DETERMINANTS OF CHOICE OF PINEAPPLE FARM SIZE IN THE AKUAPIM SOUTH DISTRICT, GHANA.

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF M.PHIL DEGREE IN AGRICULTURAL ECONOMICS

DEPARTMENT OF AGRICULTURAL ECONOMICS & AGRIBUSINESS
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DEDICATION

Dedicated

To

My beloved Wife, Maggie

And

My lovely Children, Franklyn and Pamela

For their patience, love and understanding during my long periods of absence from home.

DECLARATION

I, PAUL SANDOH AYAGIBA, the author of this Thesis titled, "DETERMINANTS OF CHOICE OF PINEAPPLE FARM SIZE IN THE AKUAPIM SOUTH DISTRICT, GHANA", do hereby declare that with the exception of references to past and current literature duly cited, the entire research leading to this thesis was carried out by me at the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon. It is further declared that this work has never been presented either in whole or in part for any degree in this University or elsewhere.

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This thesis has been submitted for examination with our approval as supervisors.

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ABSTRACT

The importance of non-traditional agricultural commodities, especially pineapple, as a major foreign exchange earner in the diversification of the economy of Ghana has long been realised. It is estimated that $5 million is added to the economy by small farmers annually from pineapple production. Despite the importance and profitability of the pineapple production and export as a good foreign export earner and an a priori expectation that increased production is directly correlated with increased farm size, most pineapple farmers in the Akuapim South District cultivate small farms rather than large ones. This study quantifies the effects of the determinants of the choice of farm size on pineapple production. It also describes the organisational structure of the pineapple industry and describes the pattern of distribution of farm size. Costs and returns of categories of farm sizes are also compared. The empirical results demonstrate that most farmers in the study area cultivate small farms ranging between 0.02 and 1.5 hectares. The major determinants of choice of farm size in pineapple production are the average wage rate, farmer age, educational level and the years of experience of the farmer in pineapple farming. Whereas age and the interactive variable of educational level and experience of the farmer exert significant positive effects on the choice of farm size, the average wage rate exerts a significant negative effect. Although small farms have a slightly higher unit cost of production per hectare, they have high unit net returns per hectare and are therefore more profitable and more preferred to large farms.

The study recommends among other things that policies for increased pineapple production and export should be geared towards alleviating the constraints faced by smallholder farmers (since they are in the majority) without loosing sight of the needs of commercial farmers. Affordable Technological packages with new innovations should also be developed for adoption by farmers. Suggestions for future research are also made.

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LIST OF ACRONYMS

COLEAP	Comite' De Liaison Europe, Afrique, Caraibes Pacifique.
EFC	Export Finance Company
ERP	Economic Recovery Programme
EU	European Union
FAGE	Federation of Association of Ghanaian Exporters
FAO	Food and Agriculture Organisation
FOB	Free On Board
FOM	Farm Ownership Model
GDP	Gross Domestic Product
GEPC	Ghana Export Promotion Council
GSB	Ghana Standards Board
HAG	Horticultural Association of Ghana
IFAD	International Fund for Agricultural Development
MOFA	Ministry of Food and Agriculture
MOTI	Ministry of Trade and Industry
MT	Metric Tonne
MTADP	Medium Term Agricultural Development Plan
NGO	Non-Governmental Organisation
NTAE	Non-Traditional Agricultural Export
NTE	Non-Traditional Export
PCS	Pineapple Co-operative Societies
SPEG	Sea-Freighted Pineapple Exporters of Ghana
SSAP	Stabilization and Structural Adjustment Programme
TIP	Trade and Investment Programme
USAID	United States Agency for International Development

CHAPTER 1

INTRODUCTION

1.1. Background and Problem Statement

The economy of Ghana declined steeply from the late 1970s to the early 1980s. By 1983, the annual rate of inflation had reached 122.8 percent. During the late 1970s, and early 1980s real wage and employment, levels of aggregate and sectoral production, and exports of traditional crops all declined sharply. Ghana's food self- sufficiency ratio declined from 83 percent in 1964-66 to 71 percent in 1978-80 and to 60 percent in 1982 (World Bank, 1984). Domestic agriculture could not meet domestic raw material requirements and the manufacturing sector operated below capacity. Poverty and income inequality increased during that time. Capacity utilisation in manufacturing fell from 53 percent in 1975 to 25 percent in 1980.

In order to halt and reverse this negative economic trend and relocate Ghana on a sustained growth path and improve the foreign exchange earnings of the country, the government of Ghana actively embarked on a package of IMF-World Bank supported Stabilization and Structural Adjustment Policies (SSAP) in 1983. The Policies which comprised restrictive monetary and fiscal policies, exchange rate and trade liberalization coupled with reforms in agriculture and industry, inter alia, have been vigorously implemented since April, 1983 (World Bank, 1984; Ewusi, 1987; Fosu, 1989; Anyemedu, 1993 and Leechor, 1994).

The annual rate of money supply (M1), which averaged -0.83 percent (showing a restrictive monetary regime) during 1983-1989 (Fosu, 1989) increased to 37.5 percent during 1990-95. This

trend of fiscal and monetary indiscipline has stimulated serious inflation consequences with the inflationary rate as at October 2001 being about 30 percent. With the depreciation of the cedi and flexible exchange rate regime which allows a currency to find its own level based largely on economic forces, most African countries are left exposed to higher inflationary rates because they have no base that would allow a national currency to strengthen (West Africa, no.4263, 19th-25th February 2001).

Agriculture is the backbone of Ghana's economy with an annual growth rate of 3.2 per cent. The sector contributes about 43 per cent to the GDP and is a major foreign exchange earner of the country. The sector also employs about 70 percent of the total population (World Bank, 1993), provides food for the ever-increasing population which has an annual growth rate of 2.6 percent which is well above that of developed countries (1.6 percent). Agriculture is also a major source of raw materials for both local industries and for export. Exports of primary commodities constitute the major source of Ghana's foreign exchange earnings. Cocoa cultivation occupies about 50 percent of the cultivated agricultural land area, employing about 24 percent of the active labour force.

In post independence Ghana, revenue from mainly cocoa export which accounts for two thirds of the country's total export earnings has been used to finance economic development (MTADP, 1991). Over dependence on one sole traditional export crop, cocoa (which is usually exported raw without much added value) and a few other commodities like timber and gold with their fluctuating world market prices, has often resulted in deficit balance of payments for the

country. For instance, at the London terminal market the price per ton of cocoa fell from 3,000 pounds in 1977 to 650 pounds in 1989 (UNCTAD, 1989). Unfortunately, fluctuating world market prices for cocoa and other primary commodities coupled with high crude oil import bills have led to unpredictable revenue pattern for the country.

Part of the agricultural reforms under SAP consisted of diversification of agricultural production and export to include non-traditional export crops like pineapple, banana and cashew. Pineapple has received priority attention since the exploration of export potentials and market for Non-Traditional Agricultural Export (NTAE). Currently, Ghana's horticultural exports, mainly pineapples and yams, generate an (fob) value of approximately US$ 20 million (GEPC Data files). Export percentage of the total pineapple production in Ghana has proved difficult to verify. While FAO figures register a production of 35,000 metric tonnes for two years, local producers regard this as a very underestimated figure and made an estimate of 180,000 metric tonnes (TechnoServe, 1998). Export volumes have been increasing in the last five years from 9,754 metric tonnes in 1992 to 25,124 metric tonnes in 1997. The profitability of pineapple cultivation (¢1,500,000 per hectare as compared to ¢1,150,000 per hectare for maize) has led to increases in the cultivation of the crop and land value in the production areas. Dixie and Sergeant (1998) report that between 1984 and 1997, non-traditional export revenue increased from US$1.9 million to US$ 330 million and that the value of horticultural export in Ghana grew at about 30 per cent annually within the period.

Despite the importance and profitability of the production and export of pineapple as a good foreign exchange earner and an a priori expectation that increased production is directly

correlated with increased size of the farm, most pineapple farmers in Ghana, and in the Akuapim South District in particular where a substantial volume of pineapples are produced, tend to cultivate small farms rather than large ones. This gives rise to the following question: Why do most pineapple farmers in the Akuapim South District tend to cultivate small farm sizes, given the export potential of this crop? Related issues are: What is the organisational structure of pineapple production and export in the aforementioned district? What is the pattern of distribution of pineapple farm size in the study area? Are there significant differences between the productivity of large and small pineapple farms? What factors affect the choice of farm size in the production of pineapple in the study area? What are the directions and quantitative effects of these determinants on the choice of farm size? These are the issues, which the present study addresses.

In Ghana, farms, which are less than 1.6 hectares, are classified as small farms, whereas those, which are at least 1.6 hectares, are categorized as large farms (MOFA, 1999).

1.2. Objectives of the Study

The primary objective of this study is to quantify the effects of the determinants of choice of farm size by pineapple farmers in the Akuapim South District, Ghana.

The specific objectives are the following:

1. To describe the organisational structure of pineapple production in the Akuapim South District.
2. To describe the pattern of distribution of pineapple farm size in the study area.
3. To compare the average land and labour productivity and average cost of producing pineapple under small and large farm sizes in the study area
4. To identify and quantify the effects of the factors, which affect the choice of pineapple farm size in the study area.

1.3. Relevance of the Study

The potency of any policy geared towards sustainable growth and development depends on reliable empirical evidence. The results of the present study will serve as a basis for the diversification policy for the Ghanaian economy at both rural and national levels. The results will also help to promote the growth and development of the pineapple industry as a viable foreign exchange earner and improve employment opportunities, incomes and the standard of living of the people. The introduction of new technology and capacity building as well as the stimulation of private entrepreneurship will also be enhanced. Increases in potential pineapple exports call for the expansion of its production. Such expansion is only possible if policy makers have full understanding of the factors, which affect the realization of the full potential of such production ventures. The present study contributes to such understanding. Although some literature exists on the growing importance of Ghana's pineapple exports on the world market, more current research will be in the right direction. The focus of most of the relevant existing literature is on macro rather than micro issues and this leaves some questions unanswered as far as specific crop production is concerned.

There are reasons why the study of farm size has been of interest to researchers. First, farm size relates to poverty in rural areas, low incomes and a desire to ensure some minimum level of living for farm people (see for instance Wolgin, 1975). Second, it has to do with business management; that is, finding combinations of resources that are productive, and discovering ways to combine them successfully on individual farms. Third, it is related to efficiency: that is, it deals with what is the least cost or best way to use a given bundle of resources not only on individual

farm units but across whole groups of farms. Fourth, it relates to distribution: that is, who is it that controls land and agricultural resources and how broadly or narrowly are these resources distributed among farmers and others. Farm size is clearly a policy issue. At one level the focus of concern is on individual farmers and their welfare. At another it centres on society as a whole and such questions as who gains and who loses with changes in farm structure over time and how much power is concentrated in the hands of how many. Publications containing some analysis of pineapple production such as working papers and special reports by Ghana Export Promotion Council (GEPC), International Trade Centre (ITC), Ministry of Trade and Industry (MOTI), Ministry of Food and Agriculture (MOFA) are often not readily available. With the high level of competition on the world market, the study will go a long way to help Ghana increase her production and share of the world market for pineapples. The study should also prove valuable to all stakeholders of the pineapple industry, namely, appropriate government Ministries and statutory bodies, private producers and exporters, NGOs, importers and wholesalers, potential investors, researchers and students in the field of pineapple production. Finally, the Akuapim South District is selected because it is a major pineapple-producing District in Ghana.

1.4. Organisation of the Study

The study is structured into five chapters. A review of the existing literature on the determinants of choice of farm size by pineapple farmers is presented in Chapter 2. Chapter 3 outlines the methodology employed to achieve the objectives of the study. The sources of primary and secondary data and a description of the study area are also presented in this chapter. The empirical results are presented in Chapter 4. Finally, the summary and policy recommendations are distilled in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

This chapter begins with a brief history of pineapple production in Ghana. The export structure and the economic performance of various Sub-Saharan African countries are then examined. The need to diversify the economy of Ghana to include non-traditional crops especially pineapple and the implication of pricing on the expansion of pineapple production are discussed. The importance of pineapple to the Ghanaian economy is then highlighted. Issues of categorisation of farm size and identification of the determinants of farm size are also outlined. The chapter concludes with the choice of a suitable model employed in the present study, giving reasons for its preference over other models.

2.1. Brief History of Pineapple Production in Ghana

According to Haizel (1971), Anokye (1975) and Solomon (1976), the use of pineapple as food, for medicinal purposes and for making clothes dates back to the beginning of the 16th Century. Although smallholder farmers have a long history of pineapple cultivation which dates back about fifty years, the growth and development of the industry came to limelight in the last two decades, with the advent of the Economic Recovery Programme (ERP) and the diversification of the production base of the country to include Non-Traditional Agricultural Export commodities (NTAE).

Pineapple originated from South America and was introduced into West Africa around 1602 by Portuguese traders. In Ghana, pineapple was first grown in the Samsam village in Greater Accra Region, which has remained one of the leading pineapple-producing areas in the country (Pinto, 1990). Nationwide cultivation of the crop only started during the latter part of the 19th Century when there was rapid agricultural development by various Christian missions and the government. Agricultural stations were for the first time used for experimental and extension purposes in 1886 (La Anyane, 1963). This stimulated the cultivation of coffee and fruits including pineapple. Pineapple cultivation also received greater attention with the establishment of the Botanical Garden at Aburi in 1890 (Ibid). Cultivation of the crop was however later hampered by the incidence of diseases and pests, leading to its temporary neglect. The establishment of the Nsawam cannery in 1940 boosted commercial cultivation of pineapple. Today, pineapple is widely grown throughout the tropics and subtropics.

The cultivation of pineapple in Ghana is fragmented with a small number of independent, relatively large producers; a slightly larger number of medium-sized producers and a large majority of small producers. The level of technology practised varies widely with the larger producers at the top and the small producers at the lower end. Pineapple production provides a good source of income and is a more lucrative venture than other cash crops (TechnoServe, 1998). The ' Smooth Cayenne' is the most widely grown variety in Ghana. This variety is regarded as of higher quality when compared with pineapples from Cote d'Ivoire and Costa Rica, thus positioning Ghanaian pineapple as premium quality pineapple in the international market. Africa's yellow pineapples are highly desirable in Europe.

The major world producers of pineapples are Thailand, Brazil, the Philippines and India respectively (Table 1). As these countries mainly produce for local consumption, the main pineapple exporters are Costa Rica, Cote d'Ivoire and the Philippines (Table 2).

Table 1. Pineapple Production by the Major World Producers

Country	*1994*	*1995*	*1996*
Thailand	2,087,707	1,986,700	2,000,000
Brazil	1.371,000	1,622,770	1,936,520
Philippines	1,542,240	1,630,940	1,700,000
India	1,060,000	1,100,000	1,100, 000

Production figures are in Metric Tonnes

Source: FAO Database

Table 2. Pineapple Export by the Major World Exporters

Country	1994	1995	1996
Costa Rica	45,832	49,735	64,314
Cote d'Ivoire	120,311	119,565	153,720
Philippines	161,512	163,524	143,994

Export figures are in Metric Tonnes

Source: FAO Database

2.2. Diversification of the Production Base of the Economy of Ghana

The Government of Ghana has actively promoted non-traditional exports (NTEs) in an attempt to reduce the country's traditional dependence on cocoa. Since April 1983, Ghana has undertaken a series of comprehensive macroeconomic policy reforms and structural adjustment aimed at reversing the economic decline, increasing the capacity of the economy to adjust to both external and internal shocks and generating sustainable growth and development (Ibid). A prominent feature of the Stabilization and Structural Adjustment Programme (SSAP) has been additional support for NTEs. The strategy focused on increasing exports of a variety of high value products, which are suitable and economical for production and manufacture in Ghana. Policies and institutional capacities were established to support and facilitate the marketing and export of these products by the private sector. Between 1984 and 1997, NTE increased its revenue from US$1.9 million to US$330 million (Dixie and Sergeant, 1998). This dramatic increase in revenue gives an indication of the important role the sector plays in the current national economic development.

Non-Traditional Agricultural Exports (NTAEs) constitute an important sub-sector of the overall Non-Traditional Export (NTE) sector. Horticulture production in Ghana has also made major contribution to the NTAE sector and has been actively promoted by the Agricultural Diversification Project. Dixie and Sergeant (1998) report that the value of horticultural export in Ghana grew by about 30 percent annually over the period 1992-98 and therefore has been the fastest sub-sector growth rate in Sub-Saharan Africa. Indeed, the need to expand production and

diversify the commodities in Ghana's export programme was realised as far back as the pre-independence era (La Anyane, 1963; Boamah, 1976; Frimpong, 1979; GEPC, 1992).

The colonial government's agricultural policy during the period was geared towards producing export crops and raw materials, which were in demand in Britain and other Western countries (Okyere, 1988). The infrastructure development programme, which focused on the southern part of the country, transformed Ghana into a leading world cocoa producer (Ibid). Only insignificant quantities of kola nut and coconut were exported.

Development plans (Government of Ghana 1963, 1967, 1970 and 1977) also reveal that various laudable measures were formulated to diversify the production and export of Ghana's crops. La Anyane (1963) observed that the need to diversify Ghana's agricultural production in order to spread the risk associated with one-crop economy was vigorously pursued, and farmers were encouraged to grow other crops than cocoa for export. GEPC (1992) however asserted that the country achieved very little results by way of diversification by the end of the 1970s. As at the time, NTE still represented a small fraction of total exports (Noye, 1976; Frimpong, 1979).

In 1991, the World Bank financed an Agricultural Diversification Project in Ghana to further promote the expansion of NTAEs. Currently, over 60 products are being exported and pineapple (as well as other NTAE crops) have seen dramatic production increases, partly in response to the government's promotional efforts and partly as a response to the ongoing decline of cocoa trade (Ampadu-Agyei, 1995).

Examining the effects of NTAEs on the Ghanaian economy, social structure and environment, focusing on pineapple, Ampadu-Agyei (1995) identified the following advantages which NTAEs have brought to the economy: diversification of the economy at both rural and national level, increased foreign exchange for the nation, improved employment opportunities and income, introduction of new technology and capacity building and stimulation of private entrepreneurship.

2.3. Importance of Pineapple to Ghana's Economy

As earlier mentioned, Ghana's horticultural exports mainly, pineapples and yams, currently generate an fob value of approximately US$ 20 million (these figures are based on statistics which are thought to underestimate the total tonnage of horticultural exports by 10-20 percent). Export percentage of the total pineapple production in Ghana has however proved difficult to verify. While FAO figures register a production of 35,000 metric tonnes for two years, local producers regard this as a very underestimated figure and made an estimate of 180,000 metric tonnes. Export volumes have been increasing in the last five years from 9,754 metric tonnes in 1992 to 25,124 metric tonnes in 1997. The profitability of pineapple cultivation (¢600,000 per acre as compared to ¢46,300 per acre for all crops) has led to an increase in the cultivation of the crop and land value in the study area (TechnoServe, 1998). During the 1980s and early 1990s, Ghana carved out a niche as the primary supplier of top quality airfreighted golden pineapple to Europe. Currently, Ghana is the dominant supplier of airfreighted golden pineapples with a market share of over 60 percent and in terms of volume; Ghana is the third largest exporter of pineapple to the EU behind Cote d'Ivoire and Costa Rica (Table 3).

Table 3. Pineapple Imports into the EU by Source, 1991-97

Country	1991	1992	1993	1994	1995	1996	1997
Cote d'Ivoire	134,795	132,062	111,915	120,311	119,565	153,720	NA
Costa Rica	34,149	38,271	39,409	45,832	49,735	64,314	NA
Ghana	6,766	7,126	10,917	13,746	11,817	22,199	23,793

The figures in the Table are measured in metric tonnes

Source: Dixie and Sergeant (1998)

Almost all commercial farms in Ghana source either from out-growers or smallholders to supplement fruit from their own farms for export. This is because, commercial farms are not sufficiently large to meet export market demand and the capital investment involved in expanding a commercial farm is high. A recent study commissioned by USAID estimates that approximately 600 small-scale farmers are producing pineapple in Ghana (TechnoServe, 2000).

2.4. Marketing, Cost and Profitability of Pineapple Production

The main target of Ghana's pineapple production is the export market. By 1997 there were about fifty registered exporters exporting mainly to Europe including countries like Belgium, Switzerland, the Netherlands, Germany, UK, and Italy. Dixie and Sergeant (1998) point out that most exporters source about 45 percent of their export from out-growers and smallholders to supplement production from their own farms. The main destinations of Ghanaian pineapple are Belgium, Switzerland, Netherlands and Germany (COLEACP, 1998; Dixie and Sergeant, 1998).

Tables 4 and 5 give the breakdown of the volumes exported to the main European destinations and to the Rest of the World.

Table 4. Initial Destination of Pineapple Exports to Europe, 1999

	Belgium	Switzerland	Netherlands	Germany	UK	Italy	France
Volume (MT)	14,300	5,450	3,000	2,600	1,000	850	275
Percentage	52	20	11	10	4	3	1

Source: Dixie and Sergeant (1998).

Table 5. Ghana's Total Volume (MT) of Pineapple Exports to the World

Year	1993	1994	1995	1996	1997	1998 1st Quarter
Quantity	13,157	14,954	15,764	27,603	25,124	6,161

Source: Ghana Export Promotion Council and Ministry of Trade, Accra.

SPEG (1998) estimates that the total (fixed plus variable) cost of production for commercial producers range between US$0.32 and US$0.39/kg. Dixie and Sergeant (1998) have estimated growing costs at US$0.08 to 0.12/kg and packaging costs at an additional US$0.12 to 0.15/kg.

Available price data show that the export market is more attractive than any of the domestic alternatives. In fact, farmers may on occasion not cover their production costs when fruits are sold locally. Crop budgets have estimated profits for smallholders engaged in pineapple cultivation in the order of ¢3.5 million per acre, assuming that 60 percent of fruit is sold on the

export market (TechnoServe, 1998). A typical crop budget is presented in Table 6 whereas Table 7 shows revenues and net margins for the different market options discussed.

Table 6. Summary of Pineapple Production Costs (cedis per acre), 1999

Cost Item	Cedis/acre	Percentage of Total Cost
Land Preparation	121,500	4
Purchase of Suckers	1,160,000	35
Treatment of Suckers	85,000	3
Planting of Suckers	120,000	4
Application of Chemicals	474,000	14
Application of Fertilizer	292,000	9
Forcing	144,000	4
Harvesting	150,000	5
Total Variable Cost	2,546,500	77
Total Fixed Cost	750,960	23
Total (fixed + variable) cost	3,297,460	100
Total Net Harvest (Kg)	22,950	
Total Cost per Kg	144	

Source: TechnoServe (1998)

Table 7. Market Options and Net Margins for Smallholder Pineapple (Cedis/acre), 1999.

Item	Processor	Local Market	Export
Price/kg	150	120	400
Total Cost/kg	144	144	144
Net Profit (Loss) ¢/kg	6	(24)	256
Total Net Harvest (kg)	22,950	22,950	22,950
Percentage Harvest for each Market	20	20	20
	(4,590kg)	(4,590kg)	(4,590 kg)
Net Profit (Loss) ¢/kg	29,008	(108,692)	3,529,524

Source: TechnoServe (1998)

Many producers complain that the industry suffers from low prices, which do not reflect the cost of production. FOB prices of Ghanaian pineapple have been declining over the past twenty years and this has squeezed the profitability of many producers. The decline in price is attributed to pineapple's transition from an exotic, luxury good to a standard good which carries with it loss in value. Exacerbating this is the general downward trend in prices of perishable commodities as increasing numbers of substitute and competing products become available on the global market (COLEACP 1998, ECOBANK Ghana 1998). Other factors, which have contributed to the decline in prices for Ghanaian pineapple exporters, include increasing competition from large Central American producers, particularly Costa Rica. The restructuring of European retail trade and increasing buying power of multiple retailers has squeezed prices for producers (Dixie and Sergeant, 1998). The fragmented nature of the Ghanaian export industry means that it has no representation in Europe and as a consequence producers have weak negotiating position with buyers. The prices for sea-freighted pineapple range between US$0.43 and US$0.57/kg, which are higher than prices of airfreighted fruit, which range between US$0.45 and US$0.50/kg. However, the price is very much dependent on quality. According to COLEACP (1998), there is a rising demand for products of a very high quality at very low cost. The declining fob prices experienced by Ghanaian producers may also be as a result of inconsistent quality and supply and the increasing competition from the Del Monte Extra Sweet variety.

The most profitable companies achieve returns of up to 30 percent on turnover although majority of companies are operating on very small profit margins (Dixie and Sergeant, 1998). The pineapple export industry is not obtaining a competitive return on investment. Exporters who

provide their out-growers with inputs and credit can be assured that the quality of their fruit meets the export specification. By pooling resources and increasing the scale of their business, commercial farmers could improve upon their profitability, have more negotiating strength, and reduce their costs through bulk purchases of inputs and joint marketing. Table 8 gives the estimated net margins for commercial and smallholder producers.

Table 8. Estimated Net Margins for Commercial Producer and Smallholder (US$ per metric tonne), 1999

	Exporter	Smallholder
Revenue (US$ per MT)	450-500[1]	170[2]
Costs (US$ per MT)		
Growing Cost	55[3]	48
Purchase of Smallholder Fruit	76.5[4]	
Packaging	120	
Fixed Costs	130[5]	13[6]
Total Cost (US$ per MT)	381.5	61
Net Margin (US$ per MT)	68.5-118.5	109
NET Margin as Percentage of Turnover	15%-24%	64%

1 FOB price $450-$500/MT.
2 Smallholder purchase price ¢400/kg, equivalent to $170/MT
3 Assumed as 55% of total export supply with growing costs ranging ($0.087-$0.12)
4 Assumed as 45% of total export supply with purchase price ¢4000/kg
5 Based on estimated figures from APEG
6 Based on crop budget calculated by TechnoServe

Source: TechnoServe (1998)

2.5. Quality Issues

Closely related to pricing is the issue of the quality of the pineapple fruit. Exporters often express dissatisfaction with the quality of the fruit of out-growers and smallholders. Smallholder fruit may be of poor quality because recommended production techniques, for example the use of fertilizers, are not strictly followed in order to save money. Small holders in turn complain that due to delayed payments, they cannot afford to purchase potash and nitrogen fertilizer (urea) to mix in the right proportions for production. High levels of potash in the mix gives rise to firm fruits and improves the shelf life of the fruit (TechnoServe, 1998). Too much urea on the other hand improves the fruit size. There are often difficulties with tracing farmers who produce poor fruits because export boxes of individual farmers are not marked.

Out-grower fruit is however more reliable in terms of quality. Where out-growers are supplied with high quality agro-chemicals they sell them in the market and purchase cheaper substitutes (TechnoServe, 1998). Quality problems are seasonal. In the dry season, quality is generally good and pineapple can be freighted by both sea and air. From April, quality becomes less reliable with the onset of the rainy season. Pineapples become water logged and develop black spot and other rot (TechnoServe, 1998). To reduce the risk of spoilage, pineapple is usually airfreighted during the summer months. This coincides with the peak fruit period in Europe when there is competition from other fruits, the demand and prices for pineapple are low and volume of export decline.

2.6. Post Harvest Losses

The infrastructure servicing the pineapple export industry is not well developed and this leads to deterioration in quality before the fruit reaches the port. Lack of cold stores at the Kotoka International Airport and Tema Harbour, shortage of on-farm cold stores and pack houses all contribute to the deterioration of the fruit. To circumvent these problems, most of the activities related to the harvesting of pineapple are carried out in the night, shortly before the aeroplane or ship departs.

Airfreight is better and faster than sea freight and is always employed to avoid the damage and deterioration of the pineapple fruit. It is however more expensive (US$0.50 – 0.65/kg) than sea freight (0.20/kg) (Table 9). Sea freight takes a long time to reach its destination.

Table 9. FOB Price for Air Freighted Pineapple (US$ per kg)

Year	*FOB Air Freighted Pineapple Price/kg*
1993/94	0.65
1994/95	0.60
1995/96	0.55
1996/97	0.50
1997/98	0.45-0.50

Source: Ghana Export Promotion Council

2.7. Research and Technical Support

Farmers lack technological know-how to increase yields and reduce production costs. Local researchers are also criticised for taking a long time to react to problems on the farm; for example, disease identification and recommendations for solutions (TechnoServe, 1988).

2.8. Classification of Farm Size

What constitutes a small or large farm varies from country to country. Farm size may be classified based on total sales per unit land area, land area, level of capital investment, labour input level or combinations of these, among others. In the United States, for instance, Hall and LeVeen (1979); Heady and Sonka (1974) classify small farms as those between 100 and 232 acres, which have total sales of $140,000 and $10,000 respectively. In Kenya, Wolgin (1975) indicates that Kenyan agriculture has historically been divided into large scale farms and small scale farms on the basis of ownership, viz., expatriate and African holdings respectively. In Pakistan, Khan and Maki (1979) define large farms as those, which are greater than 12.5 acres. Kalirajan (1981) defines small farms as those, which are less than one hectare, and large farms as those, which are greater than one hectare in a study on India's Coimbatore District.

In Ghana, farm holdings in agricultural census are divided into four size classes: less than 1.6 hectares, 1.6 - 4.0 hectares, 4.0 - 8.0 hectares and greater than 8.0 hectares. Smallholdings are classified as those which are less than 1.6 hectares; that is, about 4 acres (MOFA, 1990).

About 90 per cent of agricultural households in Ghana have small holdings. Farm size has also been classified according to the access of the farmer to the export market (TechnoServe, 1998). On that basis, smallholder farmers are those who do not have access to the export market, whereas large scale or commercial farmers have direct access to the export market and supplement their production by purchases from smallholders and out-grower farmers.

Whereas the arable farmer may classify farm size as the area of land under cultivation at a particular time, the cattle breeder may define size as the number of herd of cattle in his farm. A poultry farmer will likewise define farm size as the number of poultry birds in his farm.

Most literature on allocative efficiency in agriculture find that peasant farmers are reasonably efficient (Hopper 1965, Massell 1967, Yotopoulos 1967, Massell and Johnson 1968, Sahota 1968, Chemareddy 1969). Wolgin 1975 again asserts that such allocative efficiency is misspecified if farmers are making their decisions in the presence of risk. He concludes that small-scale farmers in Kenya under the condition of uncertainty behave as efficient, risk averse entrepreneurs.

On the contrary, Khan and Maki (1979) stated that the major argument often used against land reforms is that large farms are more efficient than small farms. There is also the belief that the price of increased equity is reduced growth. An operational concept of economic efficiency developed by Lau and Yotopoulos (1971, 1972) and Yotopoulos and Lau (1973) to measure and compare performance of farm firms concludes that differences in economic efficiency among

small and large farms may result from technical efficiency (large output with equal amount of input) and price efficiency (higher profits).

Profit maximization is implied if the value of the marginal product of each variable input is equal to its price under competitive conditions. Although the question of relative economic efficiency of large farms is central to a discussion of land reforms in underdeveloped countries, there is little empirical research due to lack of adequate disaggregated data. Some evidence for India has been presented by Yotopoulos and Lau (1973), indicating that small farms are more efficient than large farms. However, studies by Sidhu (1974) for wheat in the Indian Punjab and by Khan and Maki (1979) for wheat and rice in Pakistan conclude that there is no difference in efficiency by farm size. Whereas Bhattacharya and Saini (1972) endorse an inverse relationship between land size and its productivity, Rao (1963) and Rudra and Bandhopadhyay do not believe in the existence of an inverse relationship and argue that no systematic relationship can be established between any two variables describing land size and productivity. Bharadwaj (1974) and others dismiss the statistical validity of an inverse relationship, but generally accept it as a 'stylized fact.' Vaman and Chiogeat (1981) conclude that higher productivity is associated with large farm size holdings under infused hired labour and modern capital. Feder, Lau and Slade (1987) indicate that very high benefits accrue from investment in extension training and visit activities and that such benefits are as a result of improvement in management rather than the use of more inputs.

2.9. Determinants of Choice of Farm Size in Pineapple Production

According to Wolgin (1975), there are four primary factors in agricultural production, viz., land, labour, capital and the availability and accessibility to purchased inputs. Of these, land, most labour, and some capital can be classified, as traditional inputs owned by the farmer for which there are few well-defined markets. Purchased inputs include fertiliser, agro-chemicals, planting materials and miscellaneous inputs like tools and equipment. The critical problem facing farmers in Kenya who want to expand production is the scarcity of short-term and medium-term credit (Wolgin, 1975) and this inhibits agricultural growth. In Ghana the situation is not different. Rourke (1969) contended that agricultural output may be considered as a function of the amount and quality of land, and other physical resources available, of the capital equipment available, of labour resources available (including managerial and other skills available) and of technology.

Dadson (1969) stated that the size of a farm an owner operates depends on what he is able to acquire in the first instance. He argued that, under share tenancy, the landlord in seeking to maximize production (or value of share product) would want the tenant to apply as much of his (tenant's) resources as possible to the land, on the other hand, the tenant would wish to clear and farm as much land as is consistent with his labour and capital. The straight cash tenant would tend to farm a smaller area than the share tenant. The actual result would depend on the bargaining. The size of a farm according to Dadson (1969) also depends on other inputs besides land. Altering the capital input may vary farm size. He concludes that cash lease or owner-operator ship provides a cost and returns environment, which facilitates economic efficiency in the use of

resources on the farm and assures tenants of the full benefits of a new technology that, raises productivity and lowers the cost of production.

An important feature which influences the supply of land resources for farming is the land tenure system. The rights in land may be held as a communal property or private property according to whether they are held by the society as a whole or by the individuals in the community respectively (La Anyane, 1988). Pineapple lands are, however, largely farmed under tenancy arrangements through leasehold. In the study area, most lands are communal. However, for those who rent land, rents are paid in the form of cash; a fixed charge for the use of the land irrespective of the yields and total returns from the farm is agreed upon for a period of time. Hiring periods for land lasts for just a season; however, leases may be up to 99 years, but 50 years is a common duration. Communal lands under pineapple cultivation are few and these are largely traditional farms cultivated for the domestic market.

Many farmers have experienced problems with land ownership. In Ghana, land rights are often unclear and there are many instances of disputes arising from compensation claims by people who have been displaced from the land or claim ownership to it. Most land is communally owned in Ghana with ownership vested in a land owning-group, which can either be a family or a clan. Each member has access to right of the land unless it has already been allocated. Any land so acquired cannot be sold without the consent of all the members of the land owning-group. Land can also be granted to an outsider under *abusa* agreement, a traditional share cropping arrangement whereby a third of the production goes to the landowner. In recent years, needs for

commercial production have led to drastic changes in the communal system of land ownership (TechnoServe 1998). Export liberalization policies launched under the ERP in 1984 have resulted in a land consolidation process in some pineapple producing areas, with small farmers being displaced by large scale producers (TechnoServe 1998). Long-term leases of 50 to 80 years and outright sales have also become increasingly common.

In Kuntuse, a pineapple growing village for example, about 50 percent of the pineapple farmers, most of who are from other parts of the country, obtained their land by direct purchase or leasehold (Ampadu-Agyei, 1995). The profitability of pineapple cultivation (¢600,000 per acre as compared to ¢46,300 per acre for all crops) has led to increase in land values and rent in the area (Goldstein and Udry 1998). This favours large-scale producers who have access to sufficient capital to buy out smaller farms. In the process, land is being consolidated into the hands of fewer people and thereby squeezing out small farmers who were producing food crops for domestic consumption. As the returns of domestic production are generally less than those of export, these small farmers rarely have the capital to switch to export crops. As a result, they often sell out to the large-scale producers. Those who remain find themselves forced to cultivate increasingly marginal land, particularly on unstable hillsides thereby exacerbating deforestation and land degradation. It is from these displaced farmers that the large-scale pineapple producers obtain much of their labour (Ampadu-Agyei, 1995).

Onyenwaku (1994), using production function analysis, observed that efficiency in the use of resources in Northern Nigeria is a major determinant of the choice of farm size. He

asserted that technical efficiency is higher in irrigated farms than unirrigated ones. Both farm types were found to be allocatively efficient in the use of resources considered in the study. In relative, terms however, irrigated farms were more allocatively efficient in the use of land.

Substantial amount of research has been undertaken to test the hypothesis posed by Schultz (1950) suggesting that peasant agriculture might be efficient within the context of traditional technology and factor availability. If farmers act rationally, it follows that growth in agricultural productivity can be achieved by increasing factor availability and providing technologies and one needs not worry about the problem of peasant values and attitudes (Nair, 1961). Most literature on allocative efficiencies in agriculture is based on determining whether the ratio of the mean marginal product of any input equals its price. By such a measure, most studies have found peasant farmers to be reasonably efficient Hopper 1965, Massell 1967, Yotopoulos 1967, Massell and Johnson 1968, Sahota 1968 and Chemreddy 1969). Even though Dillon and Anderson (1971) are generally critical of the methodology employed, they concluded that using a probabilistic technique does not change the conclusion arrived at above.

Farm management and production economists were of the opinion that to improve resource efficiency and farm family income, labour needed to move out of agriculture into better income-producing off-farm occupation, and that as labour moves out, farm numbers decreased and income of remaining farmers increased with absorption of land resources (Martin, 1977).

The assumption was that in the adjustment, there were sufficient economies of size to be exploited in farming. Bachman and Barton (1954) urged a stepping up of the trend towards large farms. They argued that the adjustment would improve efficiency and income per worker. Between 1955 and 1965, a fair number of studies were made to determine the nature of economies or diseconomies to size in farming. Using regression analysis, Ottoson and Epp (1956) found no cost advantages for farms above 160 acres but a number of other studies showed important economies to size in farm production. Miller and Back (1958) studied size and efficiency of farms in the Great Plains area in the United States of America and concluded that farmers lagged in adjustments in size and efficiency in relation to the potential adjustment made possible by technology. Using alternative approaches, viz., budgeting, programming and regression, Carter and Dean (1961) studied cost-size relationship for cash crops in California. Their study showed substantial economies up to $150,000 of output. They concluded that a wide range of farms would continue to exist because their unit costs are approximately constant over a wide range.

Hallberg (1969) in objecting to the use of Markov chain model in projecting future size distribution because it is based on the assumption that transition probabilities remain constant over time, suggested the use of a method based on multiple regression technique whereby the constant transition probabilities are replaced by probabilities as a function of various factors including the structural characteristics of the industry. Dadson (1969) attributed the failure of large mechanized farms to gross inefficiencies, lack of inputs and technical know-how on the part of management. Farm size adjustment studies typically gave no attention to the social and community impact of

fewer farmers. Raup (1969) alluded to this in past studies and to what he considered to be other shortcomings of existing studies where he stated that they are static, they fail to show the capacity of different sizes to adjust to land values, they do not provide for growth in management and they fail to discuss changes in size in relation to social and community effects. Most studies have shown that important economies to size exist but that most of these are exhausted within the scope of family farm operation. Krause and Kyle (1970) took issue with this conclusion when pointing to the shortcomings of past research on size. They suggested that past studies had primarily emphasised internal technical and engineering economies with a focus on family-sized units and single product analysis. Ignored were economies of buying and selling and common ownership of related farms and non-farm activities. Identified incentives for establishing large scale units were higher net product prices as a result of eliminating some marketing steps, decreasing costs because of volume discount opportunities for organising off-season supplementary business activities that may lower labour and machinery costs, better business management and federal income tax incentives.

In studying farm size, some management and production economists have used Cohort and Markov process analysis to project the expected future number and size distribution of farms. Kanel (1963), using Cohort Analysis measured the differences in the way in which various age groups participated in agricultural adjustments. His studies showed that for the 1950s the limited number of young people entering farming had been a major factor in decrease in farm numbers, since older farmers in the 1950s left farming at about the same rate as in several other previous

decades. Hallberg (1969) pointed out the inappropriateness of the use of the first order Markov chain model in projecting future size distribution of firms.

The debate regarding the best method to measure farm performance, the choice of farm size and resource use efficiency is central to agricultural production economics. Following the principles of production economics as provided by the theory of the firm, profit maximization or cost minimization constitute the primary objective of the farm business, although many economists argue that the assumption of perfect competition is a mere delusion (Phiri, 1991). Dilan (1979) supports the view that knowledge about the future is imperfect and therefore decision-making in agricultural production takes place in an environment of uncertainty more especially in underdeveloped agricultural systems regardless of the status of the decision maker. Since all the farmers in the study area purchase their inputs and sell their produce in the same market, variation in input and product prices are generally insignificant within short periods. Profit maximization is therefore a better approach to determining the factors, which affect the choice of farm size by farmers. This forms the basis for estimating the effects of the determinants of the choice of farm size by pineapple producers in the present study.

The desire to reflect uncertainty of future events within decision-making has led to a number of risk models. Many of these models reflect the decision maker's expectations of possible outcomes and their probabilities along with the decision makers' attitude towards risk. Methodological approaches to risky decision problems range from using conservative estimates for the uncertain elements, for example pessimistic price, through methods, which include

probability density functions for uncertain parameters. A class of later models, which have arisen, is the Expected Value-Variance (E-V) model or Tobin Markowitz model. These models are used to estimate decisions involving risks. The main criticism about the E-V models is their expected utility formulation. This notwithstanding, E-V models has been used by economists in estimating decisions, which involve risk (Levy and Markowitz, 1979, Hanoch and Levy, 1969). Maximizing expected utility is the predominant theoretical foundation for risk analysis. This concept asserts that a particular alternative is preferred to another as long as the expected utility of the first is greater than that of the second. E-V analysis maintains that the solution to expected utility maximization is equivalent to the maximization of linear combination of the first two moments of the distribution of wealth. The expected utility assumption underlying E-V analyses is controversial. E-V analysis assumes that the decision process is characterised by a quadratic utility function, an underlying normal distribution of wealth, a situation in which risk is small in relation to the decision maker's wealth and E-V solutions are reasonable approximations to the expected utility solutions (Levy and Markowitz 1979; Tsiang 1974). These assumptions have been repeatedly debated. The quadratic utility assumption has been criticized because of its risk aversion assumptions (Arrow, 1974). The symmetry implied by the normality assumption has been criticized (Hanoch and Levy, 1972). The small risk assumption has been criticised because some situations do not involve risks, which are small; and the close approximation assumption (Levy and Markowitz 1972) can be criticised because the approximation may not be close enough (see Hanoch and Levy, 1972 p. 344).

The criticisms leveled against E-V analysis have not limited its widespread application. However, it would seem desirable to develop a solvable expected utility maximization model, which is free of restrictions on the forms of the utility function (particularly regarding the sign of the risk aversion parameter and its derivative with respect to wealth, and free of the assumptions regarding the distribution of the uncertain parameters.

The E-V model cannot be used in the present study because all the data are cross sectional data collected at one point in time and therefore shows less variability. The product is also assumed to have a uniform price since it is sold in the same market. The small sample size of the present study is another limiting factor to the use of the E-V model. Notably, a sample size of 200-300 farmers constitutes the appropriate sample size in the E-V model.

From the literature review undertaken in the present study, the major determinants of choice of farm size are the difference in economic efficiency between small and large farms (higher profits) (Yotopoulos and Lau 1973; Onyenwaku 1994) higher productivity associated with large farm size under infused hired labour and modern capital (Vaman and Chiogeat, 1981), scarcity of short term and medium term credit that limits expansion of farms (Wolgin 1975) amount of farmer's own resources, type of tenancy and the accessibility of other inputs such as capital (Dadson, 1969). The profitability of pineapple cultivation (¢600,000 per acre as compared to ¢46,300 per acre for all other crops) has led to an increase in land value in the study area. This favours large-scale farmers who have access to sufficient capital to buy out small farms. The age group of farmers can also affect the choice of farm size (Kanel, 1963). Profit maximization or

cost minimization is the primary objective of the farm business (Phiri, 1991). Implied in the above objective are labour cost, cost of fertilizers, agro-chemicals and capital. The failure of large mechanized farms in the past was attributed to gross inefficiencies, lack of technical knowledge and inputs (Dadson, 1969).

CHAPTER 3

METHODOLOGY

This chapter outlines the methodology used to achieve the objectives of the study. The theoretical framework as well as the statement of hypotheses validated in the study are also outlined in this chapter. The empirical econometric model employed in the study, a description of the study area, the relevant variables and sources of data employed in the study are indicated.

3.1. Organisational Structure of Pineapple Production and Export

The performance of any productive venture is a reflection of its organisational structure and conduct. The economic aspects of organisation of the pineapple industry in terms of linkages between the producers, processors, exporters and local marketers as well as the role of all other stakeholders are captured in this study using an organogram.

The organisational structure refers to the linkages in the pineapple industry; from production through the various processing and marketing channels, through the exporters, to the final destination of the product. An understanding of the linkages between the various stakeholders in the pineapple business facilitates the diagnosis of problems encountered at the various stages and prescription of ways to eliminate them.

3.2. Distribution of Pineapple Farm Size

In order to capture the pattern of distribution of farm size, the following approach is employed. In this study, small farms are defined as farms which are less than 1.6 hectares whereas large ones are those which are more than or equal to 1.6 hectares, following MOFA (1999). Area of land cultivated to pineapple by each farmer is obtained from the survey data. A frequency table is prepared using the farm size data.

3.3. Costs and Returns of Small and Large Pineapple Farms

Costs and returns are computed for both small and large farms. These are used to compare the unit cost and net returns for the two categories of farms. These figures are computed from the aforementioned survey data. The relevant means, frequencies and proportions are also computed and compared for the two categories of farms.

3.4. Effects of the Determinants of the Choice of Farm Size: Theoretical Foundation

Identified factors which affect the choice of pineapple farm size from the literature review are the unit cost of labour (SWAGE), the cost of fertilisers, agro-chemicals (AGR) and capital (CAP). The age of the farmer (AGE), his educational level (ED) and the number of years of experience in pineapple production (EX) also affect the choice of farm size. From Lau and Yotopoulos (1972), Khan and Maki (1979) and Kalirajan (1981), a profit and factor demand

function formulated within the Cobb-Douglas production function is used to test the effects of the independent variable on the choice of farm size,

$$In\Pi = \lambda + \alpha_0 + \beta_1 InSWAGE + \beta_2 InFE + \beta_3 In\ AGR + \beta_4 InCAP + \alpha_1 InFS \quad (1)$$

where Π is the unit output price (UOP) profit in cedis. SWAGE is normalized rate for labour (man-days) calculated by dividing the total wage paid by the total number of labourers used, all divided by the unit price of pineapple and FE is the normalized fertiliser price, obtained by dividing the total expenditure on fertilisers by the total amount of fertilisers in kilograms and normalizing the ratio by UOP.

AGR is normalized agro-chemicals price, calculated by dividing the total amount spent on agro-chemicals by the total amount of agro-chemicals in kilograms and normalizing this ratio by UOP. CAP is capital flow, calculated as the sum of depreciation, maintenance and opportunity costs of capital stock; FS is cultivated area in hectares. D1 =1 for small farm groups and equal to 0 otherwise; λ is a constant and "In" is the natural logarithm.

Associated with the production function are factor demand functions given by

$$\frac{-SWAGEx_1}{\Pi} = \beta^*_1{}^S D_1 + \beta^*_1{}^L D_2, \quad (2)$$

$$\frac{-FEx_2}{\Pi} = \beta^*_2{}^S D_1 + \beta^*_2{}^L D_2 \quad (3)$$

$$\frac{-AGRx_3}{\Pi} = \beta^*_3{}^S D_1 + \beta^*_3{}^L D_2 \quad (4)$$

$$\frac{-CAPx_4}{\Pi} = \beta^*_4{}^S D_1 + \beta^*_4{}^L D_2 \quad (5)$$

S denotes small farmer group; L denotes large farmer group; $D_1=1$ for small-farm group and zero otherwise; and $D_2=1-D_1$. $B_i s$ denote the relevant coefficients of the independent variables. An inverse function of the above profit function developed by Yotopoulos and Lau (1971) is used as an analytical tool to examine the effects of various factors on the choice of pineapple farm size in the study area.

From equation (1) and making farm size (FS) the subject, the inverse function is given By;

$$\text{InFS} = \lambda^* + \alpha^*_0 D_1 + \beta^*_1 \text{InSWAGE} + \beta^*_2 \text{InFE} + \beta^*_3 \text{InAGR} + \beta^*_4 \text{InCAP} + \alpha^*_1 \text{In}\,\Pi \quad (6)$$

However other socio-economic factors like the age of the farmer, his level of education, his years of experience as a pineapple farmer could influence the choice of farm size. Accounting for these additional variables gives:

$$FS=FS\ (SWAGE, FE, \Pi, CAP, AGR, AGE, EX, ED, D) \quad (7)$$

where FS denotes farm size of the ith farmer in hectares, SWAGE denotes unit labour cost, FE denotes the unit cost of fertilizer, Π denotes profits, CAP denotes the cedi value of the flow of capital services from agricultural machinery, equipment, implements and tools (including depreciation charges, repairs and operating expenses). AGR denotes the unit cost of agro-chemicals used by the farmer, AGE denotes the age of the farmer, ED denotes the educational level of the farmer, EX denotes number of years of experience of the farmer in pineapple

production. D denotes a dummy variable distinguishing farm type, which takes on a value of unity for small farms and zero for large farms.

The a priori effects are the amount of capital, profits and level of education of the farmer exert positive effects on the choice of pineapple farm size and the cost of fertilizer, the cost of labour and the cost of agro-chemicals exert negative effects on the choice of pineapple farm size.

3.4.2. Statement of Hypotheses

The statement of the hypotheses tested are as follow, where Ho denotes null hypothesis and H_A the alternative hypothesis.

I. Ho: The unit cost of labour used does not exert any effect on the choice of farm size, versus

H_A: The unit cost of labour exerts a negative effect on the choice of farm size.

II. Ho: Profits do not exert any effect on the choice of farm size, versus

H_A: Profit exerts a positive effect on the choice of farm size.

III. Ho: There is no difference in average factor productivity and average cost between the farm sizes (that is, small and large), versus

H_A: The productivity of land and labour and average cost differ across farm sizes

IV. Ho: The cost of agro-chemicals used does not exert any effect on the choice of farm size, versus

H_A: The cost of agro-chemicals exerts a negative effect on the choice of farm size

V. Ho: The unit cost of fertilizer used does not exert any effect on the choice of farm size in pineapple production, versus

H_A: The unit cost of fertilizer used exerts a negative effect on the choice of farm size in pineapple production.

VI. Ho: Education level exerts no effect on the choice of farm size versus

H_A: Education level exerts a positive effect on the choice of farm size

Hypothesis VI is repeated for the age and number of years of farming experience of the farmer.

3.4.3. Empirical Model

In the present study, the multiple regression model is adopted because it allows a quantification of the effects of the relevant variables on the dependent variable (farm size). The econometric equation is estimated for both categories of farms (small and large) and for the whole sample using equation (8).

$$FS=\lambda + \alpha^{*}_{0}D_1 + \beta^{*}_{1}SWAGE + \beta^{*}_{2}PROFIT + \beta^{*}_{3}AGE + \beta^{*}_{4}ED2 + \beta^{*}_{5}ED3 + \beta_{6}EX \quad (8)$$

Appropriateness of the estimated model is determined by a number of factors. The model should have sound statistical qualities and all empirically estimated values of the parameters should satisfy the well-known standard statistical requirements. Not only should the parameters be significant at some predetermined level of significance (as well as satisfying the a-priori expected

signs), but also the relevant F-statistic as a whole should be significant. The appropriate model should not be characterised by a heteroschedasticity problem

The consequences of heteroscedasticity are as follows:

First, the formulae for computing the variances of the coefficients cannot be applied to conduct test of significance and construct confidence intervals. Second, the OLS estimates do not have minimum variance property in the class of unbiased estimators; that is, they are inefficient in small samples. Furthermore, they are inefficient in large samples. Third, the coefficient estimates would still be statistically unbiased; that is, even if the error terms are heteroscedastic, the estimated coefficients will have no statistical bias; their expected values will be equal to the true parameters. Fourth, the prediction (of the dependent variable for given values of the explanatory variables) based on the estimated coefficients from the original data would have a high variance that is the prediction would be inefficient.

The appropriate solution for heteroscedasticity is to transform the original model in such a way as to obtain a form in which the transformed disturbance term has a constant variance. We then may apply the method of classical least squares to the transformed model. This transformation is equivalent to the application of the method of weighted least squares (WLS) which is a specialised Generalised Least Squares (GLS).

3.5. Method of Calculating the Value of Capital Services

Most pineapple farmers in the study area used their own capital resources and simple tools and equipment for production and did not source any external credit. Therefore, to obtain the cedi value of the flow of capital services from machinery, tools and equipment, depreciation was calculated from the purchase price, salvage value and life span of the various tools and equipment used in the production process. Depreciation is the slowly using up or loss in value of an asset due to age and use as well as the obsolescence of the asset. There are two types of depreciation, viz., use depreciation which is a function of time, and depreciation which is the result of obsolescence and occurs regardless of the use of the machine. Obsolescence is the loss in value of the asset as a result of technological improvements resulting in the production of better machines.

There are several methods of estimating the depreciation of assets. These include the following: annual revaluation, the straight-line method, the diminishing balance method and the sum of year's digits method. In the present study, depreciation is calculated on each machinery, tool and equipment on monthly basis per hectare. The total depreciation is then computed for the length of the cropping season (18 months). To get the cedi value of the flow of services from machinery, tools and equipment for a particular farmer, the machinery, tools and equipment used are depreciated using the rates in Table 10.

Table 10. Calculation of the Cedi Value of the Flow of Capital Services

ACTIVITY LEVEL	Q'TITY	UNIT COST OF RESOURCE	TOTAL COST	
1.Amortization				
Land-¢40,000 (Leasehold)				3,333
2.Tools and Consumables (Monthly)				
(i) Cutlass (100% p.a.)	4	10,000	3,333	
(ii) Hand Hoe (50% p.a.)	2	6,000	500	
(iii) Soso (25% p.a.)	3	6,000	375	
(iv) Hand Gloves (100% p.a.)	3	8,000	2,000	
(v) Headpan (5% p.a.)	2	30,000	250	
(vi) Wellington Boots (50% p.a.)	2	24,000	2,000	
(vii) Spraying Machine (5% p.a.)	1	360,000	1,500	
(viii) Drums (5% p.a.)	2	90,000	750	
(ix) Hand Knife (100% p.a.)	4	5,000	1,666	
(x) Goggles (50% p.a.)	3	5,000	625	
(xi) Overall (50% p.a.)	2	15,000	1,250.	14,249
3. Permanent Staff (Monthly Pay)				
Farm Manager				200,000
Total Monthly Fixed Cost				217,582
Total Area (hectares)				
Fixed Cost/Ha/Month				2
Total No.of Months (Maturity)				108,791
				18
TOTAL COST OF FIXED INPUTS				1,958,238

p.a. denotes per annum

Source: TechnoServe Data

3.6. Study Area

The major pineapple-producing areas in Ghana could be grouped into four, viz., Oboadaka, Kasoa-Nsawam, Accra-Nsawam and Nsawam-Adeiso, all within a radius of about 30 kilometres from Accra. The present study uses survey data from three randomly selected villages in the Akuapim South District, viz., Oboadaka, Fotobi and Adonteng. The area has a long history of pineapple production and export. In terms of pineapple production, the area exhibits an all year round good pattern of weather. Rainfall is bi-modal with amounts ranging between 127mm and 178mm per annum. The importance of the pineapple industry in the study area has arisen in response to the need to diversify Ghana's export base to include non-traditional agricultural crops.

The study area is endowed with improved agronomic practices, local processing industries, relatively good infrastructure including roads to and from farms, negligible wilt and pest infestation and high farmer literacy rate which has a high tendency of group work compared to other geographic areas (Amex, 1996). Oboadaka is one of the early areas to form co-operatives. Co-operative members are all out-growers with different farm holdings and they sell their produce to exporters (Amex, ibid). The area is has a population of about 4,500 (2000 census) with a fair share of developmental infrastructure and other institutions, water and sanitation facilities. It is about 45 kilometres and 72 kilometres from the Kotoka International Airport (Accra) and the Tema Harbour respectively.

3.7. Sources of the Relevant Data

Both primary and secondary data are used in the study. As already indicated, the present study uses part of the survey data on pineapple farms in the Akuapim South District (Sarpong and Owusu-Asante, 2001). The survey relates to farmers belonging to three Technoserve assisted co-operative farmer groups in Oboadaka, Fotobi and Adonteng villages in the Akuapim South District. The villages were randomly selected. The data covered a sample size of one hundred and four smallholder and commercial farmers. This sample was randomly selected from a target population of one hundred and twenty-eight pineapple farmers. The study obtained ninety-nine (99) usable responses from a field return of 104 pineapple farmers in the study area. This represents about 77.3 percent of the target farmers. There was only 1 female pineapple farmer among the enumerated farmers. The most common variety of pineapple cultivated is "Smooth Cayenne", which has a crop cycle of eighteen months.

Cross-sectional data for the cropping cycle starting from August-December 1997 to March-June 1999 are solicited from the farmers through structured questionnaires. Variables considered include farm size under pineapple cultivation, labour in man-days in land preparation, planting, fertiliser and agro-chemical application and harvesting, the cost of agro-chemicals used in pineapple production, the quantity of fertiliser in (kg) used in pineapple cultivation and the cost of miscellaneous inputs such as farm tools. Additional information on accessibility to inputs, market for produce, accessibility to credit facilities and frequency of contact with extension service personnel, among others, is also gathered from the farmers. Data on prices of inputs, quantities of output and their prices as well as export volumes of the produce are solicited from farmers and private farm input dealers.

CHAPTER 4

EMPIRICAL RESULTS

This chapter is divided into six sections. The first section presents the descriptive statistics of the key variables obtained from the respondent farmers. These variables are farmer age, level of education and number of years of experience in pineapple farming, among others. The second section presents the organisational structure of pineapple production and export. Section three discusses the pattern and distribution of farm sizes. The empirical econometric results are then presented in section four. The fifth section compares the costs and returns of small farms versus large ones and the chapter concludes by relating the study findings to existing literature.

4.1. Descriptive Statistics Characteristics of Key Variable

Illiteracy poses problems for development because there is a strong correlation between educational level and adoption of new ideas and innovations. With regards to educational level of the farmers, 93 of the pineapple farmers representing about 93.9 percent of the farmers have at least primary education. Whereas about 20.2 percent of the farmers have second cycle education or above, that is, secondary, post-secondary, only 1 farmer has tertiary level education (University) (see Table 11).

Table 11. Educational Level of Respondent Farmers

	No formal Education	Primary/JSS Middle School	Secondary/ Technical	Higher than Secondary/ Technical	Total
Number of Farmers	6	73	19	1	99
Percentage	6.1	73.7	19.2	1	100

JSS denotes Junior Secondary School.
Source: Survey Data.

The pineapple farmers have a mean farming experience of about 7 years. Whilst 41.4 percent of the farmers have less than 5 years of pineapple farming experience, about 58.6 percent of them have at least 6 years of pineapple farming experience (Table 12). About 10.1 percent have more than 10 years of experience in pineapple farming.

Table 12. Farmer Experience in Pineapple Farming (Years)

	< 5years	6-10 years	> 10years	Total
Number of farmers	41	48	10	99
Percentage	41.4	48.5	10.1	100
Mean Years of Experience	3.9	8.1	13.4	6.9

Source: Survey Data.

The strenuous activities involved in pineapple production require physical strength. Although the pineapple business is a high capital venture, the short crop cycle (18 months) and the high returns make it attractive to younger men who normally get involved in quick turnover ventures. This is reflected in the age distribution of the respondents. The age of pineapple farmers

seems to be concentrated in the 26 - 50 year bracket, indicating that the economically active population are engaged in pineapple production (Table 13).

Table 13. Age Distribution of Respondent Farmers

	Below 25 years	26-35 years	36-50 years	> 50 years	Total
Number of Farmers	4	30	54	11	99
Percentage Distribution	4.0	30.3	54.6	11.1	100.0

Source: Survey Data.

Males dominate the pineapple farm business. Only one of the respondents in the survey data is a female. This is attributed to the strenuous activities involved in pineapple farming, coupled with poor access to credit especially by women to cater for the huge initial capital investment required. Most of the farmers engaged in pineapple production are small-scale farmers. The peasant farmers learnt about pineapple production by working in the study area as labourers. Others also acquired experience through their parents and grand parents who worked for a long time on pineapple farms. Some commercial farmers who acquired their land through outright sale employ labourers to work on their farms and are almost invariably absent from the farms.

The managerial ability of the farmer as well as his experience in pineapple production and his literacy level all have a bearing on the success of his farm business. Whereas illiterates tend to be more cautious and more resistant to change, literates tend to take more risk and are

more receptive to innovations; this encourages the adoption of new and high technologies required by the industry.

The average purchase price paid to out-growers and smallholders ranges between ¢400 and ¢450/kg (US$0.17-US$0.20/kg). This is higher than the production cost of commercial farms (US$0.10/kg). Commercial producers source a significant proportion of fruit from smallholders because the commercial producers lack sufficient capital to expand their own farm due to difficulties in accessing loans at reasonable rates of interest. In addition, fruit sourcing from smallholders spreads the risk of farming and ensures that at least some fruit can be secured in case of failed harvest on their own farm as a result of pest and disease problems or drought.

Pineapple farming is a highly labour intensive venture. Labour is required for land preparation, planting, weeding, fertilising, fruit induction/forcing and spraying (pests and disease control). Two main forms of labour are used in the study area, viz., family labour and hired labour. Hired labour which can be temporary or permanent is paid for by day at ¢6,600 or monthly in the case of permanent labour. The peak requirement for labour occurs at the time of harvest. The monthly cost of permanent labour is sixty thousand cedis.

About 90 percent of the respondents indicated that they usually get additional labour when the need arises. The respondents however, showed concern about the high cost of labour. The mean daily wage rate for casual labour was ¢6,600 (without food) as against the national minimum wage of ¢4,500 during the survey period.

The pineapple farmers harvest two products from their farms: the pineapple fruit as the main crop and the sucker as a by-product. The farmers sell their fruit in three differentiated market: the export, the processing and the local market depending on the quality, weight and market conditions. The export market seems to be more attractive than any of the other domestic markets. Strict quality controls of the export market, especially the external buyers, tend to limit the proportion of pineapple to that market. The suckers are however sold to other pineapple farmers for replanting. The production cost and utilization of pineapple per hectare are detailed in Table 14. It is assumed that post harvest and other losses account for 25 percent of pineapple fruits and 30 percent of suckers. Twenty percent of the suckers is also reserved for seed; 5 percent of the fruits are however processed into fruit juice.

Table 14. Production and Utilization of Pineapple Per Hectare

ITEM	SMALL FARMS	LARGE FARM	PERCENTAGE
1. Mean Farm Size (ha)	0.54 Ha	2.27ha	
2. Output of Fruits (kg)	48,096.25	40,328.9	
3. Quantity of Fruits for Export (kg)	22,706	20,416.8	50 (% of fruits sold in export
4. Export Price of Fruits	450	450	market)
5. Revenue from Exports	10,217,700	9,187,560	
6. Quantity of Fruits for Domestic Market (kg)	10,692.95	7,863.9	20 (% of fruits sold in
7. Average Price in Domestic Market	150	150	domestic market)
8. Revenue from Domestic Market	1,603,942.5	1,117,958	
9. Quantity Processed into Fruit juice			
10. Quantity Wasted (Post Harvest & other losses) (kg)	2,673.24	1,965.98	5 (% Post harvest and other looses)
11. Output of Suckers (kg)	12,024.06	10,082.22	25 (%output of suckers)
12. Quantity of Suckers for Seed (kg)	61,661	44,455.1	
13. Quantity of Suckers for Domestic Market (kg)	12,332.2	8,891.02	20 (%Quantity of suckers for domestic market)
14. Average Price in Domestic Market	30,830.5	22,227.55	50 (%Average price in
15. Revenue from Suckers (			domestic market)
Quantity Wasted (Post Harvest & other Losses) (kg)	50	50	
	1,541,525	1,111,375	
	18,498.3	13,336.53	30 Post harvest losses of suckers
TOTAL REVENUE/HA (FRUITS + SUCKERS) (ø/ha)	13,363,167.5	11,478,520	
TOTAL COST OF PRODUCTION/HA	3,360,523.8	2,683,003	
NET REVENUE/ HA	10,002,643.7	9,195,517	

Source: Survey Data

4.2. Organisational Structure of Pineapple Production and Export

The present study examines the organisational structure of pineapple production and export, employing the various factors involved in both processes. The linkages between the two operations are also represented in an organogram. Various institutions and institutional measures which facilitate the production and export of pineapple are also discussed. The producers of pineapple in Ghana are categorised into three groups, viz., commercial producers/exporters, out-growers (cultivating 6-12 hectares) and smallholders (cultivating 0.4-4.0 hectares).

In Ghana, the pineapple industry is characterised by commercial producers/exporters. A commercial or 'large scale' pineapple farm in the context of Ghana is defined by Sea Freighted Pineapple Exporters of Ghana (SPEG) as having at least 20 hectares (specifically 20-100 hectares) of pineapple under cultivation with a tractor, packaging shed and other ancillary facilities. Some commercial farmers are also involved in export. However, production from commercial farms are not sufficiently large to meet export orders and the balance of the fruit is purchased from smallholders/out-growers whose fruit currently constitute approximately 45 percent of the total pineapple export.

Out-growers. Out-growers and smallholders who cultivate pineapple are distinguished not on the basis of the size of their land holdings but on the basis of their relationship with the commercial farmers/exporters. Neither out-growers nor smallholders have direct access to the export market and they export their produce through the commercial producers/exporters. Out-

growers typically have an agreement with a single exporter who often provides them with inputs and they are in turn committed to sell their fruit to him or at least to give him the first refusal.

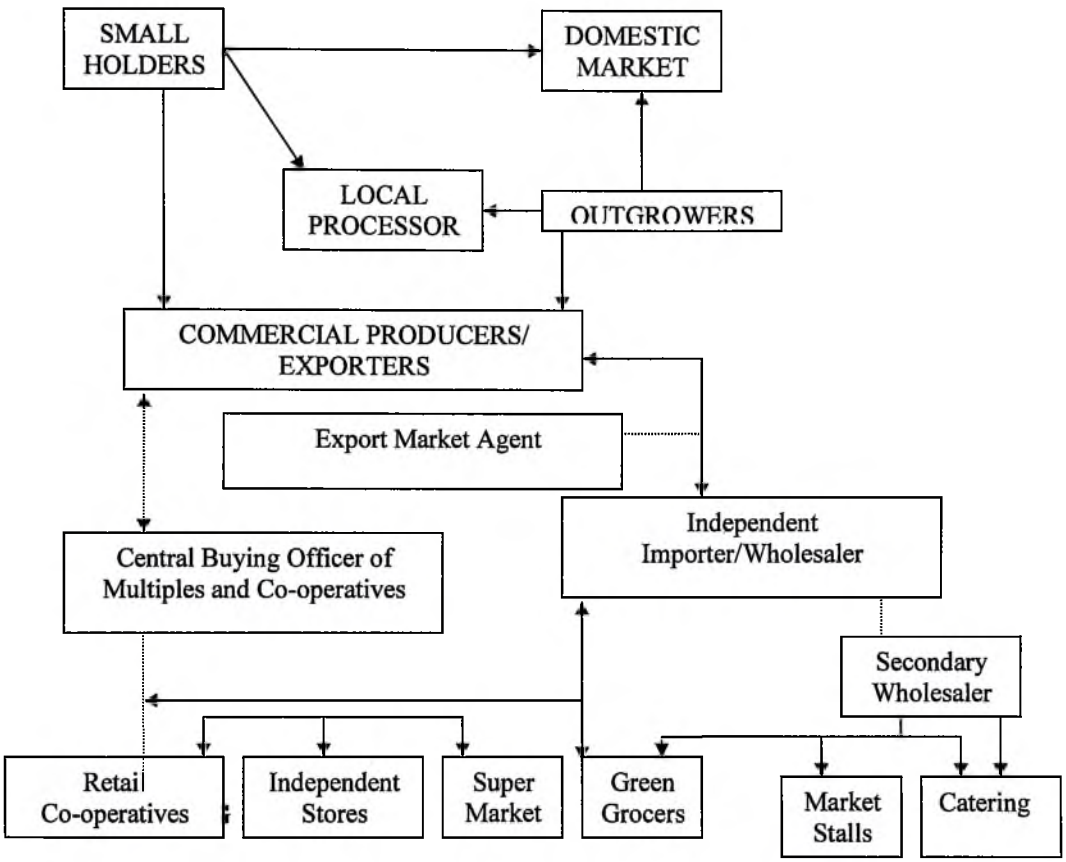
Smallholders. Smallholders on the other hand are independent farmers who have no contractual obligations to commercial farmers/exporters and sell their fruit on the open market to whichever exporter offers the highest price. The disposal of pineapple fruit is done via three main outlets, viz., the domestic market, the local processing industry and the export market as already indicated. Fruits which do not qualify for the export market are either sold to local processing industries like Astek and Athena or the middlemen to be retailed for local consumption. Payment is however not effected to smallholders in a timely fashion and this has a detrimental effect on the financial planning and budgeting of smallholders.

Post-Harvest Activities. After harvesting, various marketing functions are performed before the pineapple gets to its foreign destination. These functions include assembling, handling, transportation, standardization and packaging. Certain procedures like export procedures (either through letters of credit, bill for collection or pre-payments) also have to be strictly adhered to before pineapple is exported from Ghana. There are a number of institutions and institutional measures involved in the pineapple export business. These include Ghana Export Promotion Council (GEPC), Ghana Horticulturists Association (HAG), Ministry of Food and Agriculture (MOFA), Ghana Standards Board (GSB), Ministry of Trade and Industry (MOTI), Commercial Banks and Export Finance Company (EFC).

Despite their reliance on smallholders, most of the large companies are exporting less than 2,000MT/annum, which according to Dixie and Sergeant (1998) is the minimum level of output for a profitable mechanised pineapple farming.

Pineapple is exported by commercial producers/exporters to two main points in the international market, viz., the central buying officer of multiples and co-operatives, and independent importer/wholesaler. The fruit is then distributed from these points to various agencies like the retail co-operatives, independent stores, supermarkets and green grocers for sale (Figure 1). Consumers have developed sophisticated tastes and are very demanding with respect to timeliness, quality, price and regular delivery.

Figure 1. Organisational Structure of Pineapple Production and Export in Ghana



Source: Export Promotion Council

4.3. Pattern of Distribution of Farm Size

The pattern of farm size distribution in pineapple production in the study area is detailed in Table 15. As has already been indicated, the cultivation of pineapple is fragmented with a small number of independent, relatively large producers, a slightly larger number of medium-sized producers and a large majority of small producers. Out of 99 pineapple farmers surveyed in the study area, 76 (that is, 76.8 percent) have farm sizes, which are less than 1.6 hectares, and 23 farmers (23.2 percent) have farms greater than or equal to 1.6 hectares (Table 15). This shows a pattern of farm size distribution that is skewed in favour of small farms. The mean farm size for small farms is 0.54 hectares whereas that of large farms is 2.27 hectares. The average farm size for the whole data set is 0.94 hectares.

Table 15. Pattern of Farm Size Distribution, 1999

Characteristic	Small (< 1.6 Hectares)	Large (≥ 1.6 Hectares)	Total
Number of Farms	76	23	99
Percentage Share	76.8	23.2	100.0
Farm Size Range (Ha)	0.02-1.5	1.6-6.0	0.02-6.0
Average Farm Size (Ha)	0.54	2.27	0.94

Source: Survey Data

4.4. Empirical Econometric Results

The a priori effects are that the amount of capital, profits, level of education and the age of the farmer exert positive effects on the choice of pineapple farm size, whereas the price of fertiliser, agricultural wage rate and the cost of agro-chemicals exert negative effects on the choice of pineapple farm size. Ed2*Ex, Ed3*Ex denote interaction terms of the level of education of the farmer and his number of years of experience in pineapple farming. NSWAGE and SWAGE denote the unit cost of labour used by farmer. The regressions relate to small farms and the whole sample. White's statistic is used to test for heteroscedasticity in all three equations estimated Pindyck and Rubinfeld (1981). The statistical distributions of the variables in the model are summarised in table 16. The results relating to the full sample are detailed in table 16.

There was heteroscedasticity in the case of the equation for the whole sample in the original sample with a coefficient of determination of 0.2298 and an F-statistic of 5.5506, which was statistically significant at the 1 percent level (Appendices 7 and 8). When the model was corrected for heteroscedasticity using the well known least squares weighted, it gave a coefficient of determination of 0.1257 and an F-statistic of 2.6742 (Table 16). This implies that about 12.57 percent of the variation in farm size is explained by the independent variables in the model. The F-statistic is significant at the 5 percent level. The White's statistic for the corrected model gives an F-value of 0.8469 with a probability of 0.5642. This is not significant even at the 10 percent level, implying that there is no hetroscedasticity in the model (Table 16).

Whereas age is statistically significant at the 10 percent level, profit and the unit cost of labour (NSWAGE) are significant at the 5 percent level. The unit cost of labour, the age of the farmer and the level of profit have the correct expected signs. The interaction terms are not significant even at the 10 percent level.

Age of farmer and profit exert significant positive effects on farm size. This implies that farmers who make higher profit tend to cultivate larger farms, and vice versa. In addition, older farmers tend to cultivate larger farms whereas younger farmers tend to cultivate smaller farms. The significant negative effect of the agricultural wage rate, implies that higher wage rates tend to precipitate smaller farm sizes. As labour becomes more expensive, farmer access to labour reduces, particularly for farmers who employ hired labour.

Table 16. Empirical Econometric Results on Choice of Farm Size: Full Sample

DETERMINANT	COEFFICIENTS	T-VALUES
Intercept	0.8354	(0.5968)
NPROFIT	1.91E-08	(2.1633) **
NSWAGE	-6.90E-05	(-2.1554)**
NED2*Ex	-0.2449	(-0.1357)
NED3*Ex	0.3059	(0.1530)
NAGE	0.0940	(1.8432)*
R^2	0.1257	
F	2.6742**	
Prob (F-statistic)	0.0265	
S.E of Regression	2.2540	
White's Heteroscedasticity Test		
F-Statistic 0.8469	Probability =0.5642	
Obs* R-Squared 6.9309	Probability =0.5441	

Figures in parentheses are t-ratios.

*** denotes significance at the 1 percent level, ** denotes significance at the 5 percent level and * denotes significance at the 10 percent level. Sampling size is 99. NSWAGE denotes unit labour cost, ED2 denotes Junior Educational level (ED2 = 1 if educated and zero otherwise), ED3 denotes Higher Educational level and (ED3=1 if Educated and zero otherwise) and AGE denotes the age of the farmer. This table has been corrected for heteroscedasticity using transformed data.

Source: Author's Computation

Over 75 per cent of the pineapple producers tend to cultivate small farms, hence a model which employs data on only small producers (less than 1.6 Ha) is also estimated (Table 17). The White's statistic here gives an F-value of 1.4638 with a probability of 0.1735. This is no significant even at the 10 per cent level and implies that there is no heretoscedasticity in the model (Table 17). The coefficient of multiple determination R^2 is 0.2301. This implies that about 23 percent of the variation in farm size is explained by the independent variables in the model.

The F-ratio here is 4.1846 and it is statistically significant at the 1 percent level. The age of the farmer and profit are not significant even at the 10 percent level. The variables which are significant at the 1 percent level are the unit cost of labour and the interaction term of farmers with higher education and level of experience (ED3*EX). The interactive term of farmers with lower education and the level of experience is not significant even at the 10 percent level. All the parameters in the model have the correct expected signs.

Table 17. Empirical Econometric Results on Choice of Small Farm Sizes

DETERMINANT	COEFFICIENTS	T-VALUES
Intercept	1.0398	(2.4002) **
Profit	5.00E-10	(0.3035)
SWAGE	-1.55E-05	(-2.6756)***
ED2*Ex	0.0421	(1.4189)
ED3*Ex	0.1269	(3.2501)***
Farmer Age	0.0027	(0.2557)
R^2	0.2301	
F	4.1846***	
Prob(F-statistic)	0.0022	
S.E of Regression	0.8358	
White's Heteroscedasticity Test		
F-Statistic 1.4638	Probability = 0.1735	
Obs* R-Squared 13.9697	Probability = 0.1744	

Figures in parentheses are t-ratios.

*** denotes significance at the 1 percent level, ** denotes significance at the 5 percent level and * denotes significance at the 10 percent level.
SWAGE denotes unit labour cost, ED2 denotes Junior Educational level (ED2 = 1 if educated and zero otherwise), ED3 denotes Higher Educational level and (ED3=1 if Educated and zero otherwise) and AGE denotes the age of the farmer.
Source: Author's Computation

Table 18 Elasticities of Determinants of Choice Farm Size

DETERMINANTS	ELASTICITIES	
	ALL FARMS	SMALL FARMS
NPROFIT	0.145**	-0.0010
NSWAGE	-0.124**	-0.1152***
NED2	-0.5966	0.1455
NED3	0.091	0.1136
NAGE	0.778*	0.0792
EXPERIENCE	-0.163	0.260

Statistics are calculated at the mean of the variables

*** denotes significance at 1 per cent level, ** denotes significance at 5 per cent level and * denotes significance at 10 per cent level.
Source: Author's Computation

A 1 per cent increase in profit leads to a 0.0145 per cent increase in farm size in the case of all farms but no change in farm size in the case of small farms (Table 18). An increase of 100 per cent in the agricultural wage rate leads to a decrease of 12.4 per cent in the choice of farm size in the case of the whole sample and a decrease of 11.5 per cent in the case of smallholders. Higher education of smallholders leads to 0.1136 per cent higher land area cultivated to pineapple than to small farmers without higher education.

A 100 per cent increase in farmer age stimulates an increase of 77.8 per cent in the choice of all farms in the case of all farms combined and an increase of 7.9 per cent in the choice of

farm size in the case of small farms. An increase of 100 per cent in the level of framer experience in pineapple cultivation exerts a 26 per cent increasing effect on the choice of farm size by smallholders.

4.5. Costs and Returns: Small versus Large Farms

The mean costs and returns of producing pineapple on small and large farms are compared to ascertain which farm size is more profitable. The production costs and returns of the two groups of farms are presented in Table 19. The results show that the average gross revenue for small farms is ¢13,363,167.5 per hectare compared with ¢11,478,520 per hectare for large farms.

Similarly, the average cost of production is ¢3,360,523.8 per hectare for small farms and ¢2,683,003 per hectare for large farms. The resultant net returns are ¢10,002,643.7 per hectare for small farms and ¢9,195,517 per hectare for large farms. These results imply that although large farms produce at a lower cost per hectare than small farms, the unit net returns are much higher for small farms than those of large ones.

Table 19. Costs and Returns Per Hectare (cedis/Ha) of Pineapple Farms in the Akuapim South District, Ghana, 1999

Variable Input	Small farms (mean = 0.54Ha)	Large farms (mean = 2.27 Ha)
Variable Costs		
Fertiliser	627,378.40	659,730.40
Labour	977,005.80	149,629.40
Agro-chemicals	104,620.60	40,982.20
Total variable costs	1,709,003.80	850,342.00
Fixed Cost		
Capital(Tools&Equipment)	1,651,519.00	1,832,661.00
Total Fixed Cost	1,651,519.00	1,832,661.00
Total Cost/Hectare	3,360,523.80	2,683,003.00
Gross Revenue/Hectare	13,363,167.50	11,478,520.00
Net Revenue/Hectare	**10,002,643.70**	**9,195,517.00**

Source: Survey Data

Comparison is made between the findings of the present study and conclusions arrived at from previous studies and contained in existing literature. This is to ascertain any consistencies or variances. The present study results show that profits, the interactive term of educational level and experience of the farmer and the age of the farmer exert significant positive effects on the choice of farm size. This is consistent with the a priori expectation. Similarly studies conducted by Yotopoulos and Lau (1973) concluded that small farms are more efficient than large ones. The conclusion by Yotopoulos and Lau (1973) that the difference in economic efficiency may result from technical efficiency is also consistent with findings of the present study because small farms are technically well managed than large ones leading to higher profitability and hence their choice

in preference to larger farms. The assertion of Khan and Maki (1979) that large farm sizes are more efficient than small ones; Vaman and Chiogeat (1981) that higher productivity is associated with large size farms and by Krause and Kyle (1970) that economies to size exist are however at variance with the results of the study. Conclusions by Sidhu (1974), Khan and Maki (1977) that there is no difference in efficiency by farm size; and by Rao (1963), Rudra and Bandhopadhyaya that there is an inverse relation between farm size and productivity are at variance with the results of the study.

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

5.1. Summary

The present study has addressed the determinants of choice of farm size by pineapple farmers in the Akuapim South District. Farm sizes are grouped into two, viz., small (< 1.6 hectares) and large (≥ 1.6 hectares). A total of 99 farmers are included in the study. The effects of the determinants of choice of farm size have been quantified using an econometric approach.

The study found that majority of the farmers, specifically, 76 out of 99 respondents (76.8 percent) cultivate small farm sizes which are less than 1.6 hectares and 23 farmers (23.2 percent) have farms which are greater than or equal to 1.6 hectares. This shows a pattern of farm size skewed towards small farms ranging between 0.02 – 1.5 hectares.

About 94 percent of the farmers have at least primary level education, 19.2 percent have second cycle education 1 percent has university level education.

Whilst 41 percent of the farmers have at most 5 years of pineapple farming experience, almost 58.6 percent of them have at least 6 years of pineapple farming experience. Males dominate the pineapple business because only one respondent is a female.

There are a number of institutions and institutional measures involved in the pineapple business. Some exporters are pineapple growers themselves although they buy from out-growers and smallholder farmers to supplement their own production. There are three categories of pineapple producers in the Akuapim South District namely; commercial producers/exporters (>50ha), out growers (6-12ha) and smallholders (0.4-1.5 ha). Majority of the commercial farmers who are also exporters purchase pineapple fruits from out-growers/smallholders to supplement their production because their own production are not sufficiently large enough to meet export orders.

The major determinants of the choice of farm size in pineapple production included in the model are the average agricultural wage rate, farmer age, profit, level of education and the number of years of experience of farmer in pineapple farming. With regards to the magnitudes and directions of the effects of the determinants of choice of farm size, the study found that profit, the interaction term of educational level and experience and farmer age exert significant positive effects on the choice of farm size. The average wage rate exerts a significant negative effect on the choice of farm size. High cost of labour is impacting negatively on choice of farm size for pineapple production.

The results also show that there is a difference of ¢ 807,126.7 per hectare in favour of small farms between costs and returns of the two categories of farms. The gross revenue of small farms is ¢13,363,167.50 per hectare as compared with ¢11,478,520 per hectare for large ones. Similarly, the average cost of production for small farms is ¢3,360,523.8 per hectare as compared

with ¢2,683,003 per hectare for large farms. The resultant net returns are ¢10,002,643.7 per hectare for small farms and ¢9,195,517 per hectare for large farms. These results imply that large farms produce lower unit cost and lower per unit return per hectare than small farms. Consequently, small farms give higher profit margin. In addition, the per hectare values of all production inputs are generally higher for small farms. Small size farms tend to be more profitable than large farms. This probably gives credence to why majority of farmers choose small farms for their production.

5.2. Policy Recommendations

In order to increase the productivity of non-traditional export crops, increase farm income levels to reduce rural poverty and thereby improve the living standard of farmers, policy makers need to have a better understanding of the constraints that face smallholder farmers. One of such constraints is the optimal farm size in the production of pineapple.

Pineapple production in the study area is carried out by commercial farmers, out-growers and smallholders with majority of the farmers skewed towards smallholders. Policies to achieve increased pineapple production and export should be geared towards alleviating the constraints faced by smallholder farmers without loosing sight of the needs of commercial farmers. Since the smallholders are the most credit-strapped group, and their use of labour is tied up with their ability to pay for it, there is the need for the provision of loans on soft terms to them. This will not only enable farmers to pay for the high cost of hired labour but also enable them to adopt

improved technologies. Subsidies on some selected farm inputs will also be of immense help to farmers.

There is a strong positive correlation between educational levels and the receptivity of new ideas and innovations. Since most farmers in the study area are literate and have experience in pineapple production, affordable technological packages with new innovations should be developed for the adoption by farmers.

From the costs and returns analysis, although the unit cost of production is slightly higher for small farms than for large ones, the higher unit returns associated with the small farms however seem to compensate for their high cost of production. These costs and returns figures seem to suggest that small farms are more profitable and make efficient use of resources than large farms. In designing policies for farmers in the study area therefore, cognisance should be taken of the vast majority of the small-scale farmers who produce the bulk of pineapple in the area.

5.3. Suggestions for Future Research

Farmers' decisions are often taken, based on their experiences over time and this involves risk and uncertainty. The use of cross sectional data for the current study does not cater for these farmers' decisions over time. The risk and uncertainties in farmers' decisions are also left out of the analysis. Future studies should therefore endeavour to use time series data as well

as analytical tools, which capture risk and uncertainty. In the light of the above limitations of the study mentioned earlier in the methodology, there is the need for further research into the use of time series data in estimating the effects of the various factors on choice of farm size. This will ensure the detection of any variations in the choice of farm size over time.

Studies involving larger sample size and wider coverage in various locations should be conducted. This will greatly enhance the efficiency of the results and subsequently lead to the drawing of reliable conclusions and generalisations.

Appendix 1

A Multiple Regression Analysis between Farm Size and other Dependent Variables

LS // Dependent Variable is FS
Sample: 1 99
Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	0.032015	0.023293	1.374464	0.1726
ED2*EX	0.212521	0.061418	3.460255	0.0008
ED3*EX	0.221019	0.081141	2.723893	0.0077
SWAGE	-2.41E-05	1.44E-05	-1.673081	0.0977
PROFIT	5.07E-09	4.03E-09	1.257527	0.2117
C	-0.140218	0.991330	-0.141444	0.8878

R-squared	0.229833	Mean dependent var	2.351515
Adjusted R-squared	0.188426	S.D. dependent var	2.348300
S.E. of regression	2.115522	Akaike info criterion	1.557295
Sum squared resid	416.2154	Schwarz criterion	1.714575
Log likelihood	-211.5610	F-statistic	5.550607
		Prob (F-statistic)	0.000162

White Heteroscedasticity Test

F-statistic	2.309711	Probability	0.018385
Obs*R-squared	20.58212	Probability	0.024203

Test Equation:
LS // Dependent Variable is RESID^2
Sample: 1 99
Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.974400	19.02916	0.313960	0.7543
AGE	-0.236234	0.897129	-0.263322	0.7929
AGE^2	0.004055	0.010263	0.395079	0.6937
ED2*EX	-1.363849	1.016235	-1.342061	0.1830
(ED2*EX)^2	0.162669	0.064015	2.541108	0.0128
ED3*EX	-0.406376	1.660298	-0.244761	0.8072
(ED3*EX)^2	0.006307	0.146368	0.043087	0.9657
SWAGE	-3.29E-05	0.000212	-0.154980	0.8772
SWAGE^2	4.59E-10	1.71E-09	0.267480	0.7897
PROFIT	1.13E-07	8.49E-08	1.333478	0.1858
PROFIT^2	2.24E-16	1.69E-16	1.327025	0.1879

R-squared	0.207900	Mean dependent var	4.204196
Adjusted R-squared	0.117889	S.D. dependent var	12.57484
S.E. of regression	11.81038	Akaike info criterion	5.042397
Sum squared resid	12274.69	Schwarz criterion	5.330744
Log likelihood	-379.0736	F-Statistic	2.309711
		Prob (F-statistic)	0.018385

White Heteroscedasticity Test

F-statistic	0.846888	Probability	0.564194
Obs*R-squared	6.930867	Probability	0.544110

Test Equation:
LS // Dependent Variable is RESID^2
Sample: 1 99
Included observations: 99

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.27974	25.94324	-0.473331	0.6371
NAGE	0.742318	2.430621	0.305403	0.7608
NAGE^2	-0.006845	0.057534	-0.118967	0.9056
NED2	9.305801	13.25538	0.702040	0.4845
NED3	0.966411	14.71252	0.065686	0.9478
NPROFIT	3.97E-07	2.23E-07	1.780484	0.0784
NPROFIT^2	1.69E-15	9.41E-16	1.791496	0.0766
NSWAGE	-9.52E-06	0.000591	-0.016088	0.9872
NSWAGE^2	1.85E-09	9.96E-09	0.185888	0.8530

R-squared	0.070009	Mean dependent var	4.772639
Adjusted R-squared	-0.012657	S.D. dependent var	16.00677
S.E. of regression	16.10775	Akaike info criterion	5.645109
Sum squared resid	23351.36	Schwarz criterion	5.881029
Log likelihood	-410.9078	F-statistic	0.846888
Durbin-Watson stat	0.449699	Prob (F-statistic)	0.564194

This is the White's test for heteroscedasticity using transformed weighted data.

Appendix 4

DESCRIPTIVE STATISTICS OF THE DETERMINANTS OF CHOICE OF FARM SIZE-ALL FARMS.

DETERMI-NANTS	MEAN	VARIANCE	STD	SKEW-NESS	KURTO-SIS	MAX	MIN
PROFIT	1793476	7.47E+14	27324767	-8.39998	78.33526	27698060	-2.54E+08
SWAGE	4230.638	54400256	7375.653	5.980220	47.29756	64846.79	211.1159
ED2*EX	2.455594	4.535239	2.129610	0.533622	2.644159	8.734267	0.000000
ED3*EX	0.710701	2.432938	1.559788	2.087981	6.123994	6.308082	0.000000
FARMER AGE	19.45360	20.888386	4.569886	0.631460	3.273278	33.96659	11.64569

Number of observations = 99

Appendix 5

DESCRIPTIVE STATISTICS OF THE DETERMINANTS OF CHOICE OF FARM SIZE-SMALL FARMS.

DETERMI-NANTS	MEAN	VARIANCE	STD	SKEW-NESS	KURTO-SIS	MAX	MIN
PROFIT	-2645209	3.91E+15	62523107	7.741733	64.13469	23171120	-5.23E+08
SWAGE	9982.823	2.89E+08	17007.34	5.368595	37.79586	133639.4	435.0779
ED2*EX	4.618421	15.94579	3.993218	0.610653	3.131377	18.00000	0.000000
ED3*EX	1.250000	8.75	2.958040	2.389034	7.757494	13.00000	0.000000
FARMER AGE	39.31158	91.22579	9.551219	0.551419	2.751108	64	24

Number of observations = 76

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