.50. November was the period when the raisers were in the most trouble because the ratio was only 4.40. It was expected that this ratio would still be low until next year.

1978 During January-April the ratio decreased from 5.41 to 3.40. In this period the raisers experienced losses because the live pig price was low while the rice bran price started increasing.

From this study it appears that raisers will make a loss when the live pig/bran price ratio is less than 5.5. If the ratio is greater than 5.5 the raisers will make a profit. The greater the ratio, the more profit they can make (Table 2.4).

## 2.2 Consumption Demand for Pork

Pork demand can be divided into two categories; domestic consumption demand and foreign consumption demand.

### 2.2.1 Domestic Consumption Demand

Pork is a highly favoured source of protein for most non-Muslim Thais. Therefore, we can expect that the income-elasticity of demand for pork is positive and probably higher than for other meat. Demand can also be expected to increase as the population grows. Department of Economic Commerce (1977) data suggests total pork consumption was 4-5 million head per year, with an average increase in consumption of 2.7 per cent from 1968-1977 (Table 2.5).

Table 2.6 shows pork per capita consumption averaging at 0.11 head per annum. The most important market is the Bangkok Metropolitan Area.

TABLE 2.5

PIG PRODUCTION AND CONSUMPTION IN THAILAND

(1968-1977)

| Year | Number of Pig[1] (1,000 heads) | Rate of Change (%) | Domestic Consumption[2] (1,000 heads) | Rate of Change (%) | Consumption Per Capita (kg) |
|---|---|---|---|---|---|
| 1968 | 4503.0 | - | 4033.7 | - | 11.85 |
| 1969 | 4806.7 | 6.74 | 4152.9 | 2.96 | 11.82 |
| 1970 | 5132.2 | 6.67 | 4364.5 | 5.10 | 12.00 |
| 1971 | 5476.1 | 6.69 | 4619.9 | 5.84 | 12.32 |
| 1972 | 4572.9 | -16.49 | 4681.2 | 1.34 | 12.13 |
| 1973 | 4460.3 | -2.46 | 4445.0 | -5.04 | 11.19 |
| 1974 | 3515.5 | -21.18 | 4565.4 | 2.69 | 11.19 |
| 1975 | 3211.4 | -8.65 | 5088.9 | 11.45 | 12.38 |
| 1976 | 3019.4 | -5.98 | 5492.8 | 7.94 | 12.78 |
| 1977 | 3271.3 | 8.34 | 5049.0 | -8.06 | 11.46 |
| Average | | | | 2.69 | 11.91 |

Sources: (1) The Office of Agricultural Economics, Ministry of Agriculture and Co-operatives files.

(2) National Account Division, National Economics and Social Development Board files.

TABLE 2.6

PIG CONSUMPTION PER CAPITA IN THAILAND 1968-1974

(Unit: heads)

| Year | Number of Population (1) | Total Pig Consumption (2) | Per Capita Consumption (3) |
|---|---|---|---|
| 1968 | 31482496 | 4033733 | 0.13 |
| 1969 | 34523122 | 4152958 | 0.12 |
| 1970 | 38559008 | 4364547 | 0.11 |
| 1971 | 39950306 | 4619950 | 0.12 |
| 1972 | 41334152 | 4681209 | 0.11 |
| 1973 | 42391454 | 4445053 | 0.10 |
| 1974 | 42213711 | 4565486 | 0.11 |

Sources: (1) Department of the Interior files.

(2) National Economics and Social Development Board files.

(3) (2) ÷ (1)

Each year the population in Bangkok consume about 1 million head (Table 2.7), about 23 per cent of total domestic consumption.

TABLE 2.7

PORK CONSUMPTION IN THAILAND 1973-1977

(Unit: heads)

| Area \ Year | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|
| Bangkok | 922443 | 959341 | 996592 | 1036456 | 1078951 |
| Outside Bangkok | 3522602 | 3606068 | 4092361 | 4450430 | 4689404 |
| Total | 4445050 | 4565409 | 4088953 | 5492886 | 5768355 |

Source: Department of Economic Commerce, Ministry of Commerce, Report Paper, September, 1977, p.25.

Because of the importance of pork in the Thai diet, it is expected that when per capita real income increases or when the retail price decreases (other meat prices constant) per capita consumption demand will increase. The income elasticity of demand for pork is generally higher than for other meats (Division of Agricultural Economics, 1978). Table 2.8 shows the importance of pork to different consumers. The income elasticity of demand of farmers for pork is 0.39 which is greater than for beef (0.14) and poultry (0.22). Similarly, government official consumers show an income elasticity of demand for pork (0.46) greater than for beef (0.35) but equal to poultry.

The increase in total domestic demand depends not only on consumers' income and retail price but also on the population growth rate (currently 2.3 per cent per year).

TABLE 2.8

COMPARISON OF INCOME ELASTICITY OF DEMAND
FOR MEAT BETWEEN FARMERS AND GOVERNMENT OFFICIALS

| Type of Meat | Farmers (1972/73) | Government Officials (1976) |
|---|---|---|
| Pork | 0.386 | 0.459 |
| Beef | 0.142 | 0.353 |
| Poultry | 0.216 | 0.459 |
| All Types of Meat | 0.233 | 0.527 |
| Fish | 0.342 | 0.627 |
| Other Marine Fish | 0.503 | 0.711 |
| All Types of Marine Fish | 0.280 | 0.659 |

Source: Division of Agricultural Economics, Agricultural Economics Paper, August, 1978, p.10.

The consumption pattern for pork has changed during recent years. Lard is now valued at only about 50 per cent of lean pork at the retail level, and a price differential has developed in favour of lean pigs leading to widespread upgrading of native pigs with European and American breeding stock.

### 2.2.2 Foreign Consumption Demand

A close look at foreign consumption demand will show that the export volume of Thai pork fluctuated significantly. In 1975, Thailand exported pig products to the value of 2.8 million baht increasing at a rate of 39.9 per cent to 3.9 million baht in 1976. In 1977, the export value dropped sharply to only 0.6 million baht, but increased again to 57.8 million baht in 1978. Hong Kong accounted for as much as 99.8 per cent of pig products exported in 1978 (Division of Agricultural Economics, 1978). At present exports are mainly in the form of frozen cuts of small piglets to be roasted in Hong Kong.

According to information from private sector commercial pig producers, Thailand has a competitive position for exporting live pig, chilled or frozen pork and pork products to a number of other East Asian countries, and of particular interest is the export potential for processed meats, e.g. pies, sausages, bacon, ham (Table 2.9). Recently, competition from the People's Republic of China has reduced pig export rapidly.

However, pork exports face a number of problems. First, foreign markets often raise the issue of livestock disease control in view of the fact that the disease free zone on Thailand's peninsula has not yet been re-established. Second, many import countries have meat import quota systems which limit Thai meat exports. Third, production costs in Thailand are higher than in other export countries such as Taiwan and the People's Republic of China. Moreover, the carcass quality is lower than the other competitors because the domestic market prefers live pigs whose weight is over 100 kilograms but the other export countries produce pigs whose weight is less than 95 kilograms. Because the proportion of meat in such carcasses is low, the cost per kilogram of meat is high. Finally, other exporters are, in some cases closer to importers or have better transportation systems than Thailand.

## 2.3 Pig and Pork Price Movements

Any agricultural product price series is a composite of a number of different elements, which can be classified as:

(a) Trend influences.

(b) Cyclical influences

(c) Seasonal influences

(d) Irregular influences

In studying pig prices, we have to identify these influences for analytical purposes to obtain a better idea of the character and reason for the price movement.

TABLE 2.9

EXPORT OF PIGS

| | 1974 | | 1975 | | 1976 | | 1977 | | 1978 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Quantity (head) | Value (thousand baht) | Quantity (head) | Value (thousand baht) | Quantity (head) | Value (thousand baht) | Quantity (head) | Value (thousand baht) | Quantity (head) | Value (thousand baht) |
| Pigs for Breeding | - | - | 141 | 397.8 | 4716 | 5400.0 | 639 | 710.0 | - | - |
| Laos | - | - | 4 | 1.6 | 4716 | 5400.0 | 639 | 710.0 | - | - |
| Khmer Republic | - | - | 136 | 392.9 | - | - | - | - | - | - |
| Vietnam Republic | - | - | 1 | 2.4 | - | - | - | - | - | - |
| Pigs Not For Breeding | 1434 | 1032.6 | - | - | 924 | 890.0 | - | - | 3114 | 4956.9 |
| Hong Kong | - | - | - | - | - | - | - | - | 3114 | 4956.9 |
| Laos | 814 | 351.8 | - | - | 924 | 890.0 | - | - | - | - |
| Khmer Republic | 620 | 680.8 | - | - | - | - | - | - | - | - |
| Total | 1434 | 1032.6 | 141 | 397.0 | 5640 | 6290.0 | 639 | 710.0 | 3114 | 4956.9 |

TABLE 2.9 (Cont'd)

| | 1974 | | 1975 | | 1976 | | 1977 | | 1978 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Quantity (kg.) | Value (thousand baht) | Quantity (kg.) | Value (thousand baht) | Quantity (kg.) | Value (thousand baht) | Quantity (kg.) | Value (thousand baht) | Quantity (kg.) | Value (thousand baht) |
| Meat of Swine | | | | | | | | | | |
| Hong Kong | - | - | 81687 | 2823.0 | 102111 | 3768.7 | 15436 | 582.5 | 1288005 | 57701.6 |
| Laos | - | - | - | - | 3305 | 87.4 | 350 | 9.6 | - | - |
| Bacon, Ham and Other Pig Meat Dried, Salted Smoked | | | | | | | | | | |
| Hong Kong | - | - | - | - | 270 | 11.2 | 551 | 14.1 | 790 | 30.0 |
| Laos | - | - | - | - | 919 | 51.1 | - | - | - | - |
| Netherlands | - | - | - | - | - | - | 30 | 1.6 | - | - |
| Iran | - | - | - | - | - | - | - | - | 15 | 1.9 |
| France | - | - | - | - | - | - | - | - | 670 | 86.5 |
| Germany | - | - | - | - | - | - | - | - | 23 | 1.2 |
| Switzerland | - | - | - | - | - | - | - | - | 39 | 1.0 |
| Total | - | - | 81687 | 2823.0 | 106605 | 3918.4 | 16367 | 607.8 | 1289542 | 57822.2 |

Source: Department of Customs files.

### 2.3.1 Trend Influences

The trend is a persistent upward or downward movement extending over a relatively long period of time. Figure 2.3 shows an increasing trend of pig prices in every level in the Bangkok market. Live pig and pork carcass wholesale prices in the three regions studied are presented in Figures 2.4 and 2.5. During 1942-1979 there were two rapid increases. Firstly, during 1942-1945, the price increased due to the inflation caused by the Second World War. Secondly, during 1973-1974, the price increased due to the worldwide inflation caused by the world fuel crisis. During 1969-1979 the four price levels tend to move in the same direction but retail prices always increase or decrease later than farm price. For example in the beginning of 1972, the live pig prices tended to decrease but the retail price was still stable. This situation can be explained as 'price levelling' (Naughtin and Quilkey, 1979). The retailers suspected that the decrease in live pig was just a temporary phenomena and they did not decrease the retail price promptly. The retail price started decreasing in December, 1971.

Even though trends in prices are basically affected by determinants of both supply and demand, they are also affected in the longer term by changes in the general level of prices and demand determinants such as population and consumer income. In Thailand during the period under study increase in pig prices may be due to the increase in the population and national income as can be seen in Table 2.10. However, upward trends are not so clearly visible if inflationary forces are removed by using consumer price index as a deflator. The deflated prices in Table 2.11 show little trend.

### 2.3.2 Cyclical Influences

Pig prices move in a cyclical manner due to the farmers' responsiveness to market prices. Price in one period affects the quantity

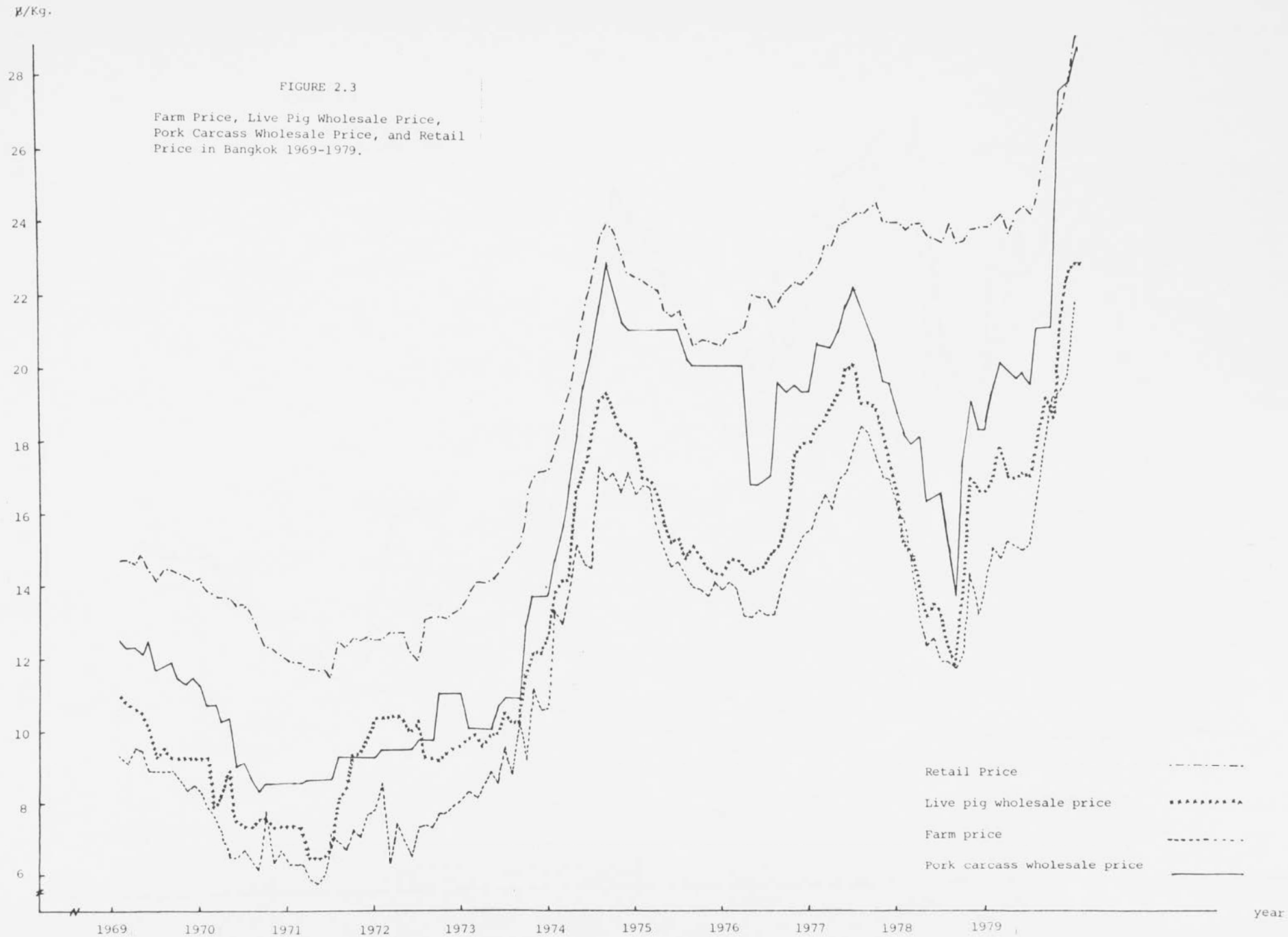



FIGURE 2.3

Farm Price, Live Pig Wholesale Price, Pork Carcass Wholesale Price, and Retail Price in Bangkok 1969-1979.

FIGURE 2.4

Live Pig Wholesale Price in the North, Northeast Region and Bangkok 1969-1979

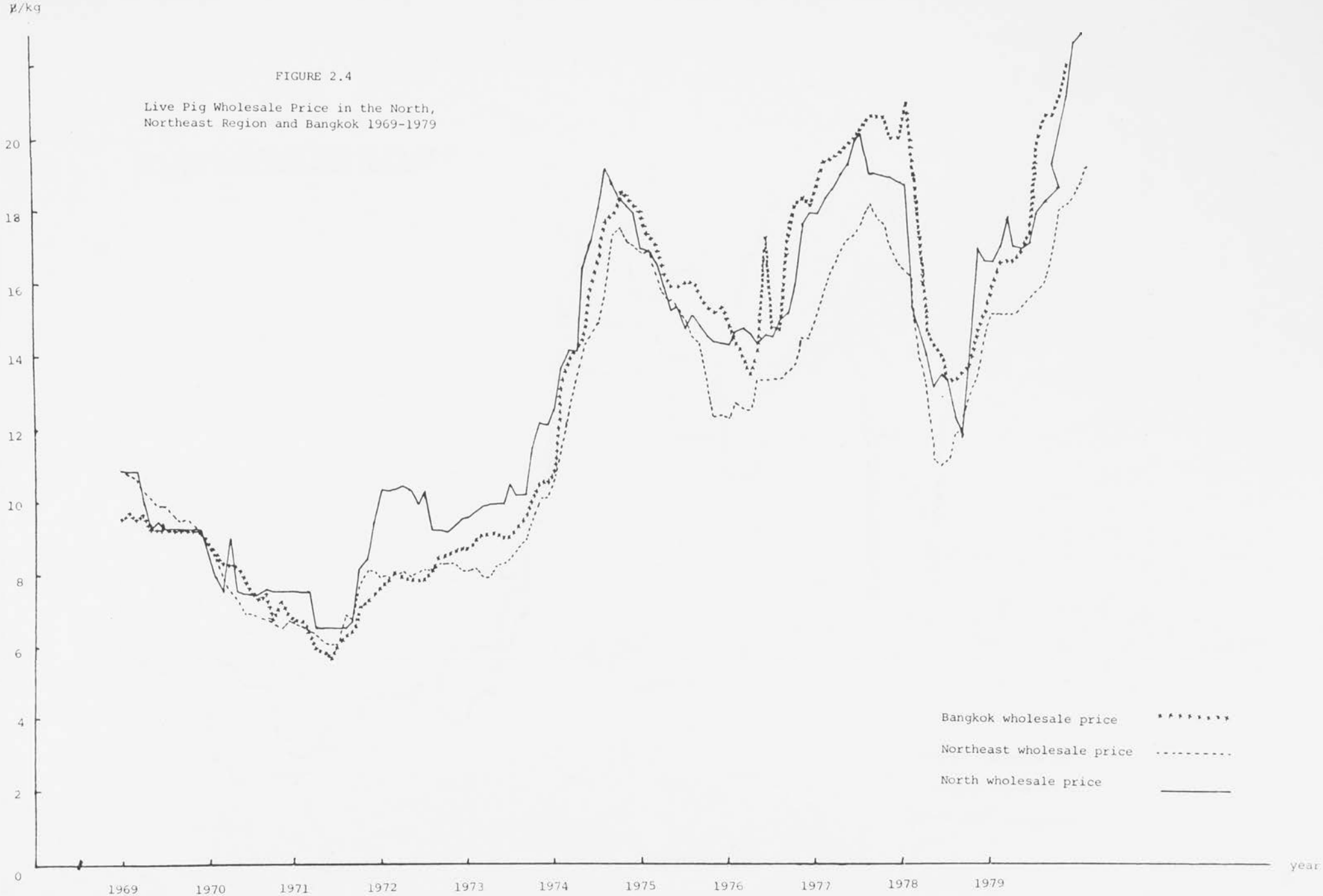


FIGURE 2.5

Pork Carcass Wholesale Price in the North, Northeast Region and Bangkok 1969-1979.

TABLE 2.10

ESTIMATION OF POPULATION AND NATIONAL INCOME OF THAILAND 1969-1979

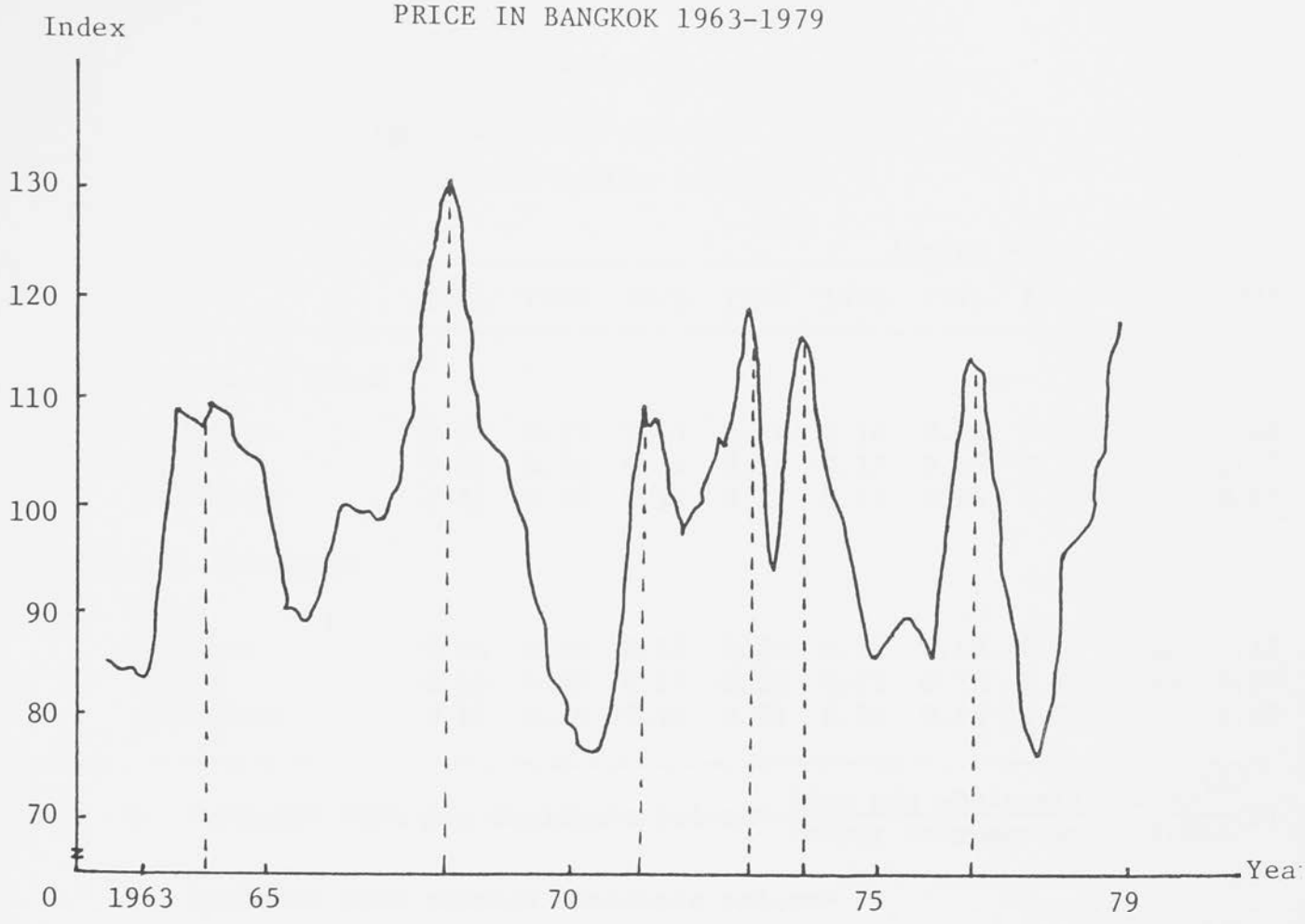
| Year | Population ('000) | National Income (1,000 billion baht) |
|---|---|---|
| 1969 | 35110 | 104.5 |
| 1970 | 36370 | 110.4 |
| 1971 | 37490 | 116.9 |
| 1972 | 38590 | 133.7 |
| 1973 | 39690 | 178.6 |
| 1974 | 40780 | 220.6 |
| 1975 | 41870 | 246.5 |
| 1976 | 42960 | 278.9 |
| 1977 | 44040 | 318.7 |
| 1978 | 45100 | 387.5 |
| 1979 | 46140 | 454.7 |

Source: United Nations, Monthly Bulletin of Statistics, July, 1980.

of pigs supplied in the following period, which in turn determines the number slaughtered. The number slaughtered affects the price which influences the pig supply in the next period. The aspect of the cyclical nature of the Thai pork market are also discussed in Monkoltananont (1977). The Division of Agricultural Economics (1963) studied the pig cycle in Bangkok and the results are shown in Figures 2.6 and 2.7, showing the cycle of live pig and pork carcass wholesale prices respectively. There were 5 cycles in the live pig wholesale price during 1963-1979 and 6 cycles in the pork carcass wholesale price during 1947-1972. It is noticeable that the cycle for pork carcass wholesale price had a long and short length alternately. There is no satisfactory explanation for this pattern. It may be possible that when

FIGURE 2.6

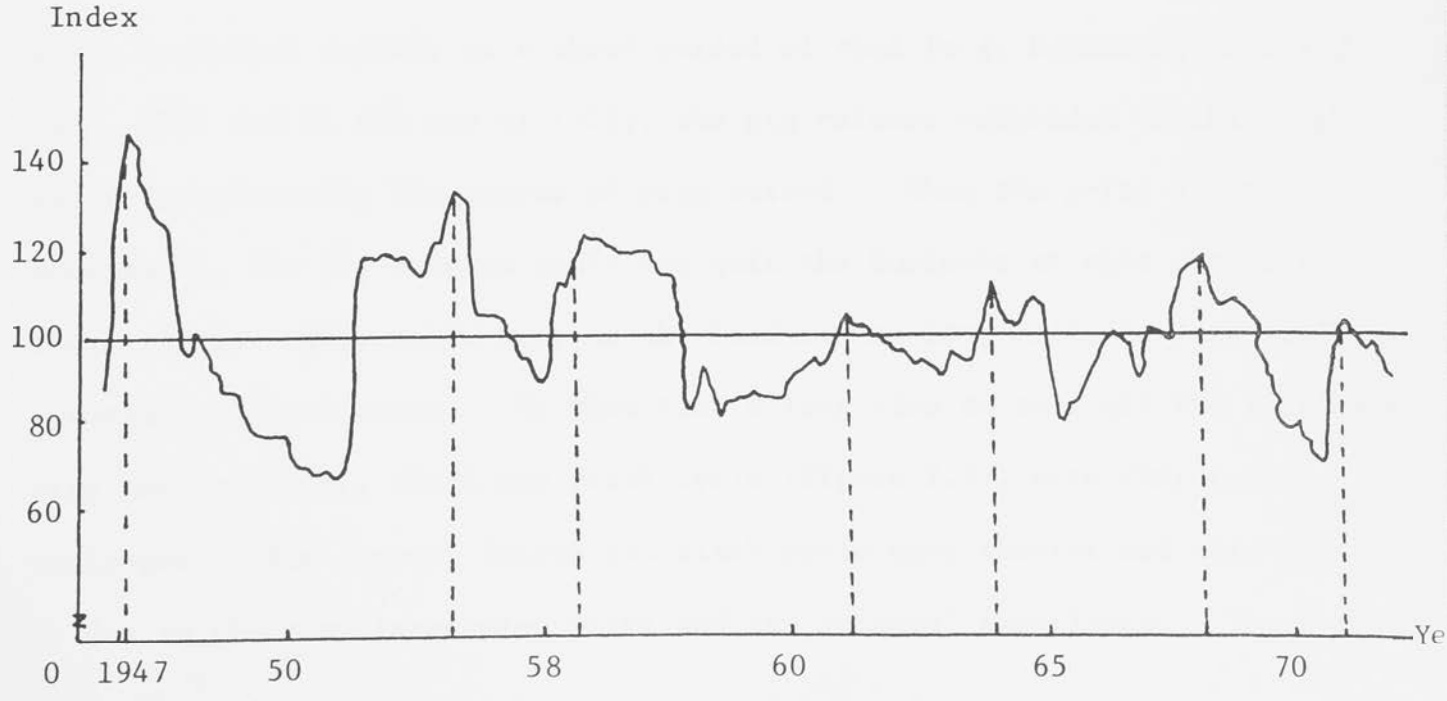
CYCLICAL MOVEMENT OF LIVE PIG WHOLESALE PRICE IN BANGKOK 1963-1979




Source: Niphon (1980), p.127.

FIGURE 2.7

CYCLICAL MOVEMENT OF PORK CARCASS WHOLESALE PRICE IN BANGKOK 1947-1971




Source: Agricultural Economics News, Vol.204, November 1973, p.8.

TABLE 2.11

DEFLATED LIVE PIG AND PORK CARCASS WHOLESALE PRICES 1971-1979

(Unit: ฿/kg)

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|---|
| Live Pig Wholesale Price | | | | | | | | | |
| Bangkok | 0.12 | 0.15 | 0.14 | 0.19 | 0.16 | 0.16 | 0.17 | 0.12 | 0.14 |
| North | 0.12 | 0.14 | 0.14 | 0.18 | 0.17 | 0.16 | 0.19 | 0.13 | 0.15 |
| Northeast | 0.11 | 0.12 | 0.12 | 0.17 | 0.15 | 0.14 | 0.16 | 0.11 | 0.13 |
| Pork Carcass Wholesale Price | | | | | | | | | |
| Bangkok | 0.14 | 0.15 | 0.15 | 0.21 | 0.22 | 0.18 | 0.19 | 0.14 | 0.17 |
| North | 0.18 | 0.18 | 0.17 | 0.24 | 0.23 | 0.23 | 0.23 | 0.19 | 0.20 |
| Northeast | 0.19 | 0.20 | 0.18 | 0.21 | 0.20 | 0.18 | 0.20 | 0.19 | 0.20 |

Notes: a. Deflated live pig wholesale prices= $\frac{\text{Live pig wholesale prices}^{(1)}}{\text{Yearly consumer price index}^{(2)}}$

b. Deflated pork carcass wholesale prices= $\frac{\text{Pork carcass wholesale prices}^{(1)}}{\text{Yearly consumer price index}^{(2)}}$

Sources: (1) Department of Economic Commerce files.

(2) National Economics and Social Development Board files.

price increased rapidly in a short period of time (e.g. beginning of 1947, 1956, 1964 and at the end of 1971), the pig raisers responded to that high price by increasing the number of pigs raised. When the price started decreasing, the pig raisers could not quit the business at once due to the fixed costs. They would stay in the business as long as their loss still covered the fixed costs. It then took a long time to sell all the increased pigs and the first, third and fifth cycle (Figure 2.7), were therefore prolonged. The second, fourth and sixth cycle were shorter and this might be due to the slow increasing price and the raisers' experience. The raisers

did not increase the number of raised pigs as much as before. Therefore, it took a shorter time to sell their animals. Another explanation for the long cycle (e.g. 6 years in the first cycle) can be the characteristic of pig raising and pig breeds used. In the past (1947-1957), most of the pigs raised were local breeds and were raised by traditional methods which took more than a year to produce pigs of marketable size. If the live pig's price was low, the raisers would keep them longer for 18-20 months. Therefore the response period was long.

The short period (e.g. 2 years 10 months in the fourth cycle) also appears to occur when the pig market was free without government intervention or when the government policy was stable. The supply responded to price change freely. The adjustment, therefore, took only a short time.

2.3.3 Seasonal Influences

Most of the pig raising in Thailand is of a traditional type and is supplementary to other farm activities. Therefore, pig wholesale prices link closely to the planting season. From the report of Division of Agricultural Economics, Ministry of Agriculture and Cooperatives published in Agricultural Economic News (1973, pp.12-3) shows that the seasonal index of pork carcass wholesale price in Bangkok is high during December-March and August and is low during April-July and September-November (Figure 2.8).

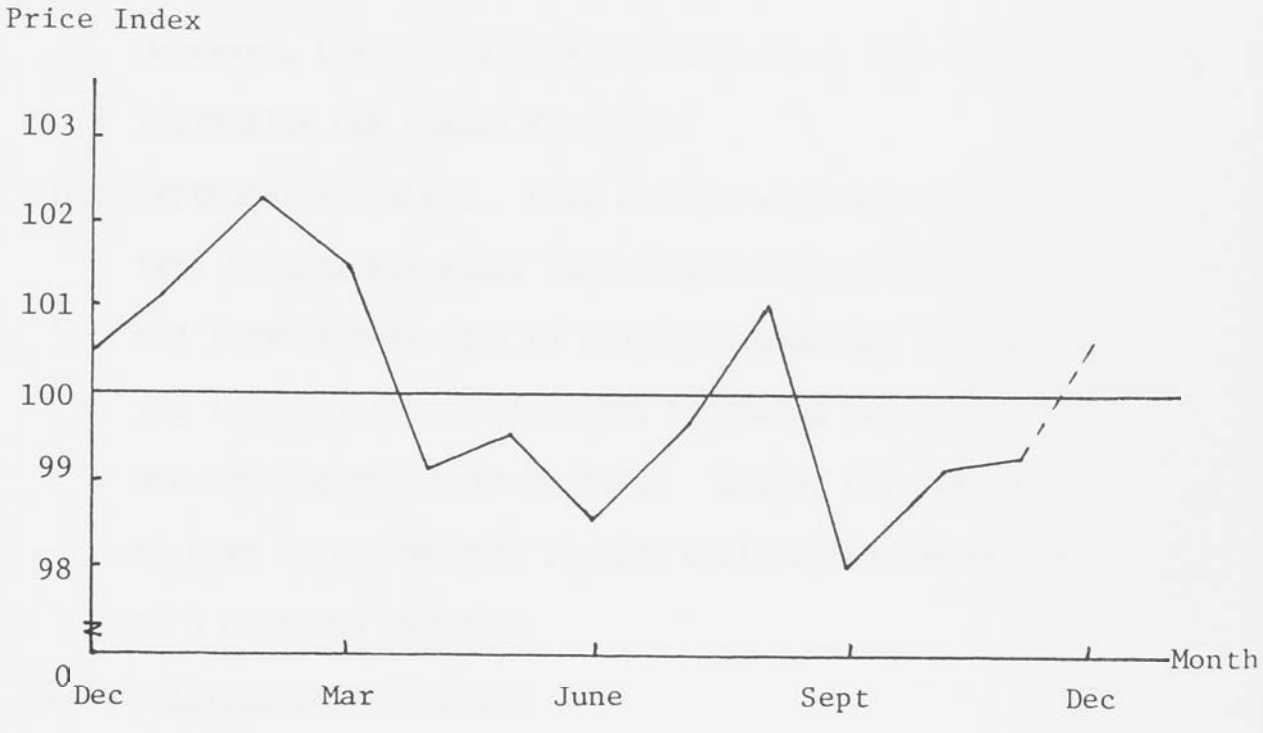
In each year the seasonal movement of pork prices can be divided into 4 periods (Agricultural Economic News, 1973):

(a) December-February. The pork carcass wholesale price is subject to upward pressure due to the New Year and Chinese New Year (at the end of January). Demand for consumption during this period is high.

(b) April-July. The pork carcass wholesale price tends to fall during these months. This period is the

FIGURE 2.8

SEASONAL MOVEMENT OF PORK CARCASS WHOLESALE PRICE
IN BANGKOK 1957-1972




Source: Agricultural Economics News, Vol.204, November 1973, p.12.

beginning of the planting season and farmers need cash to pay for labour, fertilizer and other inputs, which they often finance by selling pigs. There is an increase in supply during these months.

(c) August. The wholesale price has an increasing trend and generally reaches its peak in this month. August marks the end of the planting season and most of the pigs have been sold in the last period. The volume of pigs supplied to the market decreases. Moreover, there is a Chinese Festival in this month increasing the demand for pork.

(d) September-November. Pork carcass wholesale prices tend to decrease since this is the harvesting period and farmers need cash to pay for harvesting inputs and the pigs raised since the beginning of the year are now big enough to be sold. Hence, the supply of pigs in the markets is high again which may result in a decrease in price.

2.3.4 Irregular Influences

Irregular influences may be the result of caused known or unknown such as drought, disease, war and many diverse factors which are not a part of the general trend or cycle of prices or characteristic of the usual annual price fluctuation. They may be of long or short duration. Because of its diversity and irregularity of causes and effects, few generalizations can be made regarding such movements (Thomsen and Foote, 1952).

The analysis presented later in this thesis is based on the price data set on in Table 2.12 after the removal of trend and seasonal influences.

TABLE 2.12

WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES

IN BANGKOK, NORTH AND NORTHEAST REGION 1969-1979

(Unit: ฿/kg.)

| | Month and Year | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|---|
| 1969 | Jan | 10.92 | 12.50 | 09.65 | 16.80 | 10.80 | 17.00 |
| | Feb | 10.75 | 12.33 | 09.63 | 16.81 | 10.63 | 17.56 |
| | Mar | 10.42 | 12.46 | 09.46 | 16.83 | 10.30 | 17.67 |
| | Apr | 10.00 | 12.45 | 09.54 | 16.81 | 10.14 | 16.6 |
| | May | 09.26 | 12.45 | 09.37 | 16.81 | 09.22 | 16.67 |
| | June | 09.56 | 11.74 | 09.33 | 16.81 | 09.83 | 16.67 |
| | July | 09.25 | 11.75 | 09.37 | 16.81 | 09.71 | 16.67 |
| | Aug | 09.25 | 11.88 | 09.53 | 16.81 | 09.45 | 16.6 |
| | Sept | 09.25 | 11.51 | 09.25 | 17.25 | 09.53 | 16.5 |
| | Oct | 09.25 | 11.42 | 09.20 | 12.25 | 09.24 | 16.50 |
| | Nov | 09.25 | 11.46 | 09.02 | 11.94 | 09.18 | 16.34 |
| | Dec | 09.25 | 11.42 | 09.02 | 11.92 | 09.10 | 14.75 |
| 1970 | Jan | 07.99 | 10.66 | 08.45 | 11.18 | 08.58 | 14.42 |
| | Feb | 07.65 | 10.49 | 08.2 | 11.81 | 07.70 | 14.08 |
| | Mar | 08.90 | 10.29 | 08.31 | 12.06 | 07.56 | 14.08 |
| | Apr | 07.50 | 10.25 | 08.13 | 11.81 | 07.21 | 13.58 |
| | May | 07.38 | 09.90 | 07.75 | 11.50 | 06.90 | 13.00 |
| | June | 07.35 | 09.38 | 07.4 | 11.00 | 06.96 | 12.98 |
| | July | 07.58 | 08.20 | 07.1 | 11.50 | 06.8 | 13.00 |
| | Aug | 07.60 | 08.25 | 07.32 | 11.00 | 06.79 | 13.08 |
| | Sept | 07.30 | 08.50 | 06.54 | 11.00 | 06.74 | 12.42 |
| | Oct | 07.31 | 08.50 | 07.16 | 11.00 | 06.58 | 12.58 |
| | Nov | 07.33 | 08.50 | 06.84 | 11.00 | 06.66 | 12.58 |
| | Dec | 07.35 | 08.50 | 06.76 | 11.00 | 06.61 | 12.67 |
| 1971 | Jan | 07.34 | 09.50 | 06.63 | 11.00 | 06.51 | 11.58 |
| | Feb | 07.35 | 08.58 | 06.14 | 09.50 | 06.45 | 11.58 |
| | Mar | 06.48 | 08.60 | 05.82 | 09.50 | 06.30 | 11.99 |
| | Apr | 06.48 | 08.60 | 05.82 | 09.50 | 06.14 | 11.33 |
| | May | 06.48 | 08.60 | 05.77 | 09.00 | 06.08 | 11.33 |
| | June | 06.48 | 08.60 | 06.08 | 09.12 | 06.11 | 11.33 |
| | July | 06.48 | 09.25 | 06.39 | 09.25 | 06.96 | 13.33 |
| | Aug | 06.79 | 09.25 | 06.52 | 09.62 | 07.66 | 13.25 |
| | Sept | 08.05 | 09.25 | 07.17 | 10.00 | 08.11 | 12.83 |
| | Oct | 08.04 | 09.25 | 07.28 | 10.00 | 08.08 | 12.83 |
| | Nov | 09.38 | 09.25 | 07.42 | 10.03 | 07.99 | 12.83 |
| | Dec | 10.35 | 09.25 | 07.71 | 10.10 | 07.91 | 12.67 |
| 1972 | Jan | 10.36 | 09.25 | 07.89 | 10.11 | 08.08 | 13.50 |
| | Feb | 10.38 | 09.25 | 08.02 | 10.65 | 08.08 | 13.50 |
| | Mar | 10.40 | 09.25 | 07.78 | 10.81 | 08.07 | 13.50 |
| | Apr | 10.27 | 09.25 | 07.82 | 10.61 | 07.95 | 13.50 |
| | May | 09.93 | 09.25 | 07.81 | 10.61 | 08.01 | 13.50 |
| | June | 10.21 | 09.25 | 07.83 | 10.63 | 08.09 | 13.50 |
| | July | 09.20 | 09.25 | 08.08 | 10.61 | 08.11 | 13.50 |
| | Aug | 09.20 | 09.25 | 08.50 | 10.61 | 08.25 | 13.50 |
| | Sept | 09.19 | 11.00 | 08.50 | 10.50 | 08.28 | 13.62 |
| | Oct | 09.33 | 11.00 | 08.61 | 10.50 | 08.28 | 14.00 |
| | Nov | 09.44 | 11.00 | 08.67 | 10.50 | 08.13 | 14.00 |
| | Dec | 09.46 | 11.00 | 08.67 | 10.83 | 08.13 | 14.00 |
| 1973 | Jan | 09.78 | 10.00 | 08.92 | 11.75 | 08.20 | 14.00 |
| | Feb | 09.82 | 10.00 | 09.10 | 12.17 | 07.98 | 14.00 |
| | Mar | 09.51 | 10.00 | 09.10 | 12.17 | 08.03 | 14.00 |
| | Apr | 09.82 | 10.00 | 09.17 | 12.17 | 08.26 | 14.00 |
| | May | 09.83 | 10.25 | 09.05 | 12.17 | 08.36 | 14.00 |
| | June | 10.41 | 10.35 | 09.07 | 12.17 | 08.57 | 14.00 |
| | July | 10.20 | 10.35 | 09.36 | 12.17 | 08.68 | 14.50 |
| | Aug | 10.20 | 10.80 | 09.48 | 12.17 | 08.95 | 14.50 |
| | Sept | 11.43 | 12.98 | 10.03 | 12.17 | 09.47 | 14.00 |
| | Oct | 12.18 | 13.27 | 10.57 | 12.17 | 10.09 | 14.00 |
| | Nov | 12.15 | 13.75 | 10.53 | 12.83 | 10.65 | 14.00 |
| | Dec | 12.50 | 13.75 | 10.95 | 13.00 | 10.78 | 14.00 |
| 1974 | Jan | 13.72 | 14.62 | 13.33 | 17.08 | 12.45 | 16.33 |
| | Feb | 14.18 | 15.60 | 13.58 | 17.08 | 12.46 | 16.00 |
| | Mar | 14.18 | 16.70 | 14.17 | 17.42 | 13.37 | 17.00 |
| | Apr | 16.41 | 18.12 | 14.50 | 18.08 | 14.78 | 19.00 |
| | May | 17.17 | 19.50 | 15.92 | 21.67 | 14.97 | 19.5 |
| | June | 18.10 | 20.40 | 16.67 | 22.33 | 15.95 | 19.62 |
| | July | 19.17 | 21.72 | 17.60 | 23.33 | 17.38 | 20.75 |
| | Aug | 19.39 | 22.94 | 17.92 | 23.50 | 17.50 | 20.75 |
| | Sept | 18.79 | 22.00 | 18.50 | 24.50 | 17.19 | 20.75 |
| | Oct | 18.25 | 21.33 | 19.17 | 23.50 | 17.00 | 20.75 |
| | Nov | 18.06 | 21.00 | 17.83 | 23.50 | 16.86 | 20.75 |
| | Dec | 17.90 | 21.00 | 17.81 | 23.39 | 16.94 | 20.75 |

TABLE 2.12 (Cont'd)

| Month and Year | | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|---|
| 1975 | Jan | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| | Feb | 16.82 | 21.00 | 17.06 | 23.50 | [illegible] | [illegible] |
| | Mar | 15.49 | 21.00 | 16.25 | 22.08 | 15.07 | 19.75 |
| | Apr | 15.86 | 21.00 | 15.92 | 21.67 | 15.56 | 19.75 |
| | May | 15.20 | 21.00 | 15.23 | 21.67 | 15.31 | 19.75 |
| | June | 15.34 | 21.00 | 15.92 | 21.67 | 15.00 | 19.75 |
| | July | 14.76 | 20.75 | 16.00 | 21.67 | 14.51 | 19.25 |
| | Aug | 15.02 | 20.00 | 15.00 | 22.08 | 14.31 | 19.75 |
| | Sept | 14.80 | 20.00 | 15.29 | 22.50 | 13.93 | 17.83 |
| | Oct | 14.39 | 20.00 | 15.33 | 22.50 | 13.38 | 17.83 |
| | Nov | 14.39 | 20.00 | 15.17 | 22.50 | 13.38 | 17.83 |
| | Dec | 14.32 | 20.00 | 15.33 | 22.50 | 13.31 | 17.83 |
| 1976 | Jan | 13.61 | 20.00 | 14.87 | 21.50 | 12.75 | 17.83 |
| | Feb | 14.75 | 20.00 | 14.35 | 21.50 | 12.56 | 17.87 |
| | Mar | 14.60 | 20.00 | 13.83 | 21.50 | 12.56 | 17.92 |
| | Apr | 14.30 | 18.75 | 13.42 | 21.50 | 13.31 | 18.00 |
| | May | 14.46 | 18.75 | 14.08 | 21.50 | 13.31 | 18.00 |
| | June | 14.52 | 18.75 | 18.37 | 21.83 | 13.31 | 18.00 |
| | July | 14.97 | 18.94 | 14.75 | 22.83 | 13.34 | 18.00 |
| | Aug | 15.10 | 17.00 | 14.75 | 23.83 | 13.44 | 18.00 |
| | Sept | 15.96 | 19.50 | 17.17 | 23.75 | 13.76 | 18.00 |
| | Oct | 17.57 | 19.24 | 18.17 | 24.17 | 14.56 | 17.33 |
| | Nov | 17.87 | 19.49 | 18.25 | 24.17 | 14.40 | 17.42 |
| | Dec | 17.81 | 19.34 | 18.17 | 23.83 | 15.07 | 18.17 |
| 1977 | Jan | 18.23 | 20.56 | 18.67 | 24.00 | 15.07 | 18.44 |
| | Feb | 18.46 | 20.56 | 19.29 | 23.83 | 16.38 | 19.17 |
| | Mar | 18.81 | 20.50 | 19.37 | 23.83 | 16.75 | 19.50 |
| | Apr | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| | May | 19.94 | 21.65 | 19.79 | 24.17 | 17.25 | 20.25 |
| | June | 20.00 | 22.04 | 19.88 | 24.17 | 17.56 | 23.59 |
| | July | 18.97 | 21.55 | 20.25 | 24.84 | 18.08 | 24.00 |
| | Aug | 18.92 | 21.09 | 20.58 | 25.17 | 17.72 | 21.00 |
| | Sept | 18.75 | 20.55 | 20.58 | 25.17 | 17.56 | 21.00 |
| | Oct | 18.08 | 19.50 | 20.58 | 25.17 | 16.88 | 21.00 |
| | Nov | 17.18 | 19.50 | 19.92 | 24.83 | 16.46 | 20.62 |
| | Dec | 16.40 | 18.78 | 19.92 | 24.83 | 16.64 | 20.25 |
| 1978 | Jan | 15.16 | 18.06 | 19.81 | 24.83 | 16.17 | 20.25 |
| | Feb | 14.80 | 17.92 | 18.92 | 24.50 | 14.06 | 19.75 |
| | Mar | 14.00 | 17.92 | [illegible] | 23.25 | 13.13 | 19.75 |
| | Apr | 13.81 | 16.25 | 18.67 | 21.50 | 11.69 | 20.25 |
| | May | 13.44 | 16.38 | 18.21 | 20.17 | 10.88 | 21.83 |
| | June | 12.20 | 16.50 | 14.00 | 20.29 | 11.12 | 21.83 |
| | July | 12.23 | 15.30 | 13.33 | 20.75 | 11.80 | 21.83 |
| | Aug | 11.70 | 13.75 | 13.00 | 20.42 | 11.92 | 21.83 |
| | Sept | 13.64 | 17.38 | 13.42 | 20.92 | 12.09 | 21.83 |
| | Oct | 16.90 | 19.00 | 13.75 | 21.08 | 13.36 | 21.83 |
| | Nov | 16.50 | 18.25 | 14.67 | 21.08 | 14.56 | 21.83 |
| | Dec | 16.50 | 18.25 | 15.17 | 21.25 | 15.16 | 23.00 |
| 1979 | Jan | 16.93 | 19.33 | 15.92 | 22.10 | 15.12 | 23.25 |
| | Feb | 17.70 | 20.00 | 16.58 | 22.58 | 15.12 | 23.50 |
| | Mar | 16.96 | 19.80 | 16.50 | 23.67 | 15.12 | 23.67 |
| | Apr | 16.82 | 19.60 | 16.50 | 23.67 | 15.22 | 23.67 |
| | May | 17.00 | 19.80 | 16.83 | 23.67 | 15.30 | 23.67 |
| | June | 16.90 | 19.58 | 16.83 | 23.67 | 15.75 | 23.67 |
| | July | 18.15 | 21.00 | 17.25 | 23.92 | 15.81 | 24.67 |
| | Aug | 19.10 | 21.00 | 19.92 | 27.50 | 16.62 | 25.75 |
| | Sept | 18.42 | 21.00 | 20.50 | 28.33 | 17.88 | 26.83 |
| | Oct | 21.00 | 22.43 | 20.50 | 28.33 | 18.00 | 27.00 |
| | Nov | 22.43 | 27.64 | 21.00 | 28.33 | 18.25 | 27.00 |
| | Dec | 22.75 | 28.50 | 21.83 | 28.33 | 19.17 | 27.67 |

Notes: WBL = Wholesale price of live pigs in Bangkok
WBS = Wholesale price of pork carcasses in Bangkok
WNL = Wholesale price of live pigs in the North region
WNS = Wholesale price of pork carcasses in the North region
WNEL = Wholesale price of live pigs in the Northeast region
WNES = Wholesale price of pork carcasses in the Northeast region

Source: Division of Price and Statistics, Ministry of Commerce files.

## 2.4 Relationship Between Bangkok Prices and Provincial Prices

Bangkok is a terminal market for most of Thailand's agricultural products. The important export provinces are Nakorn Pathom, Chachoengsao, Sara Buri and Ratchaburi which surround Bangkok and the Northeastern provinces, i.e. Roi Ed, Kalasin, Yasothorn, Khon Khen.

It can be seen from Figure 2.4 that the wholesale price of live pigs in Bangkok and other regions tend to move in the same direction. Figure 2.5 shows the relationship between wholesale price of pork carcass in Bangkok and the other regions. The relationship is the same for live pigs. It is worthwhile to note here that the same direction movement of wholesale prices in different regions shows that those prices relate to each other. This relationship may be due to the transport of live pigs from the surplus region to the shortage region (i.e. 'spatial arbitrage' (Southworth et al, 1979)). However, the wholesale prices in different regions do not move together all the time since prices in each region are also determined by the local demand and supply. Whenever there is a change in local demand or supply in one region which causes the difference in price to be high enough to cover the transportation cost, one would expect a pig flow from low price to high price region. The pig markets in the two regions will be adjusted until the difference in price equals transportation cost plus intermediaries' profit.

# CHAPTER 3

# PIG MARKETING IN THAILAND

## 3.1 Formal and Informal Markets

Generally, markets can be characterised as formal and informal although the division between them is often unclear. Shaw (1980) summarises the characteristics of formal and informal markets as presented in Table 3.1.

Formal markets are normally those which can be regulated and involve government institutions. In the Thai pig market, they are normally more developed than the informal markets especially in the cities. The volume of business is large and there are many market intermediaries before the commodities reach consumers. The system is completely monetised and relatively capital intensive in transportation, storage and selling facilities. The traders use trucks for transport and refrigerators for storage (which require high energy use) and they have to pay taxes and fees to the government. Hence the overall cost of performing the marketing functions are high but spread over a high throughput. Only persons who have a large amount of capital can come into the business so ownership tends to be concentrated among few people.

Formal markets are often organized by some institution, which can be government agencies, or trader committees, and lead themselves to grading and standardization. Therefore, they are easier to control, understand and quantify. An example of an organised formal pig market run by trader committee in Chieng Mai in the North region is given by Harthamart (1976:p.59):

> ...This local pig market operates every day from a very early hour of the day to about 10.00am. After that the market is practically closed due to the heat of the day which is not good for those pigs... Buying and selling

TABLE 3.1

CHARACTERISTICS OF INFORMAL AND FORMAL MARKETING SYSTEMS

| INFORMAL MARKETING SYSTEMS | FORMAL MARKETING SYSTEMS |
|---|---|
| . May or may not be monetised (e.g. trade or barter) | . Completely monetised |
| . Local marketing only (some exceptions, e.g. betel nut) | . Local and distant marketing |
| . Diffuse ownership and participation and spread benefits | . Concentrated ownership and profits |
| . Personal: considerable dependence on friends and relatives | . Impersonal |
| . Labour intensive | . Capital intensive: transport<br>storage<br>selling facilities |
| . Low energy use of fuel, electricity, etc. | . High energy use (esp. for fresh vegetables, meat and fish) |
| . Low selling costs: producer receives high proportion of the price to the consumer | . High selling costs: producer receives smaller proportion of the price to the consumer |
| . Difficult to control, understand and quantify | . Easier to control, understand and quantify |
| . Diffuse market: likely to be considerable competition | . Monopsonistic/monopolistic (or ologopsonistic/ ologopolistic) (i.e. one or few firms involved in marketing) Less or no competition (e.g. Rice Industries in PNG) May require government control |
| . Variable throughput and quality: can cope rapidly with change in amount or type of product | . Requires high and consistent throughput and quality: less flexible |
| . Low wastage | . High wastage for fresh vegetables and root crops (etc) Low wastage for grains and other readily storable foods. |
| . Favours simple storage and processing (e.g. smoking, drying, salting) | . Favours complex processing methods requiring high throughput and capital. (e.g. milling, grinding for flour, canning, freezing, cooling, chemical additives) |
| . Low or no packaging cost | . Complex, high cost packaging and storing |

Source: Shaw (1980), mimeo.

> were taking place (SIC) through a good deal of bargaining upon prices between the sellers and buyers... The market performed well in its exchange function providing a good place and some facilities for prospective buyers and sellers of various kinds to meet for transaction. The organising committee charged a service fee of one baht for each weaner and two bahts for a large pig to the owners of the animals.

The market also provides several holding pens for large and marketable pigs brought to the market by farmers or pig dealers of near and distant sources.

Most data used in marketing research comes from the formal markets source because of their well organised and usually complete records.

Informal (or traditional) markets are those where the rules and regulations are developed from within the system itself and few government institutions get involved. Sometimes they are affected by cultural and religious institutions. Generally, this type of market is in the rural area where people like to raise pigs for their own consumption with selling as a secondary objective. Thai rural people also butcher their own pigs for ceremony to show their social status on occasions such as weddings, and monkhood ceremonies and to give pork to relatives and friends. Sometimes there is an exchange which may or may not be monetised. In some cases, there are barter exchanges for example of village rice for a pig among the hill-tribe people in the North region.

This type of market is labour intensive but requires lower energy use and low marketing costs. The traders use simple transportation for carrying pigs and they also use simple containers and lack storage facilities.

In terms of competition, the informal markets are often more competitive than the formal markets. Anybody can easily enter or leave the business in which the volume per operator and capital needed is small. The ownership and participation are diffuse and the profits are more dispersed.

Informal markets are difficult to control, understand and quantify. The villagers always kill pigs secretly without paying any licence fees to the government. They feel strongly that the government has no right to ask them to pay the money for killing their own pigs. There is no record on the volumes, prices and costs. It is also difficult to determine the margin in the marketing system. Therefore, most research done in the marketing field is forced to neglect this type of market especially in low income countries where informal markets are mixed between the cash and kinship economy. It is more commonly anthropologists and sociologists who study informal markets.

The linkages between formal and informal markets are often quite strong, with prices input and output considerably influencing prices and output in the other. Although this thesis only uses data from the formal pig market, the informal market is implicitly included through its effects on prices in the formal market.

## 3.2 Market Intermediaries

Market Intermediaries refer to agents who perform market activities between the producers and consumers. They are therefore often referred to as "middlemen". In considering types and roles of middlemen in pig markets, the institutional approach is applied because this approach focuses attention on the question of "who" performs the marketing practices. It considers the nature and character of the various middlemen and related agencies and also the arrangement and organization of the marketing system.

Middlemen are those individuals or business concerns whose marketing functions involve the buying and selling of commodities which are moved from producers to consumers.

Middlemen have often been looked upon with disfavour and suspicion. Both the farmers and the consumers have considered the middlemen as parasites

who always exploit them. Yet the middlemen's function has become more essential as economies and the marketing systems have expanded. The middleman releases farmers for specializing in agricultural production, and releases consumers from nonfarm career specialization. The specialization of middlemen in such activities as storage, transportation, processing, retailing etc. is an example of division of labour and specialization. The middlemen help reduce marketing costs because there are economies of scale in their activities. Market search and transaction cost are also reduced by middlemen's specialization in finding buyers and sellers and negotiating exchanges between them. The middlemen also transfer market risk from the farmers. Before the commodities are transferred from the middlemen to the consumers the market situation such as price or consumer demand may change: the middlemen have to bear all those risks. Market intermediaries are therefore essential in a modern marketing system in low income countries.

There are various types of intermediaries engaged in the Thai pig markets. Some perform only exchange functions, i.e. buying and selling. Others try to combine with these other functions such as transportation, storage and processing. Therefore, one intermediary may belong to more than one type and there is difficulty in making clearcut classifications. In this thesis intermediaries in the Thai pig market are classified into 7 types:

(1) Local assemblers.

(2) Provincial assemblers.

(3) Commission dealers.

(4) Local meat carcass wholesalers.

(5) Bangkok meat carcass wholesalers.

(6) Meat retailers.

(7) Slaughterhouses.

### 3.2.1 Local Assemblers

Local assemblers are small scale dealers who buy and sell pigs in local areas. They may buy only 4-6 pigs per day from farmers especially in those villages which the large scale dealers can not reach. The local assemblers bear marketing risks such as pig sickness and weight loss and also have experience in transportation and market contacts. They also have access to market information, especially at the provincial level. The assembled pigs will be resold to commission agents, local meat carcass wholesalers, meat retailers and shippers in the town. The pigs bought by local assemblers are generally small or medium size with less than 100 kilograms weight. This type of dealer will travel to many villages but sometimes the raisers will give them the information especially when pigs die. In this case the local assemblers will roast the pigs and resell them to the roasted pig traders or the meat processors. The trading of pigs that have died do not pass through the abattoirs or veterinary inspection. The law specifies that the dead animals have to be inspected by the authorized officers but in practice there is no enforcement (Animal Trade Control Act, 1959). Mostly, these animals die of old age, accident or disease. The assemblers' buying price is usually very low for this kind of pig but selling prices can be high. Hence, the assemblers can earn profits to cover their risk.

There are 2 types of local assemblers: local assemblers with and without trading licenses (Harthamart,1976). Only licensed local dealers can move their animals beyond their village boundary. Those local assemblers without licenses have to confine their buying and selling activities within their local areas. Sometimes these assemblers cooperate with the licensed local dealers in shipping the animals out of the village and share the incurred expenses.

Usually, these types of dealers are farmers, growing rice or some kind of upland crops as their main profession and who engage in pig trading after the ploughing or harvesting season is over. They will gather pigs from friends, relatives and other farmers in the villages for resale. In any period when the live pig's price is high there will be a lot of temporary dealers competing with the existing dealers. The trading during that period is quite competitive because the raisers can choose the buyers who will give them the best price.

3.2.2 Provincial Assemblers

These are big pig traders who have considerable capital since the volume traded is sometimes up to 100-200 head per day. They concentrate their business in towns or provinces where the number of pigs raised is high enough to produce a consistent surplus for exporting to other provinces especially Bangkok. Local assemblers either purchase pigs from commission dealers or sometimes will hire a permanent employee called "Loong Ju" to assemble pigs for them. Commission dealers will charge a fee 5-10 baht per head (Leumprasert, 1978).

This type of assembler has a livestock trading license that enables him to ship his pigs to other markets, mostly to Bangkok. He possesses a medium size truck to transport the assembled pigs and has pig trading as his main career. Some assemblers may begin as pig raisers and some still run their own pig farms to assure the supply of pigs. This also makes it easier to keep any low-weight pigs until they reach marketable weight.

When the supply of pigs is low, provincial assemblers may travel to many provinces by truck to purchase pigs. Besides, some assemblers will purchase underweight pigs from raisers who are short of money. These pigs are called "dived pigs" (moo dum nam). There is also a practice by which

assemblers buy sick pigs at a low price, and mix them with the other pigs which will be shipped to Bangkok wholesalers.

3.2.3 Commission Dealers

Commission Dealers buy pigs directly from farmers or from other local assemblers. They receive a commission on the value of the pigs purchased (about 3-4 per cent in the case of commission dealers in the Northeast (Poorpongsakorn, 1980)). They may give discounts and offer farmers or local assemblers a higher price; this seems to be a frequent practice with regular suppliers. The commission dealers bear a quality risk. They depend on the quality of the pigs purchased.

3.2.4 Local Meat Carcass Wholesalers

This group of dealers assemble pigs in their local area. Within the regions where large numbers of pigs are raised, they can do their business within a 5-10 kilometres radius, for example in Tambol Thammasala in Nakorn Pathom Province (Poorpongsakorn, 1980). For the regions where the density of pigs is lower, the wholesalers have to travel a long distance to get the normal 4-5 pigs per day for the small wholesalers and 10-30 pigs per day for the big wholesalers. Local meat wholesalers haul their pigs to the local slaughterhouses for hired slaughtering, and supply the meat carcasses to the meat retailers who are their regular customers.

Each day the number of pigs to be slaughtered depends upon the retailers' orders which will be known in the evening. The number of pigs requires will be slaughtered in the evening. If the number of live pigs purchased exceeds the demand in that day, those pigs will be kept in the slaughterhouse sty and slaughtered in the following day and the wholesalers will purchase correspondingly less pigs the next day.

Some local wholesalers also act as retailers renting small retailing stalls in local markets and selling carcasses themselves or with family assistance. Sometimes they sub-let their stalls.

The traders at this level therefore perform many marketing functions: assembling pigs from the farm gate, transporting pigs to local slaughterhouses, hire slaughtering services and deliver the carcasses to retailers, or even retail on their own account.

This type of vertical integration by one person gives an opportunity for large marketing profits, but at the same time these wholesalers have to bear risks both in quantity and price. They can cover some risk by having a permanent contract with pig customers or have their own farm. Risk in price is unavoidable for them because in assembling pigs, the wholesalers have to find the raisers who have marketable weight pigs and have an oral contract which specifies that they will come to purchase pigs in the next 7-10 days at the market price of the day they had contact. The raisers can refuse to sell pigs if he is not satisfied with prices in that day. But if prices fall between the contract and purchase day, the dealers will normally have to bear the loss.

3.2.5 Bangkok Meat Carcass Wholesalers

The Bangkok meat carcass wholesalers purchase from large pig raisers, provincial wholesalers and Bangkok livestock assemblers. Bangkok wholesalers normally make an advance order for 7-10 days by calling the provincial wholesalers. When there is a pig shortage, Bangkok wholesalers may order pigs direct from wholesalers in the provincial markets. Sometimes the Bangkok wholesalers travel to purchase pigs in the provinces by themselves. Pigs are purchased in the village on a lump-sum payment basis without weighing. Although the margin between the buying and selling price may be considerable, his cost is also high especially in the remote villages where transportation facilities are poor.

Orders can also be made directly to the pig raisers who regularly supply Bangkok wholesalers.

Bangkok livestock assemblers fix the buying prices for live animals delivered to them in Bangkok by various shippers throughout the country to supply Bangkok meat carcass wholesalers.

The meat carcass wholesalers normally have holding pens in which to keep pigs as a reserve to supply the meat demand for 1 week. The provincial meat carcass wholesalers will keep pigs for only 1-2 days because they want to minimize the feeding cost.

Bangkok meat carcass wholesalers send their pigs to Bangkok slaughterhouses for hired slaughtering, then wholesale their meat carcasses to meat retailers in the Bangkok Metropolitan Areas.

3.2.6 Meat Retailers

There are many types of meat retailers (Harthamart,1976):

(a) Those who purchase meat carcasses from meat carcass wholesalers for resale to consumers. Many of the retailers are of this type.

(b) Large retailers who purchase meat carcasses from wholesalers and resell to both consumers and small retailers.

(c) Small retailers who purchase meat carcasses from large retailers in the same or different markets or from illegal meat carcass wholesalers.

(d) Those who purchase live pigs for slaughtering and resell meat to consumers.

(e) Those who purchase live pigs for slaughtering and resell partly to consumers, partly to other retailers. Some retailers purchase meat carcass and resell different grades of meat to supermarkets or small

retailers in other markets. The number and size of business of some retailers are shown in Table 3.2.

TABLE 3.2

AVERAGE VOLUME OF BUSINESS BY TYPES OF PORK RETAILERS, BANGKOK CONSUMER MARKETS, 1975

| Types of Retailers | No. of Retailers | | Average No. of Hog Carcasses/Day | | |
|---|---|---|---|---|---|
| | Persons | % | Retailed | Wholesale | Total |
| Type 1 | 125 | 85.0 | 2.7 | - | 2.7 |
| Type 2 | 11 | 7.5 | 2.1 | 2.8 | 4.9 |
| Type 3 | 7 | 4.8 | 5.1 | - | 5.1 |
| Type 4 | 4 | 2.7 | 5.5 | 13.5 | 19.1 |
| Total and Overall Average | 147 | | 3.9 | 8.1 | 7.9 |

Note: Totals may not agree through rounding.

Source: Harthamart et al (1976), p.137.

Some retail markets in Bangkok and other provinces (e.g. Nakorn Pathom and Ratchaburi) have temporary retailers or hawkers selling on pushcarts or baskets carried around the streets or markets. Mostly they purchase meat carcass from illegal slaughterhouses. The number of temporary retailers or hawkers increases considerably when prices are low.

Retailers in Bangkok sell only pork as their main source of income. The retailing stalls are both big with 3-4 butchers and small with only 1 butcher. In big markets there are more than 6 retailing stalls. From the survey of Livestock Trading Corporation Ltd. and the estimation of National Economics and Social Development Board (1972), it was estimated

that in the Bangkok Metropolitan Area, there were 1,295 retailers in the total of 130 retail markets.

Meat retailers can purchase meat carcasses from big retailers, Livestock Trading Corporation Ltd.'s wholesalers, meat carcass wholesalers of other slaughterhouses in Bangkok or from meat carcass wholesalers in other provinces. The latter case is possible when Department of Interior allows shipment of meat carcass from other provinces into Bangkok.

3.2.7 Slaughterhouses

The Department of Interior has never recorded the number of slaughterhouses but it is estimated that now there are 350 slaughterhouses in the country (Harthamart,1976). Each province has at least 1 slaughterhouse. One hundred slaughterhouses out of the total are run by municipalities. Bangkok Metropolitan Area has 6 slaughterhouses altogether namely, Samroong, Phrapadaeng, Bangcae, Rungsit and Nonthaburi municipal slaughterhouses and Kluay Nam Thai slaughterhouse owned by the Livestock Trading Corporation Ltd. Table 3.3 shows the number of live pigs and the number of pigs processed through slaughterhouses in Thailand.

All municipal slaughterhouses provide slaughtering services to meat wholesalers or retailers who haul their livestock to the slaughterhouses for hired slaughtering. Ordinarily, wholesalers provide their own workers and pay them for killing and cutting services of about 20 baht per pig but the rate varies according to locality. The slaughterhouses will provide services such as holding pens, clean killing floors, electricity, hot water etc. The wholesalers will be charged fees per head of animal by the municipal authorities which run the slaughterhouses. These fees are fixed by law and are the same rate throughout the country (Table 3.4). Veterinary inspection will be made before and after the slaughtering. Diseased animals and carcasses are often rejected.

TABLE 3.3

NUMBER OF LIVE PIGS AND NUMBER OF PIGS PROCESSED THROUGH SLAUGHTERHOUSES IN THAILAND

| Year | Live Pig | | Pig Processing Through Slaughterhouses | |
|---|---|---|---|---|
| | Head | Annual Charge (%) | Head | Annual Charge (%) |
| 1969 | 4806746 | 6.7 | 1449479 | -15.3 |
| 1970 | 5132244 | 6.8 | 1607299 | 10.9 |
| 1971 | 3883870 | -24.3 | 1673943 | 4.1 |
| 1972 | 3982133 | 2.5 | 1667671 | -0.4 |
| 1973 | 4460372 | 12.0 | 1501947 | -9.9 |
| 1974 | 3515559 | -21.9 | 1628088 | -8.4 |
| 1975 | 3211412 | -8.7 | 1933123 | 18.4 |
| 1976 | 3019487 | -3.3 | 2600426 | 34.5 |
| 1977 | 3215878 | 6.5 | 2710022 | 4.2 |
| 1978 | 4942695 | 53.7 | - | - |
| Average | 4017039 | | 1863555 | |

Note: Totals may not agree through rounding.

Source: Ministry of Agriculture and Co-operatives files.

TABLE 3.4

FEES FOR SLAUGHTERING CHARGED BY MUNICIPAL AUTHORITY

(Unit: ฿/head)

| Item | Fee |
|---|---|
| Tax | 10 |
| Slaughter Fee | 10 |
| Holding Pen Fee | 2 |
| Total | 22 |

Source: Harthamart et al (1976), p.72.

Generally, there are 3 types of slaughterhouses in Thailand (Harthamart,1976):

(a) Simple Slaughterhouses

These are located in various villages in the rural areas. They are under the supervision and control of the local government office, Ministry of Interior, and governed by the municipal laws and regulations. Table 3.5 shows facilities and equipments of the 14 simple slaughterhouses

TABLE 3.5

FACILITIES AND EQUIPMENT OF 14 SIMPLE SLAUGHTERHOUSES, 1975

| Names of Slaughterhouse | Provinces | Workroom Space (sq. meters) | | No. of Boiling Pan | No. of Veterinarian | No. of Worker |
|---|---|---|---|---|---|---|
| | | Holding Pen | Killing[a] Floor | | | |
| Warin Chamrap | Ubon Ratchathani | 150 | 225 | 4 | 1 | 1 |
| Wang Chai | Khon Kaen | 30 | 36 | 2 | 1 | 1 |
| Ban Phai | " | * | 117 | 7 | 1 | 1 |
| Chonnabot | " | * | 20 | 1 | 1 | 1 |
| Muang Phon | " | * | 90 | 6 | 1 | 1 |
| Nong Han | Udon Thani | * | 180 | 1 | 1 | 1 |
| Nong Bua Lam Phu | " | 15 | 35 | 2 | 1 | 1 |
| Sawang Daen Din | Sakhon Nakhon | * | 16 | 1 | 1 | 1 |
| Wanon Niwat | " | * | 72 | 1 | 1 | 1 |
| Tha Li | Loei | 15 | 36 | 1 | 1 | 1 |
| Chatturat | Chaiyaphum | 72 | 63 | 1 | 1 | 1 |
| Phi Khieo | " | * | 98 | 3 | 1 | 1 |
| That Phanom | Nakhon Phanom | * | 50 | 3 | 1 | 1 |
| Mukdahan | " | * | 45 | 2 | 1 | 1 |
| Average | | - | 77.4 | 2.5 | 1 | 1 |

Note: a Floor for killing cattle, buffaloes, and pigs.

Source: Harthamart et al (1976), p.73.

in 7 provinces in the Northeast. Many of them do not have holding pens. All of them have only one small room for killing cattle, buffaloes and pigs in common. All kinds of slaughtering activities including carcass treatment are done in this room and each of them has an average of 2.5 boiling pans used for the treatment of pigs after killing. The abattoirs are generally insanitary and highly unhygienic. All have one verterinary officer who supervises the killing and inspects the animals and carcasses and one worker. Slaughtering labour is provided by each wholesaler as described in Section 3.2.7.

Table 3.6 shows the slaughtering capacity per day for pigs ranges

TABLE 3.6

PIGS: AVERAGE SLAUGHTERING CAPACITY, ACTUAL SLAUGHTERING VOLUME, AND OPERATION RATE OF 14 SIMPLE SLAUGHTERHOUSES, 1975

| Names of Slaughterhouses | Provinces | Slaughtering Capacity/Day (Heads) | Actual Slaughtering Volume/Day (Heads) | Operation Rate[a] (%) |
|---|---|---|---|---|
| Warin Chamrap | Ubon Ratchathani | 100 | 20 | 20.00 |
| Wang Chai | Khon Kaen | 10 | 5 | 50.00 |
| Ban Phai | " | 50 | 15 | 30.00 |
| Chonnabot | " | 20 | 8 | 40.00 |
| Muang Phon | " | 80 | 15 | 18.75 |
| Nong Han | Udon Thani | 40 | 10 | 25.00 |
| Nong Bua Lam Phu | " | 30 | 10 | 33.33 |
| Sawang Daen Din | Sakhon Nakhon | 18 | 8 | 44.44 |
| Wanon Niwat | " | 10 | 3 | 30.00 |
| Tha Li | Loei | 15 | 3 | 20.00 |
| Chatturat | Chaiyaphum | 70 | 10 | 14.29 |
| Phi Khieo | " | 23 | 10 | 43.48 |
| That Phanom | Nakhon Phanom | 10 | 5 | 50.00 |
| Mukdahan | " | 50 | 18 | 36.00 |
| Average | | 37.57 | 10 | 32.52 |

Note: a Operation Rate = $\frac{\text{Number of actual slaughtering volume(heads/day)} \times 100}{\text{Slaughtering capacity (heads/day)}}$

Source: Harthamart et al (1976), p.76.

from 10-100 heads and the actual volume from 3-20 heads of 14 simple - slaughterhouses in the northeast provinces. All of them operate below their maximum daily capacity ranging from as low as 14.29 per cent of capacity at Chatturat to 50 per cent at Wang Chai and That Phanom slaughterhouses. On the average, slaughtering capacity is 38 heads/day with actual killings totalling about 10 head/day giving a utilisation rate of about 33 per cent.

(b) General Slaughterhouses

These are municipal slaughterhouses, usually found in all main Amphoes or districts, and in all provinces of the country. They are bigger in size and capacity than the simple slaughterhouse. Table 3.7 shows facilities and equipment of 12 general slaughterhouses in the northeast provinces. All of them have holding pens, killing floors for cattle, buffaloes and pigs with varying spaces. Only those slaughterhouses at Ubon Ratchathani, Surin, Nakhon Rachasima and Chieng Mai have separate rooms for storing carcasses. None of these general slaughterhouses is equipped with freezing and refrigeration facilities. Each has about 8 boiling pans, at least one veterinary officer supervising the slaughtering and have an average of 3 workmen.

Table 3.8 shows the average slaughtering capacities, actual slaughtering volumes, and operation rates of the general slaughterhouses for pigs of 12 general slaughterhouses in the northeast. The average slaughtering capacity was about 125 head of pigs/day, while average actual pigs slaughtered was about 74 head/day. The operation rate of each slaughterhouse was quite low, i.e. about 59 per cent. The operation rates for pigs at Chieng Mai, Nakhon Ratchasima, and Kanchanaburi abattoirs are high, i.e. 90, 80 and 75 per cent respectively.

TABLE 3.7

FACILITIES AND EQUIPMENT OF 12 GENERAL (MUNICIPAL) SLAUGHTERHOUSES, 1975

| Names of Slaughterhouses | Workroom Spaces (Sq. meters) | | | | No. of Boiling Pans | No. of Veterinarians | No. of Workers | Total Space (Sq. meters) |
|---|---|---|---|---|---|---|---|---|
| | Holding Pen | Killing Floor | | Carcass Room | | | | |
| | | Cattle & Buffalo | Hog | | | | | |
| Muang Ubon Ratchathani | 300 | 600 | 600 | 400 | 6 | 1 | 3 | 1900 |
| Muang Kanchanaburi | 120 | 200 | 600 | * | 4 | 1 | 2 | 920 |
| Muang Ban Pong | 150 | 300 | 900 | * | 4 | 1 | 2 | 1350 |
| Muang Surin | 140 | 200 | 375 | 375 | 10 | 1 | 3 | 1090 |
| Muang Nakhon Phanom | 160 | 144 | 40 | * | 3 | 1 | 3 | 344 |
| Muang Nakhon Ratchasima | 140 | 120 | 100 | 100 | 19 | 1 | 5 | 460 |
| Muang Khon Kaen | 128 | 56 | 120 | * | 8 | 1 | 2 | 304 |
| Muang Udon Thani | 135 | 54 | 513 | * | 8 | 2 | 5 | 702 |
| Muang Sakon Nakhon | 160 | 120 | 120 | * | 4 | 1 | 2 | 400 |
| Muang Loei | 108 | 72 | 56 | * | 3 | 1 | 2 | 236 |
| Muang Chaiyaphum | 216 | 63 | 54 | * | 6 | 1 | 2 | 333 |
| Nakhon Chiang Mai | 240 | 500 | 432 | 432 | 17 | 3 | 5 | 1604 |
| Average | 166.4 | 202.4 | 325.8 | - | 7.6 | 1.2 | 3 | 803.58 |

Note: * None (included in killing floor).

Source: Harthamart et al (1976), p.78.

TABLE 3.8

PIGS: AVERAGE SLAUGHTERING CAPACITY, ACTUAL SLAUGHTERING VOLUME, AND OPERATION RATE OF 12 GENERAL (MUNICIPAL) SLAUGHTERHOUSES, 1975

| Names of Slaughterhouses | Slaughtering Capacity/Day (Heads) | Actual Slaughtering Volume/Day (Heads) | Operation Rate[a] (%) |
|---|---|---|---|
| Muang Ubon Ratchathani | 120 | 60 | 50.00 |
| Muang Kanchanaburi | 100 | 75 | 75.00 |
| Muang Ban Pong | 190 | 70 | 36.84 |
| Muang Surin | 100 | 50 | 50.00 |
| Muang Nakhon Phanom | 50 | 18 | 36.00 |
| Muang Nakhon Ratchasima | 300 | 240 | 80.00 |
| Muang Khon Kaen | 140 | 65 | 46.43 |
| Muang Udon Thani | 180 | 75 | 41.67 |
| Muang Sakhon Nakhon | 45 | 19 | 42.22 |
| Muang Loei | 26 | 13 | 50.00 |
| Muang Chaiyaphum | 42 | 17 | 40.48 |
| Nakhon Chiang Mai | 200 | 180 | 90.00 |
| Average | 124.4 | 73.5 | 59.08 |

Note: a See Table 3.6.

Source: Harthamart et al (1976), p.81.

(c) Modern Slaughterhouses

There are only 2 modern slaughterhouses in Thailand. The first is owned by the Livestock Trading Corporation Ltd. under the control of the Bangkok Municipal Authority and located at Soi Kluay Nam Thai, Bangkok (usually called the Kluay Nam Thai Slaughterhouse). Working 8 hours per day, this abattoir can slaughter 2,000-3,000 pigs. This is the largest and best equipped slaughterhouse in the country (Table 3.9).

TABLE 3.9

ANNUAL SLAUGHTERING VOLUME OF THE KLUAY NAM THAI SLAUGHTERHOUSES, 1963-1974

(Unit: heads)

| Year | Cattle | Buffaloes | Hogs |
|---|---|---|---|
| 1963 | - | - | 561802 |
| 1964 | - | - | 533947 |
| 1965 | 63210 | 43540 | 591631 |
| 1966 | 66910 | 39508 | 671094 |
| 1967 | 62421 | 34877 | 622351 |
| 1968 | 56991 | 38650 | 431291 |
| 1969 | 43103 | 30070 | 139901 |
| 1970 | 35042 | 28441 | 205729 |
| 1971 | 43416 | 35888 | 212724 |
| 1972 | 30116 | 32761 | 311597 |
| 1973 | 31640 | 31608 | 363963 |
| 1974 | 15299 | 14198 | 276830 |

Source: Statistics and Research Section, Sahasamakee Livestock Trading Co., Ltd., Bangkok.

The second is located at Ban Pong, Ratchburi province and owned by the Preserved Food Organization (PFO) under the control of the Ministry of Defence. This slaughterhouse is also available for hired slaughtering aside from slaughtering animals to supply fresh and red meat for its own use in the production of various preserved and canned meat. It is located in the midst of livestock producing areas and serves the licensed meat wholesalers from nearby provinces.

3.3 Illegal Slaughtering

All of the slaughterhouses in Thailand tend to operate below their capacities due to the fact that pigs are largely hauled to be slaughtered

at the unauthorized or illegal slaughter places. These places may be simple shelters, under trees, or underneath the houses. Tables 3.10 and 3.11 show estimates of the percentage of illegally slaughtered pigs by provinces and in the whole kingdom.

TABLE 3.10

ESTIMATION OF ILLEGAL SLAUGHTERED PIGS

| Year | Number of Pigs Slaughtered (heads) | | Total Numbers of Pigs Slaughtered (heads) | Number of Pigs Slaughtered in Slaughter-houses (heads) | Illegal Slaughtered Pigs (heads) | % of Illegal Slaughtered Pigs |
|---|---|---|---|---|---|---|
| | In Bangkok | Outside Bangkok | | | | |
| 1962 | 595607 | 3089970 | 3682577 | 1766287 | 1916290 | 52.0 |
| 1963 | 601154 | 3162024 | 3763678 | 1804391 | 1958687 | 52.1 |
| 1964 | 595238 | 3038495 | 3633733 | 1738477 | 1859256 | 52.1 |
| 1965 | 652318 | 2970199 | 3622517 | 1743853 | 1878664 | 51.9 |
| 1966 | 713240 | 3298293 | 4011533 | 1915184 | 2096349 | 52.3 |
| 1967 | 708917 | 3411378 | 4150295 | 1714449 | 2435846 | 58.7 |
| 1968 | 765518 | 3343761 | 4109279 | 1711960 | 2397319 | 57.9 |
| 1969 | 793077 | 3359881 | 4152958 | 1449479 | 2703479 | 65.1 |
| 1970 | 821628 | 3542877 | 4364505 | 1607299 | 2757206 | 63.2 |
| 1971 | 851207 | 3768749 | 4619956 | 1673943 | 2946013 | 63.8 |
| 1972 | 876743 | 3804500 | 4681243 | 1667671 | 3013572 | 64.4 |
| 1973 | 922443 | 3522602 | 4445650 | 1501947 | 2943103 | 66.2 |
| 1974 | 958341 | 3606068 | 4656409 | 1628088 | 2937321 | 64.3 |
| 1975 | 996592 | 4092361 | 5088593 | 1933123 | 3155830 | 62.0 |
| 1976 | 1036456 | 4456430 | 5492886 | 2600426 | 2892460 | 52.7 |
| 1977 | 1078951 | 4689404 | 5768355 | 2710022 | - | - |

Source: Poorpongsakorn (1980), pp.151-2.

(Note: The figures of Table 3.10 and 3.11 do not agree in the original reference. Since it is not clear which one is correct, both are reproduced here).

TABLE 3.11

RATE OF ILLEGAL SLAUGHTER BY PROVINCES, 1960

| Provinces | Illegal Slaughtered Pigs (heads) | Pigs Slaughtered in Slaughterhouses (heads) | Rate of Illegal Slaughtered Pigs (%) |
|---|---|---|---|
| Saraburi | 300 | 18908 | 1.6 |
| Pracheenburi | 1800 | 18912 | 9.5 |
| Cholburi | 165 | 53466 | 0.3 |
| Rayong | 60 | 13835 | 0.4 |
| Trad | 185 | 5163 | 3.6 |
| Nakorn Ratchasima | 2301 | 31960 | 7.2 |
| Chaiyapoom | 1312 | 7055 | 18.6 |
| Ubonrachthani | 3435 | 16312 | 21.1 |
| Loei | 250 | 4711 | 5.3 |
| Sakolnakorn | 949 | 5585 | 16.9 |
| Khon Khen | 1441 | 13765 | 10.5 |
| Maha Sarakram | 595 | 3101 | 19.2 |
| Roi Et | 343 | 3786 | 9.1 |
| Lampang | 3000 | 22911 | 13.1 |
| Chieng Rai | 781 | 31678 | 2.5 |
| Prae | 260 | 11561 | 2.3 |
| Pisanulok | 150 | 16458 | 0.9 |
| Sukothai | 150 | 1182 | 1.3 |
| Tak | 335 | 9337 | 3.6 |
| Kampaengpeth | 90 | 7676 | 1.2 |
| Pichit | 250 | 16164 | 1.6 |
| Chieng Mai | 2798 | 55751 | 5.0 |
| Nakorn Pathom | 400 | 26117 | 1.5 |
| Suratchthani | 635 | 30976 | 2.1 |
| Ranong | 34 | 4941 | 0.7 |
| Songkla | 900 | 57116 | 1.6 |
| Narathiwas | 512 | 15176 | 3.8 |
| Patalung | 2400 | 9694 | 24.8 |
| Total | 25831 | 513297 | 188.6 |

Source: Poorpongsakorn (1980), pp.149-50.

There are reasons leading to a wide-spread practice of illegal slaughter within the pig marketing system in Thailand.

(1) Legal slaughter involves certain formalities. Any person who desires to have their pigs slaughtered at the authorised slaughterhouses, must surrender the animal identification documents to the slaughter authority. Because of the inconvenience in getting these documents from the authority, the owners of the animals will often haul their pigs to unauthorised abattoirs and have them killed without bothering to surrender any official document or to have a veterinary inspection.

(2) A person hauling his pigs to authorised slaughterhouses for legal slaughtering must pay slaughter taxes and fees of 20 baht per pig. To avoid such payments, he may haul his livestock to unauthorised abattoirs which he knows do cheap or hired slaughtering, hence reducing the costs for his carcasses.

(3) By having their animals slaughtered at the authorised abattoirs, and officially inspected by veterinary officers, the pigs owners run a risk of losing their carcasses. Diseased pigs will be officially kept and strictly confined in quarantine for a lengthy period of time. Any diseased carcass found will be immediately destroyed. To avoid such possible quarantine holding costs or losses, lots of pig owners resort to illegal slaughterhouses.

Even though illegal slaughtering makes the market more competitive it leads to considerable leakage from the flows of both governmental and municipal revenues, encourages the existence of numerous corrupt officials and results in incomplete and unreliable statistics on the pig population and on the annual number of pigs slaughtered.

### 3.4 Marketing Channels

Pigs from the farm gate move through various channels until they reach final consumers of meat in different consumer retail markets.

The structure of marketing channels do not seem to have changed significantly since the 1964 survey conducted by the Division of Agricultural Economics, Ministry of Agriculture and Cooperatives. However, the quantity and percentage of pigs passing through each level of middlemen may change owing to the increase in the number of big farms and there may be changes in the relative volume of pigs passing through each part of the system.

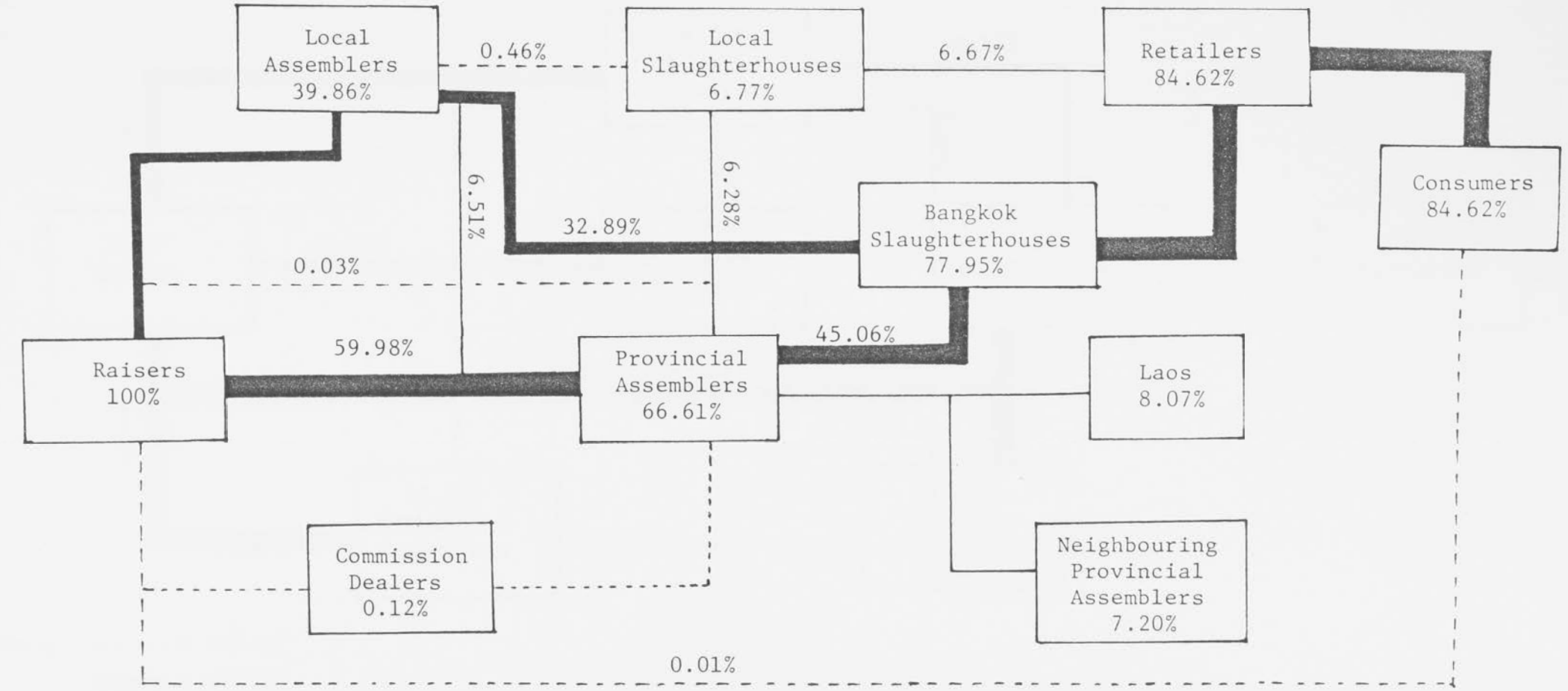
Figure 3.1 shows pig marketing channels in 8 provinces in the Northeast of Thailand during the months of June, 1963 to May, 1964. Farmers in the Northeast sold about 60 per cent of their pigs directly to provincial assemblers and about 40 per cent to various shippers. Nevertheless, most of these local assemblers were shippers as well. The major portion of pigs from farms flowed through shippers to Bangkok: approximately 85 per cent of marketable pigs reached consumers in Bangkok (Donner, 1978).

Figure 3.2 shows pig marketing channels in 8 provinces in the Central Plain of Thailand during June, 1968 - May, 1969. It is noticeable that the assemblers are very important in this market because 42 per cent of pigs from raisers flow through them. The remainder flow to wholesalers (18.3 per cent) and 30.0 per cent directly to retailers. Pig marketing channels in Thailand can be summarized as shown in Figure 3.3. Most pigs from raisers are sold to big wholesalers through commission dealers or "Loong Ju" while the remainder are sold to local assemblers. Almost all pigs are resold to Bangkok with only a small amount retained for local consumption. Pigs assembled by local assemblers are either slaughtered in slaughterhouses before being resold to retailers and or resold to big provincial assemblers who resell them to meat carcass wholesalers in Bangkok. When meat carcasses from other provinces are allowed to be shipped to Bangkok, big provincial assemblers slaughter their pigs in the local slaughterhouses and resell the carcasses to Bangkok retailers who sell pork

FIGURE 3.1

PIG MARKETING CHANNELS IN 8 PROVINCES IN THE NORTHEAST OF THAILAND

JUNE 1963 - MAY 1964




Note: ----- = <0.5%

——— = <7.0%

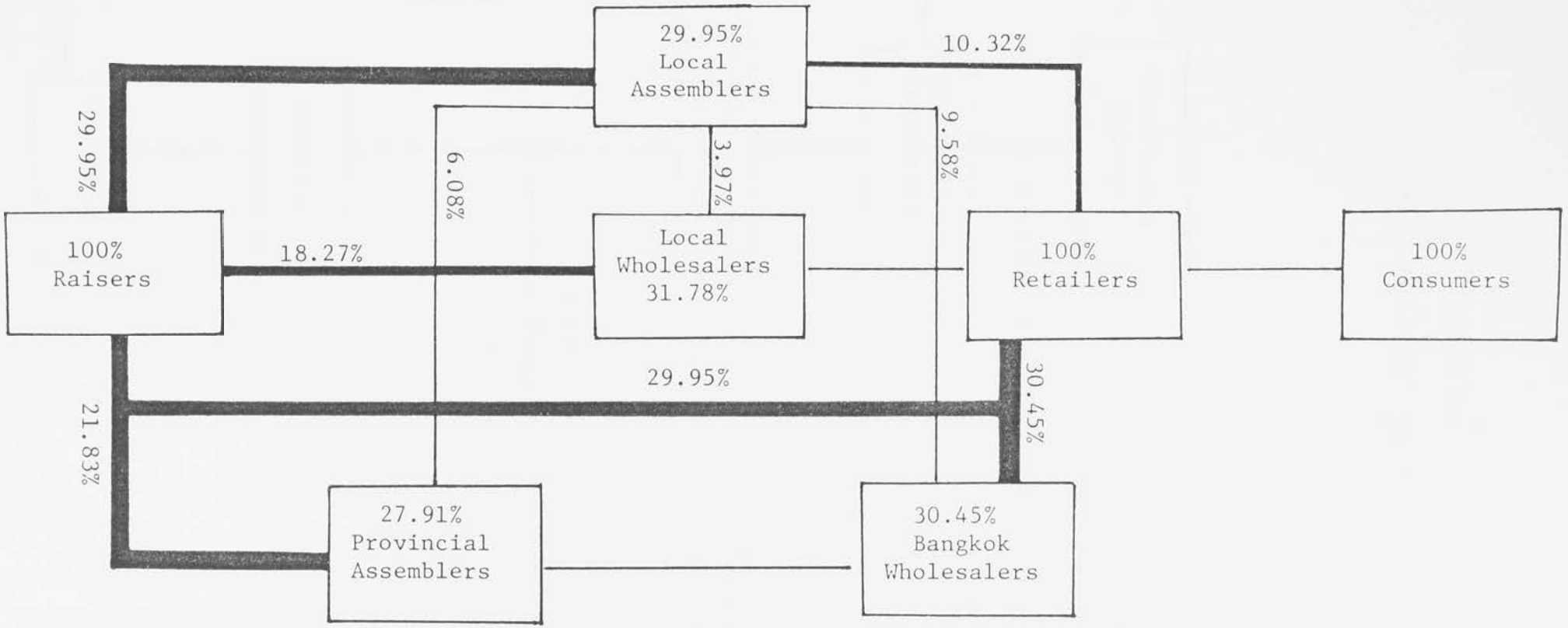
▬▬ = >30.0%

Source: Poorpongsakorn (1980), p.26.

FIGURE 3.2

PIG MARKETING CHANNELS IN 8 PROVINCES IN CENTRAL PLAIN

JUNE 1968 - MAY 1969




Note: ——— = <10.0%

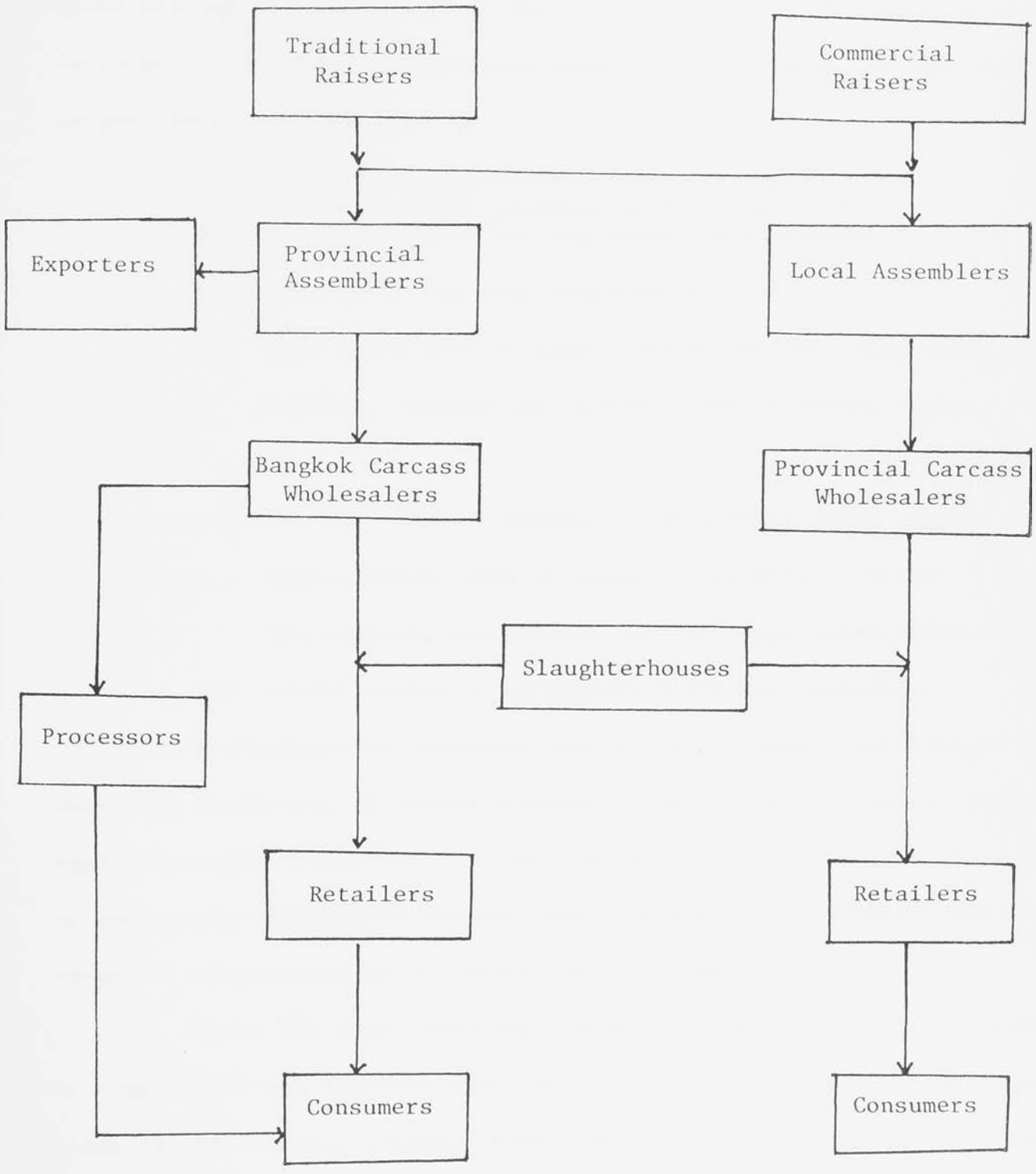
▬▬ = >10.0%

▬▬ = >20.0%

Source: Luemprasert, 1977, p.26.

FIGURE 3.3

PIG MARKETING CHANNELS




Source: Poorpongsakorn (1980), p.23.

to the consumers. Some Bangkok meat carcass wholesalers also sell their carcasses to processors such as finished meat product factories.

## 3.5 Marketing Cost and Marketing Margin

### 3.5.1 Marketing Cost

Marketing cost refers to all costs incurred as the farm product moves through the market to the final consumers; also the costs of nonfarm services to the farmer (Waught and Ogren, 1961). Kohls and Uhl (1972:223) defined food marketing cost as:

> "The difference between total consumer expenditures for all domestically produced food products and what farmers receive for equivalent farm products."

Normally, marketing cost comprises of:

(1) cash costs such as wages, transportation, processing, holding, interest on borrowing and equipment costs; and

(2) non-cash cost or implicit cost such as owner wages, depreciation, loss of weight or quality, interest for capital, acquisition cost and opportunity cost; and

(3) normal profit in performing marketing functions.

Marketing cost therefore represents consumers' expenditure on marketing services. A simple estimate of marketing cost can be done by aggregating the values added by all distributors from farm gate to retailers or taking the differences between final expenditure on products and the value of the products as it leaves the farm gate.

Since the pork marketing system (like most agricultural products) is complicated and accurate time series data for all parts of the marketing chain is unavailable, studying pork marketing cost is difficult and even then, results can be inconclusive. Wholesalers and retailers rarely gave reliable information on costs and profits and there is a lack of marketing cost data

of pig wholesalers in every region. So it is impossible to make an adequate comparison of marketing cost in any of the regions studied in this thesis and major analysis in this context is an improper approach. Table 3.12 shows the marketing cost for pig trading from the Northeast region to Bangkok from the study by the Division of Agricultural Economics (1963) and from Harthamart (1976). Comments can be made as follows:

(1) The slaughter fee is not equal in each study in spite of being a fixed amount. The reason may be that some studies consider slaughter tax (10 baht per head) as a slaughter fee and separate slaughter-house fee (10 baht per head) and sty expense (2 baht per head) into another item. Some studies do not include the slaughterhouse fee.

(2) The important components which a general study has neglected are implicit costs such as opportunity cost and the cost of borrowing (interest) which is usually a significant cost in buying/selling operations. Including opportunity cost and interest paid might make the calculated marketing cost more reliable and realistic.

(3) Data biases of various types are caused by tax avoidance from illegal pig slaughtering, bribes to government officials to get special privileges such as increased pig quotas and carcass inspection approvals. These costs may be large but data for this thesis was very difficult to collect. Different studies treat illegal costs in different ways and then are usually approximations. In Harthamart's study (1976:100) he mentioned that:

> During the course of each shipment and somewhere along the highway leading to Bangkok, shippers' trucks would usually be given a signal to stop for inspection by a highway patrol car. Shippers always pay about 200-300 baht to those uniformed persons in the car in order to move on toward destinations.
>
> These illegal charges vary on different highways.

TABLE 3.12

MARKETING COST OF PIG TRADING FROM NORTHEAST TO BANGKOK

| Items | D.A.E.(1963)[1] | | Hathamart(1976)[2] | |
|---|---|---|---|---|
| | ฿/head | % of Retail Price | ฿/head | % of Retail Price |
| 1. Local Dealers | 19.3 | 3.9 | 10.0 | 0.5 |
| Transportation | 7.0 | 1.4 | 10.0 | 0.5 |
| Wage | 3.5 | 0.7 | - | - |
| Container's Cost | 8.8 | 1.8 | - | - |
| 2. Live Pig Wholesalers | 107.8 | 22.1 | 47.0 | 2.7 |
| Transportation | 25.6 | 5.3 | 21.9 | 1.2 |
| Commission | 13.7 | 2.8 | - | - |
| Wage | 30.3 | 6.2 | 10.1 | 0.5 |
| Veterinary Inspection | - | - | 3.0 | 0.2 |
| Illegal Charge | - | - | 2.9 | 0.2 |
| Ice Cost | - | - | 1.5 | 0.1 |
| Feed Cost | - | - | 7.6 | 0.4 |
| Tax | 5.4 | 1.1 | - | - |
| Vaccination | 3.0 | 0.6 | - | - |
| Container's Cost and Office Expense | 29.8 | 6.1 | - | - |
| 3. Pork Carcass Wholesalers | 130.8 | 26.8 | 32.0 | 1.7 |
| Wage | 8.0 | 1.6 | - | - |
| Slaughter Fee | 17.0 | 3.5 | 10.0 | 0.5 |
| Tax | 19.0 | 3.9 | - | - |
| Water-Electricity-Wood | 12.0 | 2.5 | - | - |
| Loss Weight | 63.8 | 13.1 | - | - |
| Transportation | - | - | 10.0 | 0.5 |
| Hire Slaughtering | - | - | 12.0 | 0.6 |
| Others | 11.0 | 2.3 | 39.1 | 2.1 |
| 4. Profit | | | | |
| Local Dealers | 28.8 | 5.9 | 36.2 | 2.1 |
| Live Pig Wholesalers | 29.8 | 6.1 | 42.9 | 2.3 |
| Pork Carcass Wholesalers | 47.1 | 9.7 | 157.5 | 8.4 |
| Retailers | - | - | 228.3 | 12.2 |
| 5. Retail Price | 487.4 | 100.0 | 1876.9 | 100.0 |

Note: Total may not agree through rounding.

Sources: (1) Division of Agricultural Economics, Ministry of Agriculture and Cooperative, 1978.

(2) Hathamart et al (1980), p.144.

(4) In some periods when pig trading was not restricted between areas, the pork carcass wholesalers purposely underestimated the pig weight when purchasing pigs from the live pig wholesalers to get higher profits. The live pig wholesalers then also have to reduce the pig's weight correspondingly when purchasing from the raisers. This effective weight "loss" should also be included as an item of marketing cost.

These problems are partly due to data unavailability and partly due to the lack of understanding by the researchers or their unwillingness to include illegal costs. If the market intermediaries cooperate with the government agencies or the researchers by giving reliable data, marketing cost studies will give a clearer picture and a more realistic analysis.

3.5.2 Marketing Margin

The marketing margin is the portion of the consumer's food baht that goes to food marketing firms. Kohl and Uhl (1972:221) gave the definition of marketing margin as "the price of all utility adding activities and functions performed by food marketing firms".

Figures of the margin for agricultural products and of their changes over time are available in great detail in high income countries, but for low income countries only very fragmentary information is available.

Total marketing margin usually consists of marketing costs incurred when marketing functions are performed and profits taken by the distributors. Because consumers are the final buyers in the marketing channel, indirectly each baht consumers spend is the profit and cost of marketers in each market level while part goes back to the raisers.

Table 3.13 shows the marketing margin of pig trading from the Northeast to Bangkok in 1975. The marketing margin was 593 baht per head or 31.6 per cent of retail price. This amount was made up of 465 baht per head or 24.8 per cent of retail price was marketers' profit and 128 baht

TABLE 3.13

MARKETING MARGIN FROM PRODUCERS IN THE NORTHEAST REGION TO BANGKOK, 1975

| Items | ฿/head (100 kgs) | Percentage |
|---|---|---|
| Retail Price | 1876.88 | 100.0 |
| Farm Price | 1283.95 | 68.4 |
| Marketing Margin | 592.93 | 31.6 |
| Live Pig Wholesaler's Profit | 79.09 | 4.2 |
| Pork Carcass Wholesaler's Profit | 157.5 | 8.4 |
| Retail Profit | 228.3 | 12.2 |
| Marketing Cost | 128.0 | 6.8 |
| Transportation Cost | 41.9 | 2.2 |
| Wage | 10.1 | 0.5 |
| Veterinary Inspection Fees | 3.0 | 0.2 |
| Illegal Charges | 2.9 | 0.2 |
| Slaughter Taxes | 10.0 | 0.5 |
| Slaughter Fee | 12.0 | 0.6 |
| Ice Cost | 1.5 | 0.1 |
| Feed Cost | 7.6 | 0.4 |
| Others | 39.1 | 2.1 |

Note: Totals may not agree through rounding.

Source: Derived from Harthamart et al (1976).

per head or 6.8 per cent of retail price was marketing costs. Of the marketers, the pork carcass wholesalers, live pig wholesalers and retailers received 8.4 per cent, 4.2 per cent and 12.2 per cent of retail price as profit respectively. That the retailers made the greatest profit may be due to their experimental approach to the business. Harthamart (1976) noted that they sometimes tricked buyers while weighing, thus selling less meat than the buyer ordered. They also had other devices to gain high

profit such as mixing low grade meat with the high grade meat. The farmer's share, which is the farm value expressed as a percentage of the retail price, was 68.4 per cent. The rest went to the market intermediaries for their services provided. The marketing costs were relatively small (6.8 per cent). This is probably because each intermediary involved adds very little to the total value of the pig. It has been mentioned in the last section that slaughterhouses provided only basic services to meat carcass wholesalers lacking even refrigeration. Retailing was often conducted at the poor, unhygienic stalls in the retail markets.

Table 3.14 shows pig prices and marketing margins at different levels in provincial markets. Since 1970 the total margin between raisers and consumers appears to have decreased. Retail margin was highest in 1970 (50 per cent of retail price) because farm price had decreased 23 per cent from the 1969's price but the retail price decreased only 7 per cent. In comparing the average margin in each market level, the pork carcass wholesale margin was the highest (27 per cent). The reason is that the provincial retailers have only limited capital and cannot afford to buy live pigs and hire slaughtering services in the slaughterhouse. They have to rely on the carcass wholesalers for the meat they bought. So, the carcass wholesalers can charge high prices and increase their margin.

Table 3.15 shows the pig prices and margins at different levels in the Bangkok markets. The margin between raisers' return and consumers' price was highest in 1970 as in the provincial markets. But when we compare the average margins, pork carcass wholesale margin is the lowest (7.1 per cent) because of a large number of illegal slaughterings. The market became more competitive. Thus, the wholesale price was lower which caused a low margin. Retailers got the highest margin (33.7 per cent).

TABLE 3.14

PIG PRICES AND MARKETING MARGINS IN PROVINCIAL MARKETS

(Unit: ฿/kg.)

| Year | (1) Farm Price | (2) Live Pig Wholesale Price | (3) Pork Carcass Wholesale Price | (4) Retail Price | Live Pig Wholesale Margin | Percentage | Pork Carcass Wholesale Margin | Percentage | Retail Margin | Percentage | Total Margin | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1969 | 8.85 | 9.75 | 14.26 | 14.69 | 0.90 | 6.12 | 4.51 | 30.70 | 0.43 | 2.93 | 5.84 | 39.75 |
| 1970 | 6.83 | 7.67 | 12.94 | 13.72 | 0.84 | 6.12 | 5.27 | 38.41 | 0.78 | 5.69 | 6.89 | 50.22 |
| 1971 | 6.56 | 6.96 | 9.84 | 12.78 | 0.40 | 3.13 | 2.88 | 22.54 | 2.94 | 23.00 | 6.22 | 48.67 |
| 1972 | 7.82 | 8.87 | 12.01 | 13.61 | 1.05 | 7.71 | 3.14 | 23.07 | 1.60 | 11.76 | 5.79 | 42.54 |
| 1973 | 9.14 | 10.32 | 13.98 | 15.66 | 1.18 | 7.54 | 3.66 | 23.37 | 1.68 | 10.73 | 6.52 | 41.64 |
| Average | 7.84 | 8.71 | 12.61 | 14.09 | 0.87 | 6.12 | 3.89 | 27.62 | 1.49 | 10.82 | 6.25 | 44.56 |

Source: (1),(2),(3),(4) Division of Price and Statistics, Ministry of Commerce files.

TABLE 3.15

PIG PRICES AND MARKETING MARGINS IN BANGKOK MARKETS

(Unit: ฿/kg.)

| Year | (1) Live Pig Wholesale Price | (2) Pork Carcass Wholesale Price | (3) Retail Price | Live Pig Wholesale Margin | Percentage | Pork Carcass Wholesale Margin | Percentage | Retail Margin | Percentage | Total Margin | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1969 | 10.30 | 11.89 | 17.17 | 1.45 | 8.44 | 1.59 | 9.26 | 5.28 | 30.75 | 8.32 | 48.45 |
| 1970 | 8.56 | 9.26 | 15.87 | 1.73 | 10.90 | 0.70 | 4.41 | 6.61 | 41.65 | 9.04 | 56.96 |
| 1971 | 8.07 | 8.91 | 14.38 | 1.51 | 10.50 | 0.80 | 5.84 | 5.47 | 38.04 | 7.82 | 54.38 |
| 1972 | 8.81 | 10.00 | 15.30 | 0.99 | 6.47 | 1.19 | 7.78 | 5.30 | 34.64 | 7.48 | 48.89 |
| 1973 | 10.61 | 11.45 | 16.51 | 1.47 | 8.90 | 0.84 | 5.09 | 5.06 | 30.65 | 7.37 | 44.64 |
| Average | 9.27 | 10.30 | 15.85 | 1.50 | 9.40 | 1.14 | 7.09 | 5.35 | 33.74 | 7.99 | 50.23 |

Source: (1),(2),(3) Division of Price and Statistics, Ministry of Commerce files.

It is quite wrong to draw a conclusion from this that in Bangkok markets the carcass wholesale markets are efficient as are live pig wholesale markets in the provincial case. The size of the marketing margin is not a reliable indicator of physical efficiency in marketing since it depends on the number and costs of marketing functions performed. Williams and Stout (1964:594) mentioned that:

> "Operational efficiency involves a comparison of output and input. The product produced by any marketing system is services rather than products, and a marketing margin might be considered a rough measure of the value of the marketing services produced per unit of commodity marketed. But in the absence of adequate data on inputs of labour and capital required to produce these services, it can not be used, validly, as a measure of efficiency."

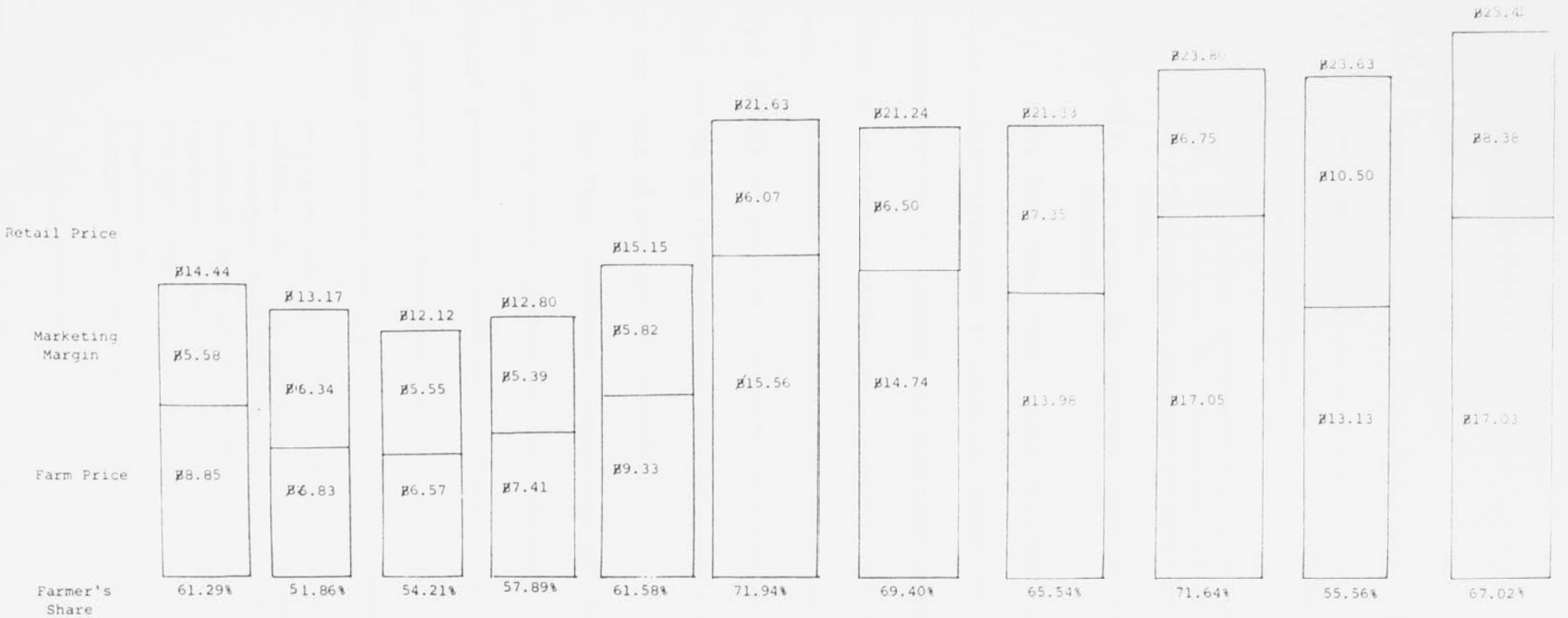
More reliable analysis can be done on trends in margins and costs than on specific levels of these variables. However, they do provide some indication of the relative size of gross return absorbed by the various marketing intermediaries in performing the different marketing functions.

Due to data limitations, long-term trends can be examined only in the Bangkok market. Average farm and retail prices and marketing margins are shown in Table 3.16. A general upward trend in both prices is apparent for the period since 1971. During 1969-1979 the marketing margin was quite stable. Eventhough in 1974 both prices were very high due to inflation, the marketing margin did not increase very much but it increased significantly in 1978 because of the drop in live pig prices.

The tendency for the marketing margin to remain quite stable in baht terms with variations in farm and retail prices is defined as an inflexible marketing margin (Kohls and Uhl, 1980).

Figure 3.4 shows the effect of an inflexible baht marketing margin on changing retail and farm prices. With an inflexible marketing margin, the change in the retail price is directly transmitted to the farm level.

Figure 3.4 Effect of a Constant Baht Marketing Margin on Farm and Retail Price



## 3.6 Government Intervention

### 3.6.1 Practices

Tomek and Robinson (1972:278) state that:

> Governments generally intervene in pricing farm products to achieve one or a combination of the following objectives:
>
> (1) to reduce price and income instability,
> (2) to improve the allocation of resources,
> (3) to increase self-sufficiency in food and fiber,
> (4) to raise the average level of prices and incomes.

The fact that farm prices fluctuate more than nonfarm prices can lead to price/production fluctuation which result in cycles so that excess resources devoted to certain agricultural commodities during some periods leading to underutilisation of processing and marketing facilities during others. Government intervention in price has been advocated by Gunnar Myrdal (1968) to provide producers with better guides for planning. Price policy can be an instrument of planning which will help to bring about a more rational allocation of resources.

The Thai Government recognises the importance of the agricultural sector and has tried to enhance the welfare of farmers in each of its National Economic and Development Plans. Market intervention is seen by the government as a necessary policy as outlined in the Fifth Plan (1982-1986) (National Economics and Social Development Board, 1981) to:

> readjust the price control policy in order to create welfare for both producers and consumers, as well as to prevent hoarding and profiteering, and to encourage business to expand and improve the quality of their products... The government must reduce various taxes, charge, regulations and controls on agricultural products to the minimal, because they depress agricultural prices and thus income of the farmers.

The Thai Government has in fact intervened almost constantly in agricultural markets to different degrees in different products, but the pig

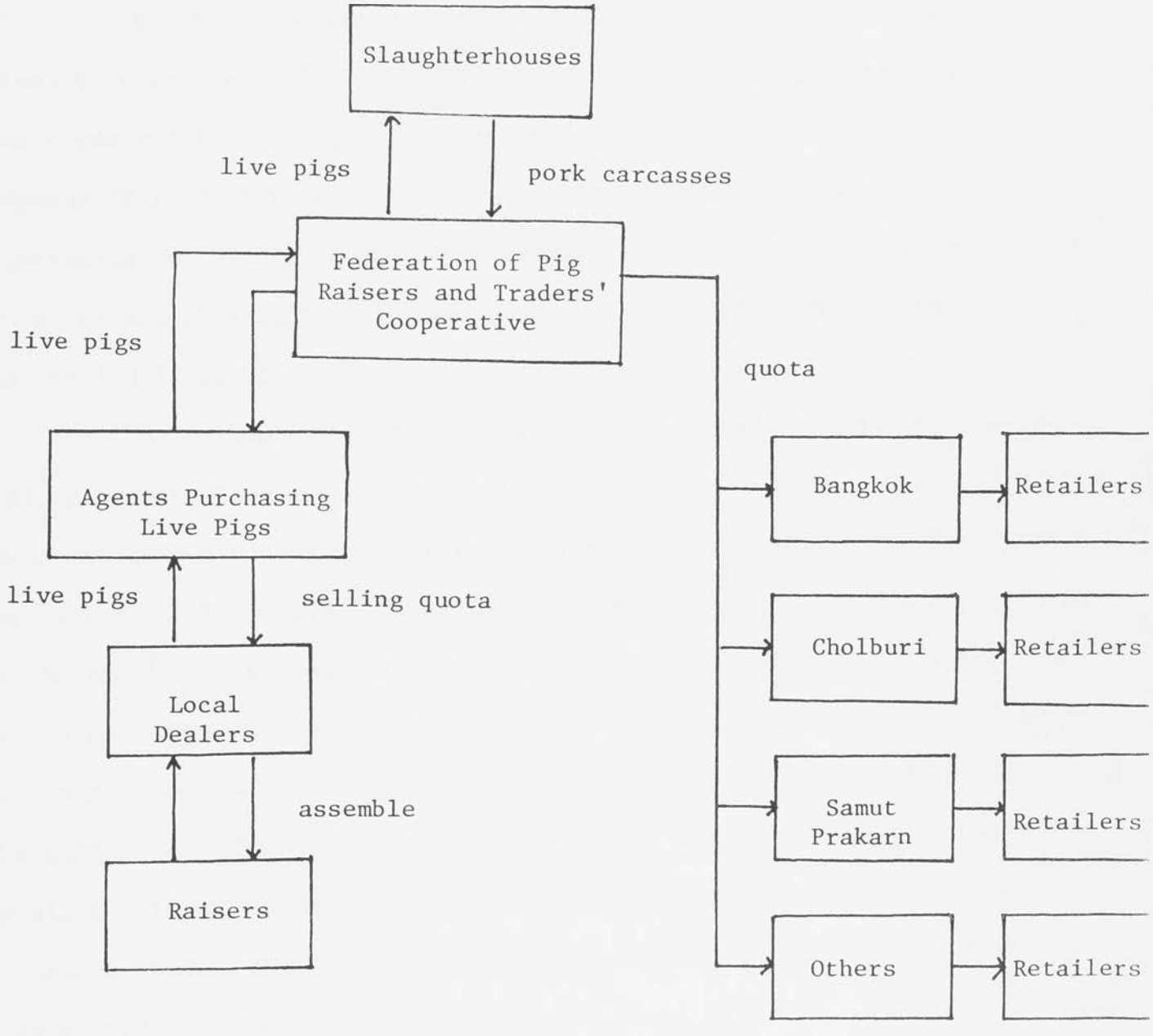
market is the one in which intervention has been most prominent. The year 1960 was the beginning of controls aimed at restricting the movement of pork. The Animal Trade Control Act (gazetted on 26th January, 1960) specified that the selling of pork from municipal slaughterhouses in other provinces to the Bangkok Metropolitan Area was prohibited. Pork could be sold only in the area where slaughterhouses were located. This act in fact lessened competition in the pork trading system. The phrase "period of restricted area" is used in this study to refer to the period of restrictions and "period of unrestricted area" is used for the period when the prohibition was abolished.

At that time the government allowed the Bangkok Municipality and the Federation of Pig Raisers and Traders' Cooperative to go into partnership with the Livestock Trading Corporation Ltd. (a private company), and they built a modern slaughterhouse. The government gave an authority to the Livestock Trading Corporation Ltd. to operate slaughtering and to the Federation to operate trading which began a trend toward a monopsony in pork trading. The Federation acted as a dealer in the pig market. It had 2 roles, a monopsonist in the live pig market and a monopolist in the carcass market. The Federation purchased pigs only from its agents with higher prices than the prices offered by the other dealers. The dealers and raisers thus tried to be members of this marketing channel so that they could sell their pigs. At the same time the Federation also controlled Bangkok slaughterhouses.

Each agent had a quota in assembling live pigs. Those animals were shipped for slaughter in Bangkok and resold to 4 channels (Figure 3.5). The number of pork carcasses supply were set to be lower than market demand in each day to fix a high price.

FIGURE 3.5

PIG TRADING SYSTEM DURING 1959-1962




Source: Poorpongsakorn (1980), p.47.

In 1962 the government revoked the Federation and gave authority to the Livestock Trading Corporation Ltd. to pursue trading. During this period, the agent channels increased to 9 and fees collected from retailers such as sale tax, transportation and miscellaneous services were abolished which reduced the costs of retailers.

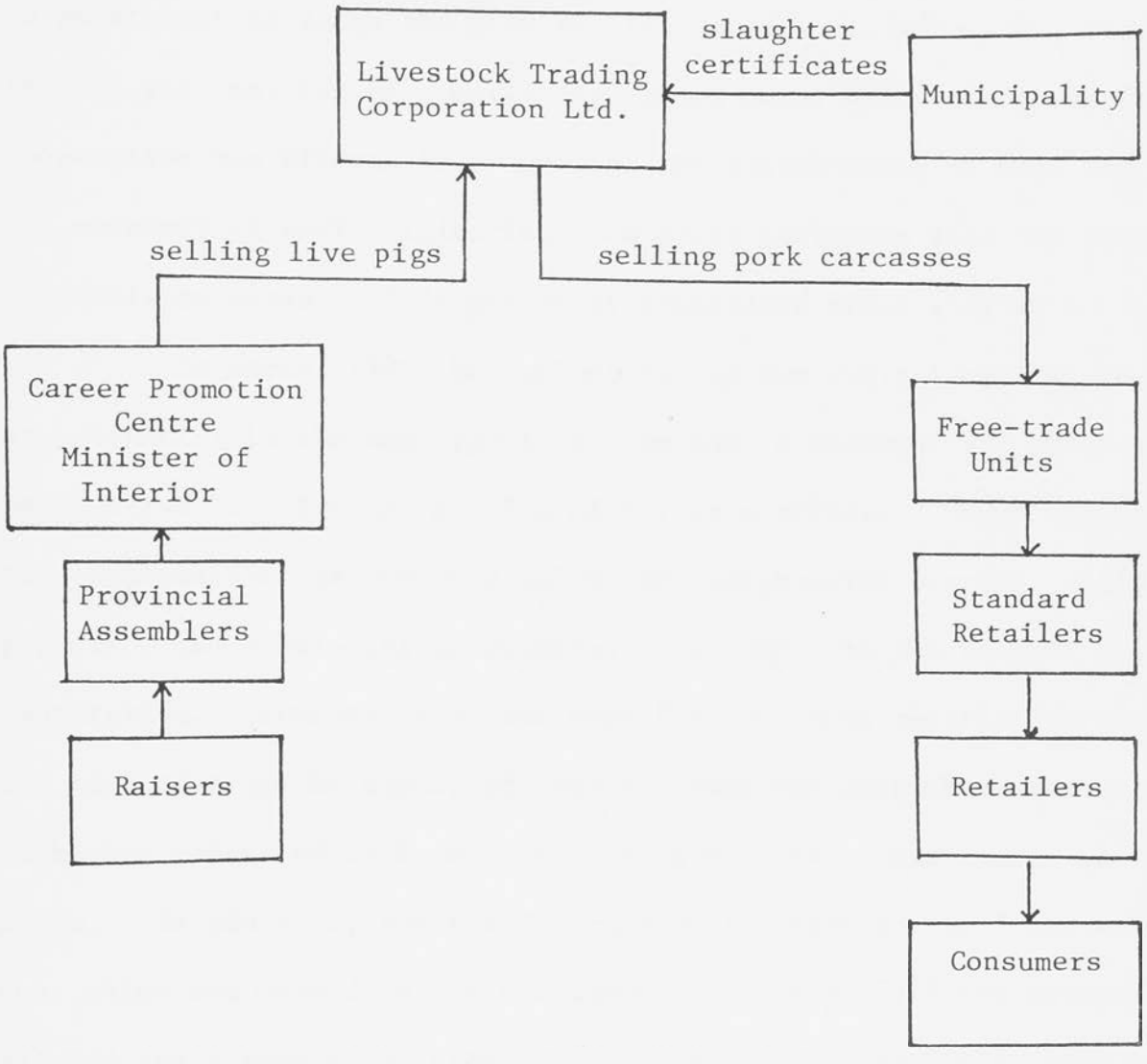
In 1964 there was a shortage of live pigs, and carcass wholesale prices increased rapidly. In the next year, 1965, the government allowed free trade and then changed to semi-free trade in 1966 by allowing the shipment of 1,000 pork carcasses from other provinces into Bangkok (Poorpongsakorn, 1980). The amount beyond that were slaughtered and traded by the Livestock Trading Corporation Ltd. The pig trading system during this period is shown in Figure 3.6.

The foregoing shows conclusively that the pig trading system since 1962 was monopolised and centralised by the Livestock Trading Corporation Ltd. Those who were disadvantaged by this system were pig raisers and live pig wholesalers. Free-trade units, those dealers (both at slaughterhouses and in the provinces) who bought live pigs and hired slaughtering services then resold pork carcasses to the retailers, paid low prices to pig raisers and live pig wholesalers. They also reduced the pig's weight before slaughtering. The general retailers and consumers had to pay a high price because those retailers had to purchase carcasses from the "standard retailers" of the Livestock Trading Corporation Ltd. Consequently, these standard retailers became middlemen instead of the Federation agent channels.

In 1969 the Pig Committee proposed that the Livestock Trading Corporation Ltd. should operate only in slaughtering without any trading. This proposal was accepted by the government. Therefore, during that period the middlemen played a dominant role in pig marketing.

FIGURE 3.6

PIG TRADING SYSTEM DURING 1962-1966




Source: Poorpongsakorn (1980), p.49.

In 1975, the cabinet decided to allow the selling of pork from municipal slaughterhouses in other provinces to the Bangkok Metropolitan Area after passing health control regulations. The pig trading system during the period of unrestricted area (1968-June, 1978) is shown in Figure 3.7. At the beginning live pig prices decreased considerably (Figure 2.4), and in an attempt to solve the problem, the cabinet passed another resolution in that year setting up a marketing system under which the Raiser's Cooperative was allowed to monopolise the slaughtering of pigs and prohibit the movement of pork originating from other provinces into the Bangkok Metropolitan Areas. This period of restricted areas started in July, 1978.

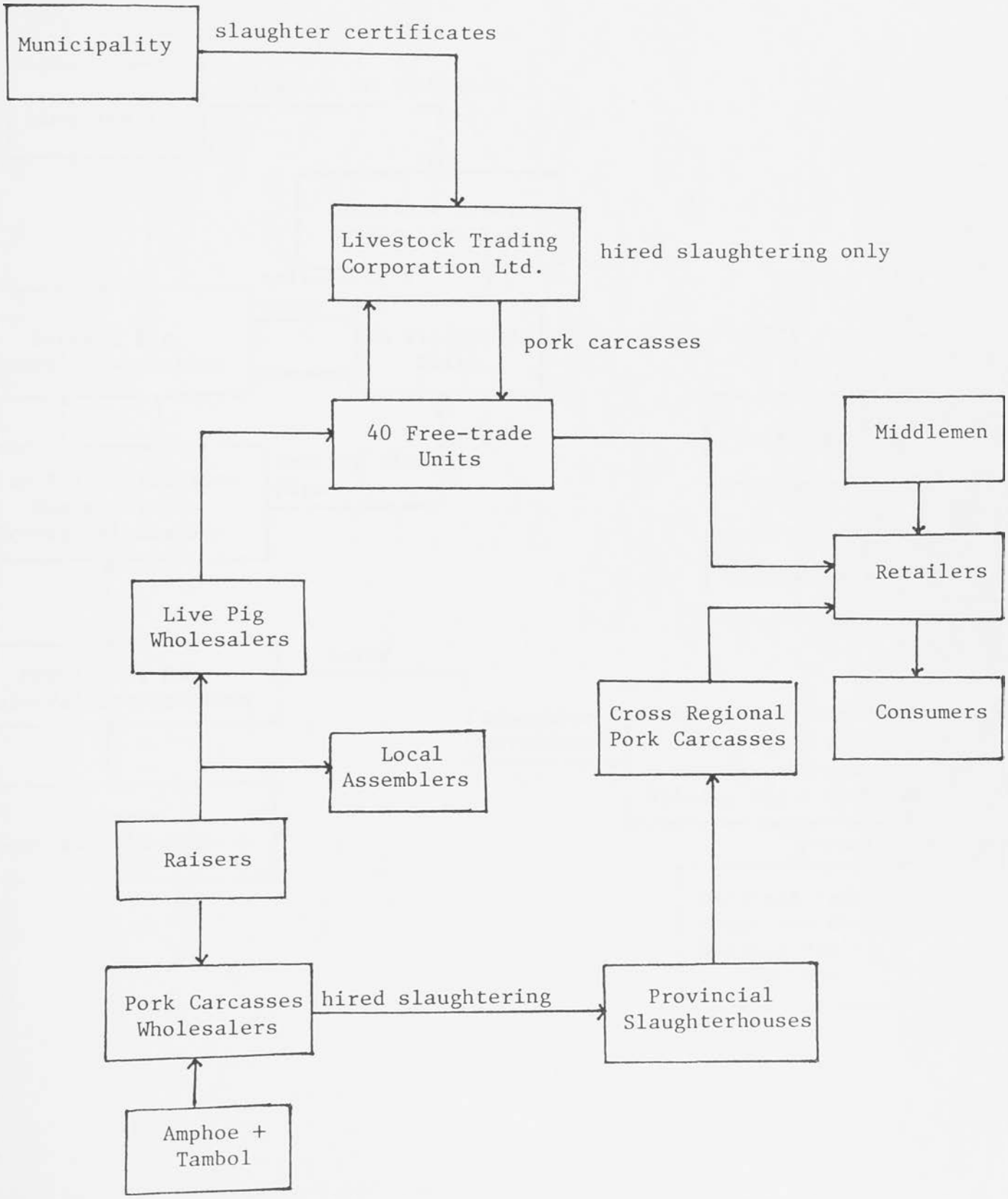
In March, 1979 the cabinet set up the pig raisers' cooperatives at provincial levels and organised them into a national pig raisers' cooperative to solve the problem of low farm prices. Under the new system, the cooperatives, as the sole holder of slaughtering permits, would collect pigs from the provincial cooperatives and supply to the Bangkok Pig Culling Cooperative. However, problems caused by the area restriction occurred. The reduction in the supply of pigs entering the Bangkok market resulted in higher prices of pork and the retailers faced a loss at the controlled price. In addition, the inefficiency of the system raised the marketing cost which was passed to the consumers. In July, 1979 the government allowed the transport of pigs originating in other provinces into Bangkok areas as a temporary measure for 6 months ending December, 1979. The pig trading system during July 1978 - July 1979 is presented in Figure 3.8.

### 3.6.2 Effects

The review of past government intervention (Figure 3.9) revealed the confusion and disorder generated by government in the pig market. The Animal Trade Control Act, the ban of pork movement from other provinces

FIGURE 3.7

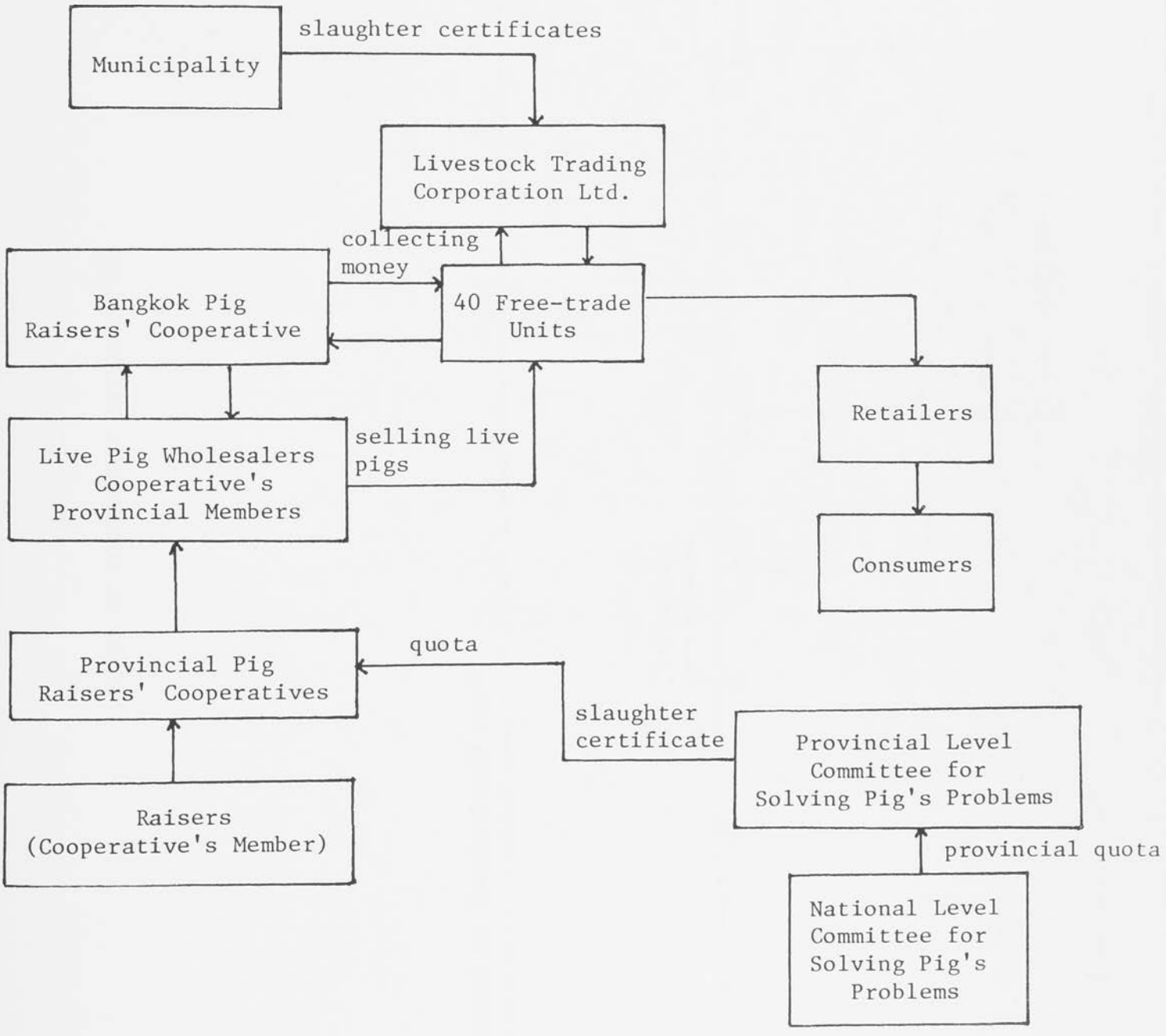
PIG TRADING SYSTEM DURING PERIOD OF UNRESTRICTED AREA
(1968-June 1978 and August-December 1979)




Source: Poorpongsakorn (1980), p.51.

FIGURE 3.8

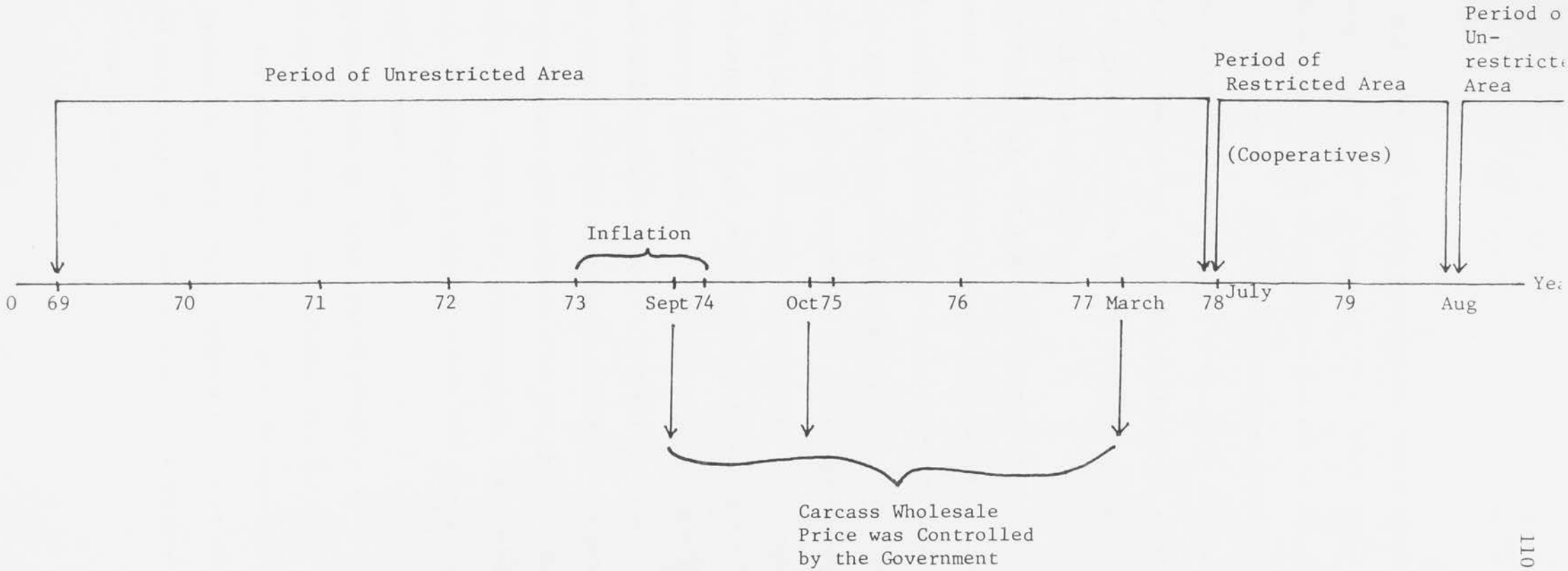
PIG TRADING SYSTEM DURING THE PERIOD OF RESTRICTED AREA
(July 1978 - July 1979)




Source: Poorpongsakorn (1980), p.53.

FIGURE 3.9

PERIOD OF GOVERNMENT INTERVENTION




Note: Derived from text.

into Bangkok results in a disadvantage to pig raising and trading which can be summarised as follows:

(1) There was no comparative advantage allowed for in pig raising during the period of restricted area. Instead of raising pigs in the provinces where the resources can be minimised and selling pigs to other provinces where there are no resources or where the surrounding country is not suitable for pig raising, each province has to raise pigs to supply its own demand due to the Animal Trade Control Act.

(2) The transportation of live pigs from oversupply areas to short supply areas increased the cost since the pigs lost weight or became sick which lowered their price. Furthermore, shipment cannot be done during daytime because the heat will reduce the pigs' weight.

(3) The irregular policy for restricted or unrestricted areas has a direct impact on live pig and carcass wholesale prices. For example, during the period of restricted area the government gave authority in trading live pigs and carcasses in Bangkok to the Federation of Pig Raisers and Traders' Cooperatives (1959-1962) resulting in a monopoly in pig marketing. The raisers could only sell pigs to the assemblers who got a quota and retailers had to purchase pork carcasses from the agent channels only. It seemed that this only created the opportunity for the middlemen to depress live pig prices and raise pork carcass prices thus distorting the real force of market demand and supply.

(4) The irregular policy for restricted or unrestricted areas plus the controlled pork retail price may have distorted the pig cycle and raisers' farm planning. For example when the government increased live pig prices and pork retail prices, the raisers might respond at once by selling all the pigs they had and increasing the number of pigs raised which would depress the price faster than it should be.

(5) The irregular policy of restricted or unrestricted areas has an effect on the quantity of slaughtered animals in provincial slaughterhouses. Such that quantity increased abruptly when the period of restricted area was abolished. Therefore, it is necessary to increase hired labour, fire-wood and other inputs which will enormously increase the cost. When the government imposed the restricted area policy, the quantity of slaughtered animals decreased to the local consumption level. Most slaughterhouses thus had no labour for killing animals. The carcass wholesalers have to hire their own labourers. Moreover, the irregular policy retards the investment and improvements in the slaughtering business.

(6) According to ministerial regulations, the slaughter fee (10 baht per head), slaughterhouses fee (15 baht per head), pig sty fee (2 baht per head), income tax (20 baht per head) and shipping fee (10 baht per head) are collected. These fees are fixed on a per head basis. Many dealers try to avoid paying the fee by slaughtering pigs illegally both inside and outside the slaughterhouses. The slaughterhouses' operators still get the hired slaughtering revenue from either legal or illegal slaughter and they therefore cooperate with the carcass wholesalers to avoid paying tax and fees. The rate of illegal slaughtering is very high as can be seen in Tables 3.10 and 3.11. During the period of restricted area only live pigs could be transported interregionally, therefore, the supply of pork carcasses in Bangkok was often limited which resulted in high pork carcass prices. This high price was an incentive to slaughter and ship carcasses illegally to Bangkok. As a result the Bangkok market, later, became more competitive with lower pork carcass prices. However, many problems emerged. An illegal slaughter results in lower taxes to both government and municipality. Added to this is the public health risk of consumption of these meats slaughtered in illegal and insanitary abattoirs

since they have never been inspected by a veterinarian. In addition, illegal slaughter has led to incomplete and unreliable statistics on the livestock population and on the annual number of livestock slaughtered.

(7) The government has been employing price control schemes in pig marketing since 1948 (Poorpongsakorn, 1980) but they are not successful. The government sets a floor price for the raisers and a ceiling price for the retailers. But in practice, the raisers get lower prices than the floor price and the consumers pay higher prices than the ceiling price.

The Thai Government is aware of problems in pig marketing and has tried to solve these through market intervention but they have never been successful. The result has been the transference of the power of allocation of resources by the pricing mechanism to political power. The government does not really understand the market price adjustment and has no definite and long-term planning strategy which will not interfere in the price mechanism. Thus, the government must re-examine its role in this particular area if desirable development of pig marketing is to happen.

# CHAPTER 4

# THE ANALYTICAL FRAMEWORK AND METHODOLOGY

The main purpose of this thesis is to investigate the Thai pork market using the concept of market integration and to suggest that market integration can be used as a proxy to indicate the degree of competition in that market. In this chapter, I emphasize the use of price data to analyze the relationship between the various pig and pork markets.

Like most third world countries, there is very little published information in Thailand on the flows of commodities between markets. However, reasonably good price data is available and for this study I have used the monthly wholesale prices of live pigs and pork carcasses for the period 1969-1979 as collected by the Ministry of Commerce in Thailand. This data has already been set out in Table 2.12 and graphically in Figures 2.4 and 2.5.

## 4.1 Interregional Marketing Theory

Interregional marketing theory seeks to explain the pattern of exchange of goods between economic regions. An economic region is defined by Grether (1950:11) as:

> a relatively large geographical area with the following four characteristics:
>
> 1. it has more than one centre of economic control,
> 2. it has greater internal homogeneity than would be present if it were merged with other contiguous areas,
> 3. it exports a characteristic group of products to other areas, and
> 4. it imports the characteristic products of other areas.

The interregional marketing theory presented by Grether predicts that commodities will be exchanged between regions if there are effective

reciprocal demands for the commodities of the regions and if there are opportunities for either absolute or comparative advantages. An absolute advantage exists when consumers in one region want commodities which cannot be produced locally but can be purchased from other regions. A comparative advantage exists among regions when there are regional differences in costs, prices, sales facilities and products.

Schwartz (1963:72) in referring to Grether's theory said:

> Under conditions of pure competition,...goods would move between regions only if there were price differences large enough to cover trading and handling costs and necessary profits. Marketing under these conditions would ultimately result in price differences between the trading regions which differed only by the amount of transfer costs. This result would materialize, according to the theory, because demand would expand in the exporting region, thus raising prices there. In the importing region prices would drop because of increased supplies.

The volume of goods marketed interregionally depends on the following factors (Vaile, Grether and Cox, 1949):

(1) The relative inequality of regions with respect to supplies of factors of production. Regions will tend to export products they can produce by using resources that are abundant and cheap within their regions.

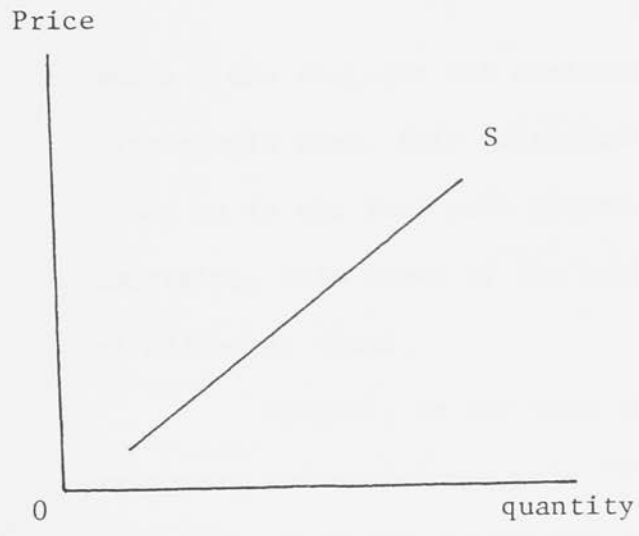
(2) The relative prosperity of regions. Ceteris paribus, regions with high total and per capita incomes will tend to generate more trade than poor regions.

(3) The strength of the reciprocal demands among regions. There will be a large total volume of trade if two trading regions have a strong demand for each other's characteristic products.

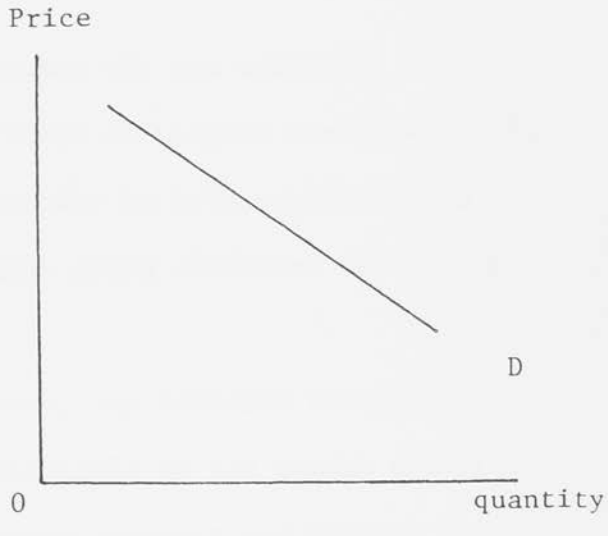
(4) The relative effectiveness of internal competition. The basis for interregional marketing should normally be stronger when competition within regions is active and effective.

The price relationships between separated markets can be used to assess the degree of market integration. Under perfect competition, the law of one price (LOOP) exists (Kohls and Uhl, 1972). This law states that under certain conditions all prices within a commodity market will be uniform, after taking into account the costs of adding place, time and form utility to products within the market. For example, if the Thai pork market were perfectly competitive, and transport costs were zero, the price of pork in different regions would be the same.

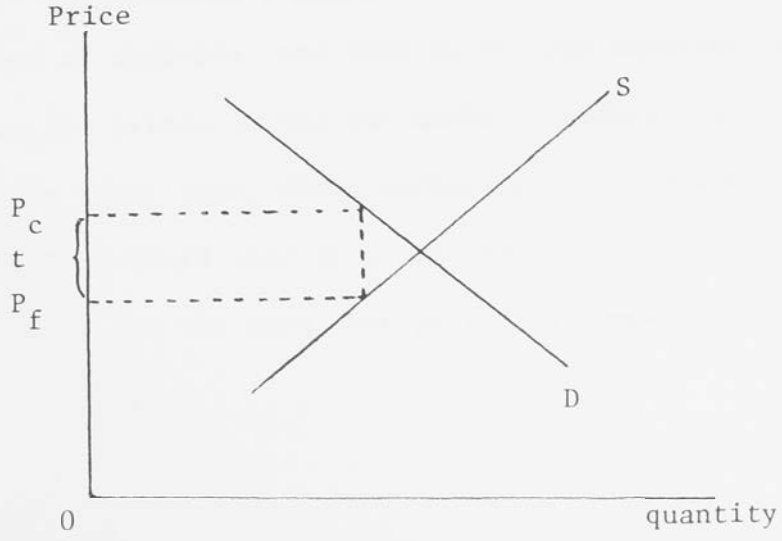
One way of presenting this, from a theoretical viewpoint, is to consider a "supplying region" and a "consuming region", between which there is a constant transportation cost for that product:




(a) Supplying Region




(b) Consuming Region




(e) Combination of Demand and Supply Curves of Both Regions

In such a model, whatever changes occur in the demand schedule (in the consuming region), or the supply schedule (in the supplying region) there will always be a constant margin between the consumer price and the farm price equal to transportation costs.

i.e.: $P_c = t + P_f$

or $P_f = P_c - t$

where $P_c$ = consumer prices

$P_f$ = farm prices

$t$ = transportation cost

For less than perfectly competitive markets, still:

$$P_f = f\ (t,\ P_c)$$

where t now includes all marketing costs between the two markets. In a very simple form, this relationship is the basis of margins analysis models. Also, as in the Thai pork market, each region may be both supplying and consuming, with flows of the product sometimes going different directions at different times.

However, as has been explained above, any analysis involving transport and marketing costs (t) is very difficult in low income countries both because of the complexity of the marketing channels and because the necessary data on marketing margins is unreliable or unavailable. One possible method of analysis, and this is the one examined in this thesis is to focus on the prices in the two markets, rather than the marketing margin.

In the ideal case, where marketing costs between the two markets are constant, there would also be a constant relationship between the prices in each market, or for the less than perfectly competitive case:

$$P_f = f\ (P_c)$$

One would expect that, for any two markets, the closer the relationship between the prices in each market, the greater the degree of competition between those markets. This also corresponds to the concept of market integration. For example if the consumer price in Bangkok were to increase by 1 baht/kg. there also will be an increase in the price of pork in the North and Northeast region of Thailand. These prices are tied together and will move together when the markets are perfectly integrated. High levels of market integration also imply high levels of competition in the marketing, transporting, processing and retailing of that product.

## 4.2 Model Specification

There are various methods for measuring the relationship existing between economic variables such as the price relationship outlined above. Ordinary least square regression analysis is one of the most commonly employed methods in estimating the relationship in econometric models because of its simplicity and it will be used here in the first instance.

Even a priori knowledge suggests that there exists a very complex relationship among markets, and that there are links of varying strength between different markets. One possible way of testing market integration is therefore by means of the simple price linkage model using regression analysis.

### 4.2.1 Price Linkage Model

Since Bangkok is the major market for pork, prices in the Bangkok wholesale market are commonly used as the basis for price negotiations between merchants and farmers and among traders. For example, Pollak (1974) suggests that (in the case of oilseeds) the Bangkok wholesale price to a large extent determines price levels in upcountry markets. I have therefore specified the estimating equations with upcountry prices as dependent variables. The

equation for live pig and pork carcass are considered separately and are of the forms:

WNL = f (WBL, WNEL)

WNEL = f (WBL, WNL)

WNS = f (WBS, WNES)

WNES = f (WBS, WNS)

where

WBL = wholesale price of live pigs in Bangkok (฿/kg.),

WNL = wholesale price of live pigs in the North region (฿/kg.),

WNEL = wholesale price of live pigs in the Northeast region (฿/kg.),

WBS = wholesale price of pork carcass in Bangkok (฿/kg.),

WNS = wholesale price of pork carcass in the North region (฿/kg.),

WNES = wholesale price of pork carcass in the Northeast region (฿/kg.).

Since there are seasonal influences in the price data (as discussed in Chapter 2), seasonal dummy variables for monthly data are also included in the equation. The regression model can therefore be expressed as:

WNL = f (WBL, WNEL, D)

WNEL = f (WBL, WNL, D)

WNS = f (WBS, WNES, D)

WNES = f (WBS, WNS, D)

where D = dummy variables for 11 months (January to November).

The other variables are as previously defined. The absolute value of monthly wholesale prices of both live pigs and pork carcasses were used in the model. Lagged variables were also included in the model to test whether

lagged prices explained more of the relationship than unlagged prices since price movements in one region may lag behind the other regions. The following one month lagged functions were included:

$$WNL_t = f\ (WNEL_{t-1},\ WBL_{t-1},\ WNL_{t-1}) \qquad (4.1.5)$$

$$WNEL_t = f\ (WNL_{t-1},\ WBL_{t-1},\ WNEL_{t-1}) \qquad (4.1.6)$$

$$WNS_t = f\ (WNES_{t-1},\ WBS_{t-1},\ WNS_{t-1},\ WNEL_{t-1},\ WBL_{t-1},\ WNL_{t-1}) \qquad (4.2.5),(4.2.7)$$

$$WNES_t = f\ (WNS_{t-1},\ WBS_{t-1},\ WNES_{t-1},\ WNL_{t-1},\ WBL_{t-1},\ WNEL_{t-1}) \qquad (4.2.6),(4.2.8)$$

Reference numbers for each function refer to the equation numbers in Tables 4.1 and 4.2.

4.2.2 The Results

The regression results for live pigs after correction for auto-correlation are presented in Tables 4.1 and 4.2. It is evident from the results that $R^2$ is very high in every equation (range 0.9720 - 0.9885). From this one, one could conclude that wholesale price of live pig and pork carcass in the North and Northeast region are therefore tightly and positively linked to the wholesale price of live pig and pork carcass in Bangkok. This result appears to indicate a very high degree of integration between all these markets. But a consideration of possible statistical biases leads us to doubt the validity of the test and to explore alternative techniques.

The demand for live pigs is a derived demand for pork carcasses and the supply for pork carcass is in turn a derived supply for live pig. These derived demand and supply schedules change when there are changes in

TABLE 4.1

REGRESSION RESULTS FOR LIVE PIGS

| No. | Dep. Var. | Const. | $WNEL_t$ | $WNL_t$ | $WBL_t$ | $WNEL_{t-1}$ | $WNL_{t-1}$ | $WBL_{t-1}$ | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | $R^2$ | $\bar{R}^2$ | S.E. | D.W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | $WNL_t$ | -0.450 (0.820) | 0.822* (0.105) | - | 0.274* (0.867) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.9813 | 0.9810 | 0.6526 | 2.1586 |
| 2 | $WNEL_t$ | 8.909 (2.181) | - | 0.193* (0.048) | 0.109** (0.055) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.9875 | 0.9873 | 0.4276 | 2.0755 |
| 3 | $WNL_t$ | -0.347 (0.946) | 0.853* (0.113) | - | 0.232* (0.093) | - | - | - | 0.128 (0.215) | 0.275 (0.279) | 0.086 (0.320) | -0.095 (0.345) | -0.013 (0.358) | 0.239 (0.361) | -0.146 (0.358) | 0.038 (0.344) | 0.193 (0.317) | 0.190 (0.274) | 0.101 (0.207) | 0.9826 | 0.9806 | 0.6591 | 2.1617 |
| 4 | $WNEL_t$ | 0.793 (0.906) | - | 0.198* (0.050) | 0.146* (0.057) | - | - | - | 0.013 (0.130) | 0.134 (0.201) | 0.162 (0.248) | -0.105 (0.275) | -0.141 (0.291) | -0.160 (0.297) | -0.188 (0.291) | -0.181 (0.272) | 0.116 (0.245) | 0.134 (0.199) | 0.148 (0.129) | 0.9885 | 0.9872 | 0.4222 | 2.1091 |
| 5 | $WNL_t$ | -1.024 (0.625) | - | - | - | 0.735* (0.107) | - | 0.405* (0.092) | - | - | - | - | - | - | - | - | - | - | - | 0.9798 | 0.9785 | 0.6951 | 2.1480 |
| 6 | $WNEL_t$ | 10.178 (2.476) | - | - | - | - | 0.071 (0.049) | 0.145* (0.056) | - | - | - | - | - | - | - | - | - | - | - | 0.9868 | 0.9866 | 0.4422 | 2.1182 |

Note: Figures in the parentheses are standard errors and the significance level using the t-test are indicated by asterisks which

* = significant at 1 per cent level

** = significant at 2.5 per cent level

# TABLE 4.2

## REGRESSION RESULTS FOR PORK CARCASS

| Dep. Var. | Const. | $WNEL_t$ | $WNL_t$ | $WBL_t$ | $WNES_t$ | $WNS_t$ | $WBS_t$ | $WNEL_{t-1}$ | $WNL_{t-1}$ | $WBL_{t-1}$ | $WNES_{t-1}$ | $WNS_{t-1}$ | $WBS_{t-1}$ | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | $R^2$ | $\bar{R}^2$ | S.E | D.W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $WNS_t$ | 8.599 (2.547) | 0.367* (0.142) | 0.373* (0.096) | 0.071* (0.096) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.9865 | 0.9862 | 0.7034 | 2.0082 |
| $WNES_t$ | 7.512 (0.572) | 0.390* (0.092) | 0.357* (0.141) | - | - | 0.100 (0.0901) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.9865 | 0.9862 | 0.7017 | 2.0168 |
| $WNS_t$ | 8.843 (2.859) | 0.378* (0.141) | 0.408* (0.097) | - | - | - | - | - | - | - | - | - | - | 0.376 (0.215) | 0.361 (0.286) | 0.436 (0.331) | 0.334 (0.361) | 0.410 (0.377) | 0.250 (0.372) | 0.490 (0.372) | 0.641 (0.353) | 0.257 (0.323) | 0.213 (0.279) | 0.176 (0.208) | 0.9874 | 0.9860 | 0.7066 | 1.9959 |
| $WNES_t$ | 13.430 (3.507) | 0.479 (0.116) | - | - | - | - | - | - | - | - | - | - | - | 0.131 (0.207) | 0.174 (0.275) | 0.215 (0.319) | 0.545 (0.347) | 0.490 (0.362) | 0.647 (0.365) | 0.923* (0.356) | 0.628 (0.340) | 0.305 (0.312) | 0.245 (0.269) | 0.148 (0.200) | 0.9736 | 0.9709 | 0.6831 | 2.0045 |
| $WNS_t$ | 10.632 (3.378) | - | - | - | - | - | - | - | - | 2.016** | 3.501* | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.9844 | 0.9842 | 0.7542 | 2.0001 |
| $WNES_t$ | 0.189 (0.296) | - | - | - | - | - | - | - | - | 0.084* (0.029) | 0.931* (0.031) | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.9700 | 0.9695 | 0.7014 | 1.8253 |
| $WNS_t$ | 9.723 (3.355) | - | - | - | - | - | - | 0.322* (0.163) | 0.194 (0.105) | 0.217** (0.103) | - | - | - | 0.402 (0.232) | 0.213 (0.312) | 0.195 (0.355) | 0.090 (0.385) | 0.308 (0.405) | 0.335 (0.410) | 0.436 (0.400) | 0.731 (0.389) | 0.419 (0.357) | 0.246 (0.306) | 0.050 (0.221) | 0.9858 | 0.9841 | 0.7571 | 1.9993 |
| $WNES_t$ | 17.157 (4.839) | - | - | - | - | - | - | - | - | 0.094* (0.942) | 0.082** (0.082) | - | - | 0.758 (0.215) | 0.163 (0.294) | 0.079 (0.335) | 1.004 (0.365) | 0.900 (0.381) | 1.450 (0.386) | 2.428* (0.379) | 1.938 (0.366) | 1.270 (0.339) | 0.019 (0.286) | 0.276 (0.206) | 0.9720 | 0.9689 | 0.7092 | 1.9803 |

Figures in the parentheses are standard errors and the significance level using the t-test are indicated by asterisks which

* = significant at 1 per cent level

** = significant at 2.5 per cent level

the primary demand and supply. In any relatively free market, demand and supply may change frequently and in any market at any time. It is difficult or impossible to tell which change occurs first and hence in which direction causality runs. In this case the regression analysis should not normally be employed because it can only be used where the effects on one dependent variable result from changes in one or more predictor or explanatory variables (Pindyek and Rubinfeld, 1976). Koutsoyiannis (1981:20) gave an example of a supply function to explain the simple linear regression model:

$$Y_i = b_0 + b_1 X_i$$

and notes that "This form implies that there is a one-way causation between the variables Y and X: on which those variables are based".

Hence, regression analysis is not an appropriate tool to measure market integration and may give spurious results.

4.2.3 Correlation Analysis

Correlation analysis is a method used in measuring the relationship existing between variables which does not assume a causal relationship. The regression hypothesis assumes one variable dependent on the other but correlation treats both variables symmetrically asking only whether two variables do or do not habitually move together - Correlation asks and answers a much less demanding question than does regression. Therefore, it is preferred to regression analysis whenever the flow of dependence between two variables is theoretically unclear (Kane, 1969).

In studying market integration correlation analysis is more convenient and possibly more powerful than margins analysis since it requires only price data which are normally more readily available and more reliable than cost and margins data. I have already defined market integration as the interrelationship between markets (Lele, 1967). Since correlation

analysis measures the degree to which any two series move in a sympathetic manner it is, therefore, an appropriate tool for examining integration between two or more markets.

In this model, 132 monthly price observations are classified into 2 groups:

(1) The period of unrestricted area, comprising 119 observations and covering January 1969 - June 1978 and August - December 1979 when the government prohibited the shipment of pork carcasses originating in upcountry provinces into Bangkok.

(2) The period of restricted area with 13 observations, covering July 1978 - July 1979 when the area restriction was abolished.

We would expect that the interrelationship between the various sectors of the Thai pork markets in these 2 periods to be different due to a change in market structure which created a marketing monopoly during the first period and was competitive during the second period. The degree of market integration during the period of area restriction would be expected to be less between the Bangkok and upcountry carcass markets than during the period of area unrestriction.

Correlation matrices of monthly wholesale prices of live pigs and pork carcasses in markets in three regions of Thailand using absolute data are presented in Tables 4.3 and 4.4. For the period of unrestricted area, correlation coefficient is very high (close to 1) in all cases, while for the period of restricted area, some correlation coefficients are lower. Nevertheless all are high and significant. This could lead one to conclude that there is high correlation (and, therefore, integration) between virtually all sectors of the market.

However, under theoretical grounds we should correct this absolute price data by using first differences to calculate a correlation matrix.

TABLE 4.3

CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND DURING JANUARY 1969 - JUNE 1978 AND AUGUST - DECEMBER 1979 USING ABSOLUTE DATA

'UNRESTRICTED AREA'

| | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|
| WBL | 1.0000 (XXX) | 0.9386 (0.000) | 0.9476 (0.000) | 0.9573 (0.000) | 0.9626 (0.000) | 0.9409 (0.000) |
| WBS | | 1.0000 (XXX) | 0.9620 (0.000) | 0.9628 (0.000) | 0.9289 (0.000) | 0.9742 (0.000) |
| WNL | | | 1.0000 (XXX) | 0.9533 (0.000) | 0.9517 (0.000) | 0.9610 (0.000) |
| WNS | | | | 1.0000 (XXX) | 0.9657 (0.000) | 0.9723 (0.000) |
| WNEL | | | | | 1.0000 (XXX) | 0.9490 (0.000) |
| WNES | | | | | | 1.0000 (XXX) |

Notes: a n = 119

b Figures in the parentheses are significant. The results of the significance tests follows the SPSS convention of presenting the probability that the observed price correlation coefficient could have occurred in a sample derived from populations whose prices were unrelated. Thus a level of significance given as 0.0000 means that under the null hypothesis that the probability of the observed correlation occurring when the prices were actually uncorrelated, was no greater than 0.00005. Any significance probability above 0.05 would satisfy the normal convention of 95% confidence. All our correlation coefficients between 0.99 and 0.60 satisfy this test. No correlation coefficients below 0.59 satisfied the 95% confidence level test.

TABLE 4.4

CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND DURING JULY 1978 - JULY 1979 USING ABSOLUTE DATA

'RESTRICTED AREA'

| | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|
| WBL | 1.0000 (XXX) | 0.6263 (0.011) | 0.6653 (0.007) | 0.7865 (0.001) | 0.7482 (0.002) | 0.6864 (0.005) |
| WBS | | 1.0000 (XXX) | 0.9625 (0.000) | 0.8308 (0.000) | 0.7062 (0.003) | 0.9137 (0.000) |
| WNL | | | 1.0000 (XXX) | 0.8624 (0.000) | 0.7966 (0.001) | 0.8974 (0.000) |
| WNS | | | | 1.0000 (XXX) | 0.9397 (0.000) | 0.9394 (0.000) |
| WNEL | | | | | 1.0000 (XXX) | 0.8178 (0.000) |
| WNES | | | | | | 1.0000 (XXX) |

Notes: a n = 13

b See Table 4.3.

One reason is that absolute price data is statistically unmanageable and using absolute price values for regression or correlation analysis can result in spuriously high r or $r^2$ for the following reasons:

(1) Price movements are relatively small in comparison to the absolute price so that a regression or correlation model based on absolute prices is insensitive to price changes unless they are very large in relation to the absolute price.

(2) Long price trends and seasonal and cyclical price movements may result in biases.

Foote (1952:285-6) mentioned the usefulness of using first differences:

> Other cases in which first differences are useful are those in which strong trend factors tend to overshadow the effects of the economic variables..., cases in which two variables are more closely associated with an unsuspected or unrealized third factor than with each (in which case use of actual data may give a spurious degree of correlation because of trend factors affecting the third factor and in turn the other two variables), cases in which two logically necessary independent variables are more highly correlated with each other in terms of actual data than of first differences..., and cases in which the residuals from the final analysis are serially correlated when the analysis is based on absolute data but are not when it is based on first differences.

Further, the use of first differences will reduce (although not eliminate) the biases mentioned above caused by trend, seasonal and cyclical factors. Therefore, the analysis based on first differences, if properly handled, should give considerably more reliable results than the analysis based on absolute price.

Correlation matrices using the first difference of monthly wholesale prices of live pigs and pork carcasses in markets in three regions in Thailand were, therefore, calculated and the correlation matrices are presented in Tables 4.5 and 4.6.

The correlation coefficients in these matrices show far wider variations in correlation coefficients than those in Tables 4.2 and 4.3 calculated on absolute prices although they do not show the high levels of integration between all markets (except the wholesale markets of live pigs and pork carcasses in Bangkok ($r = 0.8171$) during the area restriction period). Therefore, these results are unsatisfactory.

However, there are arguments that using first differences in time series data is not appropriate. The first argument is a first difference and is the difference between any observation and the preceding observation.

TABLE 4.5

CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND DURING JANUARY 1969 - JUNE 1978 AND AUGUST - DECEMBER 1979 BY FIRST DIFFERENCES METHOD

'UNRESTRICTED AREA'

| | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|
| WBL | 1.0000 (XXX) | 0.4211 (0.000 | 0.3643 (0.000) | 0.2926 (0.001) | 0.4670 (0.000) | 0.1203 (0.097) |
| WBS | | 1.0000 (XXX) | 0.1933 (0.018) | 0.1591 (0.043) | 0.2170 (0.009) | 0.1086 (0.121) |
| WNL | | | 1.0000 (XXX) | 0.4907 (0.000) | 0.5183 (0.000) | 0.1117 (0.114) |
| WNS | | | | 1.0000 (XXX) | 0.4369 (0.000) | 0.1826 (0.024) |
| WNEL | | | | | 1.0000 (XXX) | 0.3351 (0.000) |
| WNES | | | | | | 1.0000 (XXX) |

Notes: a n = 118

b See Table 4.3.

It is positive (+) if the succeeding observation is the larger of the two and negative (-) if the succeeding observation is the smaller of the two. If a series is random, approximately half the signs of the first differences should be positive and half negative, in random order (Sprowls, 1955). Again with time series data a period of general inflation will lead to a series of positive first differences and hence an apparent relationship even between two unrelated series.

TABLE 4.6

CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND, JULY 1978 - JULY 1979 BY FIRST DIFFERENCES METHOD

'RESTRICTED AREA'

| | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|
| WBL | 1.0000 (XXX) | 0.8171 (0.000) | 0.4047 (0.085) | 0.0143 (0.482) | 0.1345 (0.331) | 0.0619 (0.420) |
| WBS | | 1.0000 (XXX) | 0.4739 (0.051) | 0.3874 (0.130) | 0.0763 (0.402) | 0.1286 (0.338) |
| WNL | | | 1.0000 (XXX) | 0.1018 (0.370) | 0.2780 (0.179) | 0.2956 (0.163) |
| WNS | | | | 1.0000 (XXX) | -0.4889 (0.045) | 0.0935 (0.381) |
| WNEL | | | | | 1.0000 (XXX) | -0.1353 (0.330) |
| WNES | | | | | | 1.0000 (XXX) |

Notes: a n = 13

b See Table 4.3.

Secondly, using amounts of change by first difference results in the loss of one pair of values, although this is less of a problem where the number of observations is large.

Thirdly, if the trend is non-linear, the first differences of values fluctuating around that trend will still contain a trend element. This trend element could even be in the opposite direction to the original trend (Croxton, Cowden and Klein, 1967).

To avoid some of these problems this thesis takes the point of view of Croxton and Cowden (1955) quoted in Blyn (1973:56) that "time series correlations should be restricted to residuals remaining after the trend and seasonal components have been removed".

Trend and seasonal components influences most aspects of agriculture. The trend can reflect a rising demand caused by population increase, or rising real (or money) incomes throughout the region, and changes in supply during the year reflect the climatic pattern. Blyne (1973:56) also stated that:

> If the trend components of the different series were isolated, they would be found to have perfect correlation, r = 1.0, an element therefore tending to boost correlation coefficients based on raw series; the same would be true for the seasonal component.

Accordingly, a residual approach is the next step applied in the correlation analysis. The trend and seasonal elements of each price series was removed and correlation matrices calculated using the residuals. In using this method, we are not regressing prices directly on other prices (a method rejected above) but regressing each price series on a time trend are a set of seasonal dummies to remove trends and seasonality from all the price series. This process 'purifies' the various price series and allows us to make more appropriate influences from the correlation analysis, as suggested by Blyne (1973). The residual data are presented in Table 4.7. The results using this method are presented in Tables 4.8 and 4.9 and the ranks of correlation coefficients in Tables 4.10 and 4.11.

How well the markets are integrated can be established by examining the extent to which prices in those markets are related. In perfectly integrated markets with constant transportation costs and perfect market information the correlation one expected between prices would be 1.0. In practice we expect values below that level.

TABLE 4.7

RESIDUAL VALUE OF WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES

IN THE NORTH, NORTHEAST AND BANGKOK REGION 1969-1979

| WBL[a] | WBS[a] | WNL[a] | WNS[a] | WNEL[a] | WNES[a] |
|---|---|---|---|---|---|
| .36855978+001 | .50000000+000 | .40765762+001 | .30162407+001 | .67848536+001 | .36271831+001 |
| .35546888+001 | .43368087-018 | .37838489+001 | .30216953+001 | .68775809+001 | .37408194+001 |
| .34737796+001 | -.17347235-017 | .37511215+001 | .31435134+001 | .69448536+001 | .34490013+001 |
| .35810524+001 | -.26020852-017 | .38547580+001 | .35635134+001 | .71576264+001 | .33826376+001 |
| .31574160+001 | -.17347235-017 | .39793034+001 | .31671497+001 | .69484900+001 | .30926376+001 |
| .27874160+001 | -.17347235-017 | .31520307+001 | .26926043+001 | .68457627+001 | .28544557+001 |
| .27665069+001 | -.17347235-017 | .30920308+001 | .28907861+001 | .65375809+001 | .24562739+001 |
| .26219615+001 | -.86736174-018 | .33311217+001 | .25116952+001 | .61712173+001 | .20662739+001 |
| .23546887+001 | .86736174-018 | .22511217+001 | .20553317+001 | .17539446+001 | .19880922+001 |
| .22619615+001 | .43368087-018 | .14565762+001 | .18635134+001 | .17057627+001 | .16971830+001 |
| .21046888+001 | .43368087-018 | .16402125+001 | .16653316+001 | .13921264+001 | .16008195+001 |
| .20055978+001 | -.50000000+000 | .14229397+001 | .14907862+001 | .13475809+001 | .12471831+001 |
| .14686600+001 | .50000000+000 | .93071553+000 | .57226526+000 | .62515558+000 | .47156465+000 |
| .11477510+001 | .43368087-018 | .82798823+000 | .46771983+000 | .33788286+000 | .25201040-001 |
| .10868419+001 | -.17347235-017 | .37526096+000 | .75953800+000 | .63515563+000 | -.22661716+000 |
| .90411462+000 | -.26020852-017 | .74889728+000 | .91953795+000 | .57606471+000 | -.52298078+000 |
| .92047825+000 | -.17347235-017 | -.77655715+000 | .50317442+000 | .31879199+000 | .77298085+000 |
| .75047832+000 | .17347235-017 | -.81382996+000 | .43137104+000 | .11606470+000 | .77116254+000 |
| .35956919+000 | -.17347235-017 | -.12638299+001 | -.41318926+000 | .31211702+000 | .13193444+001 |
| .11502371+000 | .86736174-018 | -.15047391+001 | .64228013+000 | .11784807+001 | .15293444+001 |
| -.53224908+000 | -.86736174-018 | -.20647390+001 | .17986438+001 | .10357534+001 | -.17375263+001 |
| -.11149762+001 | .43368087-018 | -.26692844+001 | .14404619+001 | .10839352+001 | .18984353+001 |
| -.12722490+001 | .43368087-018 | -.26256481+001 | -.17586437+001 | -.10875716+001 | .18547990+001 |
| -.15013398+001 | -.50000000+000 | -.26029208+001 | -.20131892+001 | -.11121170+001 | .21784353+001 |
| -.18382776+001 | .50000000+000 | -.25351452+001 | -.24917100+001 | -.20945423+001 | .25340537+001 |
| -.21091867+001 | .43368087-018 | -.25878725+001 | -.26562555+001 | -.35118151+001 | .23604173+001 |
| -.21900958+001 | -.17347235-017 | -.26205997+001 | -.28844374+001 | -.34645422+001 | .24222356+001 |
| -.23828231+001 | -.26020852-017 | -.22169633+001 | -.26744373+001 | -.32736332+001 | .25285993+001 |
| -.24464594+001 | -.17347235-017 | -.24824179+001 | -.29208010+001 | -.39409059+001 | .26385992+001 |
| -.26264594+001 | -.17347235-017 | .25996907+001 | -.30453464+001 | -.39236332+001 | -.27367810+001 |
| -.20873685+001 | -.17347235-017 | .20196905+001 | -.25771647+001 | -.41018150+001 | -.21649628+001 |
| -.22519139+001 | -.86736174-018 | .19105997+001 | -.27862555+001 | -.40981788+001 | -.15949626+001 |
| -.22191867+001 | -.86736174-018 | -.26205997+001 | .25626192+001 | -.35754514+001 | .13031448+001 |
| -.23019139+001 | .43368087-018 | .32251451+001 | -.25644373+001 | -.36236332+001 | -.13340538+001 |
| -.22991868+001 | .43368087-018 | -.31815088+001 | -.24226193+001 | -.35972696+001 | -.15504174+001 |
| -.24382776+001 | -.50000000+000 | -.31587815+001 | -.23071646+001 | -.35518151+001 | -.18140537+001 |
| -.26052154+001 | .50000000+000 | -.30910059+001 | .24756855+001 | -.45242404+001 | -.18996722+001 |
| -.27261245+001 | .43368087-018 | -.32237331+001 | -.23202310+001 | -.38915131+001 | -.16660358+001 |
| -.27270336+001 | -.17347235-017 | -.32764603+001 | -.20684128+001 | -.38942404+001 | -.15878540+001 |
| -.28797607+001 | -.26020852-017 | -.29628240+001 | -.19884128+001 | -.37033313+001 | -.16542177+001 |
| -.33133972+001 | -.17347235-017 | -.31382785+001 | -.21247765+001 | -.38706040+001 | -.16242176+001 |
| -.36033972+001 | -.17347235-017 | -.27555513+001 | -.25393218+001 | -.39733312+001 | -.16923995+001 |
| -.28543062+001 | -.17347235-017 | -.28255512+001 | -.21311401+001 | -.42815131+001 | -.19505813+001 |
| -.29088517+001 | -.86736174-018 | -.27164604+001 | -.20502309+001 | -.46478768+001 | -.19605813+001 |

TABLE 4.7 (Cont'd)

| WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|
| -.30661244+001 | -.86736174-018 | -.21764604+001 | -.23665946+001 | -.45651495+001 | .20887631+001 |
| -.31588517+001 | .43368087-018 | -.27810058+001 | -.24784128+001 | .46633312+001 | .20896722+001 |
| -.30461244+001 | .43368087-018 | -.27373695+001 | -.24165947+001 | .46669676+001 | .22560358+001 |
| -.30652153+001 | -.50000000+000 | -.27146422+001 | -.25911401+001 | -.43615131+001 | -.25296721+001 |
| -.29421531+001 | .50000000+000 | -.36468666+001 | -.26896609+001 | -.44239383+001 | -.27152907+001 |
| -.26230623+001 | .43368087-018 | -.37795938+001 | -.24842064+001 | .39212111+001 | .27016542+001 |
| -.27439713+001 | -.17347235-017 | -.38323210+001 | -.21923883+001 | -.38739384+001 | -.26134724+001 |
| -.28866985+001 | -.26020852-017 | -.35186847+001 | -.18823883+001 | -.36830292+001 | -.22798360+001 |
| -.26503349+001 | -.17347235-017 | -.30741393+001 | -.21787518+001 | -.38503019+001 | -.22098361+001 |
| -.23103349+001 | -.17347235-017 | -.29614121+001 | -.25432973+001 | -.39530292+001 | -.21480179+001 |
| -.24512441+001 | -.17347235-017 | -.30314120+001 | -.20951156+001 | -.42612110+001 | -.23161998+001 |
| -.24157895+001 | -.86736174-018 | -.29223212+001 | -.23142064+001 | -.46275747+001 | .21361997+001 |
| -.16930622+001 | -.86736174-018 | -.15023212+001 | -.21405700+001 | -.44848475+001 | .18143816+001 |
| -.71578960+000 | .43368087-018 | -.13368665+001 | -.17623882+001 | -.45330292+001 | -.11752907+001 |
| -.59306225+000 | .43368087-018 | -.12932302+001 | -.18005701+001 | -.38766656+001 | -.12716543+001 |
| -.64215319+000 | -.50000000+000 | -.12705029+001 | -.16551155+001 | .37312110+001 | -.81529060+000 |
| -.22909086+000 | .50000000+000 | -.33272736+000 | .47636362+000 | -.63363638+000 | .49909089+000 |
| .35000007+000 | .43368087-018 | .51454542+000 | .55181824+000 | -.55090913+000 | .84272724+000 |
| .12090909+001 | -.17347235-017 | .15618180+001 | .16336363+001 | .16363646+000 | .18409090+001 |
| .24063634+001 | -.26020852-017 | .32954544+001 | .22036364+001 | .68727271+000 | .28045454+001 |
| .31927274+001 | -.17347235-017 | .45000000+001 | .34972727+001 | .41100000+001 | .34645454+001 |
| .40927272+001 | -.17347235-017 | .52827272+001 | .38127272+001 | .46672727+001 | .42563636+001 |
| .94827765+000 | -.17347235-017 | .14442361+001 | .31017100+001 | .16272696+001 | .24140538+001 |
| .12755505+001 | -.26020852-017 | .21678724+001 | .35117101+001 | .19881788+001 | .27476901+001 |
| .14119139+001 | -.17347235-017 | .27324178+001 | .36353465+001 | .19909060+001 | .29376901+001 |
| .15919140+001 | -.17347235-017 | .30051452+001 | .32908010+001 | .18881786+001 | .30995083+001 |
| .12410048+001 | -.17347235-017 | .24451451+001 | .38189829+001 | .22499694+001 | .33413265+001 |
| .11564594+001 | -.86736174-018 | .20942361+001 | .38098919+001 | .22136332+001 | .29013265+001 |
| .79918678+000 | -.86736174-018 | .84423609+000 | .34335283+001 | .23563604+001 | .25331447+001 |
| .63645942+000 | .43368087-018 | -.81030931+000 | .32717101+001 | .23081786+001 | .18522355+001 |
| .60918669+000 | .43368087-018 | -.76667298+000 | .26135281+001 | .19645424+001 | .13958718+001 |
| .48009581+000 | -.50000000+000 | -.14639458+001 | .24389827+001 | .19399694+001 | .13022356+001 |
| .13315816+000 | .50000000+000 | -.21161701+001 | .19804620+001 | .95757168+000 | .57661708+000 |
| .42249018-001 | .43368087-018 | -.23888975+001 | .11159164+001 | .71029900+000 | -.12997464+001 |
| .21339923-001 | -.17347235-017 | -.23416246+001 | -.51226523+000 | .75717257-002 | -.21515647+001 |
| -.32138738+000 | -.26020852-017 | -.37979881+001 | -.26522654+001 | -.20515192+001 | -.41279284+001 |
| -.49502381+000 | -.17347235-017 | -.38434429+001 | -.31886290+001 | -.35487920+001 | -.43679283+001 |
| -.74502378+000 | -.17347235-017 | -.38407155+001 | -.38331743+001 | -.35315192+001 | -.42761102+001 |
| -.48593282+000 | -.17347235-017 | -.51107156+001 | -.43449926+001 | -.33797010+001 | -.38742919+001 |
| -.11304783+001 | -.86736174-018 | -.65516245+001 | -.50140835+001 | -.40760648+001 | -.38842919+001 |
| -.12677511+001 | -.86736174-018 | -.36316247+001 | -.49704471+001 | -.34333376+001 | -.30724737+001 |
| -.10604783+001 | .43368087-018 | -.26161700+001 | -.48022652+001 | -.33215193+001 | -.26033829+001 |
| -.99775108+000 | .43368087-018 | -.33225337+001 | -.38804471+001 | -.33251556+001 | -.14397465+001 |
| -.10668418+001 | -.50000000+000 | -.32998064+001 | -.35549926+001 | -.31797010+001 | -.11133828+001 |
| -.11437798+001 | .50000000+000 | -.21520308+001 | -.31535134+001 | -.33121264+001 | .14090013+001 |
| -.11346887+001 | .43368087-018 | -.16147580+001 | -.24680589+001 | -.27493991+001 | -.11753649+001 |
| -.16055978+001 | -.17347235-017 | -.18674854+001 | -.22562407+001 | -.16121265+001 | .10871831+001 |
| -.11983251+001 | -.26020852-017 | -.17538489+001 | -.20162407+001 | -.14212173+001 | -.93354675+000 |
| -.96196149+000 | -.17347235-017 | -.17293035+001 | -.18126044+001 | -.15884900+001 | -.68354668+000 |

TABLE 4.7 (Cont'd)

| WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|
| -.12219615+001 | -.17347235-017 | -.20665763+001 | -.22471498+001 | -.16912174+001 | -.58172848+000 |
| -.11928706+001 | -.17347235-017 | -.71657615+000 | -.16689679+001 | -.17493991+001 | -.79991034+000 |
| -.87415973-001 | -.86736174-018 | -.60748523+000 | .66194102+000 | .14642374+001 | -.11991040+000 |
| .47531130+000 | -.86736174-018 | -.13174853+001 | .86557749+000 | .24369645+001 | .98190772+000 |
| .72258402+000 | .43368087-018 | .45079691+001 | .70375937+000 | .23887827+001 | .11009988+001 |
| .15753111+001 | .43368087-018 | .47616055+001 | .12055775+001 | .23851464+001 | .13146352+001 |
| .26962203+001 | -.50000000+000 | .56443329+001 | .18610320+001 | .23606009+001 | .19809987+001 |
| .48218182+001 | -.17347235-017 | .65327271+001 | .49090901+001 | .53590909+001 | .54481817+001 |
| .50272727+001 | -.86736174-018 | .78618181+001 | .48818180+001 | .51627273+001 | .54381818+001 |
| .47400000+001 | -.86736174-018 | .62118182+001 | .50854546+001 | .53054546+001 | .49699999+001 |
| .41072726+001 | .43368087-018 | .49372727+001 | .45936363+001 | .52572727+001 | .47790909+001 |
| .34300000+001 | .43368087-018 | .46509091+001 | .42554545+001 | .52536363+001 | .46027271+001 |
| .31709090+001 | -.50000000+000 | .46736363+001 | .40609091+001 | .51190907+001 | .44090908+001 |
| .28839713+001 | .50000000+000 | .47414120+001 | .31523883+001 | .42466656+001 | .40734724+001 |
| .26330622+001 | .43368087-018 | .46086848+001 | .30078427+001 | .43293929+001 | .36671086+001 |
| .24921532+001 | -.17347235-017 | .45559575+001 | .24696610+001 | .29566656+001 | .32529071+001 |
| .17194258+001 | -.26020852-017 | .48695938+001 | .23796609+001 | .27375747+001 | .31489270+001 |
| .14557894+001 | -.17347235-017 | .46941393+001 | .22532973+001 | .25703019+001 | .28689270+001 |
| .15257894+001 | -.17347235-017 | .45768666+001 | .18187519+001 | .24675746+001 | .24107452+001 |
| .83488033+000 | -.17347235-017 | .37568666+001 | .20569337+001 | .21593929+001 | .16425634+001 |
| .69033487+000 | -.86736174-018 | .36159576+001 | .17178428+001 | .22030293+001 | .13125633+001 |
| .15306223+000 | -.86736174-018 | .29059575+001 | .11314791+001 | .27657566+001 | -.12561840+000 |
| .18033493+000 | .43368087-018 | .23014121+001 | .50966095+000 | .27175747+001 | -.77652749+000 |
| .12306223+000 | .43368087-018 | .23450484+001 | .35147913+000 | .27139384+001 | .81289111+000 |
| -.36028616-001 | -.50000000+000 | .23677757+001 | .33933664+000 | .26893930+001 | -.11565275+001 |
| .27033578-001 | .50000000+000 | .24355513+001 | -.47158724+000 | .70696767+000 | -.13921460+001 |
| -.10387552+000 | .43368087-018 | .23028241+001 | -.96613267+000 | .78969499+000 | -.92859604+000 |
| .35215464-001 | -.17347235-017 | .22500968+001 | -.11943145+001 | .83696771+000 | -.84032784+000 |
| -.21751192+000 | -.26020852-017 | -.68626674+000 | -.13643145+001 | .10278768+001 | -.36691433-001 |
| -.27114823+000 | -.17347235-017 | -.86172135+000 | -.83067807+000 | .86060410+000 | -.66691431-001 |
| -.24114822+000 | -.17347235-017 | -.97899406+000 | .30247764+001 | .10878768+001 | -.21487323+000 |
| -.95205729+000 | -.17347235-017 | -.85899424+000 | -.43704169+000 | .17796949+001 | .46305506+000 |
| -.81660277+000 | -.86736174-018 | -.68990313+000 | -.77613257+000 | .14133313+001 | .49305504+000 |
| .25612447+000 | -.86736174-018 | .11000968+001 | .12675036+001 | .24760586+001 | -.33123681+000 |
| .44339726+000 | .43368087-018 | .23555116+000 | .21056855+001 | .28478766+001 | .46785402+000 |
| .36612458+000 | .43368087-018 | .52918748+000 | .21875037+001 | .28442402+001 | .27149043+000 |
| -.39703355+000 | -.50000000+000 | .40191491+000 | .19329581+001 | .24796949+001 | .66785405+000 |
| .56009588+000 | .50000000+000 | .16896906+001 | .20844372+001 | .16672697+001 | .41223561+000 |
| .96918678+000 | .43368087-018 | .15569633+001 | .27298919+001 | .15799969+001 | .18558720+001 |

Note: a See Table 2.9.

TABLE 4.8

CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND DURING JANUARY 1969 - JUNE 1978 AND AUGUST - DECEMBER 1979 BY RESIDUAL METHOD

'UNRESTRICTED AREA'

| | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|
| WBL | 1.0000 (XXX) | 0.0007 (0.497) | 0.8928 (0.000) | 0.8979 (0.000) | 0.9133 (0.000) | 0.8915 (0.000) |
| WBS | | 1.0000 (XXX) | -0.0078 (0.466) | -0.0034 (0.485) | 0.0008 (0.497) | 0.0026 (0.489) |
| WNL | | | 1.0000 (XXX) | 0.8509 (0.000) | 0.8603 (0.000) | 0.8936 (0.000) |
| WNS | | | | 1.0000 (XXX) | 0.8996 (0.000) | 0.9426 (0.000) |
| WNEL | | | | | 1.0000 (XXX) | 0.8573 (0.000) |
| WNES | | | | | | 1.0000 (XXX) |

Notes: a n = 119

b See Table 4.3.

Both the period of unrestricted and of restricted area are analysed and the results are set out in Figures 4.1 and 4.2 which show these linkages by lines whose width is proportional to the correlation coefficients.

4.2.4 The Results

I have hypothesized that a high correlation coefficient between pairs of markets is an indicator of a high level of market integration.

Wholesale prices for live pigs in markets in the three regions were highly and positively related (r values ranging between 0.9133 and 0.8603)

TABLE 4.9

CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND, JULY 1978 - JULY 1979 BY RESIDUAL METHOD

'RESTRICTED AREA'

| | WBL | WBS | WNL | WNS | WNEL | WNES |
|---|---|---|---|---|---|---|
| WBL | 1.0000 (XXX) | -0.0638 (0.418) | -0.4261 (0.073) | -0.3213 (0.142) | -0.3875 (0.095) | -0.4351 (0.069) |
| WBS | | 1.0000 | 0.1470 (0.316) | 0.0653 (0.416) | -0.0293 (0.462) | -0.0507 (0.435) |
| WNL | | | 1.0000 (XXX) | 0.8152 (0.000) | 0.7698 (0.001) | 0.8668 (0.000) |
| WNS | | | | 1.0000 (XXX) | 0.9068 (0.000) | 0.8740 (0.000) |
| WNEL | | | | | 1.0000 (XXX) | 0.7708 (0.001) |
| WNES | | | | | | 1.0000 (XXX) |

Notes: a n = 13

b See Table 4.3.

during the period of unrestricted area (Figure 4.1). (Note on the levels of significance used, is included as a note to Table 4.3.)

The correlation between pork carcass wholesale prices in the North and Northeast region in the same period also showed the close relationship to the wholesale prices of live pigs in Bangkok (r values were 0.8979 and 0.8915 respectively)(Figure 4.1). These high correlations between markets suggested well integrated and efficient markets.

There are many factors which might explain this high degree of market integration between sections of the pork market in Thailand. Firstly,

TABLE 4.10

RANKS OF CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND DURING JANUARY 1969 - JUNE 1978 AND AUGUST - DECEMBER 1979

'UNRESTRICTED AREA'

| Markets | Correlation Coefficient | Significance |
|---|---|---|
| First Difference Method | | |
| 1. WNEL-WNL | 0.5183* | 0.000 |
| 2. WNS-WNL | 0.4907* | 0.000 |
| 3. WNEL-WBL | 0.4670* | 0.000 |
| 4. WNEL-WNS | 0.4369* | 0.000 |
| 5. WBS-WBL | 0.4211* | 0.000 |
| 6. WNL-WBL | 0.3643* | 0.000 |
| 7. WNES-WNEL | 0.3351* | 0.000 |
| 8. WNS-WBL | 0.2926 | 0.001 |
| 9. WNEL-WBS | 0.2170 | 0.009 |
| 10. WNL-WBS | 0.1933 | 0.018 |
| 11. WNES-WNS | 0.1826 | 0.024 |
| 12. WNS-WBS | 0.1591 | 0.043 |
| 13. WNES-WBL | 0.1203 | 0.097 |
| 14. WNES-WNL | 0.1117 | 0.114 |
| 15. WNES-WBS | 0.1086 | 0.121 |
| Residual Method | | |
| 1. WNES-WNS | 0.9426* | 0.000 |
| 2. WNEL-WBL | 0.9133* | 0.000 |
| 3. WNEL-WNS | 0.8996* | 0.000 |
| 4. WNS-WBL | 0.8979* | 0.000 |
| 5. WNES-WNL | 0.8936* | 0.000 |
| 6. WNL-WBL | 0.8928* | 0.000 |
| 7. WNES-WBL | 0.8915* | 0.000 |
| 8. WNEL-WNL | 0.8603* | 0.000 |
| 9. WNES-WNEL | 0.8573* | 0.000 |
| 10. WNS-WNL | 0.8509* | 0.000 |
| 11. WNES-WBS | 0.0026 | 0.489 |
| 12. WNEL-WBS | 0.0008 | 0.497 |
| 13. WBS-WBL | 0.0007 | 0.497 |
| 14. WNS-WBS | -0.0034 | 0.485 |
| 15. WNL-WBS | -0.0078 | 0.466 |

Note: * = significant at 5% level

TABLE 4.11

RANKS OF CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS OF THAILAND DURING JULY 1978 - JULY 1979

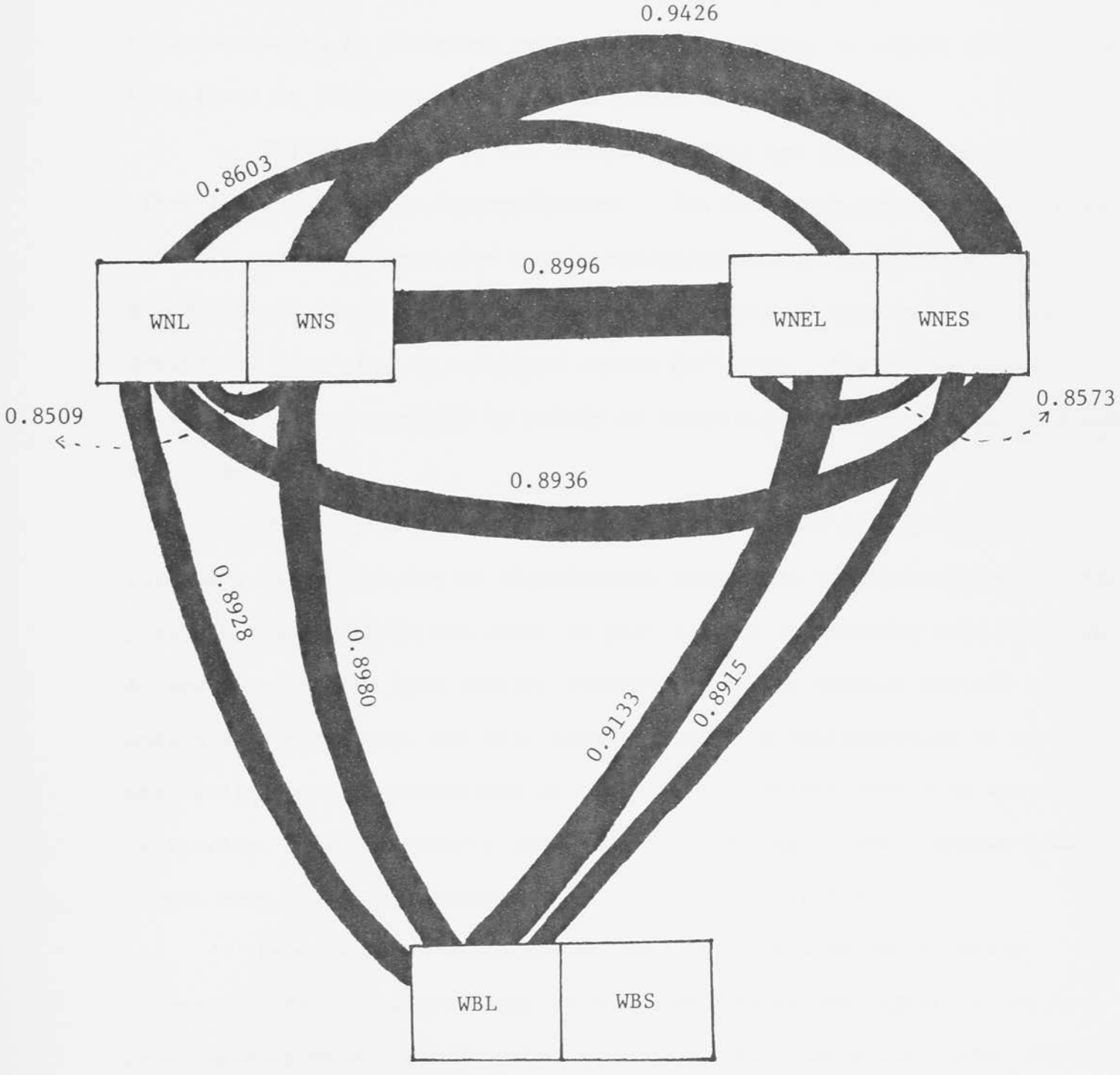
'RESTRICTED AREA'

| Markets | Correlation Coefficient | Significance |
|---|---|---|
| First Difference Method | | |
| 1. WBL-WBS | 0.8171* | 0.000 |
| 2. WBS-WNL | 0.4739 | 0.051 |
| 3. WBL-WNL | 0.4047 | 0.085 |
| 4. WBS-WNS | 0.3374 | 0.130 |
| 5. WNL-WNES | 0.2956 | 0.163 |
| 6. WNL-WNEL | 0.2780 | 0.179 |
| 7. WBL-WNEL | 0.1345 | 0.331 |
| 8. WBS-WNES | 0.1286 | 0.338 |
| 9. WNL-WNS | 0.1018 | 0.370 |
| 10. WNS-WNES | 0.0935 | 0.381 |
| 11. WBS-WNEL | 0.0763 | 0.402 |
| 12. WBL-WNES | 0.0619 | 0.420 |
| 13. WBL-WNS | 0.0143 | 0.482 |
| 14. WNS-WNEL | -0.4889 | 0.045 |
| 15. WNEL-WNES | -0.1353 | 0.330 |
| Residual Method | | |
| 1. WNEL-WNS | 0.9068* | 0.000 |
| 2. WNES-WNS | 0.8740* | 0.000 |
| 3. WNES-WNL | 0.8668* | 0.000 |
| 4. WNS-WNL | 0.8152* | 0.000 |
| 5. WNES-WNEL | 0.7708 | 0.001 |
| 6. WNEL-WNL | 0.7698 | 0.001 |
| 7. WNL-WBS | 0.1470 | 0.316 |
| 8. WNS-WBS | 0.0654 | 0.416 |
| 9. WNEL-WBS | -0.0293 | 0.462 |
| 10. WNES-WBS | -0.0507 | 0.435 |
| 11. WBS-WBL | -0.0638 | 0.418 |
| 12. WNS-WBL | -0.3213 | 0.442 |
| 13. WNEL-WBL | -0.3875 | 0.095 |
| 14. WNL-WBL | -0.4262 | 0.073 |
| 15. WNES-WBL | -0.4352 | 0.069 |

Note: * = significant at 5% level

FIGURE 4.1

DEGREE OF CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS IN THAILAND DURING JANUARY 1969-JUNE 1978 AND AUGUST-DECEMBER 1979



the wholesalers have good information about prices and supply and they can get market information from the mass media. The traders in a particular market usually act in response to price signals from and substitution possibilities in related markets in other parts of the country. Secondly, excellent transport facilities and highways exist between the regional markets studied and this is another reason for close co-ordination of markets. Most wholesalers have their own trucks to transport the pigs and if they do not have their own trucks, they can easily hire them. Then price movements in different markets are more likely to adjust to each other when there is free movement of commodities between markets.

Thirdly, parts of the markets studied are spatially close and often involve the same intermediaries. The wholesale prices of live pigs and pork carcasses were also highly correlated which would be expected since the supply of carcasses is a derived supply of live pigs and the demand for live pigs is a derived demand for pork. The adjustment of these demands and supplies is likely to cause a co-ordinated responsiveness in prices.

One surprising result is that the wholesale prices of pork carcasses in Bangkok had no significance with those in other markets. The possible reason may be the level of pork carcass inventories held in Bangkok. As mentioned in the last chapter slaughterhouses in Bangkok are the most modern in the country, are well equipped and have refrigerators to store meat while the slaughterhouses in the provinces do not have such storage facilities. It is possible that the stock holding in the slaughterhouses causes some divergence between local and upcountry prices.

Some pairs of wholesale prices also showed no relationship. It is possible that suppliers consistently compensated for higher prices in other markets by sending too many supplies to the high price market depressing

it and raising prices in their own area causing prices in each market to move in different directions.

In the period of area restrictions (as in the unrestricted period), the wholesale markets for live pigs and pork carcasses in the North and the Northeast regions remained tightly integrated, (r value ranging between 0.9068 and 0.7708) (Figure 4.11). This is to be expected with spatially close markets. But the correlations between wholesale prices of live pigs and pork carcasses in the North and the Northeast region and Bangkok prices were low (r values ranging between 0.1470 and -0.4352) and not significant (Figure 4.2).

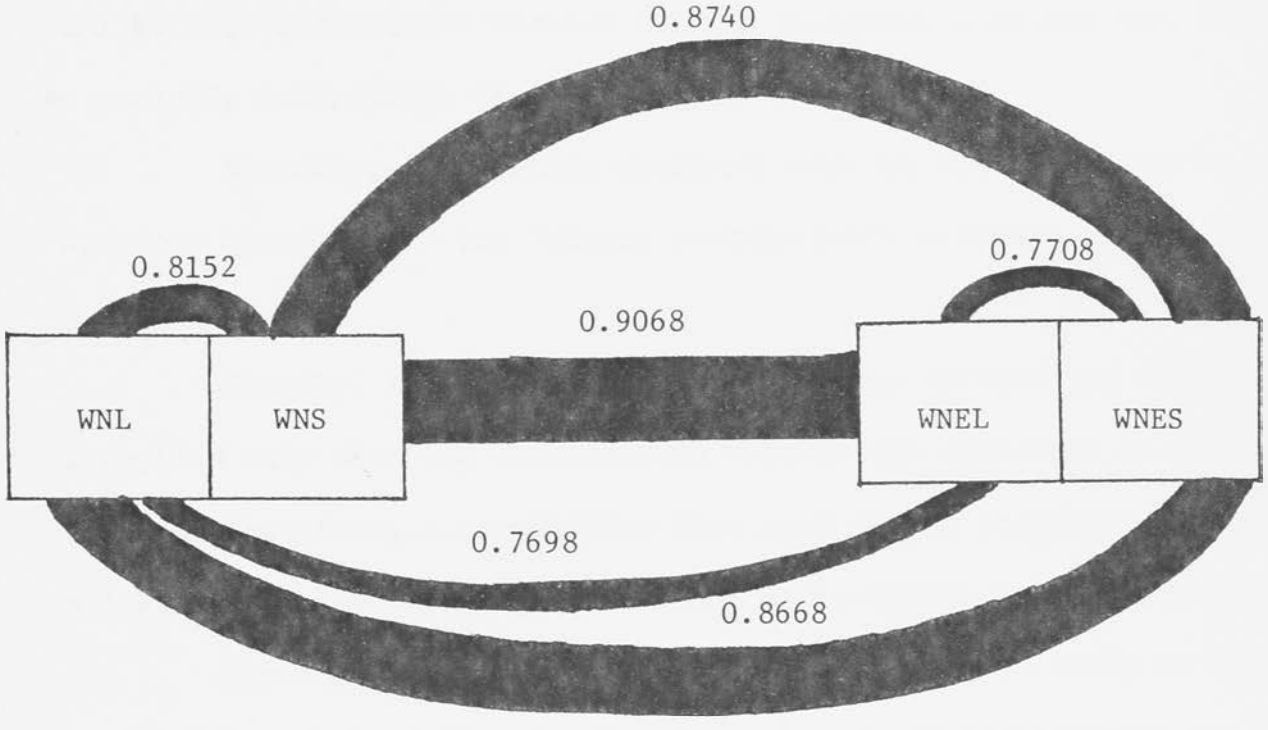
This implies that the government regulations in not permitting the shipment of pork carcasses from other regions into Bangkok was effective. Wholesale markets in the North and the Northeast region were loosely connected to the wholesale market in Bangkok. Even though there was some smuggling by shipping the illegal slaughtered pig's into Bangkok, the proportion of the smuggled pigs to the total supply in Bangkok may not have been large. Certainly it does not seem to have been sufficient to induce a significant price correlation.

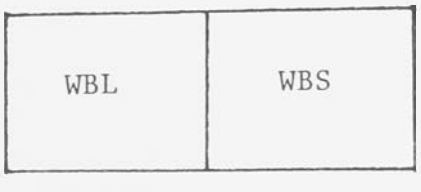
Overall the results show that pig markets in the three regions in Thailand were, in general, highly integrated. But during the period when the government intervened in the market, only markets in the North and the Northeast regions were tightly integrated and the upcountry markets were only loosely connected to the Bangkok market. This further implies that these markets, and the marketing system, are quite competitive.

These results which generally correspond with those we would expect (especially when comparing the period of restricted area and unrestricted area) give us considerable confidence that the technique of correlation analysis using residual values is a powerful means of assessing

FIGURE 4.2

DEGREE OF CORRELATIONS BETWEEN MONTHLY WHOLESALE PRICES OF LIVE PIGS AND PORK CARCASSES IN MARKETS IN THREE REGIONS IN THAILAND DURING JULY 1978 - JULY 1979



the degree of integration between two markets. These high correlation between prices in most parts of the Thai pork market also supports the hypothesis that many agricultural markets in low income countries are fairly or even highly competitive or efficient and they are tightly linked to each other.

However, some reservations should be made here. Firstly, a close relation between variables may be due to the effect of another common factor. In time series when two variables have strong time trends, there will be high correlation between the two variables although they happen to be causally independent (Koutsoyiannis, 1981).

Secondly, the results obtained from correlation analysis can be "spurious correlation" (or "chance correlation") although in this case it is universal.

Thirdly, the formula used to calculate correlation coefficients is applied only when the relationship between the variables is linear. There is, therefore, a possibility that some of the variable pairs showing an insignificant correlation could have a non-linear relationship.

However, various means have been used in this study to reduce these effects (especially the first). This study investigates the degree of market integration in the Thai pork sector. Some problems of that sector have been discussed. Despite data limitations the overall conclusion suggests that the methodology used is useful and that there is considerable integration of the markets considered. However, there is a need for additional research to provide a more complete understanding of the problems involved and a need to collect better and more consistent data for more conclusive analysis.

# CHAPTER 5

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 5.1 Summary and Major Conclusions

This thesis studies the concept of market integration using price data from the Thai pork sector, on the major pork markets in the North, Northeast and Bangkok regions of Thailand during 1969-1979.

Pig raising is characterised by family or small-scale enterprises scattered over the country as a supplementary activity. There are also large scale or commercialized pig farms which produce high quality meat for domestic and export consumption. Pig production tends to fluctuate in a cyclical manner due to the way in which producers respond to changes in market prices.

Domestic consumption demand for pork is expected to increase as population and incomes increase since the income elasticity of demand for pork is greater than for other meats. Pig export volume has fluctuated violently due to competition from other export countries, market restrictions and high production costs.

Pork and pig price movements are complicated by trend, cyclical and seasonal factors. The trend influences caused by the determinants of both supply and demand, population, consumer income and the inflation. On the average the full "hog" cycle took around 4 years. Seasonal changes in pig prices are related closely to other seasonal activities on farms and to the demand for pork for religious and seasonal festivals.

There are several levels and types of market intermediaries performing various activities within the pig marketing system. Some

intermediaries do only one activity while others try to combine many activities. The intermediaries in local markets and retail markets are quite competitive whereas the intermediaries in the Bangkok carcass wholesale markets are much fewer with oligopoly and monopoly power.

Most slaughterhouses, except the two modern ones in Bangkok were insanitary and lacking in facilities. Illegal slaughtering is a widespread practice due to the inconvenience in getting animal identification documents and the tax and fees avoidance.

The marketing channels are also numerous and complex, although the most familiar channels are from producers to local assemblers (provincial assemblers) to carcass wholesalers to slaughterhouses to retailers and to consumers.

There are many problems in studying pig and pork markets in a country such as Thailand since the information available is incomplete and sometimes unreliable. In existing margins analysis studies many items are neglected such as opportunity cost, illegal charges and weight losses.

In Chapter 3 I have set out margins for the sections of the pork market studied in this thesis. In the provincial markets, pork carcass wholesalers had the highest average margin (27.6%) (Table 3.14) whereas in the Bangkok market, the retailers got the highest average margin (33.7%) (Table 3.15). However, the size of the margin is not the sole indicator from which we can estimate the degree of efficiency in the market. Table 3.16 showed that the absolute marketing margin varied little over time, which partly explains the relatively high instability of farm prices.

The Thai Government has often intervened in the pork market. In the Bangkok region, marketing was monopolised by the Federation of Pig Raisers and Traders' Cooperative during 1959-1962 and by the Livestock

Trading Corporation Ltd. during 1962-1966. Pig raisers and live pig wholesalers were disadvantaged during those periods because of lower prices while consumers were paid higher prices.

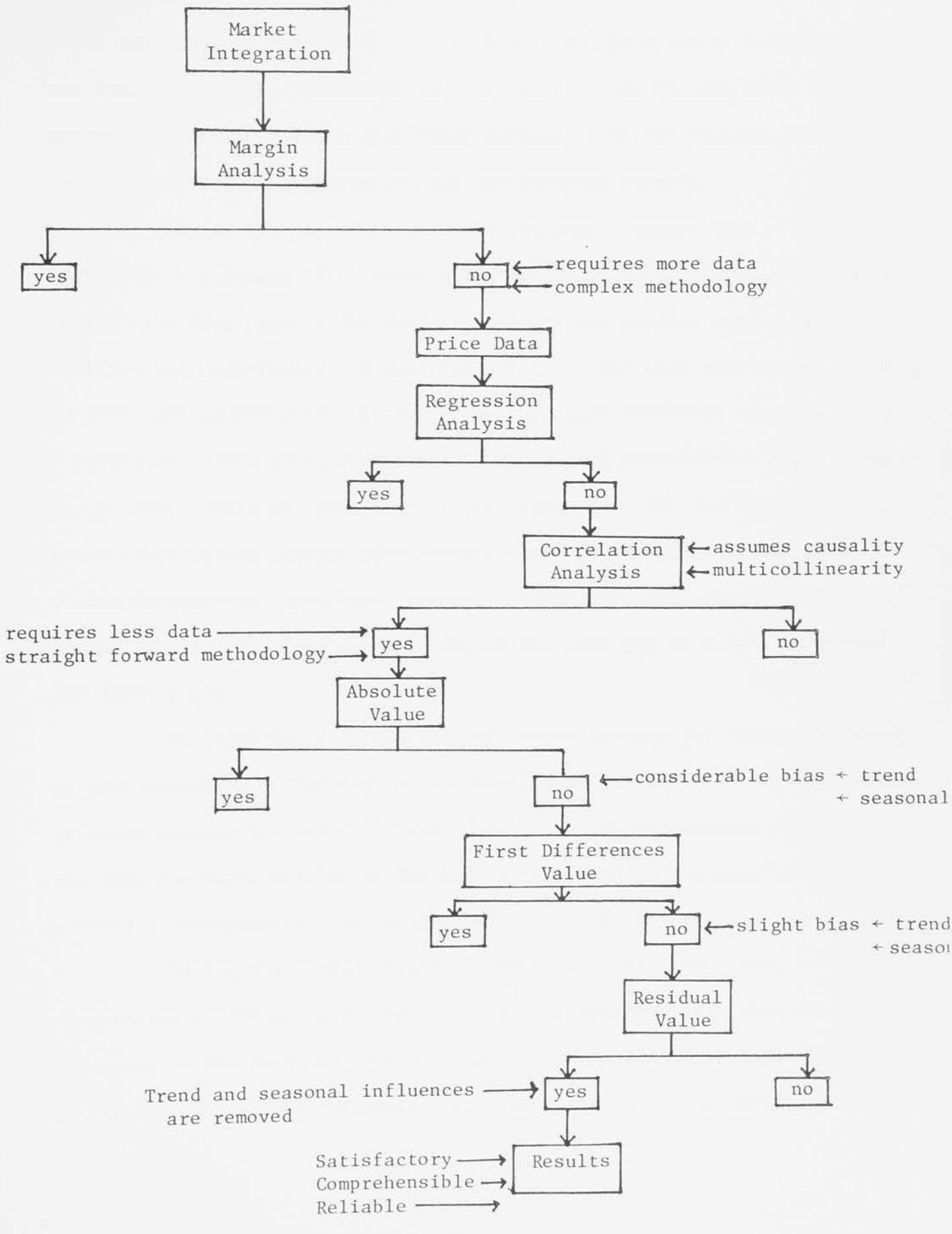
There was a change in the Thai pig market structure in 1969. Pig marketing systems became more competitive because the Livestock Trading Corporation Ltd. could operate only in slaughtering but not trading. But during July 1978 - July 1979, the government imposed a policy of restricted area when the shipment of pork carcass originating from other provinces was not permitted into Bangkok. Because of this considerable structural change of the Thai pork market subsequent analysis, therefore, divided the price data into 2 periods, the unrestricted area period (January 1969 - June 1978 and August - December 1979) and the restricted area period (July 1978 - July 1979).

The analytical conceptual framework of this study is presented in Figure 5.1. Most studies in high income countries generally use margins analysis to show the degree of market competition and efficiency. In my opinion this methodology is complicated and requires data such as prices, all types of marketing cost and profit at each market level which are frequently unavailable or unreliable. Therefore, this thesis has attempted to show that with only price data (which is the most reliable market data available in low income countries) and using a simple and straight forward methodology such as correlation analysis we can achieve reliable and useful results.

Regression analysis was firstly attempted by regressing the wholesale prices of live pigs and pork carcasses in the three regions studied including the seasonal dummy and lag variables. However, the method was rejected because of the need to specify the direction of causal relationship and because of multicollinearity.

FIGURE 5.1

ANALYTICAL CONCEPTUAL FRAMEWORK



Absolute price data was used in correlation analysis but rejected in favour of first differences for the reason outlined in Chapter 4. However, the use of first differences did not remove biases caused by trend and seasonal influences. A method of analysis using residuals after the removal of these influences was then used. The results from this method generally coincided with those expected from the changes in market structure between the restricted and unrestricted periods.

During the period of unrestricted area (January 1969 - June 1978 and August - December 1979) correlation coefficients between the wholesale markets for live pigs in the North, Northeast and Bangkok region were positive and high (Table 4.8 and Figure 4.1). The same results were true of pork carcass wholesale prices in the North and Northeast region and the live pig wholesale price in Bangkok. These high correlations suggest well-integrated markets and efficient market linkages. The high degree of market integration between pork markets might be explained by the good market information, excellent transport facilities, free movement of commodities and the fact that the demand for live pig is a derived demand for carcass pig.

No significant correlation was found between the wholesale prices of pork carcasses in Bangkok and the other pork carcass wholesale markets (r value ranging between 0.654 and -0.4352). The explanation suggested was that the stock holding in the more modern Bangkok slaughterhouses enabled a divergence of the Bangkok and provincial prices.

During the period of restricted area (July 1978 - July 1979) correlation coefficients between wholesale markets for live pigs and pork carcasses in the North and the Northeast regions were still high (Table 4.9 and Figure 4.2). This suggested the tight integration between those

markets. But the correlation coefficients between wholesale prices of live pigs and pork carcasses in the North and the Northeast region and Bangkok prices were low (r values ranging between 0.1470 and -0.4352) which suggested low integration between these markets. This showed that the government regulation in restricting the movement of pork carcasses into Bangkok was effective.

The results of this analysis suggested that many parts of the pork markets in the North, Northeast region and Bangkok were integrated (and competitive) and quite probably that the pork marketing system is more efficient than others have concluded.

The conclusion can also be drawn here that the correlation analysis used in this thesis is an appropriate and useful methodology. It generally matches the type of data available in agricultural markets in the Third World countries. It can be used to analyse the markets whose structures are complex (e.g. where there is a mixture between formal and informal or illegal markets). It is also more useful than margins analysis because of its minimal data requirement. Therefore, it can be used to analyse the agricultural market which is a very important sector in the Third World countries.

## 5.2 Recommendations

After studying the conditions and degree of market integration of pig markets in Thailand, the following recommendations can be made:

(1) At present, government policies tend to contradict each other. The price policy tries to decrease the monopoly power of the wholesalers while the area restriction policy promotes the monopoly power of those wholesalers. The government should have a clear cut policy in intervening in the pig marketing system and should let the price mechanism in the market adjust itself as much as possible.

(2) The government should encourage the private slaughterhouses so that there will be an incentive in improving the existing facilities. New investment should be directed to construct the modern slaughtering plants in all appropriate locations. At the same time auction stations which are fully equipped with weighing scales and relevant facilities for the benefits of both buyers and sellers should be widely established in all livestock trading areas to facilitate and encourage the buying and selling activities and to increase the bargaining power of the farmers.

(3) The current tax policy should be revised in order to facilitate the marketing of livestock and to decrease illegal slaughtering.

(4) Data on pig production, consumption and marketing is often not available, and what data there is may be incomplete, inconsistent and unreliable. For example, the total number of pigs surveyed by the Division of Agricultural Economics in 1977 and 1978 were 4.13 and 5.36 million heads respectively whereas the survey done by the Division of Agricultural Economic Research showed that in 1979 and 1978 the total number of pigs were 3.22 and 4.92 million heads respectively. This is true not only in the case of pigs but also happens for other agricultural commodities. There should be more cooperation among the different departments in collecting the data and assuring it is consistent so that the analysis done can give the correct and reliable results.

(5) The concept of market integration is more usable and relevant to the Third World marketing system where price is the most reliable data. To know whether markets are integrated will help in the development of better organized upcountry and urban terminal markets. The analytical method used in this thesis should also be useful to analyse agricultural markets in other Third World countries. For Thailand it would be useful for other

commercially traded products such as beef or poultry as well as other agricultural products. Further studies would also help us to assess the worth of this useful and straightforward approach to the study of agricultural markets in low income countries.

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