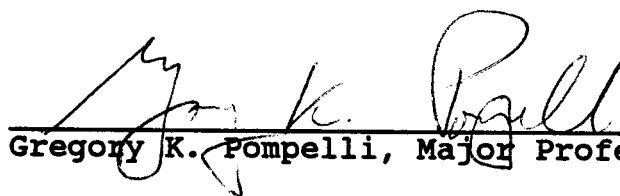
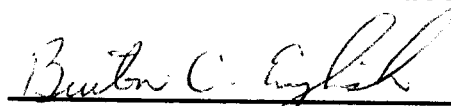


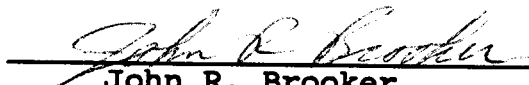
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**PERUVIAN MILK DEMAND AND THE STRUCTURE OF DAIRY
FARMS IN THE LA LIBERTAD REGION**

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Jorge Alfredo Huarachi Chavez

May 1993

DEDICATION

The Author wishes to dedicate this study to his parents, brothers, and sisters: Armando Huarachi and Consuelo Chavez de Huarachi, Armando, Antonio, Maria Eugenia, Juana, Carmen, y Veronica. Through these years, their support, love, and encourage provided the strength and perseverance to complete this research and my graduate studies.

In choosing the theme for my research, I tried to contribute to understanding of the problems that dairy producers faced in my country. I also dedicated this research to them.

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ABSTRACT

Peruvian per-capita milk consumption has fallen by almost fifty percent during the last twenty years. This decreasing pattern in Peru's milk consumption has been attributed to a combination of factors including domestic agricultural and dairy policies which attempted to lower consumer and processor milk prices, prolonged macroeconomic troubles which led to decline in consumer purchasing power; and depressed dairy world prices which results in lower prices for imported dairy products.

The overall objective of this study was to examine the implications of possible changes in the Peru's government dairy policies on dairy farmers of La Libertad coastal area. This objective was accomplished by a combination of national data and regional set data. First, the determination of Peru's milk demand structure estimates by using the Rotterdam model. Second, through the historical analysis of dairy policies in Peru since 1963. Third, the regional data collected by surveying directly dairy farmers.

The coefficient estimates obtained were not statistically significant. The Cuornot own-price elasticities calculated for different types of milk, with the exception of pasteurized milk, were negative and inelastic as expected. The cuornot price elasticities

suggested a substitution relationship between evaporated and recombined milk and complementary relationship between fresh milk and evaporated milk. The conditional expenditure elasticities for evaporated and powdered milk were positive and elastic. The expenditures conditional elasticities for fresh and pasteurized milk were positive but inelastic. Recombined milk showed a negative expenditure elasticity indicating that this milk was considered an inferior good.

Peruvian governments had intervened following a substitution growth strategy. Food pricing and exchange rate policies served this general strategy biased manufacturing against agriculture. Dairy policies such as price control system, import inputs subsidies, and monopoly on imported dairy policies were set in place.

Correct characteristic of the structure of dairy farmers in La Libertad coastal region were documented. Three types of dairy production system were founded: extensive (17 percent), mixed (24 percent) and intensive (59 percent) dairy production system. Extensive production's farmers were primarily small farmers with herd size less than 11 cows. The use of AI, concentrate and dairy facilities were almost none. In contrast, the intensive system had a higher daily milk productivity (11 liters per cow) In the intensive system especially in Trujillo province were founded many "Landless" farmers depending on their feeding supply from off-farm sources. The two main channels

of distribution were the retailer and consumer which accounted of 92 percent of the total sold milk through commercial channels.

Given the macroeconomic scenario in which stabilization and structural reforms will continued to drive Peruvian macro-policies for the next few years, as much as the limited implementation of new polices can be expected significantly effects. For domestic producers might represented market opportunities because of the elimination of imported dairy subsidies and overvalued exchange rate. Unfortunately, the potential increase could be tempered by decreasing milk demand as unsubsidies prices rise, especially for evaporated, recombined and powdered milk, products with high content of imported raw material. However the inelastic nature of the estimates own-price elasticities assuming no further income losses would occur, no dramatic drop will be expected. It appears that evaporated and fresh milk would be affected by changes on price of each because of the complementary relationship. The expenditure conditional elasticities imply that price effects may be dwarfed by further losses in incomes. However if income increases, the expenditure on evaporated and powdered milk will increase at higher rate that income increases. It seem that the impacts on dairy farmers in La Libertad will differ due to the evidence of heterogeneity among La Libertad dairy farmers and farming system.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Between 1970 and 1990, Peruvian domestic milk production decreased by 5.8 percent while dairy imports grew 21 percent. Although the total milk supply increased, it did not keep pace with the Peruvian population annual growth rate of 2.8 percent. As a result, Peruvian per-capita milk consumption has fallen by almost fifty percent in the last twenty years. At the same time, the market share held by various dairy beverage products, fluid and powdered, changed as consumers incomes fell, and the relative milk product prices changed because of government policy actions and increased imports of powdered milk.

Many of the changes in Peru's milk market have been attributed to a combination of factors including: domestic agricultural and dairy policies, which attempted to lower consumer prices by subsidizing processed milk (evaporated and recombined) producers; prolonged macroeconomic troubles, which led to declines in consumer purchasing power; and depressed dairy product prices in world markets, which resulted in lower prices for imported powdered dairy products in Peru.¹

¹ Additional background information on Peru's physical, economic, and dairy industry characteristics is contained in the Appendix A.

Over the past twenty years, successive Peruvian government administrations have followed dairy policies that favored consumers by providing low priced dairy products. The policies used by the Peruvian government to achieve their low consumer price objectives ranged from price controls to direct subsidies for the dairy industry. Often, firms in Peru's evaporated milk industry were singled out by the Peruvian government because this type of milk had a longer shelf life, a large market share, was distributed throughout the nation, and producers had the option of using lower cost imported powdered dairy inputs. As a result, domestic dairy producers who could not match the lower import dairy product prices lost access to their domestic processing markets, as did other non-evaporated milk processors.

The effects of the differential policies were experienced most readily by those dairy producers and dairy processors who competed directly with evaporated milk in fluid milk markets. However, as will be shown in subsequent chapters, as the problems of the Peruvian economy increased most dairy producers and processors were negatively affected by the combination of past Peruvian dairy and agricultural policies, and the worsening condition of the overall Peruvian economy.

Although the initial policies appeared to benefit consumers, the longer term effects have harmed both

consumers and producers. As is apparent in hindsight, the Peruvian dairy sector not only had contributed to the nutritional needs and the income opportunities in rural Peru, it had also contributed to the nutritional needs and income opportunities in urban areas as well. Thus, the declines of the last twenty years felt in the Peruvian dairy industry were also felt throughout the Peruvian economy.

1.2 Research Objectives

The overall objective of this study was to examine the implications of possible changes in the Peruvian government's dairy policies on dairy farms in one representative region of Peru, La Libertad Coastal area.

The La Libertad region was chosen for this study because the dairy farms in this area possess a range of characteristics that are generally present in other dairy areas throughout Peru. This area is Peru's fifth largest milk producing region with production distributed across a large number of small and medium sized producers. The region also possesses the full range of marketing channels from major dairy processors to informal retailers who sell milk on street corners. In addition, Trujillo, the third largest city in Peru, is located in this region.

The specific objectives of this study were to:

1. examine the structure of milk demand in Peru;
2. provide an historical analysis of the development of dairy policies in Peru since 1963;

3. describe and analyze the structure of dairy farms in La Libertad area.

The information developed in the three specific objectives will be used to address the effects of possible changes in Peruvian Government dairy policies.

The first objective will be achieved by using the Rotterdam demand system to estimate the demand interrelationships among the basic fluid milk products. Given that the interest of this study was on the demand relationships within a specific commodity group, the Rotterdam model was appropriate because it allows for independent measures of conditional price and income elasticities while maintaining the theoretical aspects provided in consumer demand theory.

Objective two will be accomplished by presenting and analyzing historical information about Peruvian agricultural and dairy policies. This information were obtained from Peruvian government and industry sources as well as from Peruvian newspapers and previous studies. Although a wide range of macroeconomic and agricultural policies will be dealt with, this section of the study primarily concentrated on the impacts on the dairy sector of the major policies

The third objective will be accomplished by analyzing information obtained from a survey conducted by for the Peruvian Ministry of Agriculture (PMA). The PMA team

visited the dairy farmers of the four coastal provinces of la Libertad department: Pacasmayo, Chepen, Ascope, and Trujillo, in August, 1991. The data collected in this survey includes information related to the following dairy farm characteristics:

Herd size and location of dairy farms, income, land tenure, level of technology employed, farmer characteristics, prices received for milk, marketing channels utilized.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

This review is divided into three general sections, which address the three broad topic areas covered in this study. The three sections are as follows: 1) a review of consumer demand theory including the Rotterdam Model, and selected dairy product demand studies; (2) a review of macroeconomic and agricultural policy studies; and (3) a review of dairy policy studies. The first section opens with a brief overview of consumer demand theory and the use of demand systems. This section closes with a review selected of milk demand studies. The second section presents an overview of macroeconomic and agricultural policies studies with an emphasis on developing nations. The final section examines previous dairy policy studies.

2.2 Review of Consumer Demand Theory

Consumer demand theory contends that individual consumers derive satisfaction or utility through the consumption of goods, and that consumers attempt to maximize their utility subject to budget constraints (Goddard, 1985). In general, a demand function can be derived from an individual's utility function by maximizing the value of the utility function with respect to the consumer's budget constraint. The solution to this maximization problem

represents the optimal the allocation of that consumer's budget. In addition, the quantity demanded is expected to be inversely related to its own price, possibly affected by the prices of other goods in consumer's budget, which is constrained by consumer income. Tastes and preferences are assumed given and unobservable.

The influence of income and prices on consumption are typically assessed by measuring elasticities. Apart from prices and income, socioeconomic and demographic factors, in cross-sectional studies, may also be incorporated in a model to examine their influence on the quantity demanded of a good (Haidacher, 1989). Once estimated a demand function can be used to predict the individual's consumption behavior under differing prices and income situations (Barewal, and Goddard, 1985).

In an attempt to more accurately incorporate consumer theory in demand equation estimation, several "complete demand" systems have been proposed such as the Almost Ideal Demand System (AIDS), the Linear Expenditure System (LES), the Translog System and the Rotterdam model (Barten, 1977). In general, these systems are based on a two-stage demand process in which the amount expended on a specific set or category of goods is determined in the first stage. The second stage utilizes a set of demand equations to describe the allocation of the expenditure among the goods in that category. As a result of the maximization process, the sum

of the individual good expenditures in the category equals the total expenditure allotted in the first stage (Raunikar, and Huang, 1987).

2.2.1 The Rotterdam Model

Among the complete demand systems employing the general two-stage concept of consumer choice is the Rotterdam model. Theil proposed the Rotterdam system, in 1967, as a variation of more general log-linear specifications. The estimation of demand function parameters in this approach is achieved using product prices and a measure of real income. (Barten 1977; Theil 1967). The approach allocates expenditures for a given category among the competing products within the group. The demand relationships estimated in the second step are called "conditional" because they are based on the level of expenditure allocated to that category (Sparks, 1991). Use of this two stage process is valid for any group of commodities that are considered weakly separable from all other goods. Two goods are considered weakly separable if price changes for one good do not affect the demand for the other good.

Barten (1977) points out that the Rotterdam model is superior to models such as the indirect addilog, direct addilog, and LES. A study by Lee (1984) indicated performance similar results when the Rotterdam Model was compared with a double logarithmic model. Lee found that the Rotterdam Model demand relationships were more

consistent with the theoretical expectations than those obtained in the double logarithmic model.

Researchers have used the Rotterdam Model to examine consumer demand for a variety of agricultural goods. Lee (1984) used the Rotterdam Model to estimate the demand parameters for fruit beverages market. Dahlgran (1987) used the model to detect evidence of structural change in beef, pork, and chicken demand. Sparks (1991) applied the Rotterdam Model to examine the competitive relationship between United States and other major exporting countries in four foreign fresh orange markets.

Although few studies directly address Peruvian milk demand, as Cho (1982) notes, international comparisons may be helpful in forecasting a country's demand patterns. Useful information may be derived when comparisons are made of countries at different stages of economic development.

2.2.2 Dairy Products Demand Applications

Jarvis (1986) points out that the demand for milk in Latin America grew rapidly during the 60's and 70's as a result of rapid increases in per-capita income, population and urbanization. However, as noted in Chapter 1, Peruvian per-capita milk consumption fell by almost fifty percent between 1970 and 1990. Thus, Peruvian milk producers and consumers did not necessarily benefit from the gains witnessed in other parts of Latin America. The reasons for the Peru's declining milk consumption may be partly

attributed to the effects of twenty years of government intervention, but is also partly due to changes in consumer incomes as well as changes in relative prices. The results of selected milk and milk product demand studies are summarized in Table 2.1.

In a 1980, cross sectional study conducted by Muchinik and Nores income elasticities for milk products were calculated for eleven Latin American cities, included Lima, Peru. The Muchinik and Nores results indicated that income elasticities for milk were highest in the poorest quartile about +1.0, while the lowest income elasticities, at about +.40, were found for the wealthiest income quartiles.

Amat, Leon and Curonisy (1981) using cross-sectional data from Peru's 1971-72, National Food Consumption Survey (ENCA) estimated a double logarithmic function and calculated that the overall income elasticity for milk in Peru was +0.48. Amat et al. also calculated income elasticities for evaporated and fresh milk by consumer place of residence. The income elasticity estimates for evaporated milk were: +0.34 for consumers in Lima; +0.42 for consumers in big cities; +0.46 for consumers in small towns and +0.51 for consumers in rural areas.

Table 2.1 Previous Milk Demand Elasticity Estimates

Author	Year	Nation	Data Period	Model	Product	Elasticities		
						Expenditure	Income	Own-Price
Sae & Sasaki	1973	Japan	1958-68	LES	Milk & eggs		1.37	-0.68
Amat et al.	1981	Peru	1971	OLS	Milk		0.48 (Lima)	
					Evap		0.34 (Lima)	
					Evap		0.42 (Large Cities)	
					Evap		0.46 (Small Towns)	
					Evap		0.51 (Rural Areas)	
					Fresh		0.43 (Lima)	
					Fresh		0.81 (Large Cities)	
					Fresh		0.75 (Small Towns)	
Cho	1982	Korea	1966-79	LES	Milk & eggs		1.72	-0.74
	1985	U.S.	1953-83	System	Fluid Milk	-0.22		-0.25
Oskam	1986	U.K.	1977	OLS	Fluid Milk		-0.23	+0.06
					Cream		-0.23	+0.90
					Condensed Milk		-0.35	-0.24
Room	1986	Holland	1965-83	OLS	Fluid Milk		-0.28	0.00
Gould et al.	1990	U.S.	1955-85	AIDS	Whole Milk	0.65		-0.32
					Low-Fat	0.06		-0.43
Heien & Wessells	1988	U.S.	1977	AIDS	Milk	0.77		-0.63

The Amat, et al. income elasticity estimates for fresh milk were: +0.43 for Lima residents; +0.81 for "big cities" residents; +0.75 for small towns residents; and +0.89 for rural areas residents. Given the assumption that income per family and size of urban area were positively associated, Amat, et al. concluded that income distribution was the primary reason for differences by level of urbanization. Thus, the highest values of income elasticities are the consequence of the lowest income. At a subsistence level families only focused their consumption on essential food commodities. Rural residents were found by the Amat, et al. to consider goods in the milk group to be luxuries goods.

In 1982, Cho compared the results from a study on Japanese milk demand using Powell's Linear Expenditure system by Sae and Sasaki (1973), with his 1981 study of Korean Milk demand. Although Japan's data were from the period 1958 to 1968, and Korean data were from the period 1966 to 1979, Cho found that in both countries as income increased so did the per-capita consumption of dairy products. Cho also noted that the consumption of dairy products in both countries was more closely related to income than prices. The estimated price elasticities for the milk and eggs group were -0.744 and -0.688 for Korea and Japan. Cho estimated the income elasticities for milk and eggs group at +1.725 for Korea and +1.375 for Japan.

Huang (1985) applied a complete demand system using a 1953 to 1983 times series of U.S. food consumption to estimate the own-price elasticities and expenditure elasticities for forty foods items. During this period, which included the demographic growth of World War Two Baby Boomers from childhood to adulthood, fluid and evaporated/dry milk consumption declined on a per capita basis. Huang estimated expenditures elasticities for fluid and evaporated/dry milk at -0.2209 and -0.2664 . In addition, Huang found that processed products such as evaporated/dry milk were comparatively more own-price elastic than fluid milk. The own-price elasticities estimate for evaporated-dry milk was -0.8255 , while it was only -0.2566 for fluid milk. Using the estimated cross price elasticities, Huang found that fluid milk was considered a substitute for evaporated/dry milk.

Oskam (1986) used an OLS model to estimated the demand parameters for dairy products by households in the U.K. using survey data from 1977. In this study Oskam estimated the own-price elasticity for milk and milk products to be -0.23 . and the income elasticity for milk and milk products to be 0.06 .

Haidacher (1988) notes that U.S. demand for dairy products is sensitive to changes in relative prices and income. In the early 1980's, rising U.S. consumer incomes and falling dairy prices relative to other foods generated

an increase in dairy products consumption. However, because the data used by Huang were times series, it should be recognized that the income elasticities calculated by Huang and presented in Table 2.1, may embody trend effects.

Using data from the 1977-78 USDA Household Food Consumption Survey, Heien and Wessells (1988) examine U.S. dairy products demand in the U.S. Using the AIDS Model, Heien and Wessells estimated the own-price elasticity for the milk group, which included whole, skim, chocolate, and buttermilk, to be -0.63 . Heien and Wessells also calculated the expenditure elasticity for the milk group at 0.77 . Heien and Wessells concluded that U.S. demand for dairy products was generally own-price inelastic, cross-price effects were moderate, and that income effects were small and negative. In addition, Heien and Wessells found that factors such as age, sex, and the proportion of meals eaten at home were significant factors in determining milk demand.

In 1990, Gould, et al. used the AIDS Model to estimate the demand relationships for fluid milk using U.S. times series data from 1968 to 1985. Gould et al. found that compensated own-price elasticities for whole milk, and low-fat milk were -0.324 , and -0.437 , respectively. The cross-price elasticities were not statistically significant. However, cross-price between whole milk, other foods, juices and other beverages were statistically significant and indicate a substitution relationships. Gould et al. also

noted shift in consumer demand away from whole milk towards reduced fat milk.

Finally, Schelhaas (1991), notes that in developing countries there may be the potential for increased demand for milk and dairy products as incomes in those countries increase. However, the increases in demand will not be proportional to the increases in incomes. In Peru, for example, the income elasticity for milk in Peru was estimated by the FAO to be about 0.7.

In summary, most studies indicate that milk demand in Peru and elsewhere is income inelastic, and typically own-price inelastic. However, too few studies have examined the cross-price relationships of various milk varieties to accurately determine the effects of relative price changes on milk products. As will be seen in the following chapters, it is the effects of the relative prices, whether the result of market or government actions, that will most likely affect the prospects of Peru's dairy farmers. Especially since access of Peruvian dairy farmers to specific marketing channels is heavily influenced by their size.

2.3 Economic and Agricultural Policy Interactions

As Mcalla and Josling (1988) point out, all nations have national objectives that reflect the collective desires about a nation's welfare. Consequently, the primary policy problem is to select instruments and choose their values in

ways that maximize national welfare subject to the national endowments and the international opportunities. In this context, policy is defined as actions and government decisions designed to achieve general objectives in issues such as income growth, population, food supply, employment and equity.

Sectoral policies such as agricultural, food, dairy contain more specific purposes related with the sectors themselves. For example, agricultural policies are related with issues such as land use and ownership, credit, technology, input and rural income. The food policy, which lies in the interaction between national policy and agricultural policies, deals with the nutrition consumer level, food supply and food security issues. However, sectoral policies may conflict with or be affected by macropolicies. These interactions are possible because the relative prices of factors and outputs, on which producer and consumers base their decisions, may be affected by the policies.

As Timmer (1984) notes, in designing food policies policy-makers must be aware that food prices play a dual role determining food consumption levels especially among low income consumers, and determining the farmer income thereby the adequacy of food supplies. Mellor (1968) points out that agricultural prices plays three important functions: (1) to allocate farm resources; (2) to distribute

income; and (3) to encourage or retard investment and capital formation in agriculture.

Sectoral policies must serve at similar purposes and be integrated with macropolicies (Orden et al., 1982). In one way or another a pervasive macroeconomic environment could undermine the best sectoral policy. The opposite is also true, that is, sectoral policies may affect the performance of the agricultural sector which in turn will affect the overall economic performance depending on (1) the relative importance of the agricultural sector on the GDP, and foreign exchange balance; and (2) the size of food expenditure in consumers budgets. Finally, as Pinstруп-Andersen (1988) notes, in developing countries there is no unique pattern in designing policies. Each country must choose its particular mix of economic, social and political conditions and international constraints and opportunities.

2.3.1 Inflation Rates

As Tweeten (1991) points out macropolicies can affect farmers by distorting the allocation of economic factors and diverting them from their most productive uses. For example, an expansionary monetary policy in conjunction with fiscal deficit may cause inflation which is defined as a continuous increase in general prices. Inflation could affect farmers when farmer input prices increase at higher rate than farmer output prices. The impact on farmers will depend on the farmer ability to transfer inflated cost to consumers, and

the price flexibility of the specific commodity. Imperfect markets and a weak competitive farmer's positions may aggravate farmer's situations since inflation could push farmgate prices down due to the marketing margins expansion. Inflation may also affect the operation of the farm by depreciating highly seasonal operative capital. In addition, inflation may distort relative factor prices and bring uncertainty and instability on farmer's output prices.

If inflation is not controlled, it may develop into hyperinflation. As a World Bank study (1988) asserts, the main social and economic cost of hyperinflation are:

(1) declining real wages, incomes and consumption levels;
(2) social unrest; (3) political instability; (4) distorted relative prices and inefficient allocation of resources;
(5) declining investment; (6) progressive decline of the use of local money; and (7) the collapse of the potential for financial intermediation and possibly the institutions as well.

Timmer (1984) notes that governments affect agricultural and food sectors by budgetary and fiscal policies. However, fiscal policies depend on a government's ability and willingness to tax the domestic economy and its willingness to run and finance budget deficits.

2.3.2 Exchange Rate and Interest Rates

Changes in exchange rates, and interest rates have major impacts on agricultural sectors (Timmer, 1984).

An exchange rate devaluation increases domestic prices of tradable goods relative to non-tradable goods. In the short term, devaluation stimulates output provided that domestic final prices of output increase more than prices of production factors. Whether the total output rises or falls depends on the relative strengths of the demand reducing or supply increasing effects that depend on the relative price elasticities of imports and exports.

Knudsen et al. (1990) suggest that many developing countries have chosen to maintain overvalued exchange rates to support their industrialization process. Such intervention keeps the cost of foreign exchange below its market clearing levels, which discourages exports by lowering their prices in terms of domestic currency, and encourages imports by cheapening those goods in terms of domestic currency. Therefore, overvalued exchange rate policies are biased toward consumers. However, as Valdez and Siamwalla (1986) note, overvalued exchange rates may occur even without government intervention due to differential inflation rates, protectionist trade, or fiscal policies.

Rosegrant and Siamwalla (1986) point out that although negative interest rates may in the short run benefit farmers by reducing interest farm expenses, subsidized credit will favor the adoption of capital intensive technologies generating rural unemployment, distort relative prices of

factors affecting the allocation of capital to efficient activities, and undermine the viability of the financial system by decapitalizing, rationing and finally reducing the capital available for the sector.

2.3.3 Trade Policy and Food Aid Influences

Valdez and Siamwalla (1986) note that trade policies among the more controversial issues in agricultural development. The free trade philosophy argues that the efficiency on countries's welfare is reached when agricultural prices reflects the opportunity cost at border prices. Often trade policies are implemented to:

(1) stabilize domestic prices relative to international prices; (2) improve rural income; (3) satisfy political concerns of its constituency; and (4) reduce dependency in what are considered strategic commodities.

Trade policy include import tariffs, import subsidies; export taxes, export subsidies, import quotas, state trade monopolies, supply management programs and food and agricultural price programs such as price support, direct income or subsidy payment programs and consumer subsidy programs.

Finally, although the nature of food aid is unstable, and insecure source of food supply, the food aid's share in food supplies has increased markedly in less developing countries. As Von Braun and Huddleston (1984) note there is no evidence that food aid and growth in domestic food

production are mutually exclusive. In this regard, government policy plays an important role. If food aid substitutes commercial imports and it is not an addition to normal supplies domestic prices are not affected. Instead, saving in foreign exchange will take place. Domestic prices only will be affected, but only if the amount of foreign exchange forces an increase in the value of the domestic currency.

In the case that food aid does not replace commercial imports, but is injected into domestic markets at prevailing prices, there is a significant negative impact on domestic production. Foreign exchange is not saved and to the extent that food aid is provided on the basis of long-term loans, fiscal debt pressure will arise from food debt.

2.4 Review of Dairy Policies Studies

Dairy policy actions are not carried out in a vacuum. Rather, the effects of consumer demand and other economy wide factors must be considered in the development and implementation on dairy policies. In addition, policy makers in developing countries face policy tradeoffs between import substitution and free trade, fiscal restraint and government subsidies, and public intervention and market forces (Girardot, 1988). In many countries subsidize part or all their domestic production, imports are commonly restricted and exports are frequently subsidized. Novakovic and Boyton (1988) note several reasons for interest in dairy

markets: (1) milk continues to be considered staple food; (2) milk is highly perishable and storage is only possible in the form of products that cannot be reversed into fluid milk; and (3) milk handlers would use their oligopolistic position to set prices and quantities marketed; and (4) government intervention is preferable to order the market to avoid excessive marketing cost and duplication of services that derive from the nature of competition of milk markets. Furthermore, the ability of milk markets to coordinate economic activities depends on the inherent characteristics of the milk market such as inelastic demand, bulkiness of raw milk, disease which requires rapid transportation, seasonality between production and consumption, and supply response lags to price changes because of biological cycles (Fallebert et al., 1990).

Bowender, et al (1986) argue that dairy development offers the potential to improve nutritional standards, and rural income. Dairy development also plays important role in overall development process because it provides higher returns and it captures the economic benefits of the use of farm surplus resources through animal-crop linkages such as crop residues-animal feeding, draft power-cultivation, manure fertilizer, and improvement in cash flow. However, as McIntire et al (1992) note the possibility to expand milk production depends on the agroclimatic condition of the areas and within them on population density pressure.

CHAPTER 3

METHODOLOGY AND DATA

3.1 Introduction

Each of the three principal aspects of this study, Peruvian milk demand, Peruvian government policy review, and the basic description of dairy farmers in the La Libertad Department requires the utilization of different techniques. The milk demand analysis, for example, is quantitative in nature and will utilize the Rotterdam Model. The review of Peruvian economic, agricultural, and dairy policies lends itself to a more descriptive presentation. Finally, the analysis of the La Libertad dairy farmers' survey data will be accomplished using descriptive statistics and cross tabulations.

The data analyzed in this study were drawn from a number of Peruvian and international, and private and public sources. The dairy demand times series data were obtained from Peruvian government and the Peru's National Association of Dairy Processors. Information about Peru's economic, agricultural, and dairy policies was acquired from Peruvian government agencies and private organizations. The August 1991, La Libertad Dairy Farmer Survey data were obtained from Peru's Ministry of Agriculture.

As suggested in Chapter One, if Peru's dairy policies are expected to promote legitimate market opportunities,

then an accurate evaluation of consumer preferences is crucial. The policies must be based on a reasonable appraisal of milk demand. Thus, the first part of this study examines the price relationships among the five main types of fluid milk consumed in Peru (fresh, pasteurized, evaporated, recombined, and powdered).

3.2 The Rotterdam Model

The Rotterdam Model was selected for use in this analysis because it provides a theoretically correct approximation of consumer demand. The model is also parsimonious in the number of parameters estimated, which is important because the number of observations is limited to twelve years of annual data from 1979 to 1990.

The Rotterdam Model as developed by Theil (1967) and Barten (1968, and 1969), assumes that the demand for a specific good in a given market is weakly separable from the demand for other goods not included in the system, but not from goods in that group.

As noted in Chapter Two, the Rotterdam Model belongs to a group of consumer demand models based on the concept of a two-stage budgeting process in which consumers first allocate their budgets among all groups of goods, and then allocate the expenditure within that group of goods. In this study Peruvian demand for fluid milk is considered weakly separable from all other goods. Within the fluid milk group the demand for the different types of milk is not

considered separable. Thus, the demand for fresh milk, pasteurized milk, evaporated milk, recombined milk, and powdered milks is considered to be determined in the second stage of this two stage budgeting process.

Following the econometric evidence provided by Heien and Wessells (1990) that first stage food prices have little effect on the second stage food demand, this study focusses on the development of second stage estimates. The Theil-Barten approach for the second stage estimation of parameters for a commodity group can be defined by the following equation:

$$(W_{it}^* * Dq_{it}) = \phi_i * DQ_{it} + \sum_j \pi_{ij} * Dp_{it} + e_{it} \quad \text{eq. 3.1}$$

Where:

$W_{it}^* = (W_{it} + W_{i,t-1})/2$ and W_{it} is the expenditure proportion of i^{th} type of milk during time period t .

$Dq_{it} = \log(q_{it}/q_{i,t-1})$ and q_{it} is the demand for i^{th} type of milk during period t .

ϕ_i is the conditional marginal budget share for milk market.

$$DQ_{it} = \sum_i (W_{it}^* * Dq_{it})$$

$Dp_{it} = \log(P_{it}/P_{i,t-1})$ and P_{it} is the j^{th} price for i^{th} type of milk in time period t .

π_{ij}^* = the conditional Slutsky price coefficient between the i^{th} type of milk and j^{th} price of type milk.

ϵ_{it}^* = error term, which is assumed to be log-normally distributed with an expected value equal to zero and constant variance (σ^2) overall observations.

The following restrictions from demand theory are imposed in the Rotterdam model:

$$\sum_i \phi_i = 1 , \quad \text{Adding-up;} \quad \text{eq. 3.2a}$$

$$\sum_j \pi_{ij} = 0 , \quad \text{Homogeneity; and} \quad \text{eq. 3.2b}$$

$$\pi_{ij} = \pi_{ji} \quad \forall (i \neq j) , \quad \text{Symmetry;} \quad \text{eq. 3.2c}$$

The theoretical restriction of adding-up requires that as a result of any change in price of good or in the income of the individual, the consumer will adjust the quantities purchased of each good so as to results of this incremental income being exactly spent.

The homogeneity restriction of degree zero in prices and income requires that if all prices and the individual income simultaneously increase or decrease by the same percentage, then there will be no change in the quantities of goods purchased by the individual.

The symmetry restriction states that if an individual's income is adjusted to maintain a constant level of satisfaction or utility, then the change in the quantity purchased of good A, as a result of an incremental change in the price of good B, will be the same as the change in the quantity purchased of good B due to an incremental change in the price of good A (Goddard and Barewal, 1985).

The system of equations arising from the development of the Rotterdam Model will be estimated using the iterative three-stage least square (3SLS) procedure contained the SAS/SYSLIN program. As a result the regression estimates will be consistent and asymptotically efficient (Pindyck and Rubenfield, 1991). The equation of the last good will be deleted to avoid non-singularity of the error covariance matrix. However, the parameters in the deleted equation will then be derived from the parameters of other equations using the symmetry and homogeneity conditions (Theil, 1971).

The parameters estimated in using the Rotterdam model parameter estimates can be used to calculate Slutsky and Cournot price elasticities, and the conditional income elasticity for each type of milk contained in the system. The formulas used in the calculation of these elasticities can be specified as follows:

The Slutsky price elasticity is defined as:

$$S_{ij} = \Pi_{ij} / W_i$$

Where Π_{ij} is the Slutsky price parameter obtained from equation (1) and W_i is the average budget share of the i th type milk.

The Slutsky price elasticity values incorporate the influence of a theoretical income compensation that would allow consumers to achieve the same bundle of goods after the rise in price while real expenditures in milk are held constant.

The Cournot price elasticity is defined as:

$$C_{ij} = S_{ij} - \phi_i (W_j / W_i)$$

Where ϕ_i is the estimated expenditure parameter for the i th type milk and W_j is the average budget share of the j th type milk.

The Cournot price elasticity reflects both substitution and income effects while nominal expenditures are held constant. The Cournot price elasticities are reported in this study because they reflect both substitution and income effects.

In addition, the Rotterdam Model parameter estimates will be used to calculate the conditional income elasticity for each good in the demand system as follows:

The conditional income elasticity is defined as:

$$E_i = \phi_i / W_i$$

Where ϕ_i is the expenditure parameter for the i th type of milk, and W_i the average budget share of the i th type of milk in the Peruvian milk market.

The conditional income elasticities will be calculated from the estimated expenditure coefficients, and measure the changes in the quantities demanded of each type of milk in response to changes in consumers' expenditures on each milk category.

The data used to estimate the milk demand relationships were times series from 1979 to 1990. Price and quantity data were obtained from the Peruvian Ministry of

Agriculture, Institute of Statistics (INE, Peru: Statistical Compendium 1990-1991), the National Association of Dairy Farmers (FONGAL) and the National Association of Dairy Processors (ADIL) for Fresh (FRE), pasteurized (PAS), recombined milk (REC), evaporated (EVA) and powdered (POW) milks. The consumer milk prices used are expressed in constant soles using a 1979 base year CPI to deflate the prices.

Because of the absence of national fresh (FRE) milk consumer prices, farmgate fresh milk prices are used as an approximation. Although there was no way to test for similarity between the farmgate and consumer price series, it was assumed that these price series move in similar manner over the period studied. This assumption is recognized as a compromising aspect of the demand model estimation.

3.3 Government Policies and Dairy Sector

In general, the presentation of the macroeconomic, agricultural and dairy governmental policy information will follow a chronological order. In most cases the primary focus will be on the relationships and implications of these policies on the Peruvian dairy sector. The purpose of this presentation will be to introduce background information that may indicate specific policy preferences on the part of the Peruvian government. This information will also serve

to help explain how the government has intervened in the activities of Peru's dairy industry.

The primary sources of information for the policy aspects of this study were obtained from official published sources such as government agencies, such as the Ministry of Agriculture and the Institute of Statistics (INE), and producers organizations such as the National Association of Dairy Producers (FONGAL) and the Association of Dairy Processors (ADIL). Another important source was the Peru's official newspaper "El Peruano," in which all legal regulations, such as agricultural policy changes are published. Finally, given that the analysis of individual policies in beyond the scope of this study, the findings of other research related with the Peruvian agricultural and dairy sector was also be introduced where appropriate.

3.4 Dairy Farmer Survey

The La Libertad Dairy Farm survey was conducted by Peru's Ministry of Agriculture using direct interviews with farmers in la Libertad region. The names and addresses of the dairy farmers were obtained from the register of the Agricultural Statistics Division. The names and addresses of the respondents are not contained in the data, but the Ministry of Agriculture's Agricultural Statistics Division attests to the validity of the data.

The Ministry of Agriculture's survey was conducted using four teams of interviewers assigned to each of the

coastal provinces of La Libertad department. The teams were comprised of three people from Peru's Agricultural Extension Service. Each interviewer was trained before the field work and supervised by an official from the Ministry of Agriculture's headquarters. The survey was conducted between August 15 and August 30, 1991.

The purpose of the survey was to obtain information which described main features of dairy farms and farmers in the region.² Information collected on dairy farm characteristics included herd size, milk production, land utilization, and types of farm and land tenure, and information on milking facilities, farm equipment, forage production, storage facilities, concentrate feeding and artificial insemination.

Operator characteristics such as age of operator, sex, years of experience and education were also collected. In addition to the dairy farm facilities and herd management practices, information was obtained about the farmers' access to various milk marketing channels. The combination of farm and farmer characteristics with the marketing information offers the opportunity to better understanding about the possible relationships between technology levels and market access.

Given the large amount of information and its "snapshot" nature, this information will be presented in a

² A copy of the survey translated into English is contained in Appendix B.

descriptive fashion. Tables using frequencies, means, and percentages will dominate this aspect of the study.

3.5 Integration of Demand Results with Policy and Survey Information

An important objective of this study was to assess possible the implications of dairy policy changes using the demand estimation results, and the dairy farm structure analysis for la Libertad. Thus, the accomplishment of this objective will primarily involve a merging of the analyzes developed to attain the three previous sections. In general, the impacts of the possible policy changes were examined in terms of the effects on the dairy farms in La Libertad, as well as the effects on the demand for different types of fluid milk. For example, an accurate estimate of own-price and cross-price elasticities will be useful in determining the extent to which a subsidy in one milk category, such as evaporated milk, would effect Peruvian milk consumption and market shares. Then using the milk market access information obtained from the survey description it will be possible to recognize how farmers with differing capital and resource bases are affected by the expected changes in consumer demand generated by the Peruvian subsidy policy.

CHAPTER 4

PERUVIAN MILK DEMAND MODEL RESULTS

4.1 Introduction

As introduced in Chapter 3, the Rotterdam Model was selected for use in this analysis because it provides a theoretically correct approximation of consumer demand. The model is also parsimonious in the number of parameters estimated, which was important because the number of observations was limited to twelve years of annual data.

The data in Table 4.1 indicate that evaporated and fresh milk hold dominant shares in Peru's milk market. The introduction of powdered milk in 1979 appears to have had a greater affect on the market share of recombined milk than it had for evaporated and fresh milk shares. Pasteurized milk, in contrast to the variations in shares of the other milk types appears to have maintained a small, but steady share of Peru's milk market.

However, the variations in milk share should be examined recognizing that without powdered milk the overall quantity of milk in the Peruvian milk market was almost constant from 1979 to 1990, as is shown by the Adjusted Milk Volume presented in Table 4.1. It was only during the period from 1986 to 1989 that the fluid volume of milk in Peru's milk market increased, and with the reduction in

powdered milk imports milk volume have returned to the previous lower levels.

Table 4.1 Market Share by Type of Milk
(Fluid Milk Equivalents)

Year	Type of Milk ^a					Total	Adjusted ^b
	Evap.	Fresh	Reco.	Powd.	Past.	Volume	Volume
	----- Percent -----					1,000 Metric Tons	
1979	45.7	41.0	11.9	0.1	1.4	621.3	620.9
1980	41.5	41.2	13.8	2.2	1.3	635.6	615.1
1981	45.6	40.9	10.6	1.8	1.1	721.4	698.5
1982	51.0	35.9	9.9	2.2	1.0	733.7	704.4
1983	51.2	34.4	9.3	4.2	0.9	694.0	653.5
1984	47.9	37.0	8.6	5.6	0.9	716.3	649.5
1985	43.5	40.0	9.5	5.9	1.2	685.6	609.3
1986	34.9	41.6	7.0	15.3	1.2	840.4	600.8
1987	43.6	35.3	6.8	12.2	2.1	886.4	655.9
1988	47.9	33.6	6.5	10.1	2.1	811.4	625.6
1989	35.8	47.2	4.5	10.9	1.6	716.9	610.4
1990	50.8	33.4	6.2	8.2	1.4	615.1	563.2

^a Evap. = Evaporated Milk; Reco. = Recombined Milk
Powd. = Powdered Milk; Past. = Pasteurized Milk

^b Adjusted Volume excludes the volume accounted for by Powdered Milk.

After consideration, the general milk market features, milk demand in Peru was estimated using the Rotterdam model presented in Chapter 3. Equation 4.1 and the attendant restrictions are based on individual utility maximizing behavior. However, the use of Equation 4.1 with aggregated market level data requires two additional assumptions: 1) that all consumers' utility functions converge that underlay the Rotterdam model; and 2) that all consumers face the same prices (Clement and Selvanathan, 1988) . Both assumptions are quite presumptive, but these assumptions as shown by Clement and Selvanathan (1988), allow the individual

homogeneity and symmetry restrictions to hold in aggregate as well. The use of these restrictions is not especially important in theoretical terms in light of the two previous rather grand assumptions, but they are useful in estimation. The inclusion of the homogeneity and symmetry restrictions reduce the number of parameters to be estimated, and this reduction also mitigates the possible influence of collinearity in the milk price series. The collinearity concerns arise as a result of "normal" economic activities, and as a result of the milk price policy actions taken by the Peruvian government during the period examined (These policy actions are detailed in Chapter 5).

The Rotterdam model parameters presented in this section were estimated for the fluid milk group using the following representative demand equation:

$$(W_{it}^* * Dq_{it}) = \phi_i * DQ_{it} + \sum_j \pi_{ij} * Dp_{jt} + e_{it} \quad \text{eq. 4.1}$$

Where:

$W_{it}^* = (W_{it} + W_{i,t-1})/2$ and W_{it} is the expenditure proportion of the i^{th} type of milk during period t .

$Dq_{it} = \log(q_{it}/q_{i,t-1})$ and q_{it} is the demand for the i^{th} type of milk during period t .

ϕ_i is the conditional marginal budget share coefficient for milk.

$$DQ_{it} = \sum_i (W_{it}^* * Dq_{it}) \quad \text{eq. 4.2}$$

$Dp_{it} = \log (P_{it}/P_{i, t-1})$ and P_{it} is the j^{th} price for i^{th} type of milk in time period t .

π_{ij} = the conditional Slutsky price coefficient between the i^{th} type of milk and the j^{th} price of type milk.

e_{it} = error term, which is assumed to be log-normally distributed with an expected value equal to zero and constant variance (σ^2) overall observations.

4.2 General Model Results

The values of the parameters for each type of milk for the Rotterdam model are showed in Table 4.2. In estimation, one equation was omitted to avoid a singularity. However, maximum likelihood estimates are invariant to the omission of one of these equation (Barten, 1969). The maximum likelihood coefficient estimates of the demand parameters were determined using the iterative three stage least squares procedure in the Statistical Applications System (SAS). The system MSE for the model was 0.8 with 30 degrees of freedom.

The collinearity diagnostics for the model indicated the presence of only moderate levels of collinearity among the price variables. The price series for evaporated and recombined milk were expected to highly collinear because of Peruvian government policies, but use of the restrictions may have limited the degree of collinearity between the two price series.

Table 4.2 Rotterdam Parameter Estimates^a

Type of Milk	Conditional Marginal Share (ϕ_i)	The conditional Slutsky price coefficients(Π_{ij}) ^b					Durbin Watson	
		Evap.	Past.	Reco.	Fresh	Powd		
Evaporated	0.7451** (0.1976)	0.0425 (0.0687)	0.0025 (0.0098)	0.0607 (0.0356)	-0.1185 (0.0663)	0.0128 (0.0453)	1.675	
Pasteurized	0.0088 (0.0197)	-0.0024 (0.0098)	0.0095 (0.0068)	0.0064 (0.0083)	-0.0015 (0.0077)	-0.0168* (0.0053)	1.104	
Recombined	-0.0867 (0.0713)	0.0607 (0.0356)	0.0064 (0.0083)	-0.06396 (0.0324)	0.0385 (0.0252)	-0.0418* (0.0172)	1.489	
Fresh	0.1742 (0.2750)	-0.1185* (0.0663)	-0.0015 (0.0077)	0.0385 (0.0252)	-0.0185 (0.1001)	0.1000 (0.0560)	2.055	
Powdered	0.1585 (0.1877)	0.0128 (0.0453)	-0.0168** (0.0052)	-0.0418* (0.0172)	0.1000 (0.0560)	-0.0543 (0.0558)	1.913	

^a Standard errors are shown in parentheses.^{**} Significant at $\alpha = 0.05$; * Significant at $\alpha = 0.10$.^b Evap. = Evaporated Milk; Reco. = Recombined Milk
Powd. = Powdered Milk; Past. = Pasteurized Milk

The Durbin Watson statistics all fell into the inconclusive or fail-to-reject regions. The Pasteurized Milk equation had the most dubious Durbin Watson Statistic at 1.104, but even this figure fell into the inconclusive region for 11 observations, because of the small number of observations. Given these results the data were not corrected for possible autoregressive disturbances.

As a result of the Durbin Watson and the multicollinearity diagnostics, the parameter estimates do not appear to have suffer from the violation of the major econometric estimation assumptions that may be affected by the use of times series data. Thus, the results presented in Table 4.2 may be considered unbiased, and consistent. The issue of efficiency remains in question, because of the limited number of observations used in this study.

4.3 Analysis of Coefficients Estimates by Equation

In general, the coefficient estimates are not statistically significant. This may be because of the limited number of observations, as well as, the possibility that consumers in aggregate due not view each of these types of milk as substitutes or complements. For example, as noted in the Appendix A, recombined milk is only available in Lima, thus about half of Peru's population does not have access to this type of milk. In addition, as shown in Table 4.3, pasteurized milk is a product primarily available only

Table 4.3 Monthly Per Capita Milk Consumption in Metropolitan Lima
by Income Quartiles.

Milk	<u>I quartile</u>		<u>II quartile</u>		<u>III quartile</u>		<u>IV quartile</u>	
	1989	1990	1989	1990	1989	1990	1989	1990
Powdered Kg	0.10	0.09	0.20	0.05	0.12	0.05	0.24	0.14
Evaporated Kg	0.59	0.58	0.75	0.72	0.91	0.94	1.50	1.43
Fresh Lt	0.24	0.08	0.02	0.02	0.16	0.25	0.13	0.19
Recombined Lt	0.20	0.15	0.31	0.64	0.37	0.34	0.44	0.52
Pasteurized Lt	n/a	n/a	n/a	n/a	n/a	0.03	n/a	0.09
% of Population	21.0	20.4	23.7	24.0	26.4	25.8	28.7	29.6

Source: National Institute of Statistics, 1990.

to wealthy Peruvians: Nonetheless, these factors were not sufficient reason alone to remove these types of milk from the model. They do, however, lend support for the absence of statistical significance some of the coefficients.

4.4 Calculation of Elasticities

The interpretation of the Rotterdam model results is based on their transformation into elasticity estimates. As shown in equations 4.3, 4.4 and 4.5, conditional demand elasticities are calculated using the coefficients from Table 4.3. In all cases, these elasticity estimates are considered conditional because of their are derived from the second stage of a two-stage budgeting process. Thus, their values are conditional upon changes derived from the first stage.

The Conditional Slutsky Price Elasticity is defined as:

$$S_{ij} = \Pi_{ij} / W_i \quad \text{eq. 4.3}$$

Where Π_{ij} is the Slutsky price parameter obtained from equation (1) and W_i is the average budget share of the i th type milk.

Conditional slutsky price elasticities represent the percent change in the quantity demanded of the i_{th} for a percent change in the price of the j_{th} type of milk assuming that the consumer's income is theoretically compensated to allow the consumer to obtain the same bundle of goods as before the price change. Thus, the embody only the

substitution effect of a price change. The conditional Slutsky elasticities are presented in Table 4.4

The Cournot price elasticity is defined as:

$$C_{ij} = S_{ij} - \phi_i (W_j / W_i) \quad \text{eq. 4.4}$$

Where ϕ_i is the estimated expenditure parameter for the i th type milk and W_j is the average budget share of the j th type milk.

The Cournot price elasticity reflects both substitution and income effects while nominal expenditures are held constant. The Cournot price elasticities are reported in Table 4.4. These elasticities are perhaps more useful in depicting consumer demand for milk in Peru because they reflect both substitution and income effects of a price.

Finally, the Rotterdam Model parameter estimates may be used to calculate the conditional income elasticity (E_i) for each good in the demand system as follows:

$$E_i = \phi_i / W_i \quad \text{eq. 4.5}$$

Where ϕ_i is the conditional marginal budget share parameter for the i_{th} type of milk, and W_i the average budget share of the i_{th} type of milk in the Peruvian milk market.

The conditional income elasticities measure the percent changes in the quantities demanded of each type of milk in response to percentage changes in consumers' expenditures on each milk category. The conditional expenditure elasticities are also presented in Table 4.4.

Table 4.4 Conditional Demand Elasticities by Type of Milk ^a

Milk	Types of Milk ^b				
	Evap.	Reco.	Fresh	Past.	Powd.
Conditional Cournot Price Elasticities					
Evaporated	-0.6505	0.0094	-0.9011	-0.0168	-0.0802
Recombined	1.1430	-0.6473	0.8242	0.0872	-0.4139
Fresh	-0.5120	0.0606	-0.2224	-0.0101	0.2304
Pasteurized	-0.1137	0.4232	-0.3679	0.6986	-1.2970
Powdered	-0.8906	-0.8480	0.5953	-0.2888	-0.9859
Conditional Slutsky Price Elasticities					
Evaporated	0.0529	0.1606	0.2501	-0.0192	0.0385
Recombined	0.8298	-0.7086	0.2938	0.1017	-0.5167
Fresh	-0.3190	0.0685	-0.0301	0.0064	0.2567
Pasteurized	-0.0639	0.6561	0.1772	0.0297	-1.0670
Powdered	0.2765	-0.7184	1.5290	-0.2300	-0.8569
Conditional Expenditure Elasticities					
	1.658	-0.9939	0.4532	0.6582	2.417

a Elasticities calculated at sample means.

b Evap. = Evaporated Milk; Reco. = Recombined Milk
 Past. = Pasteurized Milk; Powd. = Powdered Milk

Since the types of milk are consumed primarily for their nutritional content, it would seem reasonable that each type of milk is a potential substitute for the other type of milk within group. However, concentrating on the cournot conditional elasticity results in Table 4.4 it is apparent that the level of substitutability among milk types is lower than expected. Instead, the results suggest a complementary relationship between fresh milk and evaporated milk. Thus, dairy farmers supplying evaporated milk plants may be affected by changes in consumer demand for fresh milk, and the reverse is also indicated to be true.

The results also suggest the inelastic nature of milk demand. The conditional expenditure elasticities indicate that increased expenditures on the milk group would lead to greater increases in quantities demanded of evaporated and powdered milk. These results were somewhat anticipated because of the ease with which both powdered and evaporated milks can be stored by consumers, and the requirements for refrigeration, or immediate use for the other types of milk. The nearly unitary negative conditional expenditure elasticity for recombined milk indicates that it is considered an inferior good.

Finally, the validity of the parameter estimates and resulting elasticity estimates is heavily affected by the validity of the assumption that the national farmgate price of fresh milk was an acceptable approximation for the price

of fresh milk at the consumer level. Given that fresh milk in some markets may be used as an input for producing processed milks, or may serve as a competing beverage with processed milks in the milk market, the price assumption is substantial. Unfortunately, there is no way to objectively test this assumption.

CHAPTER 5

PERUVIAN ECONOMIC, AGRICULTURAL AND DAIRY POLICY REVIEW

5.1 Introduction

This chapter describes the macroeconomic, agricultural and dairy policies implemented in Peru. The purpose of presenting this information is to provide a context in which Peru's dairy industry and the effects government intervention may be viewed. The discussion of policies is divided chronologically by changes in Peru's political leadership. Given that the most pressing issues facing Peruvian dairy farmers are those arising from the general health of the Peruvian economy each section opens with a discussion of macroeconomic policies. The macroeconomic policy summary is followed by a review of general agricultural policies implemented in Peru during the period. The final part of each section presents a review of policies directed at the dairy industry in Peru, and a brief analysis, where appropriate, of the interactions between dairy policies, and economic and agricultural policies.

5.2 Peruvian Policy Overview

Although a detailed review of macroeconomic, agricultural and dairy policies is beyond the scope of this study, a sufficient amount of information is presented to describe the economic environment in which the Peru's agricultural and dairy sectors operate. In this regard,

Timmer (1983) points out that macropolicy and food systems often affect each other through budgetary policies (subsidies and investment), monetary policies (taxes and inflation), and the setting of macroprices (interest rates, exchange rates and wages). As in many nations, Peru's macroeconomic stability depends in part on agricultural production and prices in the food sector. However, macroeconomic stability also affects the allocation of resources used to produce agricultural output as well as the determination food prices.

In an historical context, Paredes (1991) suggests that the last forty years of Peruvian macropolicies can be divided into three periods. The first period, from 1950 to 1962, was a period in which the emphasis of the Peru's governments was to export primary goods. The second period, from 1963 to 1975, is one in which civil and militaries governments emphasized import substitution as a strategy for growth. The governments also played a more active role in the management of the basic sectors of the economy. The current period from 1976 until present, no strategy has been set and the economy has experienced growth and recessionary cycles.

5.2.1 Policies Prior to 1963

As Sheetz (1986) pointed out, during this period, in contrast to the rest of Latin America, Peruvian administrations adopted a strategy based on exports of

primary goods. Government intervention took the form of legislation that created incentives for investment in the exploitation of Peru's abundant raw materials. However, the strategy failed when price declines in raw materials markets worldwide led to lower prices for Peru's primary goods as well. Beginning in 1957, Peru experienced trade deficits and deterioration of foreign reserves. As a result, stabilization programs were implemented to reduce aggregate expenditures and the trade deficit. An exchange rate devaluation also occurred, which cut imports and increased export opportunities. In general, the programs were aided by increasing international prices, which made the adjustment less severe (Sheetz, 1986). As a result the economy was able to grow again with relatively low inflation rates and without resorting to international borrowing.

5.2.2 Agricultural Policies

In general, the objectives of the agricultural policies of successive Peruvian administrations prior to 1962, favored the agricultural export sector, and benefitted the growing urban population. However, the intent of the policies was not always achieved (Sheetz, 1986).

5.2.3 Dairy Policies

A complete review of government intervention in the dairy industry can be found in (Olivera, 1985). Olivera indicated that intervention was limited to set the condition to the establishment of evaporated and recombined dairy

plants via tax incentives and preferential tariffs for imported inputs. The government intervened controlling prices only when the economic crises occurred as in 1953, 1959 and 1968. The general pattern of the government intervention was limited only to encourage private initiative through extension and technical assistant programs of its ministry of agriculture.

Merril (1966) note that in the Lima milkshed almost 38 percent of the dairy herd was affected by tuberculosis. As a result, of tuberculosis and Brucellosis eradication programs were developed. Answering this concern the government created the Inspection quality control division in the ministry of agriculture to improve the quality of dairy products marketed to consumers.

5.3 The Belaunde Administration (1963 to 1968)

In 1963, the civilian government lead by President Belaunde opened with an ambitious program of public investment in public education, housing, and roads. The manufacturing sector became a pivotal sector of development, and reached its highest rates of growth in the ten years. However, Belaunde only initiated a limited social program of agrarian land reform, while fostering the "colonization" of the upper rain forest. Unfortunately, the attendant expansionary fiscal policies were not financed by similar increases in fiscal revenues, and fiscal deficits rose (Paredes, 1991).

In 1967, the government addressed a serious balance-of-payments problem, caused by unfavorable terms of trade and fiscal imbalances, by devaluating the exchange rate, which had remained fixed since 1961. The shock of devaluation, almost 44 percent, and a controversial contract with a foreign oil company led to a military interruption of Peru's democratic process (Sheetz, 1988).

5.3.1 Agricultural Policies

The agrarian and food policies of the Belaunde Administration need to be examined in the context of the development movement, which at the time included Kennedy's Alliance for the Process, as well as Peru's general economic and social policies highlighted in the previous section (Sheetz, 1988). In addition, the use of the import substitution approach was gaining momentum as the ideal development path for Latin American countries. This approach maintained that the agricultural sector could be viewed as being comprised of two different sub-sectors. One sector was largely associated with modern markets and production technologies comparable to other world markets. The other sector, the traditional sub-sector, was mainly identified by small farms that were poorly integrated into the economy. The traditional sector was considered self-sufficient, though not especially productive.

During this period Belaunde embarked on ambitious public infrastructure programs, such as large irrigation

projects, which were devoted mainly to the Coastal region. In addition, Developmental Corporations were created in each Peruvian department to identify problems and conduct development projects. However, because the industrial sectors had received preferential treatment in trade and exchange rate policies, capital moved out of agriculture and into manufacturing sectors (Paredes, 1991).

The Belaunde Administration's food policies differed little from previous administrations, because the political constituencies of the Belaunde party were primarily from urban areas. Thus, subsidy programs that favored consumers were continued.

5.3.2 Dairy Policies

During the Belaunde Administration the role of the government in the dairy industry was to serve as a mediator between dairy farmers and dairy processors. This policy was carried out by the creation of several organizations such as the Technical Commission of the Dairy industry (1965) and the National Advisory Milk Industry Committee (1966) (Kuan, 1982). These organizations included representatives of dairy farmers, dairy processors and governmental officials.

The policy role of mediation appeared initially to succeed because processors, in 1966, agreed to buy all domestically produced milk prior to importing dairy products, which would only be used to supplement the domestic supplies. However, milk producers at the time

could not meet the growing demand for milk, and domestic prices were lower than international prices. Merrill (1966) notes that at the beginning of the 1960s the demand for milk grew more rapidly than domestic milk production. During this period, the Peru's population began shifting from rural areas to urban areas, especially to the Lima. The increased milk farmgate prices, aided by a fixed exchange rate regime which prevailed until 1968, made it cheaper to produce milk from imported source than from the domestic sources.

Consequently milk processors especially in Lima began to increase their use of whole dry milk and anhydrous fat milk in reconstitution processes. Many other processors also threatened to switch completely to dairy imported inputs if local milk prices continued to increased. Thus, shortly after the initial agreement, dairy processors were allowed to rehydrate up to 30 percent of the total milk production with imported milk.

During the Belaunde period there were no dairy import restrictions on private firms. In 1965, almost 70 percent of dairy imports were final dairy products such as canned milk, butter and cheese. The remaining 30 percent of commercial dairy imports consisted of dry milk imported by private enterprises and the government (Merino, 1982). The government also imported dairy products under the U.S. Public Law 480 at preferential prices and, unfortunately, sold this aid to dairy processors. Only a small percent

went to social programs. Food aid imports increased from 11 percent of total milk imports in 1956 to 53 percent by 1965.

During the mid-1960s direct Peruvian government intervention on milk prices was nonexistent. The only possible government influence on price was derived indirectly through the sales of Public Law 480 aid (Merril, 1966).

5.4 Military Administrations (1969 to 1980)

Throughout the 1970s, Peru's military dominated political activities in the country. Control by the military was split into two periods the Velazco Military Administration (1969-1975), and the Morales Bermudez Military Administration (1975-1980).

5.4.1 Velazco Administration (1969 to 1975)

The military government presided by General Velazco Alvarado introduced a number of social reforms, which were an attempt to strengthen existing economic activities. However, by the end of the Velazco regimen the state had become an active economic agent controlling most of Peru's mining operations, and all of Peru's oil refineries, public utilities, fish meal, cement, and steel industries (Paredes, 1991).

In addition, the Velazco government also carried out a radical land reform policy, aimed at reducing the size of large agricultural estates. Ownership of targeted agricultural estates, which had been controlled by one

percent of the population, was transferred to workers on the estates in the form of agricultural cooperatives and social ownership enterprises (Lajo, 1985).

Similarly, the government enabled workers of medium and large sized firms in the manufacturing, mining and fishing industries to receive part of their companies profits in the form of shares up to a maximum of fifty percent of the equity capital of the enterprise. This measure, along with job stability regulations, discouraged private investment. In addition, pervasive government intervention weakened the banking system in an already inflationary environment by placing a ceiling on interest rates, making real interest rates negative (Paredes, 1991).

The Velazco government also introduced an unusual tariff system. The import tariff strategy favored cheaper consumer goods prices rather than intermediate goods and capital goods that would have provided possible employment opportunities. At the same time, the strategy effectively opposed export opportunities by keeping the exchange rate fixed and cheapening food imports with subsidies. Paredes (1991) stated that the combination of these measures made the industrial sector overprotected, uncompetitive, and consequently weak.

The Velazco government also increased the size of the public sector by increasing fiscal expenditures while revenues were stagnant. By mid-1975 the fiscal deficit was

about 8 percent of the GDP. The drop in the terms-of-trade made the economic situation worse. However, by borrowing "easy" money from international private banks and using the country's foreign reserves, the deficits were financed. On the other hand, key prices in the economy, mainly set by government run enterprises were kept low with a growing program of subsidies. Nonetheless, by the end of the Velazco Administration inflation rates of 19 percent to 23 percent plagued the Peruvian economy (Sheetz, 1988).

Paredes (1991) noted that these reforms despite their intentions had limited impact on the distribution of wealth. The reforms transferred 2 or 3 percent of the nation's wealth to 18 percent of the labor force, but only benefitted the top 25 percent of the population.

5.4.2 Morales-Bermudez Administration (1975 to 1980)

In 1975, the Velazco military leadership was replaced by the Morales-Bermudez Administration. The new administration began to change political direction of the reforms in effort to cope with the imbalances inherited from the previous government. However, the new government delayed implementing most economic adjustments until 1978, and by that point the government was no longer able to finance budget deficits without resorting to foreign loans or to deplete the country's international reserves (Sheetz, 1988).

In an effort to correct the trade imbalances experienced during the Velazco Administration, the Morales-Bermudez Administration devalued the exchanged rate. However, the government did not follow-up this policy with fiscal restraints and the inflation rate rose to 33 percent in 1976. In addition, Peru's GDP continued to fall its international debt increased. In 1978, the government was unable to meet its international debt obligations and initiated a severe austerity program based on reducing expenditures and further devaluations of the exchange rate. The government renegotiated debt service and obtained increased financial resources from the IMF. The policies brought about stability, but aggravated the social inequalities related to the distribution of income. Unfortunately, government measures were not sufficient to control inflation, which reached 67 percent in 1979. Trade liberalization policies also began to be implemented, first with the elimination of nontariff barriers and reduction of some tariffs. The government also promoted nontraditional exports through the use of subsidies (Nogues, 1991).

5.4.2 Agricultural Policies

Lajo (1986) notes that the agricultural and food policies during the Velazco Administration were largely based on land reform. However, the success of land reform efforts was gauged only by the agricultural sector's ability to provide cheap raw materials for Peru's industries, and

low food prices for its urban population. As a result, the Military agricultural policies included food, farm and credit subsidies, deepened government intervention in agricultural marketing, direct price controls, and the creation of state monopolies that controlled imports of staple foods and exports of agricultural products. Price controls were so extensive that price adjustments involved not only changes in the price of final products, but also the prices their inputs.

The government created the following public enterprises to exert monopoly rights: Public Agricultural Service Enterprise (EPSA), National Inputs Marketing Enterprise (ENCI), and Fish Meal and Oil production Marketing Enterprise (EPCHAP). These monopolies controlled wheat, milk, yellow maize, meat, oilseed, rice, and fertilizer markets. In addition, the state intervened in the export marketing of coffee, sugar, and fish products.

The agricultural credit policy of the government was based on the enhanced role of the Agrarian Bank as the main supplier of credit in the agricultural sector. The bulk of the credit was channeled to agricultural cooperatives and destined to food products primarily. However, a ceiling was placed on the interest rates, which diminish market signals.

The Morales-Bermudez Administration's agricultural policies were overshadowed by macroeconomic stabilization efforts. Fiscal restrictions forced the reduction in

consumer subsidies, but helped to correct, to some extent, relative prices. Although food imports were cutback, food aid increased, and by the end of 1980 more than a million Peruvians were dependent of food aid.

5.4.4 Dairy Policies

The Velazco (1969-1975) and Morales-Bermudez (1976-1980) military governments implemented dairy policies which were directed by the objectives of their food and agricultural policies, which were to promote the consumption of staple foods at low prices and in an adequate supplies for the population especially low income urban population; and to promote domestic production and industrial processing of foods products. In this context milk was viewed as a staple food, and the expansion of milk consumption was viewed as a goal.

Thus, along with agrarian land ownership reform the government promoted the formation of new dairy farmer organizations such the Dairy Cattle Development Funds (known by its Spanish acronym FONGAL). These organizations were created to improve the bargaining power of dairy farmers in the input and final product markets.

In 1973 the Velazco military government created a price control system for essential foods which included most fresh and processed milk products, as well as intermediate imported milk products such as dry milk and anhydrous fat milk. Prices were controlled by the Ministries of Economy,

Finance, and Agriculture, and in the case of imported milk input prices required the approval of the Ministries Council (Kuan, 1982). Dairy farmers through their FONGAL representatives and dairy processors through their representatives presented their proposed price changes to the Ministry of Agriculture. Independently, the Ministry of Agriculture conducted its own cost of production studies. At the same time the other ministries examined the proposed changes in terms of their impacts on the economy and consumer welfare. Finally, Economic Affairs and Finance Ministry officials would develop political price policies that were accompanied by possible changes in subsidies, other price controls, and changes in the exchange rate, and dairy import subsidies programs. Generally, the dairy processing industry, especially the evaporated and recombined firms, and consumers were the main beneficiaries of the subsidy programs (Lajo, 1986).

Following a scheme of industrialization known as import substitution, Velazco military government set high tariffs and non-tariffs restrictions for all manufactured food products. Thus, the mix of dairy imports changed from manufactured final dairy products to intermediate dairy products such as nonfat dry milk, whole dry milk and anhydrous fat milk. The government also established a dairy imports monopoly. By 1975, 95 percent of Peru's dairy imports were intermediate dairy products. Sixty percent of

these imports were designated for evaporated plants, 25 percent were destined for reconstituted milk plants and the remaining 15 percent was destined for other uses (Merino, 1982).

Dairy imports were subsidized for almost the whole Morales-Bermudez period (Kuan, 1982). However, the subsidies on nonfat dry milk and anhydrous fat milk differed for recombined or evaporated processing industries. Nonetheless, although one industry was favored over the other at different times, these subsidies on imported dairy imports allowed milk processors in each industry grow despite the high inflation levels until the 1979 economic recession.

Farmgate milk prices were subject along with other milk prices to a price control system (Kuan, 1982). As part of a general strategy of industrialization by substitution, food prices were kept almost unchanged despite a moderate inflation rates. In order to alleviate the harmful effects on dairy farmers, the government provided subsidies on agricultural inputs such as fertilizer, fuel and credit.

Curiously, during the 1970s, farmgate prices were fixed for all milksheds without consideration of cost differentials among the milksheds. In addition, feedstuff prices for wheat, cottonseed and brewery residues were controlled and rationed in quotas by the Ministry of Agriculture.

Finally, although the price controls brought the government into the milk market, the bulk of government expenditures, as noted by Bolling (1989) were channeled to irrigation projects. As a result, the Arequipa milkshed experienced an increase in milk production which allowed this region to become the third largest milk producer in Peru. The Morales-Bermudez government in its last year also established direct subsidies to milk producers who sold their milk to recombined and evaporated milk processors.

Although the Morales-Bermudez policies were intended to expand milk consumption, especially by low income urban households, the per-capita milk consumption fell because of population increases and the loss of purchasing power by people.

5.5 Belaunde's Second Administration (1980 to 1985)

The second term of President Belaunde was inaugurated with a policy goal of diminishing the role of the state in most sectors of the economy. The first measures were intended to liberalized trade by reducing tariffs and relaxing legislation that restricted imports. There was also an effort to reduce distortion in relative prices by reducing subsidies. Unfortunately, the high inflation rate inherited from the last regime remained. As a result, adjustments in the rate of devaluation of the exchange rate was used to fight inflation (Paredes, 1991). However, this measure was counter-productive because the real appreciation

of the currency encouraged imports and consequently contributed to a negative balance-of-trade. Unfavorable terms-of-trade, in addition to the increased fiscal deficit, brought on Second Belaunde Administration's the next economic crisis.

Peru's economic situation was made worse by floods in northern Peru and droughts in southern Peru, caused by changes in the "el nino" current. As a result, the country experienced an unprecedented recession in 1983, with a drop in the GDP of 12 percent accompanied by an inflation rate of 111 percent. The government requested assistance from the IMF, but the government's adjustment program failed to achieve the IMF targets, and Peru fell 2-billion dollars behind in payments by the middle of 1985 (Bolling, 1989).

5.5.1 Agricultural Policies

The objectives of the agri-food policy of the Second Belaunde Administration called for the liberalization of farm land markets, and incentives for investors in agricultural projects in the Amazon. The administration also gave agricultural cooperatives the right to parcel their land among their members (Orden, 1982). In addition, the list of the products subjected to price controls was reduced to rice, milk inputs, cottonseed and cottonseed cake (Bolling, 1989).

The liberalization process was also extended to tariffs which were reduced, and nontraditional agricultural export

subsidies set by the last government were removed. Real interest rates for agriculture loans were negative because inflation was not controlled. This situation seriously harmed the financial strength of the Agrarian Bank.

Finally price supports for rice and yellow corn were initiated. This sectoral policy was an attempt to compensate producers of these food products for the negative effects of the macropolicy. However, this program mainly benefitted only farmers in the Coastal and Selva regions (Paz-Cafferata, 1988).

5.5.2 Dairy Policies

The Second Belaunde government continued the direct subsidies to dairy farmers that were set by the previous administration. However, milk farmgate prices were differentiated by milkshed. Thus, producers in the Lima milkshed, who were high-cost concentrated users, were favored with the highest milk prices followed by producers in the Arequipa and Cajamarca milksheds, who were had lower costs because they used a mixed pasture-concentrate feed system. Again, market signals were muddled.

In addition, differential prices were established for off- and on-farm milk delivery, and for cooled and noncooled milk. The price premiums were also based on percent of fat and were paid for milk from herds with certified as disease free. In 1980, the Second Belaunde government also passed a law which forbid the sale of unprocessed milk directly to

consumers in those areas where milk processing plants existed.

In 1982 the government introduced a modification of the law for which allowed dairy farmers to sell their milk directly to consumers at the discretion of the regional Ministry of Agriculture offices. In the same year the government decided to enhance the milk productivity by extending its services throughout the country, and by coordinating its efforts with other programs, such as the artificial insemination program.

In response to these policies milk farmgate prices increased initially during the Second Belaunde Administration and in 1981 their highest levels in almost a decade. However, the domestic milk supply was stagnant despite the higher milk international prices and producer subsidy programs. In 1983 the domestic milk production fell by a combination of purchasing capacity lost and unfavorable climatic conditions (drought and flooding).

In spite of the Second Belaunde government's initial intentions to deregulate agricultural markets and initiated a partial trade liberalization, the government continued dairy product price controls, dairy imports subsidies, and the state trade monopoly on dairy imports. The only real government innovation was to sell whole dry milk directly to consumers using imported and domestic milk. However, the production of dry milk was limited to the capacity of

Perulac, Inc., which at the time was the only firm producing dry milk in Peru.

In the last two years of the Second Belaunde Administration the price control system was relaxed to match inflation rates. Thus, in 1984, milk farmgate price determination changed from a control price system to a regulated price system. Dairy farmers also continued to benefit indirectly from the subsidies on agricultural inputs. In addition, in 1983, the government passed a law in which dairy farmers were allowed to import directly capital goods and other inputs without paying any taxes or levies.

Although the Second Belaunde Administration opened with a call for the progressive deregulation of markets, the government, nonetheless, reserved the right to intervene in areas in which consumer welfare was at issue (Orden, 1982). As a result, the government reduced dairy product tariffs because those products were considered staples. The state milk monopoly (ENCI) begun during the military government period was untouched and as were credit subsidies. However, a new criteria for import quota assignments to evaporated and recombined milk plants was established in 1983 based on the use of domestic milk as a percent imported milk used in the recombination process. Producers of cheese, yogurt and milk desserts were granted imported dry milk at subsidized

prices, if they used at least 50 percent domestic milk in manufacturing of their products.

Although the dairy policy was aimed to maintaining low consumer milk prices, per-capita milk consumption declined during the Second Belaunde government. However, evaporated and dry milk consumption increased over previous periods. As Celis (1987) notes the Second Belaunde Administration's dairy policies were regressive because the main beneficiaries were not low income consumers, but rather middle and high income urban consumers. Low income people reduced their consumption of recombined and evaporated milk and replacing those products with potatoes, and rice as their main sources of energy and protein. Real prices of evaporated and pasteurized milk improved slightly during the period while fresh, recombined and whole dry milk declined. As a result, whole dry milk sold at lower real prices than fresh milk.

5.6 Garcia Civilian Administration (1986 to 1990)

In his presidential inauguration address, Garcia announced a unilateral reduction in the foreign debt service to 10 percent of the total exports. Garcia also abandoned the previous diagnosis of excess aggregate demand as a primary cause of domestic price increases. In addition, Garcia's economic team implemented a supply side program which included, among other measures, a devaluation of the exchange rate that put it closer to its real value. Garcia

then introduced also a multiple exchange rate system with a licensing approval process. Initially, food, industrial inputs and capital goods industries were granted concessionaires rates, but after an increase in the general prices, they were frozen and subjected to tight controls. The Garcia government also decreed an increase in real wages (Hopkins, 1991).

To compensate and stimulate private enterprises the government offered tax reduction incentives and reduced the interest rate for the banking system with the preferential rates for agricultural and decentralize investment. These policies worked well for about two years. The inflation rate fell to 4.6 in 1986, though rising to 9.6 percent in 1987. Gross Domestic Product grew 8.6 in 1986 and 6 percent in 1987. However, restraint on public expenditures was abandon and the fiscal deficit rose to 6.7 percent of GDP in 1987 (Paredes, 1991). As Hopkins (1991) suggests, two factors were crucial to the initial success of Garcia's programs: first, the existence of industrial excess capacity and a surplus of international reserves inherited from the Second Belaunde government. When those two buffers were diminished by the initial Garcia policies, inflationary pressure increased. Ultimately, hyperinflation undermined all of the Garcia Administration programs as well as successive attempts by the government to stabilize the economy. By the end of Garcia's

administration the inflation rate had risen to 10,323 percent.

5.6.1 Agricultural Policies

Although the agricultural sector grew 5 percent annually from 1985 to 1988, growth was uneven among sub-sectors. If the rate of the poultry industry's growth was excluded, the overall annual rate of agricultural growth was only 3 percent, well below to the growth rates experienced by other sectors.

The Garcia government increased substantially the amount available for lending through the Agrarian Bank. The government established zero interest rate credit for targeted depressed areas. In 1986, nearly of 16 percent of the total amount of money for lending was destined to depressed areas. However, this credit policy undermined the stability and viability of the financial institutions particularly the Agrarian Bank. Thus, by the middle of 1990, the Agrarian Bank was nearly bankrupt. The Bank was forced to reduce the amount of money for lending to 20 percent of the amount available before the implementation of the policy. As a consequence, agricultural output decreased by 9 percent in 1989/1990.

Departing from its initial programs the Garcia government revived several old policies under a program called "Program of Agricultural Reactivation and Food Security." Under this program a support price system

originally initiated with rice and corn in during Second Belaunde government was augmented to include wheat, white maize, barley, quinoa, habas, beans and soybeans. However, the Garcia government financed this program by buying international food commodities and by selling the imported food products in Peru at prices above the level of the world market.

A key component of the new Garcia program were the implicit subsidies through the multiple exchange rate regimes that increased imported foods through the availability of exchange rates at concessionaire levels.

Despite the Garcia Administration's attempt to fund the price support program, it started to fail as the macroeconomic situation deteriorated and inflation rates soared. As a result, the Garcia program vanished as the amount of the subsidies could not keep pace with the rate of inflation. Consequently, prices started to fall in real terms. Income transferred to a sector did not stay in the intended sector as the terms of trade between agricultural and manufacturing sector once again favored the manufacturing sector (Hopkins, 1990).

5.6.2 Dairy Policies

In the dairy sector, the Garcia government's policies were much like those implemented in the Second Belaunde Administration: import subsidies and quotas, for at least part of the time, price controls, and continuation of the

state monopoly. In addition, the Garcia Administration created The National Fund for Dairy Development. The main objectives of this fund were to finance the acquisition of dairy cattle, machinery, and other inputs (fuel and fertilizer) by dairy farmers, and to promote vertical integration of the dairy producers through milk manufacturing and marketing. The government partially financed this Fund by charging a tariff on dairy product imports. Depressed world milk prices enabled the government to set imported milk prices lower than milk farmgate prices and still produce revenue for the Fund. Later the government extended the purposes of the Fund to include compensating dairy producers and milk processors squeezed by rising costs and price controls.

Along with the direct programs, dairy farmers, in addition to the exoneration of all taxes and duties, were granted overvalued exchange rates for their direct imports. Maranon (1989) estimated that the Garcia Administration's financial subsidies represented 0.5 and 1.52 percent of Peru's GDP.

Real milk farmgate prices increased in 1985 and 1986 as all food prices increased. However, as the macroeconomic conditions worsened, real milk farmgate prices declined steadily, and in 1990, reached their lowest levels in two decades. Despite the declines, domestic milk production increased from 1985 until 1988 at an annual average higher

than in any previous administration. Unfortunately, in following three years, the milk production fell.

The guidelines of dairy imports were established in 1987, assigning a new criteria for the allocation of imported milk quotas base in the use of domestic milk. In addition other processors were allowed to received stimulus prices with the only requirement to use at least 50 percent of domestic milk.

However, in response to macroeconomic troubles direct subsidies were eliminated for all dairy products except of whole dry milk. However, direct subsidies for all dairy imports were reassumed in 1989 and 1990 when international milk prices were at their highest levels in 10-years.

Whole dry milk was subsidized during almost the whole Garcia Administration, which contributed to the increase of the whole dry milk consumption. Although the consumption of pasteurized milk increased slightly in 1987, by 1988 it fell to traditional consumption levels. Consumption of evaporated milk also declined slightly, and recombined milk consumption declined 37 percent compared to consumption levels during the Second Belaunde Administration. In contrast, whole dry milk increased 245 percent between 1984 and 1988. Between 1985 and 1988 the market share of whole dry milk grew from 22 to 30 percent. Real milk prices for almost all milk products fell drastically during the last

two years during the Garcia Administration because of hyperinflation.

5.7 Fujimori Administration (1990 to Present)

Contrary to promises made prior to the election, Fujimori introduced a severe stabilization program while at the same time announcing his intention to reintegrate Peru into the international financial community. The main objectives of this program were to cope the hyperinflation inherited from the last government, and to decontrol Peruvian markets. The components of the stabilization program were: (1) a huge increase in prices of goods and services supplied by state owned enterprises; 2) the introduction of emergency taxes to finance day to day public expenditures; (3) the unification of various exchange rates in one determined by market forces; (4) a trade liberalization with tariffs levels ranging between 10 and 50 percent with no exception regime; (5) a tight credit policy that eliminated the ceiling on interest rates; (6) elimination of government intervention in price determination; (7) a drastic reduction on fiscal expenditures which were limited to the amount the government was able to generate as revenue; (8) an increased sales tax and temporary tax on traditional exports; and (9) a social program designed to cushion the impacts of the stabilization program upon the poor (Paredes, 1991).

To curtail hyperinflation, the money supply and the fiscal deficit were targeted as the primary foci of the stabilization programs. Simultaneously, the government introduced legislation to delineate structural adjustment program aimed to correct all distortions that prevent a sustainable long run framework for a free market. Although these efforts have reduced the inflation to a rate of about 70 percent in 1992, the Peruvian economy has yet to show significant signs of recovery.

5.7.1 Agricultural Policies

The Fujimori administration has also focussed primarily on macroeconomic adjustment programs. As a result, the agricultural and food policies of the Fujimori administration can be best described in terms of their relation to macropolicies. Once again "free" market forces have been given the task of determining prices. In addition, anyone may import and export goods subject only to limitations applied to sanitation, tax regulations.

The states monopolies were eliminated. The state government intervention was limited to assist small farmers and areas with less development. Agricultural price control were abolished. ENCI, the parastatal enterprise, was reorganized so that it will operate within a free competition framework. Ecasa, the state rice marketing enterprise was eliminated. The Agrarian Bank was reformed to allow participation of the private system in financing

agricultural activities. It was recognize as national interest the problem of drainage and salinization of cropland.

5.7.2 Dairy Policies

Under the Fujimori Administration livestock technical assistance programs such as cattle disease eradication, artificial insemination, which improved dairy productivity, dismantled because of drastic budgetary cuts and the loss of trained personal to an early retirement program. In addition the Ministry of Agriculture closed many of its offices and programs were transferred to regional governments in a decentralization process that was mandated by the constitution.

As a result the main objective of the Fujimori government has been to rescue the Agrarian Bank. Although the government restructured much of the Bank's loan portfolio, the Bank was unable to meet the usual credit requirements. The resulting reduction in available credit left many dairy farmers with no source of credit. Furthermore, participation on the part of commercial banks was limited by the high (real) interest rate loans and institutional limitations.

Unlike previous administrations, the Fujimori Administration initially abandon price controls and basic food prices were determined by supply and demand conditions, despite the apparent chaos in those markets. The dairy

import monopoly was also abolished. Under the new rules the state enterprise, ENCI, operates without tariff and tax advantages. Furthermore, dairy imports are only limited by health and quality requirements set by international regulations.

However, in 1991, the Fujimori government introduced market regulations that required the payment of a specific compensatory levy over the CIF value on imported foods, including dairy products. This intervention was aimed at stabilizing internal prices, and reducing fluctuations caused by changes in international prices and subsidies by exporting nations. This mechanism was implemented because many food internal prices were higher than international prices, and the overvalued exchange rate caused by the heavy flow of drug trafficking dollars entering the nation. Thus, tariffs were viewed as a source of revenues that could help finance development programs in the agricultural sector.

The Fujimori government's most controversial attempt to improve the market for domestic milk production was the prohibition on manufacturing recombined and reconstituted milk using imported dairy products. However, this law was blocked in the Peruvian Supreme Court due to a ruling that the policy ran counter to the free trade concepts sanctioned by the constitution. However, the Fujimori government was able to maintain the requirement that all food aid must be sold in the domestic market, and that the valuation of the

aid must be determined at market prices and subjected to the tariffs and taxes (Paredes, 1991).

Finally, although consumer prices have risen as a result of the removal of price controls and regulations, supplies have not increased due to the previously mentioned constraints on dairy farmers. The Fujimori government's only attempt to provide price subsidies for dairy products requires that these products must be destined for social programs that target poor people, and this program is recognized as insufficient and unorganized. Thus, even the most basic attempts by the Fujimori Administration to support the dairy industry are frustrated by the economy's chaotic condition, and the government's lack of fiscal resources.

CHAPTER 6

LA LIBERTAD DAIRY FARM SURVEY RESULTS

6.1. Introduction

This chapter describes the characteristics and structure of the milk production sector in the La Libertad Coastal area. These results are based on an August, 1991, survey of all the commercial dairy registered with the La Libertad FONGAL, the regional dairy producers organization. The data were jointly collected by staff from the Peruvian Ministry of Agriculture, and the Inter-American Foundation. The english language version of the survey is contained in the Appendix B.

The description of the dairy farms and farmers in this region includes operator characteristics, herd size, milk productivity, land tenure and land use, herd management practices, sources of income, credit, use of marketing channels of distribution, milk prices, the average amount of time needed reach markets, machinery, installations, and transportation facilities. This description is developed to underscore the technological and economic diversity of dairy farms in this region. As will be addressed in Chapter 7, this diversity may play an important role in determining how Peruvian dairy producers may be affected by changes in Peruvian macroeconomic, agricultural and dairy policies.

6.2 Operator characteristics

This section presents the characteristics of dairy farm operators. Age, education, years farming, and related characteristics are used to open the analysis of dairy farmers in this region. Aggregation of some of the results in the tables contained in this chapter may not sum to 100 percent because of rounding error.

6.2.1 Age of operators

The average age of the dairy operators in the region was 52 years old, and more than 60 percent are over 45 years of age. As shown in Table 6.1, farmers with small dairy herds of less than 5 cows and those with herds greater than 50 cows tended to be older than 45 years. Dairy farmers with herd sizes of 11-25 cows and 26-50 cows tended to be younger.

Provincial differences also appear to exist. In Trujillo and Chepen provinces, dairy farmers tended to be younger than farmers in Ascope and Pacasmayo provinces. Although not shown in Table 6.1, Ascope and Pacasmayo provinces tended to have a greater number of dairy farmers over 45 years old, averaged 53 and 54 years old.

6.2.2 Years of the dairy operation

The average number of years of experience in dairy operations for the whole region was 14 years. As shown in Table 6.2, dairy farms with less than 5 cows and greater than 50 cows tended to have more than 6 years in the dairy

Table 6.1 Age of Operator by Herd Size

Years	Herd Size					All Farmers
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Percent of farms -----						
Less 25	0.0	1.3	0.0	0.0	0.0	1.3
26-35	1.3	3.4	2.6	1.3	0.0	8.6
36-45	3.9	5.2	6.9	5.6	0.4	21.9
46-55	10.3	9.4	7.3	3.4	0.4	30.9
>56	7.7	12.0	8.6	5.2	3.9	37.3

Table 6.2 Years of Dairy Farm Experience by Herd Size

Years	Herd Size					All Farmers
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
	----- Percent of farms -----					
< 6	2.8	6.5	5.7	2.0	0.8	17.9
6-10	8.5	8.5	6.5	4.1	0.8	28.4
> 10	11.0	15.4	13.4	8.5	5.3	53.7

business, which follows the results for age. Dairy farms with herds of 6-10 and 11-25 cows accounted for 20 to 22 percent of dairy farms with less than 6 years in operation.

Unlike the age relationship shown above, dairy farmers in Chepen and Pacasmayo possessed the highest number of

years of experience with 19 and 18 years on average. In contrast, Trujillo and Ascope, 13 percent each, had the greatest percentage of dairy farmers with less than 6 years of experience.

6.2.3 Education Levels of Operators

Table 6.3 indicates that 3 percent of the farmers surveyed reported no formal education. These farmers had mainly herds with sizes less than 10 cows. Almost half of farmers had attended at least high school and 25 percent attended college. Farmers with herd sizes between 26 to 50 cows, had the highest percent of high school and college education. As can be seen in Table 6.3, as herd sizes increase the level of formal education also tends to increase up to the high school level. Among provinces, Chepen and Trujillo, at 74 and 67 percent, reported the highest percentages of dairy farmers with college or high

Table 6.3 Dairy Operator Formal Education by Herd Size

Education Level	Herd Size					All Farmers
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Percent of All Farmers -----						
No Formal Education	0.8	2.5	0.0	0.0	0.0	3.3
Elementary	14.0	13.2	6.5	2.8	2.2	38.7
High School	5.3	11.9	10.6	5.7	0.0	34.6
College	2.4	4.1	8.2	6.1	2.4	23.4

school degrees. Ascope, in contrast, had the lowest percentage of dairy farmers with college and high school educations at 23 percent.

6.2.4 Additional Operator Characteristics

Almost 90 percent of the operators were males, and approximately 50 percent of the dairy operators lived on their farms. As shown in Table 6.4, 94 percent of the farmers employed non-family labor in their operations. As might be expected herd size and number of hired workers is positively related.

6.3 Dairy Farm Characteristics

6.3.1 Herd Size and Milk Productivity

Of the 249 dairy surveyed farms, 59 percent were located in Trujillo province, 21 percent in Ascope, 12 percent in Pacasmayo and the remaining 6 percent in Chepen.

Table 6.4 Number of Non-family Employees by Herd Size

Number of Workers	Herd Size					All Farmers
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
	----- Percent of Farms in Category -----					
One	85.2	68.9	31.6	5.5	0.0	47.6
Two	12.7	29.8	48.4	27.8	11.1	29.3
Three	2.1	0.0	11.6	30.5	5.6	8.5
Four	0.0	1.3	6.7	25.0	27.8	8.0
≥ Five	0.0	0.0	1.7	11.1	55.5	6.6

In August of 1991, the average herd size for dairy farms in La Libertad coastal area was 25 cows.

As shown in Table 6.5, almost 80 percent of the dairy farms had herd sizes of less than 26 cows. The largest dairy herds (greater than 51 cows) were mainly located in Ascope, and Pacasmayo provinces accounting for 7 to 10 percent of the dairy farms in each province. Chepen was the only province which reported no large dairy herd operations.

Table 6.6 shows the percentage of La Libertad milk production by province. Trujillo and Ascope were the largest milk producer provinces accounting for 48 and 30 percent, respectively, of the total milk production in La Libertad Milkshed. Pacasmayo with 19 percent and Chepen 2.5 percent of the total milk production in La Libertad account for the remainder of the milk produced in La Libertad.

Table 6.5 Dairy Farm Herd Size by Province

Provinces	Herd Size					Average	
	Less	6 -	11 -	26 -	51 or	Herd	Farms
	than 5	10	25	50	more	Size	Surveyed
	--- Percent of All Farms ---					-- Number --	
Trujillo	8.8	18.4	16.8	11.2	4.4	20.2	149
Ascope	9.6	7.6	2.0	0.8	1.6	32.2	54
Pacasmayo	2.8	2.0	4.4	1.6	1.2	45.4	30
Chepen	0.8	2.8	2.0	0.8	0.0	12.0	16
Totals	22.0	31.0	26.0	14.0	7.0	25.3	249

Table 6.6. Milk Production by Herd Size and Province

Provinces	Herd Size					All Provinces
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Percent of Total Milk Production -----						
Trujillo	0.6	4.4	11.8	18.6	12.6	48.1
Ascope	0.9	1.3	0.6	1.2	26.2	30.1
Pacasmayo	0.2	0.3	2.1	2.2	14.6	19.3
Chepen	0.1	0.4	0.7	0.9	0.0	2.5
Total	1.8	6.4	15.2	22.9	53.4	100.0

The highest milk production period occurred during the months from April to August, with production peaking in June. The summer months (November, December, and January) were the lowest milk production months. This seasonal cycle appears to reflect demand conditions, such as the school year calendar, as well as the availability of crop residues for feed.

Almost 87 and 75 percent of the milk produced in Pacasmayo and Ascope, respectively, was supplied by large dairy farms, i.e. farms with herd sizes of at least 51 cows. Although small dairy farms, farms with herd sizes of less than 10 cows, represented 53 percent of the total dairy farms, they only accounted for 8 percent of La Libertad's total milk production.

As presented Table 6.7, the average daily milk production per cow for La Libertad was 10 liters of milk.

Table 6.7 Daily Milk Output per Cow by Herd Size and Province

Provinces	Herd Size					Average Milk Yield
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
	----- Percent of All Farms -----					Liters/cow
Trujillo	6.5	8.2	10.7	11.3	9.3	10.1
Ascope	9.1	5.3	6.1	9.0	12.2	11.0
Pacasmayo	5.3	5.6	7.2	8.8	9.6	9.0
Chepen	11.6	5.2	6.6	10.2	n/a	7.5
Average Yields by Herd Size	6.5	7.1	9.5	10.7	10.6	10.0

Ascope province averaged the highest rate of daily milk productivity with 11 liters per cow a day, followed by Trujillo with 10.1 liters and Pacasmayo and Chepen with 9 liters 7.5 liter per cow respectively.

Dairy farmers, with herd sizes of less than or equal to 5 cows, or 6 to 10 cows reported the lowest milk yields at 6.5 and 7.1 liters of milk per cow per day, respectively. As herd size increased milk production per cow also increased, with the exception of herds in Trujillo province.

6.3.2 Land Utilization and Land Tenure

A majority of dairy farms, 92 percent, were owned by individuals. The remainder of the types of ownership included private enterprises and family business at 2.8 percent each. Cooperative ownership accounted for only 2 percent of the total number of dairy farms.

As shown in Tables 6.8 and 6.9, almost 75 percent of the dairy farmers surveyed reported farming cropland in addition to their dairy operations. The remaining 25 percent of dairy farmers did not have land and consequently were depending on other farms for feedstuffs.

Trujillo, the largest milk producing province, showed the highest percent of "landless" dairy farmers and they were evenly distributed across herd size categories. Most of these dairy farmers were located near or within the Trujillo city limits. The proximity of these farmers to consumers is one reason why, as will be shown, much of La Libertad's milk production is sold directly from farmers to consumers.

Table 6.8 Dairy Farms with Tillable Cropland by Herd Size and Province

Province	Herd Size					All Farms
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Percent of Farms -----						
Trujillo	68.1	67.3	69.0	60.7	63.6	66.4
Ascope	100.0	84.2	80.0	50.0	50.0	87.0
Pacasmayo	100.0	80.0	72.7	100.0	100.0	86.6
Chepen	50.0	85.7	100.0	50.0	0.0	81.2
Averages by Herd Size	85.4	74.0	73.0	63.8	66.6	74.3

Table 6.9 Average Area Tillable Cropland Hectares
By Herd Size and Province

Provinces	Herd Size					Average per Farm
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Number of Hectares -----						
Trujillo	0.1	11.2	26.8	15.3	1,241.0	103.4
Ascope	6.1	8.8	15.0	50.0	16,050.0	691.3
Pacasmayo	6.6	21.2	23.8	40.0	55.0	24.9
Chepen	13.0	13.5	12.4	42.0	0.0	5.2
Averages by Herd Size	7.8	11.5	23.7	22.3	3431.0	235.5

Dairy farmers with herd sizes of five cows or less cows represented the highest percent of farmers reporting tillable cropland compared with those farmers with highest herd size. The lowest percent of farmers reporting tillable cropland were in the category of farmers with herd sizes between 26 to 50 cows. This may be caused by smaller herd farmers needs to augment their incomes with other crop sales. This may be one reason that the data in Table 6.8 appear to indicate a negative relationship between herd size and utilization of tillable cropland.

Among provinces, Trujillo and Ascope, as a result of their greater number of large herd dairy farms (greater than 51 cows), had the highest average levels of tillable land per farm at 1,241 and 16,050 hectares, respectively.

However, these high averages were influenced by the presence of sugar cane land holding cooperatives in the region.

Excluding large cooperative holdings dedicated to sugar cane, the main crops of dairy farmers expressed in percent of the land dedicated to them were as follows: sugar cane (20 percent), corn (15 percent), asparagus and rice (13 percent each), alfalfa (9 percent), and green chopped corn (4.7 percent).

In general, as the herd sizes increase from 5 cows to 25 cows, the area of tillable land dedicated to grow exclusively roughages such as alfalfa, green chopped corn and other cultivated pastures decreased from 15 percent to 6 percent. The tillable land dedicated to crops that offered the opportunity for the residues to be used as animal feedstuffs increased from 50 to 61 percent.

Farms with herd sizes greater than 26 cows had increased amounts of land dedicated to the production of roughage. In contrast, the area dedicated to cash crops with residues used as feedstuffs decreased from 47 to 20 percent.

6.4 Technological Characteristics

The following presentation of technological characteristics farms and the definition of three general production systems is intended to provide a more refined basis for identifying dairy herds beyond their size. It is also intended to provide an initial basis for understanding

why similar sized farms might be affected differently by changes in dairy policies.

6.4.1 Level of Production Intensity

The level of technology adoption helps to more accurately define differences among dairy farms and farmers. This distinction was especially important in an area such La Libertad, where intensive cropping with irrigation systems and fertile soils, and a high population density has made the land values higher than in others areas.

For this study three general milk production system classifications were developed. They were specified as the extensive, mixed, and intensive production systems. In the extensive production system, dairy herds were mainly fed by grazing on crop residues or cultivated pastures such as kim grass, elephant grass and natural grasses. Dairy cows usually did not received feed concentrates. This system was practiced by small dairy farmers with herd sizes of less than 10 cows. These farmers generally own upgraded, but not pure Holstein-Frisian breed herds. Thus, the combination of low genetic potential and diet deficiencies caused low milk productivity (5.2 liters, see Table 6.10) and short duration of lactation periods (up to 6 months). The extensive production system is particularly predominant in Ascope province where cropping was the main activity and dairying was complementary.

The mixed system was an intermediate category between extensive and intensive production systems. In this system, dairy farmers feed their cows during different periods of by grazing and by confinement. The main types of roughages used as feedstuffs were alfalfa, green chopped corn, and crop residues such as corn stalks, corn straw, rice straw, asparagus and other leguminous plants. Dairy herds were usually rotated in a short radius area from crop residues to cultivated pastures and returned every day to the stockyard for milking and concentrate supplementation. In this survey, the mixed system was predominant in Pacasmayo and Chepen provinces. As shown in Table 6.10 the average milk yield for this system was 6.7 liters per cow a day.

In the intensive milk production system, cows were confined in dry lots and fed with concentrate and roughages. This system was predominant among dairy farmers with herd sizes of ten or more cows.

Table 6.10 Production System by Herd Size

System	Herd Size					All Farms	Average Yield
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more		
	----- Percent of All Farms -----						lt/cow
Extensive	8.9	6.4	2.0	0.0	0.4	17.7	5.2
Mixed	5.6	9.7	5.6	2.4	0.0	23.4	6.7
Intensive	7.6	14.9	17.3	12.1	6.8	58.9	10.8

Trujillo province had the largest percent of dairy farmers practicing intensive milk production system. The average yield per cow for this system was about 10.8 liters of milk per cow per day. Although intensive system farmers were often "landless" peri-urban dairy producers. These producers utilized feedstuffs such as brewery wastes, oil-cake seed, asparagus and sugar cane by-products, and crop residues such as corn plants, which were purchased from off-farm sources.

6.4.2 The Use of Concentrate

Table 6.11 indicates that in La Libertad area only 52 percent of the dairy farmers surveyed reported the use of concentrates in the animal feeding system. Sixty-four percent of the dairy farmers surveyed prepared their own concentrates while the remaining 36 percent purchased commercial concentrates. As the size of the farm increases the use of concentrates becomes more widespread. Thus, 90 percent of farmers with herd sizes higher than 25 cows reported use of concentrates. Trujillo, Pacasmayo and Ascope were the provinces with highest percent of concentrate use among farmers. The main ingredients reported were corn grain, wheat by-product, cotton meal, polished rice and fish meal.

6.4.3 Artificial Insemination

The use of artificial insemination (AI) is another indicator related with the potential improvement of the

Table 6.11 Dairy Herd Management Practices

Item	Herd Size					All Farms
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
--- Percent of Farms in Category ---						
Concentrate	21.8	35.0	63.5	91.6	94.4	51.8
Artificial Insemination	14.7	24.6	53.9	77.7	94.4	43.0
Mechanical Milking	0.0	0.0	11.1	44.0	66.0	14.1
Veterinary Service	12.2	24.5	63.4	72.2	100.0	45.2

genetic value of the dairy herd in the medium and long term, and consequently with the potential for increasing milk yields.

Across La Libertad coastal area, 43 percent of the dairy farmers reported the use of AI. The average percent of the herd in an AI program was 37 percent. However, the percent in AI programs increased as the size of herds increased. Thus, dairy farmers with herd sizes less than 5 cows reported an average of 10 percent of their herd under AI program. In contrast, dairy farmers with herd sizes greater than 50 cows, 80 percent of their cows were in AI programs.

Among the four provinces, Trujillo reported the highest AI rate with nearly 64 percent of the dairy farms' herds in AI programs. Other provinces showed lower ratios of AI use,

Pacasmayo with 16 percent and Ascope with 11 percent of their dairy farmers reporting using AI respectively. In Chepen province dairy farmers reported no use of AI programs.

6.4.4 Mechanical Milking

Mechanical milking requires a great deal of investment and it is usually positively correlated with the size of the herd. In farms with herds of more than 25 cows, almost 58 percent of dairy farmers reported the use of mechanical milking systems. The highest rate of mechanical milking facilities reported were for farmers with herd sizes greater than 50 cows, about 66 percent of farmers of this category reported having mechanical milking system.

Among provinces, Trujillo, with 54 percent, had the highest percent of farms reporting the use of mechanical milking systems. In Ascope province 45 percent of dairy farmers reported using mechanical milking systems followed by Pacasmayo with 11 percent of the total dairy farmers. In Chepen province no milking mechanical systems were reported in use.

6.4.5 Veterinary Assistance

Veterinary assistance is another indicator related to the degree of production intensity in Peruvian dairy operations. On average only about 45 percent of the farmers surveyed routinely used veterinary assistance. As the herd size increased, the percent of dairy farmers routinely using

veterinarian services increased. While 63 percent of the dairy farmers with herds between 11 and 25 cows used veterinarian services, the rate increased to 72 percent for dairy farms with herd sizes between 25 to 50 cows. The use of veterinary assistance was almost 100 percent in farmers with herd size greater than 51 cows.

Among provinces, Chepen, Trujillo and Pacasmayo had the highest percent of their dairy farmers reporting veterinary assistance at 68, 59, and 46, respectively.

6.4.6 Dairy Farm Facilities

As shown in Table 6.12, as herd size increases, the percent of dairy farmers reporting more advanced facilities increases. Among items reporting by the highest percent of farmers were feed storage facilities, tubular wells, water reservoirs, and pick-up trucks.

Among the feeding animal facilities used were stationary green choppers and feed storage. Almost 70 percent of the dairy farmers in the greater than 50 cow herd category used milking facilities and milking machines. As the size of the herd increased the percentage of dairy farmers reporting the use of rent tractors also increased. The high percentage of farmers reporting the use pick-up trucks across all farm categories indicates the importance of transportation not only for carried inputs, but also possibly for marketing products.

Table 6.12 Facilities, Machinery and Vehicles by Herd Size

Items	Herd Size					All Farms
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Percent of All Farms -----						
Feeding Warehouse	0.0	11.6	25.3	38.8	50.0	19.2
Molasses Tank	3.6	10.4	30.1	52.7	72.2	24.4
Stationary Chopper	12.7	31.1	44.4	66.6	77.7	38.8
Grain Mill	7.2	7.8	20.6	33.3	55.5	18.0
Feedbunk	36.3	58.4	79.3	97.2	94.4	66.8
Milking Equipment	0.0	2.5	12.6	44.4	77.7	16.0
Milking Parlor	0.0	1.2	15.8	36.1	72.2	14.8
Tubular Well	16.3	9.1	17.4	25.0	50.0	64.0
Water Reservoir	47.2	57.1	58.7	61.1	38.8	54.4
Electricity	14.5	12.9	22.2	36.1	38.8	20.8
Own Tractor	18.8	19.4	17.4	27.7	55.5	22.4
Rented Tractor	14.5	12.9	9.5	11.1	5.5	11.6
Pickup Truck	41.8	63.6	80.9	94.4	94.4	69.6

6.5. Sources of Income and Credit

6.5.1 Total Farm Sales

Table 6.13 shows the distribution of farms by sources of income. Table 6.13 presents total farm income, the percent of income from dairy operation, percent of income from crop sales and non-farm income for the four provinces of La Libertad milkshed. In general, dairy farms showed a positive relationship between herd size and total farm income. Not too surprisingly, as herd sizes increases total income also increases.

Grouping dairy farms by herd sizes, 50 percent of dairy farmers with herds less than 5 cows reported total farm income of less than 123 soles a week. In contrast, 64 percent of dairy farmers with herd sizes greater than 50 cows reported total farm income greater than 1986 soles a week.

Comparing the averages for total farm income among provinces, Chepen had the lowest average total farm income with only 316 soles a week while Pacasmayo and Trujillo had the highest, with 3,225 soles and 2,225 soles a week. The high variability in average total farm income in those provinces may be attributed to the presence of large enterprises. The differences may also be related to the differing markets opportunities in each province.

Table 6.13 Farm income by Source and by Herd Size

	Herd Size					
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	All Farms
----- Percent of Farms -----						
Total Farm Sales in Soles						
Less 123	50.2	22.8	7.8	0.0	0.0	20.1
124-289	27.6	33.2	14.5	0.0	0.0	20.1
289-725	20.4	22.8	27.5	8.1	0.0	19.7
726-1985	0.0	17.2	20.8	47.3	35.3	20.1
>1985	1.8	3.9	29.1	44.6	64.3	20.1
Percent of Income From Dairy Sales						
1-20	19.2	40.5	51.6	33.3	35.3	43.2
21-40	30.3	24.3	11.2	16.7	17.6	20.2
41-60	32.3	8.1	8.0	11.2	0.0	8.8
61-80	12.1	8.1	4.8	8.3	0.0	4.9
>80	6.1	20.0	24.2	30.5	47.1	22.9
Percent of Income from Crop Sales						
none	25.4	36.3	53.9	61.2	66.7	44.1
1-20	5.4	7.8	14.3	11.1	5.5	9.3
21-40	7.2	6.4	4.8	8.4	0.0	6.0
41-60	9.1	11.9	7.9	2.7	11.2	8.8
61-80	36.3	27.2	9.5	11.1	5.5	20.9
>80	16.4	10.4	9.6	5.5	11.1	10.9
Percent of Income From Non-farm Sources						
None	65.4	57.3	47.6	47.2	72.3	56.2
1-20	7.2	15.5	7.9	11.1	5.5	10.4
21-40	5.5	6.4	1.6	8.3	0.0	4.9
41-60	5.4	7.8	9.5	8.4	5.6	7.6
61-80	10.9	6.3	15.9	13.9	11.1	11.2
> 80	5.6	6.6	17.5	11.1	5.5	9.7

6.5.2 Income From Farming

As indicated above a representation of the degree of specialization in dairy operations can be drawn from the percentage of farm income received from dairy operation sales. Only about half of the farmers with dairy herds of less than 5 cows reported 41 percent or more of the total farm income derived from dairying. Generally, farms with smaller herd size had the tendency to be less specialized in the dairy operation and consequently less dependent on dairy product sales as an income source.

As the herd sizes increased (6-10, and 11-25 cows), only 38 and 37 percent of farmers, respectively, reported 41 percent or more of the total farm income derived from dairying. However, the percent of farms who reported total farm income derived from dairying greater than 81 percent or more increased.

At the province level, Trujillo showed the highest percent of part-time dairy farmers with 62 percent of them just reporting 40 percent or less of the total farm income derived from dairying. In contrast, Pacasmayo province showed the highest percent of dairy farmers, reporting 62 percent of them, just 60 or more of the total farm income derived from dairying.

Sales from cropping activities appear to be more important as a source of income for farmers with less than

10 cows, than for farmers with more than 11 cows. As herd sizes increased the percentage of crop income decreased.

6.5.3 Non-farm Income

From 47 percent to 72 percent of the dairy farmers across all herd size categories received no income from non-farm operations in 1991. In general, the distribution of non-farm income was bimodal. Non-farm income either represented a small part of total income or it represented over 60 percent of a family's income. Even farms with herd sizes greater than 50 cows, tended to be either in the highest non-farm or the lowest non-farm income group.

As might be expected given their proximity to a large urban area 89 percent of the farmers in Trujillo had non-farm income and 65 percent reported that 41 percent or more of their total income was derived from non-farm sources.

6.5.4 Credit

Given the Peruvian government's reduction in support for the Agrarian Bank, it was not too surprising that 91 percent of dairy farmers did not received loans. Of the small number of dairy farmers who received loans, 50 percent received loans from commercial banks, 40 percent received loans from the Agrarian Bank, and the remaining 10 percent borrowed from private lenders. Most of the credit was used on crops. Of the dairy farmers who do not received loans, almost 56 percent indicated that they did not ask for credit, or even preferred to work with their own capital,

another 15 percent considered the cost of credit was too expensive and another 30 percent answered that credit was not available.

6.6 Marketing Channels of Distribution

6.6.1 Milk distribution

Eighty-nine percent of the milk produced in la Libertad milkshed was sold through commercial channels, 1.6 percent was consumed on-farm, 7.3 percent was used for calves feeding and the remaining 0.7 percent was manufactured on farm as butter and cheese.

Of the 56,620 liters of milk sold every day, 70 percent was sold to consumers as fresh fluid milk. The remaining 30 percent of the volume was absorbed by local processing plants. Danlac, Inc., the main dairy processing plant, which was located in Pacasmayo province, purchased 94 percent, or 16,000 liters/day, of the milk utilized by processing plants. Almost 86 percent of the milk purchased by Danlac, Inc., was used to manufacture pasteurized milk, which it shipped nationwide (only 1,000 liters of Danlac Pasteurized milk were sold in the La Libertad area). The remaining milk was purchased by small dairy factories in Trujillo, which specialized in cheese and traditional desert products.

Table 6.14 shows how the total commercial milk was distributed through marketing channels. Processors were the main marketing channel, accounting for one third of the milk sales. Thirty-one percent of the milk was marketed directly to consumers (roughly the twice the percentage noted for the nation in Table 4.1). Retailers accounted for another thirty percent and wholesalers only accounted for 6 percent of the total milk marketed.

Even though, dairy farmers with herd sizes less than 10 cows represented 53 percent of the total dairy farmer population in La Libertad, they accounted for only 8 percent of the marketed milk. In contrast, dairy farmers with herd sized grater than 50 cows, represented 7 percent of the total dairy farms population, they accounted for 48 percent of the total marketed milk.

Table 6.15 shows the decomposition of marketed milk by provinces. Trujillo accounted for 48 percent of the total milk marketed in La Libertad coastal area with 58 percent of its milk marketed through retailers and the remaining 34 percent sold directly to consumers. Small processing plants, and wholesalers accounted for a total of 8.1 percent of the total milk sales.

Ascope and Pacasmayo provinces accounted for 30 and 19 percent of the total marketed milk, respectively. In Ascope province, 56 percent of the milk went to processing plants in Pacasmayo and the remaining 33 percent was sold directly

to consumers. Wholesaler and retailers channels had little participation in the milk markets in these provinces.

Table 6.14 Milk Sales by Marketing Channel and Herd Size

Channels	Herd Size					All Farms
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
----- Percent of All Farms -----						
Processor	0.0	0.0	0.0	0.0	59.2	32.8
Wholesaler	13.0	13.8	8.7	14.3	0.6	5.8
Retailer	55.5	39.2	43.0	42.2	19.5	29.7
Consumer	31.5	47.0	48.3	43.5	20.6	31.5

Table 6.15 Milk Sales by Province and by Marketing Channel

Channels	Provinces			
	Trujillo	Ascope	Pacasmayo	Chepen
----- Percent of All Farms -----				
Processor	1.6	56.5	73.1	0.0
Wholesaler	6.5	3.9	2.9	48.9
Retailers	57.6	6.1	3.1	5.4
Consumers	34.3	33.3	20.9	45.7
All provinces	48.1	30.1	19.3	2.5

In Pacasmayo province, 73 percent of the marketed milk went to processing plant and other 21 went directly to

consumers. As in Ascope, and Pacasmayo retailers and wholesalers played a minor role in the milk marketing.

6.6.2 Profiles of the Marketing Channels

Each dairy farmer was asked questions about their use of the marketing channels, and about prices paid, location where sales took place, distance to markets, and frequency of sales and payments.

6.6.3 Processor Channel

As noted, in August, 1991, the main operating processing plant, Danlac, Inc., was located in Pacasmayo Province. Danlac Inc., was a vertically integrated dairy operation with two large dairy farms, one in Pacasmayo and the other in Ascope, with an average herd sizes of 900 cows. In Trujillo there were small dairy factories dedicated mainly to manufacturing traditional milk desserts. Other major processing plants had operated in Trujillo over the years, but the last of those, the Trujillo public processing plant, closed in 1990 because of Peru's poor economic conditions.

Given that Danlac, inc. dominated the local market, the milk price paid was mainly set by the processing plant. As presented in Table 6.16, the average travel time from the farm to the plant was 38 minutes for the whole area. In Trujillo province the time trip was only 15 minutes, while in Ascope the average travel time was 60 minutes.

Table 6.16 Average Travel Time in Minutes From Farm to Market

Channel	Herd Size					Average time trip
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more	
	----- minutes -----					
Processor	0.0	0.0	0.0	0.0	37.5	37.5
Wholesaler	10.0	17.5	12.5	31.2	0.0	20.9
Retailer	18.7	24.2	20.0	14.8	25.0	19.7
Consumer	19.0	23.8	23.4	17.8	10.0	21.0

6.6.4 Wholesaler Channel

Although the frequency of milk sales to wholesalers was daily, only 18 percent of dairy farmers received their payments on daily basis; 70 percent of farmers received their payments on weekly basis. Most of the dairy farmers who sold to wholesalers, 70 percent, delivered their milk to wholesalers. Once delivered the milk was packaged and distributed by the wholesaler to retail outlets.

Prices received by farmers were determined as follows: 50 percent of farmers reported that prices were determined by wholesalers; and 33 percent reported that prices were negotiated. Among the reasons mentioned for using a wholesaler were: that wholesalers purchased milk on a regular basis, 37 percent; wholesalers purchased the whole production, 27 percent; and the producer had no alternative or lacked transportation, 23 percent.

As indicated in Table 6.16, the travel time for milk delivery to wholesalers increased as herd sizes increased. Since the average time trip reported for the whole region was 31 minutes, it can be assumed that milk sold to wholesalers came from within a radius of 30 to 40 km.

6.6.5 Retailer Channel

Dairy farmers also sold their milk to retailers on daily basis and received their payments daily (42 percent) and weekly (54 percent) basis. Half of the farmers reported that sales took place on their farms and the other half at the retailer. Prices to retailers were determined in a variety of ways. Thirty-five percent of farmers reported that the retailer price was set by farmers, 23 percent reported that prices were set by the local FONGAL, and 10 percent reported that prices were set by retailers.

Dairy farmers with herd sizes of less than 5 cows and between 6-10 cows had almost the same travel time to retailers' locations. However, dairy farmers with herd sizes between 26 to 50 cows were on average closer to retailers, with travel times averaging only 15 minutes. This situation was observed principally in Trujillo province, and may be related to the increased availability of engine powered transportation.

6.6.6 Consumer Channels

Most of the dairy farmers who sold their milk to consumers sold their milk at their farms. Only 26 percent delivered milk to consumers. In this market deliveries and payments were closely matched on a daily basis, with the exception of institutional consumers such as hospitals, restaurants and hotels where the frequency varied from weekly to a bi-weekly basis.

The average time trip for a dairy farmer to deliver their milk to consumers was 21 minutes. The shortest time corresponded to farmers with herd sizes greater than 51 cows and the longest time corresponded to farmers with fewer than 5 cows.

6.6.7 Milk Channel Prices

Tables 6.17 and 6.18 present the average milk prices received by dairy farmers. The provincial prices are categorized by herd size and by marketing channel. In general, producers receive higher prices by selling their milk directly to consumers. However, although this marketing channel is a viable marketing option for producers in the La Libertad region, where producers and consumers are near each other, it may not necessarily be an option for producers in larger milksheds.

Trujillo province had the highest consumer price in the area while Ascope had the lowest. The highest retailer milk

Table 6.17 Average Prices per Liter by Marketing Channel and Herd Size

Channel	Herd Size				
	Fewer than 5	6 - 10	11 - 25	26 - 50	51 or more
	----- soles -----				
Processor	n/a	n/a	n/a	n/a	0.260
Wholesaler	0.252	0.239	0.241	0.264	0.300
Retailer	0.270	0.287	0.315	0.330	0.325
Consumer	0.332	0.361	0.373	0.376	0.381

Table 6.18 Average Prices per Liter by Marketing Channel and by Province

Channels	Average Price	Provinces			
		Trujillo	Ascope	Pacasmayo	Chepen
		----- soles -----			
Processor	0.260	0.250	0.255	0.280	n/a
Wholesaler	0.248	0.247	0.250	0.290	0.220
Retailer	0.330	0.320	0.262	0.313	0.325
Consumer	0.355	0.363	0.331	0.356	0.340

price corresponded those in Chepen while the lowest corresponded those in Ascope.

In Ascope and Pacasmayo, wholesaler prices were the highest among provinces. This may be caused by the limited participation of wholesalers in the milk market. In contrast, the lowest wholesaler prices correspond to those in Chepen province where wholesalers played a greater role in the milk marketing.

It is important to note that in Pacasmayo, the lowest milk price was paid by the Danlac. Inc., processing plant. This could be one of the reason why dairy farmers preferred to market their milk in Pacasmayo through regular channels, rather than sell to Danlac.

As the herd size increased, dairy farmers got higher consumer prices across provinces. The same pattern occurred with retailer prices. This may reveal a certain amount of bargaining power and selling ability on the part of middle and large farmers. For wholesaler prices the only exception was found with farms with less than 5 cows, these farms received higher than farmers with herd sizes 6-10 and 11-25 cows.

Finally, as a point of reference, at the time when the survey was carried out, consumer milk prices in Trujillo for evaporated, pasteurized, and powdered milk were 0.60, 0.45, and 0.50 soles per liter, respectively. As shown in Table 6.17, the average price of fresh milk sold to consumers by retailers and farmers was 0.363 soles per liter.

CHAPTER 7

CONCLUSIONS

7.1 Summary of Findings

The overall objective of this study was to examine the implacations of possible changes in the Peruvian government's dairy policies on dairy farms and farmers in Peru's La Libertad coastal area. To achieve this overall objective the following sub-objectives were developed:

1. To examine the structure of milk demand in Peru;
2. To provide an historical review of the development of dairy policies since 1963; and
3. To describe and analyze the structure of dairy farm and farmers in La Libertad, Peru.

The examination of Peru's milk demand structure was aimed at determining the nature of consumers response to changes in prices and indirectly in income. This aspect of the study utilized aggregate milk consumption and price data in a Rotterdam Model. Using the parameter estimates conditional price and expenditure elasticities were developed so that consumers' reactions to possible price and expenditure changes could be quantified.

As it might be expected, the limited number of available observations (twelve years of annual data) reduced the possibility of claiming any statistical properties, beyond unbiasedness, for the estimated coefficients. However, the Cournot own-price elasticities calculated for

the different types of milk, with the exception of pasteurized milk, were negative, inelastic and similar to those presented in the literature review.

The Cournot cross-price elasticity estimates suggest that our a priori expectations about substitutability among types of milk was incorrect. The only notable substitution relationship found was between recombined and evaporated milk. More surprisingly the elasticity results suggest a strong complementary relationship between fresh and evaporated milk even though these milks hold the largest share of Peru's milk market.

The complementarity result is important because it suggests that any possible policies aimed at enhancing the market opportunities for one type of milk may also enhance the opportunities of the other type. Thus, dairy farmers supplying fresh milk to evaporated milk plants may be affected by changes in consumer demand caused by policies aimed at the fresh milk market. One possible reason may be that fresh milk serves as both an alternative beverage in the milk market, and as an input in the production of evaporated milk. In addition, given the differences in perishability and shelf-life, the two types of milk may not be compared as alternatives for many uses by consumers.

A second set of elasticity estimates, which are especially important in the context of Peru's macroeconomic condition, are the conditional expenditures elasticities.

Although, expenditure estimates are not quite comparable with Peruvian income elasticities reported by Amat et al., the values were similar in sign. The expenditure elasticities for evaporated and powdered milk were positive and elastic indicating that as consumers' incomes rise consumers' expenditures on those products will increase by an even greater amount. The expenditure elasticities for fresh and pasteurized milk were positive, but inelastic. Finally, the negative conditional expenditure elasticity for recombined milk indicated this milk was considered an inferior good by Peruvian consumers.

As detailed in Appendix A, the Peruvian economy had experienced rapid expansion and strong contractions over the last 15 to 20 years. As a result of these cycles Peru's economic growth declined, and trade imbalances increased. Fiscal deficits rose beyond the capacity of the nation to service them without serious fiscal and monetary restrictions, international debt rose, and there was an acute deterioration of income distribution. And with these economic disorders came soaring inflation, widespread poverty, institutional and political crises and finally a destructive civil war.

As discussed in Chapter 5, Peru's government has attempted to play an active role in the management of basic economic sectors in an effort to resolve some of these problems by influencing macro-prices and distorting relative

prices of factors and goods in the economy. As noted, this intervention has tested the strength of the nation's fiscal reserves and possibly exacerbated some of the problems that it set out to solve.

Government intervention in agriculture was heavily subjected to the general strategy for growth based on import substitution and domestic oriented economy structure. Food pricing and exchange rate policies served the general strategy by cheapening inputs, capital goods, and imported foods and depressing domestic food prices. As a result domestic agriculture was discriminated against. In addition, public agricultural investments were channeled into costly irrigation projects and programs that favored large scale holdings mainly located in the coastal regions.

Recognizing that its macro-policies were discriminatory with agriculture, the government established offsetting policies to assist farmers by subsidizing farm inputs, credit and irrigation. However, these programs were limited and could not be sustained as the government's fiscal position deteriorated because of recessions and inflation.

Although the explicit objective of Peru's dairy policies was to promote milk consumption of the low income urban population and to increase domestic milk production, neither increased milk consumption nor self reliance was achieved. Government intervention was limited by balance payments pressures and a lack of foreign exchange especially

during crises. However, a price control system complemented by import input subsidies and a monopoly on imported dairy inputs were the key elements of the government's dairy policies.

Subsidy programs utilized imported milk inputs to reduce manufacturing costs and assure profitability of the processing industries. The government also granted implicit subsidies to dairy imports via overvalued and concessional exchange rates. Another minor subsidy was channelized through credit.

In general terms, pricing policies affected relative milk prices favoring processed milk (evaporated milk) over other types of milk, most notably fresh milk. Evaporated milk was chosen as the core of the dairy policy because this milk was viewed as the dominant milk with nationwide distribution. The processing industry was protected by non-tariff barriers and tariffs on imported manufactured food products. Occasionally, evaporated milk processors were granted export subsidies and other subsidies to encourage exports when evaporated stocks increased as the result of reduction in domestic demand.

The only mechanism established to get funds to support the other intervention efforts was to impose levies on imported dairy milk. However, these funds were used mainly to compensate processors. As macroeconomic conditions worsened, milk consumption declined by almost half, on per

capita basis, while domestic milk production remained stagnant.

Chapter 6 characterized the structure of dairy farms and farmers in La Libertad and the channels used by dairy farmers to market their milk. In general, farm size as measured by number of cows was found to be an important factor in examining the marketing channels used and the types of technology utilized by the farmer. Seventy percent of the milk sold in the area went to consumers as fresh non-processed milk. The remaining 30 percent was absorbed mainly by one processing plant, Danlac, located in Pacasmayo province. Danlac was vertically integrated relying on its own two large dairy farms (Ascope and Pacasmayo), one independent supplier in Ascope along with a collection system in Cajamarca for its milk supply. In Pacasmayo and Ascope the bulk of the milk was absorbed by Danlac, Inc. Wholesalers and retailer played a relatively minor role in those provinces.

Herd size, production system, and other characteristics related with the level of technology involved in the dairy operation were used to describe differences among farmers and degree of specialization in dairying. Three types of production system were identified among dairy farmers in the provinces extensive, mixed, and intensive. The extensive production system was practiced primarily by small farmers with herd sizes of less than 11 cows, fed their cows gross

roughage, and these animals had low milk productivity, 5.2 liters per cow. These farmers could be described as traditional farmers for whom dairying was a complementary activity to cropping. The use of concentrate, AI, mechanical milking and other dairy farm facilities were almost non-existent. These farmers represented 17 percent of the total number of farmers in La Libertad. Chepen and Ascope provinces had higher concentrations of the more traditional farmers.

The mixed system represented an intermediate technological level between the extensive and intensive production systems. This system characterized a broad range of farms with herd sizes up to 50 cows. The milk productivity on these farms was slightly higher than the extensive system's farmers. Mixed production system's farmers were predominantly located in Pacasmayo province.

Intensive production system dairy farmers had an average herd size of 11-25 cows with the highest milk productivity with almost 11 liters of milk per cow. In addition, a large percentage of them reported the use of concentrate, AI, mechanical milking, and other dairy facilities, that were positively related with the herd size and degree of specialization.

As the herd size of farmers increased, the amounts of tillable land increased, and so did the amount dedicated to roughage. Trujillo province had the largest number of

intensive system farmers, who in some cases were "landless" dairy farmers. These farmers based their feeding system on by-products, concentrates, and roughage purchased from off-farm sources. The Trujillo area also possessed the most part-time dairy farmers with 62 percent of its farmers reporting 40 percent or less of their total farm income from dairying.

In Trujillo the two main channels of distribution were the retail and consumer channels, which jointly accounted for 92 percent of the milkshed. It was not surprising that Trujillo farms obtained the highest average consumer milk prices, with a positive relationship between herd size and prices received. Farm location and herd size were also related with higher consumer milk prices.

7.2 Implication of the Findings

As reported in the Chapter 5, the Fujimori government has undertaken a severe stabilization program to halt hyperinflation. The stabilization program includes tight fiscal and monetary policies, limit control over exchange and interest rates, and a realignment of distorted relative prices.

Given this macroeconomic scenario and assuming that stabilization and structural reforms will continue to drive macropolicies for the next few years, the absence of old policies as much as the limited implementation of continuing policies can be expected to significantly affects Peru's

national dairy markets and the milk markets in La Libertad. However, for domestic producers this may not be bad news because some of the past policies have promoted the use of imported dairy products. Thus, the combination of exchange rate devaluation along with the elimination of imported dairy subsidies should increase the demand for domestically produced milk.

Unfortunately, the increased need for domestic milk supplies would be tempered by decreased milk demand as unsubsidized prices rise, especially for evaporated, recombined and powdered milk, which had high levels of imported raw materials and packaging. However, because of the inelastic nature of the estimated own-price elasticities, assuming Peruvian incomes will remain constant, if no dramatic drops in milk demand is not expected. The other types of milk may also gain some of the market share formerly accounted for by imported powdered milk.

It appears that evaporated and fresh milk would also be affected by changes in the prices of each because of the complementary relationship between those milk products. However, the validity of this complementary relationship depends on the assumption that the farmgate price series is a good approximation of fresh consumer prices.

The expenditure elasticity results imply that price effects may be dwarfed by further losses in consumer

incomes. However, if incomes increase, the expenditures for evaporated and powdered milk will rise faster than expenditures for any other type of milk.

With these possible outcomes in mind, it is clear that the impacts on dairy farmers in La Libertad will not be uniform, primarily because of the diversity found in la Libertad's farms and farming systems. Traditional (extensive) farmers may be affected in different way because their dairy activities are complementary to their cropping activities.

Finally, farmers classified as intensive, and especially landless farms are more likely to experience the effects of the macroeconomic measures, especially when prices for farm inputs are affected. However, the average size of these farms and their ability to market their milk locally through fresh channels may offset part of the cost increases. Since a majority of dairy farmers in La Libertad market their milk locally as non-processed fluid milk, this fact might put dairy farmers in an envious position compared to farmers from other dairy producing areas such as Arequipa, Cajamarca and Lima, which are dependent on processors' purchases.

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APPENDICES

Appendix A

A.1. Introduction

The purpose of this appendix is to present a general overview of Peru's geographic, social, economic, and agricultural characteristics, and to outline the structural characteristics of the milk processing industry in Peru. Where possible, the characteristics of La Libertad Department are compared to similar figures for Peru.

A.2 Peru's Geography

Peru is the third largest country in South America with an area of 1,200,000 square kilometers. Because of its location, on the West-Central side of South America, Peru possesses a wide variation of climates and soils. In general, however, there are three geographic regions: the coast (Costa), the highlands (Sierra) and the Amazon (Selva).

The coastal region is contained in a three thousand kilometer band between the Andes and the Pacific Ocean. The widest part, comprised by the northern departments of Tumbes, Piura, Lambayeque and La Libertad, is 100 kilometers wide. The coastal region contains 11 percent of the Peru's total land area. The region is essentially a desert with an average temperature ranged between 18° to 21° centigrade.

Cutting through the coastal region are valleys through which Andean rivers flow to the Pacific Ocean. The Andean rivers supply the irrigation systems that serve about 700-thousand hectares dedicated to crops. The most important northern river valleys are Piura, Lambayeque and

La Libertad. Unfortunately, as Bolling (1989) points out, almost one third of the cropping land in this area is affected by drainage and salinization problems.

The highland region is dominated by the Andes which run south to north. Within this region, altitude dictates a wide variation of climates, even across short distances. Subtropical hill forests are found at 2,000 meters above sea level (m.a.s.l.), on the oriental slope of the Andes. Mesothermic Inter-Andean valleys are located at 3,000 m.a.s.l., and Tundra conditions exist above 4,000 m.a.s.l.

The area between 2,000 to 3,500 m.a.s.l., known as the Quechua zone, is especially important because it is home to a majority of the highland population and most of the region's 1.3 million hectares of arable land. In the Quechua zone, the less productive rainfed land is located on the steeply sloped hillsides, while the more productive land is located in the Inter-Andean valleys where irrigation is available. The high altitude plateau, from 3,500 to 4,000 m.a.s.l., and the Puna region, above 4,000 m.a.s.l., possess natural pastures that are mainly dedicated to livestock production.

The Amazon region, on the eastern side of the Andes, comprises about 61 percent of the country's territory. The region is divided in two sub-regions: 1) The upper forest between 400 to 2,000 m.a.s.l.; and 2) the lower forest, or

flat Amazonian land below 400 m.a.s.l. The Amazon region contains over 4-million rainfed hectares of cropland and 67-million hectares of rain forest (I.N.E, 1990).

A.2.1 The La Libertad Coastal Area

La Libertad department is located in the north of Peru covering a total area of 23-thousand kilometers square. This department contains the followings provinces: Bolivar, Sanchez Carrion, Otuzco, Pataz and Santiago de Chuco, which are located in the Sierra; and Pacasmayo, Trujillo, Ascope and Chepen provinces, which are located in the coastal region.

The geography of the coastal terrain is dominated by five valleys which are irrigated by rivers originating in the Sierra. The area between the valleys is classified as subtropical desert with poor vegetation.

The Jequetepeque valley is the biggest valley in the department with about 77-thousand hectares under irrigation, many of which are double cropped. The Jequetepeque Valley is also the second most populace departmental population with 87-thousand inhabitants who live in scattered towns across Pacasmayo and Chepen provinces. The rice production in the Jequetepeque valley covers 70 percent of the available arable land. Other important crops are corn, sorghum, beans, alfalfa and vegetables.

The next largest valley, Chicama, has an area of 46-thousand hectares under irrigation. Sugar productions covers 69 percent of the total available arable land. Most

of the sugar is processed by agri-industrial cooperatives which were created by the 1970's land reform.

The Santa Catalina Valley has an area of 19-thousand hectares under irrigation. This valley hosts Trujillo city capital of the department and the third largest city in Peru with population of almost half million of persons. Finally, the Viru, and Chao valleys produce asparagus, sugar cane, corn and beans.

A.3 Demographic Trends in Peru

The Peruvian population was estimated at about 21-million in 1990, making it the fourth largest population in South America, with a growth rate 2.4 percent. Currently, two- thirds of the population resides in urban areas. Among the three regions, the coastal region is the most highly populated with over fifty percent, followed by the highlands region with thirty-seven percent and the Amazon region with eleven percent of the total Peruvian population. Lima, the capital of Peru has 6-million inhabitants. The next level of major cities such as Trujillo, Arequipa, and Chiclayo are also located in the coastal region with populations of about 500-thousand inhabitants.

Internal migration is a phenomenon which helps explain the structure of regional population. In 1985, a quarter of Peru's population was lived outside their provincial birthplaces. Half of this migration was within regions, and

the other half across regions. The migration from highland areas has been accelerated by the rural violence.

In addition to being highly mobile, Peru's population is quite young. Almost 40 percent of the total population is less than fifteen years old while only four percent is sixty five years old or older. By comparison 14-percent of the U.S. population under fifteen years old, and the average for South American is 38 percent.

La Libertad department is the fifth most populace department in Peru with a population of about one-million. Sixty-five percent of the population resides in urban areas. The overall contribution of La Libertad to the Peru's 1990 GDP was 6.9 percent. Manufacturing was the largest sector representing 40 percent of the La Libertad's GNP. The agricultural sector was the second largest representing 12 percent of the department's Gross Product.

A.4 Peru's Economic Structure

Peru, by World Bank standards is a middle income country with a per-capita GDP equivalent to \$901 and a total GDP of \$18.5-billion in 1987. Until to the 1950's, the Peruvian economy followed a path of growth led by its export sector that was based mainly on natural resources. Thus, the economy experienced booms and busts related to the exploitation of rubber, saltpeter, guano, fish, oil, cotton, sugarcane, copper and silver. As a result, the manufacturing sector became highly dependent on capital

goods and technology imports, which made the economy highly vulnerable to fluctuations in the prices of Peru's traded commodities.

Currently, the main sector of the economy is the services sector, which also employs about 50-percent of the workforce and is responsible for about 55-percent of the national income. Within this sector, the informal service is the most dynamic and growing sub-sector (Table A.1).

Although, the manufacturing sector grew at rates higher than the overall economy during the 1960s and middle 1970s, as a result of the application of import substitution policies, its growth has been seriously curtailed since. Presently, it accounts for about 16-percent of total employment and represents 21-percent of the GDP. The manufacturing sector is now domestically oriented and composed of primarily consumer goods. However, it is highly dependent on imported materials and technology (Paredes, 1991).

Table A.1 Peru: Sectoral structure of GDP, 1950-1990.

Sector	1950	1960	1970	1985	1990
	----- Percent -----				
Agriculture	23.7	17.1	14.2	9.9	12.9
Fisheries	0.2	1.0	1.9	0.5	1.2
Mining & Oil	7.6	10.3	9.1	12.9	9.9
Manufacturing	19.3	23.6	24.9	23.8	21.6
Electricity	0.3	0.4	0.6	1.1	1.5
Construction	5.9	5.4	5.3	5.5	5.9
Housing Services	4.1	3.3	2.6	2.4	3.1
Govt. Services	5.9	5.5	5.7	6.4	6.9
Other Services	31.3	30.9	32.4	34.7	35.0
Import duties	2.0	2.5	3.3	2.8	2.0
Total	100.0	100.0	100.0	100.0	100.0

Source: INE, Compendium of Statistics, 1990.

Although the agriculture sector accounts for 36-percent of employment, it only represents 12-percent of the GDP, which is down from 25-percent in 1950 (INE, 1990). The apparently poor performance of this sector was, as noted in Chapter 5, the result of macropolicies that favored other sectors over agriculture and growth in other sectors that benefitted from those policies.

The fourth largest economic sector is the mining sector which generated 11-percent of the GDP during the eighties. Almost all of the mining products are exported as raw materials, and account for 45-percent of Peru's exports. However, mining is a highly intensive capital sector and only employs two-percent of nation's workforce.

The national production and labor force are geographically highly concentrated. Lima and Callao account for 45-percent of the GDP, and for 34-percent of the national labor force. The remaining departments accounted for 55-percent of the total production and absorbed 66-percent of the workforce (Paredes, 1991).

A.4.1 Long Term Economic Trends in Peru

Paredes (1991) notes that the Peruvian economy grew at an average rate of 5.3 percent from 1950 to 1975. Since then the Peruvian economy has experienced rapid expansion and strong contractions with an overall result of a one-percent annual rate of GDP growth from 1976 to 1989 (Table A.2). Consequently, per-capita GDP decreased to the levels of

Table A.2 Annualized Growth Rate of Peruvian GDP by Sector.

Period	Overall					Other Services
	Economy	Agriculture	Manufacturing	Mining	Fisheries	
	Percent					
1950-1955	6.5	1.9	9.0	7.2	8.2	5.9
1955-1960	5.2	2.7	7.0	10.9	35.6	5.2
1960-1965	6.2	2.8	7.0	3.3	15.1	6.8
1965-1970	4.4	4.0	4.6	4.6	10.4	4.8
1970-1975	5.0	0.7	5.1	0.2	-19.9	7.4
1975-1980	2.6	-0.5	-1.5	15.1	3.9	1.7
1980-1985	-0.4	2.7	-2.1	-0.7	9.0	-0.2
1985-1990	-0.1	0.6	-3.3	5.7	17.1	-0.4

Source: INE, Compendium of Statistics 1990.

earliest 1960's. Several authors (Bolling, 1989; Webb, 1991; and Paredes and Hamman, 1991) have attributed this decline to the following causes: (1) terms-of-trade fell sharply due to declining international prices for traditional exports commodities; (2) Peru's high international debt, equalling its GDP, Peruvian balance-of-payments vulnerable to raising international interest rates; and (3) Peruvian macroeconomic policies, in addition to government intervention failed to correct macroeconomic imbalances. It is generally recognized that where applied, intervention worsened the economic situation and left the government unable to cope with the deepening of inequalities in the income distribution that inflation and recession have wrought (Bolling, 1989; and Paredes and Hamman, 1991).

As Paredes (1991) states several trends can be seen over the last forty years: (1) a persistent deceleration of growth, savings, and investment; (2) instability of economic policies; (3) intensification of the business cycles; (4) deterioration of the distribution of income; and (5) increases in the number of people who lived in abject poverty. The first point can be seen to a limited extent in Table A.3. Paredes (1991) also suggests that the poor performance of the economy was caused by the frequency of incorrect government actions after 1963. These actions included direct government participation in oil, electricity, water, mining, cement, and steel industries.

Table A.3 Peruvian Macroeconomic Indicators, 1970 -1990

Year	GDP	GDP	Variation	Population	Gross	Fiscal	
	dollars,-	Per-capita	GDP Per-capita		Invest.	Deficit	
	<u>dollars,-</u>	<u>dollars,</u>	<u>Percent</u>			<u>Percent of GDP</u>	
1970-75	12613125	888.8	5.1	2.2	14166.7	23.0	3.71
1976-80	15130684	921.1	2.6	0.1	16424.3	22.9	5.54
1981	16944264	954.3	4.4	1.7	17754.8	32.6	6.72
1982	16986766	932.0	0.2	-2.4	18225.7	30.2	7.34
1983	14891060	796.0	-12.6	-14.9	18707.0	21.1	9.82
1984	15601126	812.6	4.8	2.1	19197.9	18.1	6.18
1985	15969247	810.7	2.3	-0.3	19697.5	15.8	2.39
1986	17490321	865.6	9.2	6.9	19840.3	19.2	4.99
1987	18849155	909.4	8.5	6.2	20261.4	22.6	6.73
1988	17188817	808.7	-8.3	-10.2	20684.4	22.4	6.72
1989	15268015	723.1	-11.6	-13.4	21112.5	16.9	6.62
1990	14526822	674.0	-4.9	-6.8	21550.3	19.2	3.00

1/ Base on constant dollars 1979.

Source: INE, Compendium of Statistics 1990.

Peru's government intervention also included marketing boards for agricultural commodities, as well as management of financial systems, and regulation throughout the economy. This heavy level of intervention distorted the relative prices in labor, capital and land markets which resulted in an inefficient allocation of resources.

Bolling (1989) also suggests that Peruvian economy was highly vulnerable to price fluctuations in world raw material markets. As Draker (1991) noted, by 1989, the raw material economy worldwide had been in its most serious and most prolonged depression for almost a decade. The worldwide surplus of farm products, however, did not slow the tremendous expansion in agricultural output. At the same time, the agricultural population steadily decreased. Thus, the drop in farm incomes and purchases had little effect on national income. Table A.4 shows the Peru' main financial indicators from 1970 to 1990.

A.4.2 Peru's Agricultural Sector

The Peruvian agricultural sector is heterogeneous, geographically and technologically, because of Peru's climatic diversity. Table A.5. shows Peruvian land resources by region. As Bolling (1989) noted only 6-percent of the total land is arable land, characteristic which limits seriously the expansion of agricultural output due to expansion of agricultural frontier.

Table A.4 Peruvian Financial indicators 1970-1990.

Year	<u>Per-capita</u>		Balance of Payments	Foreign Reserves	Peru Debt	Inflation	Nominal Exchange Rate	Minimum Wage Index
	Export	Import						
<u>Dollars²</u>		<u>Million dollars²</u>		<u>Percent</u>	<u>Soles 1979=100</u>			
1970-75	147.9	88.2	-8.3	397.4	4472	12.3	38.9	154.3
1976-80	167.8	111.8	2160	-1047.0	8841	51.1	161.9	111.3
1981	178.8	81.7	-504	771.0	9606	75.4	422.3	105.4
1982	191.0	77.9	124	896.0	11465	64.5	697.6	92.3
1983	165.0	71.7	-40	856.0	12445	111.2	1628.6	100.0
1984	169.5	44.6	247	1103.0	13338	110.2	3466.9	75.6
1985	172.2	55.9	280	1383.0	13721	163.4	10978.1	67.5
1986	150.6	131.0	-517	866.0	14477	4.6	15142.7	70.2
1987	147.6	157.0	-785	81.0	15337	9.6	16840.0	75.6
1988	132.3	135.0	-389	-308.0	16493	41.0	128830.0	56.7
1989	168.7	108.5	863	546.0	16827	2775.3	2666190.0	29.7
1990	157.2	133.8	146	692.0	17347	10323.0	1878856300.0	27.0

2/ current dollars.

Source: INE, Compendium of Statistics 1990.

Table A.5 Peru's Land Resource Utilization

Region	Crops	Permanent crop	Natural pastures	Forest	Total
----- Thousand hectares -----					
Costa	1,140	496	1,622	172	13,637
Sierra	1,341	20	10,576	2,092	39,198
Selva	2,421	2,707	17,916	46,432	75,686
----- Percent of Total Area -----					
Costa	8.4	3.6	11.9	1.3	100
Sierra	3.4	0.1	27.0	5.3	100
Selva	3.2	2.9	7.6	61.3	100

Source: INE, Compendium of Statistics, 1990.

The coastal area is the most developed area in terms of electricity, paved road and port facilities. It hosts most of the commercial farms and is the primary source of most export crops such as cotton and sugar. Almost 96-percent of farms use irrigation water. Chemical fertilizer and mechanical energy are also extensively used, 67-percent of farms use chemical fertilizer and 40-percent of farm use mechanical energy.

The main products in order of importance are: rice, yellow corn, cotton, sugar, potatoes, beans, poultry, milk and fruit and vegetables. This region accounts for less than 22-percent of the crop land, however produces over 40-percent of all crops in terms of value.

The Sierra region contains 37-percent of Peru's total cropland, but only 20-percent of the cropland is irrigated while the rest is rainfed. In this area, two levels of technological farms can be found: The traditional peasant communities and the large holdings transformed by land reform in social ownership enterprises. The peasant communities characterized by overgrazing, uncontrolled soil erosion, and soil depletion which lead to low productivity.

The next zone (2,000 to 3,500 m.a.s.l.) is mostly devoted to potato and native tuber cultivation. This area is mostly rainfed, with soil erosion and overcropping problems due to steep topography. This area is home to

700-thousand small and traditional farmers in the Sierra region who farm less than 5-hectares. Modern fertilizer and mechanical energy are almost nonexistent. Most of the products consumed on the farm or marketed in local towns because of limitations with transportation and communication infrastructure.

The Inter-Andean valleys possess not only the most fertile and irrigated lands, but also the biggest cities in the region. The main products are corn, barley, wheat and potatoes. Cropping system is usually intensive and inputs such as fertilizer and mechanical energy are used but in less extends than in the coast.

The upper forest amazon region crop land has developed through slash and burn system. Fallow is the principal means of maintaining soil fertility. However, after one harvest soil fertility typically declines due to soil erosion and acidification process. The main crops are coffee, rice and yellow corn which are marketed abroad and in coastal markets. Coca cultivation has increased tremendously in the last 10 years and has become the largest source of foreign currency earnings at \$1.2-Billion in 1990 (CIA, 1991). Table A.6 shows the main Peruvian crops, productivity, land allocation and the livestock population.

As Hopkins (1991) notes, the Peruvian agriculture sector's performance is poor compared with the overall

Table A.6 **Peru's Cropland Allocation and Livestock Inventory**

	1972	Metric Tons per Hectare	1990	Metric Tons per Hectare
Main Annual Crops (1,000 Ha)				
Maize	115,570	2.7	171,836	2.7
Rice	118,055	4.1	186,076	5.2
Sugar	48,865	176.2	47,384	128.4
Cotton	127,580	1.8	85,756	2.8
Potatoes	279,935	6.3	149,800	7.9
Coffee	127,722	0.5	208,921	0.4
Coca*	n.a	-	121,000	-
Cultivated Pastures	241,993		414,490	
Livestock (1,000 head)				
Bovine	4,145		4,065	
Ovine	15,033		12,249	
Swine	2,075		2,342	
Poultry	24,681		60,194	
Alpacas	2,659		2,666	

Source: INE, Compendium of Statistics, 1990.

* CIA, 1991, In World Fact Book, 1991.

economy performance. In the 1980's agricultural performance was erratic and decreased by the end of the decade.

Table A.7 shows the indices of agricultural output of major crops and foods. Overall, agricultural production is mixed. However, Escobal and Saavedra (1990) reported a reduction in land dedicated to export crops from 20 to 10 percent in the last 20 years. Agricultural trade has been negative since 1979, and the agricultural sector has been a net foreign currency drain (Table A.8). Tables A.9 and A.10 show the main indicators of the agricultural sector from 1970 to 1990.

Potatoes, wheat, barley, mutton and native tubers mainly produced in the Sierra region exhibited declines in production and on-farm consumption. In contrast products going to urban consumers or agriprocessing industries have increased in output (rice, poultry, pork and corn).

As Escobal and Saavedra (1990) note, although agricultural trade declined, farm income increased steadily from 1950 to middle 1970. However, real agricultural prices decreased. Thus, the income increases were due to productivity increases. Orden et al, (1982); Alvarez, (1984); Cafferata and Larios, (1988); Hopkins, (1991) have all examined the underlying the stagnant and uneven pattern of growth of Agricultural sector.

Table A.7 Indices of Agricultural Output¹

Sector	1970-75	1976-80	1981-85	1986-90
Rice	88.2	89.7	150.1	173.2
Corn	100.3	102.9	109.1	140.7
Wheat	98.6	83.9	76.9	104.8
Barley	91.4	77.0	61.6	71.8
Fruits	91.2	84.5	74.4	72.8
Vegetables	96.8	96.4	86.2	87.1
Cotton	94.8	84.3	91.8	108.8
Coffee	105.9	130.1	127.9	146.6
Sugar	116.3	101.4	85.8	81.5
Beans	95.1	90.9	88.0	100.6
Potatoes	90.5	84.2	83.6	87.8
Poultry	159.6	229.9	338.4	435.0
Mutton	91.1	92.1	81.0	82.7
Beef	101.4	102.0	116.9	127.4
Pork	115.9	115.8	121.9	145.2
Eggs	183.0	164.9	265.9	295.5
Milk	100.4	98.6	95.3	98.85

1/ Index of Agricultural Output = 100 in 1969.

Source: INE, Compendium of Statistics, 1990.

Table A.8 Percent of Major Agricultural Imports

Year	Wheat	Oil Seed	Rice	Sugar	Corn	Beef	Milk
1970	80.7	42.3	3.9	0.0	0.9	30.9	17.2
1971	85.1	20.0	0.0	0.0	0.0	20.4	18.1
1972	87.7	61.4	0.0	0.0	31.9	17.5	23.7
1973	86.1	67.8	0.0	0.0	49.7	12.4	28.2
1974	84.9	69.3	0.0	0.0	55.1	6.6	27.0
1975	86.7	70.0	17.6	0.0	50.9	4.4	31.2
1976	85.4	78.6	15.6	0.0	36.9	5.4	28.2
1977	86.9	72.5	0.0	0.0	28.8	5.4	27.7
1978	87.4	74.6	7.5	0.0	27.5	1.1	22.5
1979	89.8	40.3	28.3	0.0	24.1	0.0	24.5
1980	91.5	51.3	44.2	0.8	59.1	4.5	32.1
1981	88.8	58.8	22.1	2.4	45.3	10.9	33.0
1982	90.3	62.4	9.8	0.0	52.4	19.5	32.8
1983	92.8	80.2	15.0	4.0	49.4	8.3	30.5
1984	91.6	59.5	6.5	1.8	15.6	8.0	28.2
1985	89.9	42.1	0.0	0.0	32.5	4.0	24.5
1986	90.7	51.0	21.2	2.7	34.2	23.6	38.1
1987	88.1	58.9	10.8	3.3	39.5	18.8	42.5
1988	85.1	51.7	1.5	3.7	47.6	12.8	32.9
1989	82.0	52.7	16.6	1.4	16.4	7.7	22.2
1990	85.5	n.a	22.7	1.9	54.8	n.a	22.5

Source: INE, Compendium of Statistics, 1990.
 Lajo, 1990. In: Presente Pasado y Futuro de la Alimentacion.

Table A.9 Peruvian Agricultural Indicators 1970-1990.

Year	<u>Agricultural share</u>		Credit Allocation	Relative Prices		
	GDP Real	Labor Force		Export	Urban	Total
	<u>Percent</u>		Million Intis ¹	<u>Index²</u>		
1970-75	12.8	45.8	99.4	83.8	104.0	93.1
1976-80	10.8	40.9	75.4	88.2	112.1	104.4
1981	10.4	39.5	78.2	68.6	118.5	97.6
1982	10.1	39.2	74.9	53.8	110.8	82.8
1983	11.0	38.4	63.5	61.5	90.8	87.6
1984	11.5	37.5	83.8	100.6	98.8	96.5
1985	11.6	36.6	76.3	78.7	88.9	78.4
1986	11.2	35.8	125.1	77.1	102.7	96.7
1987	10.9	35.2	122.9	n.a	n.a	n.a
1988	12.7	34.8	26.6	n.a	n.a	n.a
1989	13.6	34.4	23.0	n.a	n.a	n.a
1990	13.0	34.0	8.4	n.a	n.a	n.a

1/ Real initis measured at constant 1979 level.

2/ Index 1960=100

Source: Malletta, 1991, in Strategic Proposal for Rural Development in Peru.INE, Compendium of Statistics, 1990.

Table A.10 Peruvian Agricultural Trade Indicators 1970-1990.

Year	Agricultural Exports		Agricultural Imports			Agriculture's share of Imports	
	Value	Share in Exports	Share in Agri- GDP	Goods	Inputs		Total
	Million Dollars	Percent		Million Dollars		percent	
1970-75	246.1	21.0	17.5	167.9	32.0	199.9	24.5
1976-80	324.4	14.9	19.6	249.9	64.7	314.9	17.4
1981	232.0	7.1	8.8	504.4	98.0	602.4	17.2
1982	290.0	8.8	11.2	370.2	109.6	479.8	15.5
1983	250.0	8.3	11.3	427.0	93.5	520.5	24.2
1984	272.0	8.6	16.2	301.2	58.1	359.3	19.2
1985	318.0	10.7	15.1	204.4	39.8	244.2	15.3
1986	409.0	16.3	14.5	385.8	59.6	445.4	20.6
1987	264.0	10.1	7.1	421.0	100.9	521.9	18.5
1988	257.0	9.5	5.3	415.0	115.4	530.4	20.7
1989	352.0	10.1	5.9	358.0	54.5	412.5	21.6
1990	291.2	8.9	5.5	433.0	91.2	524.2	21.3

Source: INE, Compendium of Statistics, 1990.

Orden et al, (1982) note that if sectoral policies work, then several conditions must be hold: 1) Trade and exchange rate policies must not discriminate against agriculture; 2) Domestic producer prices must be equivalent to the world producers prices accounting foreign oligopolistic practices; and 3) food subsidies must be targeted without hurting farm income and prices of factors such as capital, labor and labor. Unfortunately, Peruvian trade policy has discriminated against agriculture (Orden et al, 1982; Rossini, et al 1991). Thus in 1982, effective rate of protection through tariffs for agricultural products and inputs was 30-percent compared with 107-percent for processed food and beverages, and 104-percent for textiles and clothing. Within the agricultural sector the tariff structure created negative protection for export products and low or no level of protection for basic food staples. In 1989, the total effective rate of protection for agriculture was -40.2 percent.

On the other hand, the exchange rate policy for most of the period (1970-1990) was a key component of the import substitution strategy (Alvarez, 1984). The overvaluation of exchange rate cheapened inputs and capital goods mostly imported for manufacturing sector and food product imports for the urban population. This policy helped change consumption patterns from traditional food products to imported foods.

The situation was aggravated by agricultural price policies which kept farm prices low and then further cheapened prices through consumer subsidies. Only when government set a support prices, as happened between 1985 and 1987, did agricultural producers recover in real terms.

In addition, agricultural credit policies and fertilizer subsidies lowered artificially the value of capital and fertilizer relative to labor bringing inefficiency in the allocation of resources.

A.4.3 Land Reform in Peru

Peru experienced three major land reform efforts in 1964, 1969 and 1984, in an effort to mitigate Peru's highly skewed distribution of land tenure. However, the wealthy landholding class and most governments have successfully opposed any changes.

The first land reform was carried by President Belaunde, in 1964. It was limited in scope affecting only 11-thousand families with 300-thousand hectares. The second reform and the most effective, was launched by the Velazco military government. Almost 9-million of hectares were expropriated and 379-thousand families benefitted. Old large estates in the Sierra and Costa were transformed in cooperatives and social agricultural enterprises. Although nearly of 40-percent of the arable land was expropriated only 25-percent of the rural population was benefitted

leaving three out of four peasant households untouched (Hopkins, 1991).

By the end of the 1970's, the failure of the cooperatives induced many of them especially in the Costa region to parcel their land among their members. In 1980, during the second term of Belaunde regimen legal rights based on free choice to parcel cooperative lands was set (Melmed, 1988). Table A.11 shows the comparison in terms of farm size between period before land reform and 1990 (Maletta, 1991). As a consequence of the land reform process farms in the larger farm's category have decreased in importance number and average size. However, the number of farms categorized as large farms has increased but mainly due increases in the jungle region.

Table A.11 Peru's Estimated Farm Size Structure Before 1970 and After 1990

Size	<u>1,000 farms</u>		<u>1,000 hectares</u>		<u>Average Size¹</u>	
	Before	After	Before	After	Before	After
Private Small Holdings						
0-5 Ha	1,184	1,200	1,560	1,920	1.44	1.6
5-20 Ha	232	35	2,036	3,650	8.78	9.5
Sub-total	1,316	1,550	3,596	5,570	2.7	3.6
Private Middle Holdings						
20-50 Ha	47	95	1,278	3,150	27.2	33.1
Private Large Holdings						
Over 50 Ha	28	50	12,550	5,480	448.0	109.6
Total Private Holdings						
	1,391	1,695	14,009	14,200	10.7	8.4
Cooperatives						
	.	.	.	1,650	.	.
Communal Land						
	.	.	6,121	8,000	.	.
Total Holdings						
	1,391	1,695	23,545	23,850	.	.

Source: Based on the Agricultural Census, 1972, and Encuesta de Hogares Rurales (ENHR), 1984.

Note: ¹ Hectares per farm.

A.5 National Milk Consumption Trends

On a per-capita basis, availability of milk in Peru including domestic and imported sources is one of the lowest in the Andean region. In 1988, Peruvian milk availability per-capita was about 61 liters of milk, in contrast, Ecuador had 239 liters of milk, Venezuela had 159 liters and Colombia had 115 liters of milk per-capita a year. The U.S. per capita figure was about 267 liters in 1986.

In 1990, evaporated and fresh milks accounted for 47 and 38 percent by volume of all sales in the fluid milk market. Recombined and pasteurized milks accounted for 5, and 1 percent by volume of milk sales. Since 1979, when it became commercially available, powdered milk's market share has grown to 9 percent of the fluid milk market. In contrast, pasteurized, fresh and recombined milk market shares declined of by 12, 7, and 1 percent, respectively.

As summarized in Table A.12, several household food consumption surveys conducted by the Institute of Statistics indicate that the average expenditure per family in Lima has declined 67 percent in real terms from 3.4 million intis in 1972 to 1.1 million intis in 1990. During the same period, the average food expenditure per family decreased from 1.5 million intis in 1972, to 626 thousand intis in 1990.

Table A.12 Household Food Expenditures: Percent of Total Expenditures and Real Expenditures in Lima, Peru

	1972	1977	1986	1988*	1989*
	----- Percent of Total Expenditures -----				
Food, Beverage & Tobacco	43.0	42.6	46.9	51.3	55.9
Milk & Cheese	3.3	3.3	2.5	2.7	2.6
Real Expenditures in 1,000 1979 Intis**					
Average Total Expenditures Per Family	3,442	3,265	2,329	1,526	1,120
Expenditures on Food, Beverage & Tobacco	1,480	1,391	1,092	784	626

* Unpublished data.

** 1 inti = 1000 soles

Source: National Institute of Statistics, 1990.

In 1989 dairy expenditures accounted for 2.6 of the total expenditures and about 8.8 percent of the food budget consumed at home. By comparison, the bread and cereals group accounted for 27 percent, meat products 22.3 percent, and fruits and vegetables-legumes for 7.6 percent each. The proportion of total expenditures spent on milk and cheese products declined from 3.3 percent to 2.6 percent during the same period. In contrast, bread & cereals, tubers/roots have increased their share in the food budget.

The expenditure changes have been especially dramatic for low-income households. The average consumption of evaporated milk for low income families dropped 34 percent from 0.578 to 0.384 kilograms of milk per family/day. Consumption of "fluid" milk declined nearly 71 percent from 0.390 kilograms in 1972 to 0.110 kilograms of milk per family/day in 1979. The latest household survey (1989-90), provides an indication that low-income households have continued to reduce their consumption of evaporated and powdered milk, but have somewhat increased their consumption of recombined milk. In general, these declines in milk consumption levels can be attributed to a fall on real income (Jacob, 1984).

In 1987, milk consumption in La Libertad, as estimated by the author, was dominated by evaporated and fresh milk jointly representing 87 percent of total milk consumption. Evaporated milk accounted for 44 percent and fresh milk accounted for the remaining 43 percent. Pasteurized and powdered milk accounted for 8 and 5 percent of the total milk consumption in La Libertad coastal area. Recombined milk is only consumed in the Lima area.

A.5.1 Milk Price Trends

Until the Fujimori Administration, all milk prices were subject to government control (Table A.13). Only the price of pasteurized milk, a relatively minor component of the milk market, was deregulated in 1980. As a result, the real prices for evaporated, pasteurized and recombined milk were

Table A.13 Nominal Milk Prices in Peru (1970 to 1990)

Year	Fresh Milk	Evaporated Milk	Pasteurized Milk	Recombined Milk	Powdered Milk
----- soles x liter -----					
1970	5.1	7.3	6.9	5.9	n.a
1971	5.2	6.9	7.3	6.2	n.a
1972	5.5	7.4	7.5	6.6	n.a
1973	6.6	7.9	8.4	6.6	n.a
1974	7.6	9.5	9.2	7.8	n.a
1975	8.9	12.3	11.3	9.3	n.a
1976	11.8	14.3	17.6	11.0	n.a
1977	14.5	19.1	25.5	15.9	n.a
1978	26.1	23.2	37.7	32.0	n.a
1979	44.1	60.9	77.5	47.2	n.a
1980	71.4	79.6	95.7	59.6	49.5
1981	142.1	187.9	206.7	129.0	88.5
1982	193.6	291.9	295.5	245.0	130.7
1983	330.6	570.0	665.0	373.0	310.6
1984	743.0	1260.9	1367.5	792.0	548.2
1985	1760.0	3290.0	3568.0	2130.0	1150.0
1986	3950.0	5200.0	6000.0	3530.0	1980.0
1987	6700.0	7920.0	10000.0	6150.0	2880.0
1988	50300.0	68070.0	70250.0	52640.0	22250.0
1989	1175000.0	1285880.0	2015000.0	1440000.0	856750.0
1990	70050000.0	137511750.0	148571700.0	120511580.0	98000000.0

Source: Dairy Industry Association Annual Reports 1970 -1991
Ministry of Agriculture - Administration of Agro-Industries.

Table A.14 Real Milk Prices in Peru (1970 to 1990)

Year	Fresh Milk	Evaporated Milk	Pasteurized Milk	Recombined Milk	Powdered Milk
----- constant soles 1979 -----					
1970	45.0	65.2	61.4	52.1	-
1971	43.0	57.0	60.4	51.7	-
1972	42.4	57.7	57.9	51.0	-
1973	46.5	55.6	59.2	46.5	-
1974	46.1	55.4	55.5	47.3	-
1975	43.4	60.0	55.4	45.4	-
1976	43.1	52.2	64.4	40.2	-
1977	38.5	50.5	67.5	42.1	-
1978	43.8	55.7	63.2	53.6	-
1979	44.0	60.9	77.5	47.3	49.5
1980	44.8	50.0	60.2	37.5	31.1
1981	50.8	67.2	74.1	46.2	31.7
1982	42.1	63.5	64.4	53.4	28.5
1983	34.0	58.7	68.6	38.5	32.0
1984	36.4	61.8	67.1	38.9	26.9
1985	32.7	61.2	66.5	39.8	21.4
1986	41.3	54.4	62.8	37.0	20.7
1987	37.7	67.4	85.1	52.3	24.5
1988	36.8	50.0	51.6	38.6	16.3
1989	24.6	26.9	42.3	22.0	18.0
1990	19.3	38.0	41.1	33.4	27.1

Source: Dairy National Industry Association Annual Reports 1969-1990,
Statistics Director-Ministry of Agriculture, 1990.

maintained at almost the same levels from 1970 to 1980 (Table A.14). Since then, however, there has been a downward trend in milk prices. The price of fresh milk, which reflects the farmgate price, has also followed a similar pattern.

A.5.1 Milk Supply and Demand

In 1990, the dairy industry accounted for \$152-million in farm receipts, or about 6.1 percent of total farm receipts. The milk sector produced about 776-thousand metric tons of milk from a herd of 700-thousand cows.

As shown in Table A.15, Peru imported nearly 208-thousand tons of dairy products and received 16-thousand metric tons of dairy products in food aid. Since the early 1960's, Peru has increased its dairy product imports of nonfat milk powder and anhydrous milk fat.

Table A.16 shows dairy imports broken down by type of product. Note how the importance of whole dry milk has increased since the introduction to the powdered milk into the Peruvian market. Also, since 1973, the first year food aid data were available, the food share of food aid in the milk supply has increased from 0.7 percent in 1973 to 7 percent in 1990. Until 1980, food aid was received and sold by the governments through commercial channels. Since 1980, food aid has distributed to charitable institutions and to special groups such as school children, young mothers and poor people.

Table A.15 Composition of Milk Supply in Peru

Year	Imported Milk		Domestic	Rate of
	Commercial ¹	Food Aid ¹	Milk	Self-sufficiency
---- thousand metric tons ----				Percent
1960-69	92.287	n.a	593.870	86.5
1970-74	240.891	6.296	831.071	77.0
1975-80	226.783	21.898	813.350	76.4
1981	328.684	56.752	784.900	70.5
1982	363.037	28.445	805.000	68.9
1983	300.831	28.850	752.200	71.4
1984	260.933	44.922	780.400	74.9
1985	219.551	42.260	808.800	78.6
1986	486.045	17.067	819.300	62.8
1987	582.680	30.429	830.000	58.8
1988	394.572	21.702	849.500	68.3
1989	206.827	21.068	802.300	79.5
1990	208.820	16.297	776.900	78.8

Source: Ministry of Agriculture-Agricultural Statistics, 1991
¹ Equivalent in tons of fluid milk.

Table A.16 Components of Peru's Commercial Dairy Imports

Year	Whole Milk Powder	Non-Fat Milk Powder	Anhydrous Milk Fat
	----- Thousand metric tons -----		
1970-74	0.6	22.6	5.6
1975-79	0.0	21.6	9.7
1980	2.5	25.8	8.7
1981	2.2	23.8	9.4
1982	2.9	25.0	9.9
1983	4.0	23.6	9.0
1984	6.6	20.7	7.4
1985	7.6	15.5	5.7
1986	23.9	16.6	5.5
1987	23.0	22.0	7.3
1988	18.5	18.1	6.4
1989	10.6	10.8	3.9
1990	5.1	10.4	3.9

Source: Central Reserve Bank of Peru, Management of
 External Sector, 1990.

Table A.17 shows the C.I.F prices of the different types of dairy products imported into Peru from 1970 to 1990. The recent price increases for these three main imported products may indicate that downward price pressure on domestic milk prices previously generated by the import prices maybe easing.

Table A.17 Average C.I.F Imported Milk Prices

Year	Whole Milk Powder	Non-Fat Milk Powder	Anhydrous Milk Fat
----- US \$ per metric ton -----			
1970	\$1,210	\$374	\$1,434
1971	1,248	413	1,542
1972	1,120	671	1,188
1973	-	633	1,360
1974	-	1,085	1,537
1975	-	1,011	1,455
1976	-	561	1,145
1977	-	291	763
1978	-	410	1,021
1979	-	652	1,395
1980	1,305	1,061	1,929
1981	1,434	1,237	2,571
1982	1,482	1,192	2,698
1983	1,145	984	2,143
1984	988	801	1,747
1985	899	763	1,437
1986	992	839	1,261
1987	927	948	1,223
1988	1,344	1,453	1,317
1989	1,714	2,192	2,323
1990	1,669	2,865	3,021

Source: Agricultural, and Economic & Finance Ministries, 1990.

A.5.4 Milk Production at the National Level

According to Peru's last Agricultural Census (1972) almost 50-percent of the 1.4-million farms had cattle. Of those farms almost 70-percent were classified as small farms with less than 5 hectares. In addition, 72-percent of the cattle population was located in the Sierra region, in the area above 2,500 m.a.s.l. As Jarvis (1986) notes, this area is more suitable to dual purpose cattle exploitation because of a lack of alternative agricultural opportunities. Farms in this are small and labor intensive.

As shown in Table A.18, much of Peru's dairy sector consists of dairy farmers from milksheds located in the Coastal and Sierra valleys close to larger cities. These modern milksheds were developed by government and private actions because these areas presented ideal conditions to dairy activity, better climate, better fodder resources and access to input and output market, high population density and well developed infrastructure, and where close to the urban markets. Thus, dairy farmers became integrated with urban markets directly supplying their milk production through consumers or indirectly through processing plants. In these areas, producers became organized at local and at national levels in dairy farmer organizations (FONGALs), which lobby dairy governmental policy decisions.

Table A.18 Main Milk Producing Departments in Peru

Year	1964 ¹		1972 ¹		1982 ¹		1991 ¹	
	M.T	%	M.T	%	M.T	%	M.T	%
Lima-Callao	73.8	14.8	118.1	14.4	149.6	18.5	89.2	11.3
Cajamarca	109.9	22.0	163.8	20.0	160.2	19.9	88.8	11.2
Arequipa	31.4	6.3	71.5	8.7	146.0	18.1	167.6	21.3
La Libertad	30.4	6.0	48.2	5.9	25.3	3.1	25.9	3.2
Junin	46.4	9.3	16.7	2.0	22.5	2.7	15.8	2.0
Huancavelica	43.2	8.6	18.2	2.2	16.0	1.9	17.8	2.2
Cuzco	16.4	3.2	34.1	4.1	33.2	4.1	26.3	3.3
Ancash	37.6	7.5	45.2	5.5	52.6	6.5	17.5	2.2
Apurimac	29.7	5.9	46.1	5.6	42.2	5.2	18.4	2.3
Puno	14.0	2.8	14.7	1.8	10.0	1.2	9.7	1.2
Sub-Total	432.8	86.8	576.6	70.6	657.6	81.7	477.0	60.7
Others	65.6	13.2	239.3	30.4	147.4	18.3	308.9	39.3
Total	498.4	100.0	815.9	100.0	805.0	100.0	785.9	100.0

Source:¹ Ministry of Agriculture-Agricultural Statistics Office, Agricultural Census

M.T : Metric Tons

Lajo (1986) notes in the main milkshed almost 70 percent of dairy producers are middle or small producers who have a wide range of milk productivity and technological utilization. The main milksheds include: (1) the Coastal South made up of Arequipa, Tacna and Moquegua departments; (2) the Northern Sierra located in the Cajamarca department; (3) the Central Coast or Lima milkshed located in Lima and surrounding valleys; (4) the Central Sierra or Mantaro milkshed located in Junin department; and (5) the Coastal Northern milkshed which serves cities such as Trujillo, Chiclayo and Piura. In 1991, milk production in the most important departments, Arequipa, Cajamarca and Lima, provided about 345,600 tons of milk, which represented about 44 percent of the total domestic milk production (Table A.18).

The Arequipa department accounted with 21.3 percent of the Peruvian domestic milk production. Arequipa department's milk production grew 127 percent from 1964 to 1972 at an annual rate of 15 percent. From 1972 to 1982, growth continued but at slightly lower rate at 10 percent per year. However, in the last ten years production only increased 14 percent. In contrast, the milk production of Lima-Callao and, especially, Cajamarca department have decreased in the last 20 years. In 1991, although Cajamarca department accounted for 11.2 percent of Peru's milk production, production in the region declined 24 percent since 1964. The

production milk of Lima-Callao area has decreased only 17-percent mainly due to urban expansion and land reform which affected especially large dairy farms.

The modern dairy farmers are characterized by: (1) high productivity compare with traditional farmers; (2) possession of higher yielding breeds, such as Holsteins; (3) increased use of purchased inputs such as fertilizer, mechanical power, concentrates, high value roughage, agricultural by-products and veterinary medicines; (4) adoption of new technologies and use of skilled labor; and (5) integration with urban markets directly or by processing plants.

The milkshed in southern Peru was developed by Gloria, Inc., an evaporated milk processing firm, and subsidiary of General Mills until 1988 when it was sold to a regional group. Gloria, Inc., processed 80 percent of the total milk produced in the milkshed (Jacob, 1984). Southern producers based their production on semi-intensive and intensive technological systems. In 1978, nearly 50 percent of the available arable land was dedicated to grow alfalfa.

In the Central Sierra (Mantaro Valley) and Lima milksheds, large and middle herd dairy producers based their production on an intensive milk production system in which concentrate and purchased forages were the basis of the feeding system. In these areas, milk is channeled into pasteurized, recombined and cheese processing plants.

The Northern Sierra, Cajamarca department, was developed by Perulac, Inc., a subsidiary of Nestle corporation, which produces mainly evaporated milk and other dairy products such as powdered and baby-milk formula. Most of the milk production comes from small farms, where the production system is semi-intensive base on grazing cultivated pastures such as legumes and grasses.

Table A.19 shows the indices of milk productivity of the main milksheds under the Service of Milk Productivity program conducted by The Agrarian University and the Ministry of Agriculture. As indicated in Table A.19, Arequipa and Lima were the milksheds with the highest milk productivity ratios.

A.5.3 Milk Producers in the La Libertad Milkshed

In La Libertad almost 90 percent of the total milk production is produced by the coastal provinces (Ascope, Trujillo) close to Trujillo city. The Chicama (Ascope), Santa Catalina and Viru (Trujillo) valleys accounted for 86 percent of the total milk production of the coastal region. Santa Catalina has showed the highest increase in milk and number of dairy cows (Tables A.20 and A.21).

According to the last Agricultural Census (1972), almost 60 percent of La Libertad dairy farm were small with less than 5 hectares of land. Another 33 percent of dairy farms utilized between 6 to 20 hectares.

Table A.19 Indices of Milk Productivity by Milkshed,
1970-90

Milkshed	Daily Milk Productivity		Cow per Farm
	Herd	Cows in Production	
Cajamarca			
1970-75	8.9	12.3	57
1976-81	9.2	11.4	65
1982-87	9.8	12.2	52
1988-90	10.8	13.1	37
Lima			
1970-75	13.0	14.8	199
1976-81	11.3	13.0	199
1982-87	10.7	13.0	140
1988-90	12.5	16.4	136
La Libertad			
1970-75	10.9	12.7	91
1976-81	9.4	11.3	132
1982-87	10.7	12.5	145
1988-90	14.3	16.9	67
Arequipa			
1970-75	-	-	-
1976-81	11.7	14.5	27
1982-87	14.1	16.3	25

Source: Official Milk Productivity Service-Agrarian National University.

Table A.20 Dairy Cow Numbers in the Coastal Valleys in la Libertad Department

Year	1979	1985	1986	1987	1988	1989	1990
	-----			dairy cows	-----		
Valleys:							
Chicama	1,055	1,850	1,848	1,876	1,853	1,857	1,486
Sta Catalina	569	2,700	2,849	2,853	3,200	3,146	3,300
Viru	693	718	742	718	772	658	721
Jequetepeque	662	1,292	1,286	1,335	1,245	1,105	1,252
Total	2,978	6,442	6,725	6,782	6,986	6,706	6,759

Source: Ministry of Agriculture - La Libertad Region 1979-1990.

Table A.21 Milk Production in the Coastal Valleys of La Libertad

Year	1985	1986	1987	1988	1989	1990
Valleys	-----thousand metric tons-----					
Jequetepeque	3.4	3.3	3.5	3.3	3.1	3.3
Chicama	5.1	5.1	5.1	4.7	5.1	5.3
Sta. Catalina	7.8	8.3	8.3	9.3	9.2	13.8
Viru	1.5	2.1	2.1	2.4	1.9	2.9
Total	17.8	18.7	18.9	19.7	19.4	24.6
	----- Kgs Milk/Cow -----					
	2,758	2,780	2,797	2,817	2,889	3,640

Source: Ministry of Agriculture - La Libertad Agrarian Region, Trujillo, 1990.

It was estimated by the author that in 1987 almost 60 percent of the milk produced was consumed on-farm (9.3 percent) or sold directly to consumers (50.7 percent). Another 17 percent of milk production went into pasteurized milk at a Trujillo processing plant. The remaining 23 percent was used for calf-feeding (13 percent) and for export to other areas (10 percent).

A.5.4 The Processing and Milk Distribution System

Base on the 1990 data in Table A.22, twenty-seven percent of Peru's domestic milk production is shipped to processing plants for manufacturing drinking milk, such as evaporated, recombined and pasteurized milk; 23 percent is consumed on-farm; 15 percent is sold directly to consumers; 16 percent is designated for calf feeding; and 3 percent of the milk is designated to processing dairy products plants. The remaining 16 percent is used by farmers to produce traditional dairy products.

Fifty-four percent of the milk imported is designated for producing evaporated milk, 7 percent goes to recombined plants, 30 percent is sold directly to consumers as powdered milk, while the remaining 7 percent is distributed to produce other dairy products and pharmaceutical products (Table A.23).

The Peruvian milk processing industry only processes about one quarter of the total domestic milk production.

Table A.22 Final Product Utilization of Fresh Milk

Year	Drinking Milk Evaporated	Pasteurized	Dairy Products ¹	On farm* Consumption	Calves Feeding	Total
	Thousand metric tons					
1970	81.4	67.2	207.9	295.2	173.3	825.0
1971	88.1	60.2	231.7	328.6	188.4	897.0
1972	85.2	50.4	199.8	309.2	171.4	816.0
1973	82.9	42.3	204.6	314.8	171.4	804.0
1974	86.6	40.1	203.4	312.2	170.7	813.0
1975	84.7	34.2	204.2	319.2	170.7	813.0
1976	93.9	38.1	200.1	315.9	172.4	821.0
1977	116.3	38.4	193.2	399.9	172.2	820.0
1978	133.4	37.5	180.4	298.1	172.6	822.0
1979	141.8	32.2	185.6	291.6	173.0	824.0
1980	142.4	35.8	173.4	264.3	163.8	780.0
1981	139.2	34.0	121.0	325.9	136.9	756.5
1982	158.7	33.0	124.1	320.6	139.9	774.0
1983	145.7	25.7	116.8	309.9	131.6	729.7
1984	150.1	26.0	121.5	324.4	136.9	758.0
1985	169.7	28.0	128.0	307.5	126.8	760.0
1986	174.9	27.1	129.5	307.4	127.9	766.8
1987	187.0	33.0	134.0	293.6	129.6	777.2
1988	194.0	30.0	157.9	281.9	132.8	796.6
1989	186.3	24.4	145.3	315.5	134.3	805.8
1990	175.9	22.0	132.2	281.0	122.2	733.3

Source: - Asociacion de industriales lacteos(A.D.I.L), Direccion general de agroindustria y comercializacion. Ministerio de Agricultura.
 Dairy Products¹ Include traditional and processed dairy products.
 * Includes Direct Sales.

Table A.23 Utilization of Imported Dairy Inputs by Type of Product

Year	Evaporated Plants		Recombined Plants		Dairy Products		Others ¹ Products		Total	
	NFMP	AMF	NFMP	AMF	NFMP	AMF	NFMP	AMF	NFMP	AMF
-----thousand metric tons -----										
1970	8.2	3.3	3.6	1.2	1.7	1.9	1.1	0.00	14.4	6.4
1971	11.7	6.0	5.8	2.2	2.2	2.4	1.4	0.12	21.0	9.9
1972	15.1	5.7	6.1	2.2	1.8	1.8	1.9	0.13	24.9	9.9
1973	16.7	6.2	8.2	2.8	1.9	1.3	1.7	0.15	28.6	10.6
1974	13.2	5.8	7.8	2.4	1.9	1.5	0.8	0.08	24.0	9.7
1975	15.6	6.9	9.2	2.9	2.2	1.7	1.0	0.09	28.0	11.7
1976	14.5	6.2	8.5	2.6	2.1	1.5	0.7	0.10	29.9	10.4
1977	14.4	5.4	6.6	2.3	2.0	1.4	0.7	0.10	23.8	9.3
1978	13.3	6.1	5.9	2.1	1.2	0.9	1.1	0.07	21.5	9.2
1979	10.3	4.3	6.2	2.1	1.5	1.1	1.0	0.06	19.1	7.7
1980	12.3	5.1	7.1	2.4	1.6	1.1	1.4	0.01	22.5	8.7
1981	15.0	6.3	5.2	1.7	1.8	1.1	1.2	0.01	23.8	9.4
1982	17.1	7.3	5.2	1.7	1.7	0.9	0.8	0.07	24.8	9.9
1983	15.8	6.4	5.7	1.9	1.4	0.6	0.7	0.04	23.6	9.0
1984	11.6	4.6	5.6	1.9	2.6	0.8	0.9	0.08	20.7	7.4
1985	7.6	3.1	5.0	1.8	2.1	0.7	0.7	0.02	15.5	5.7
1986	6.8	2.8	4.5	1.5	3.8	1.0	1.4	0.12	16.6	5.5
1987	13.2	5.5	2.7	0.9	3.9	0.8	1.6	0.04	21.5	7.3
1988	11.8	4.8	3.0	0.9	1.1	0.5	2.1	0.03	18.1	6.4
1989	6.6	2.7	1.9	0.7	0.8	0.4	1.2	0.01	10.8	3.9
1990	7.8	3.1	1.1	0.4	0.7	0.3	0.7	0.04	10.4	3.9

Source: Dairy Industry Association. A.D.I.L. 1991.

NFMP: Non-Fat Milk Powdered

AMF. Anhydrous Milk Fat

¹ Luxury plants and Laboratories.

This level is lower than the levels exhibited by other Latin American countries such as Argentina (90 percent), Brazil (59 percent), Chile (59 percent), and Uruguay (69 percent) (F.A.O, 1990).

Lajo (1986) indicates that the processing dairy industry is highly concentrated, product differentiated and mostly private owned. Evaporated milk is marketed nationwide and is dominant product in the Peruvian milk market.

Evaporated milk is produced by only two firms: Gloria, Inc., which possess 85 percent of the evaporated milk market and Perulac, Inc., which has the remaining 15 percent of the market share (Table A.24). As Jacob (1984) notes, both firms were established in the early 1940s and were instrumental in developing the Southern Coast and Northern Sierra milksheds. In addition, both evaporated enterprises have integrated their raw milk recollection and product distribution systems. Both enterprises are almost the only purchaser raw milk in their respective milksheds. Gloria recollect almost 75 percent of the total milk produced in southern departments (Arequipa, Moquegua and Tacna). The firm has its own fleet trucks and cooling milk centers which facilitate milk recollection. In addition Gloria distributed through two distribution companies.

Although the evaporated milk industry was protected from foreign competition by tariffs and non-tariffs

Table A.24 Fresh Milk Deliveries at Processing Plants

Year	Evaporated Plants				Pasteurized				Total
	Gloria		Perulac						
	TM	Index	TM	Index	TM	Index	TM	Index	
----- thousand of metric tons -----									
1970	63.0	100.0	18.0	100.0	67.0	100.0	148.0	100.0	100.0
1971	71.0	112.7	17.0	94.4	60.0	89.6	148.0	100.0	100.0
1972	68.0	107.9	17.0	94.4	50.0	74.6	135.0	91.2	91.2
1973	65.0	103.2	18.0	100.0	42.0	62.7	125.0	84.5	84.5
1974	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1975	65.0	103.2	20.0	111.1	34.0	50.7	119.0	80.4	80.4
1976	71.0	112.7	23.0	127.8	38.0	56.7	132.0	89.2	89.2
1977	88.0	139.7	29.0	161.1	38.0	56.7	155.0	104.7	104.7
1978	105.0	166.7	28.0	155.6	38.0	56.7	171.0	115.5	115.5
1979	113.0	179.4	29.0	161.1	34.0	50.7	176.0	118.9	118.9
1980	114.0	181.0	29.0	161.1	36.0	53.7	179.0	120.9	120.9
1981	108.0	171.4	31.0	172.2	34.0	50.7	173.0	116.9	116.9
1982	120.0	191.6	37.6	208.9	33.0	49.3	191.3	129.3	129.3
1983	113.3	176.3	34.4	191.1	25.7	38.4	171.4	115.8	115.8
1984	115.9	184.0	34.2	190.0	26.0	38.8	176.1	119.0	119.0
1985	133.0	211.0	36.7	203.8	28.0	41.7	197.7	133.1	133.1
1986	136.2	216.1	38.7	215.0	27.1	40.4	202.0	136.4	136.4
1987	145.4	230.7	41.6	231.1	33.0	49.2	220.0	148.6	148.6
1988	149.2	236.8	44.8	248.8	30.0	44.7	224.0	151.3	151.3
1989	141.6	224.7	44.7	248.3	24.4	36.4	210.7	142.3	142.3
1990	128.4	203.8	47.5	263.8	22.0	32.8	197.9	133.7	133.7

Source: Asociacion de Industriales Lacteos A.D.I.L, 1991.

concessions granted by several Peruvian governments. The product itself provided the advantages that allowed evaporated milk to become the dominant milk in the Peruvian market. First, the evaporation and sterilization processes prolong product shelf-life for months without refrigeration. Second, the tin cans facilitate storage, transportation and, even more importantly, make the product available to a wider the range of consumer outlets.

The evaporated milk companies are also the main purchaser of imported powdered milk and butter oil base on the percentage of imported raw milk used. In the last decade, the percent has declined, from 65 percent during the period 1970-74 to 38 percent during the period 1986-90.

Another important characteristic of the evaporated industry is its reliance on imported inputs. Almost 70 percent of the total cost is provided by local market and the remaining 30 percent is imported. However since the tin plate represent 22 percent of the total cost and half of this component is imported the percent of domestic components is overvalued.

Recombined milk is only sold in the Lima market. As in the case of evaporated milk only two enterprises were authorized to produce recombined milk: Egasa, Inc., and Maranga-Upa, Inc. Egasa has 70 percent share of recombined milk market while Maranga-Upa has the remainder. Recombined milk was introduced into the market in 1978, until then only

reconstituted milk was processed. Until recently demand for those milks increased. Because the land that surround the Lima was transformed into suburban areas, local producers in Lima milkshed were unable to meet the increasing demand of milk. Milk processors began to use more imported milk because of its availability and low price. As a result, recombined milk plants in Lima did not develop collection raw milk systems. Instead, producers must take their milk to the plants.

In addition to evaporated and recombined milk there are other medium and small plants located in the main Peruvian cities which manufacture pasteurized milk and other dairy products such as cheese, yogurt, etc. Pasteurized milk and dairy products plants located in Lima are: El Escorial (Yogurt and Pasteurized milk), Proderlac (Cheese), Inderlac (UHT milk, cheese), Don Martin (Yogurt and Pasteurized milk), Laive (Yogurt and cheese), and La Molina (Pasteurized milk). In the interior, there are plants dedicated to manufacturing of pasteurized milk or UHT milk and other dairy products. The pasteurized plants are located: in Trujillo (La mocherita), Pacasmayo (Danlac), Junin (Manataro), Cuzco (Cuzco), and Tacna (Tacna). The UHT milk plants are located in : Sullana (Sullana), and Arequipa (Prolacsur). The Sullana, Trujillo, and Cuzco plants were part of a public dairy enterprises.

Table A.25 shows the dairy processing plants with their idle capacities in 1990. The high percentage of idle capacity provides a substantial burden to the production cost due to fixed cost. Thus, in Lima City, the two recombined plants had a combined excess capacity of 84 percent. Others dairy processing plants dedicated mainly to other dairy products had 37 percent excess capacity. The two evaporated plants jointly had an excess capacity of 37 percent. Others dairy plants in the interior of the country had 95 percent of excess capacity due to closing of several public dairy processing plants.

Table A.25 Real capacity versus Install capacity of dairy Processing Plants in Peru, 1990.

Enterprise	Reception			Processing		
	Max Cap MT/day	Real Cap MT/day	Excess Capacity	Max Cap MT/day	Real Cap MT/day	Excess Capacity
Gloria S.A	420.0	352.0	16.0	755.0	520.0	31.0
Nestle Peru S.A	130.0	130.0	0.0	350.0	176.0	50.0
Unileche S.A	288.0	11.0	96.0	288.0	32.0	89.0
Egasa	250.0	32.0	87.0	250.0	53.0	79.0
Prolacsur	80.0	15.0	81.0	40.0	-	100.0
Soc Ganadera Centro S.A	30.0	19.0	37.0	30.0	2.0	93.0
Planta Lechera Mantaro	21.0	5.0	76.0	36.0	2.0	94.0
Planta Lechera Tacna	20.0	3.0	85.0	20.0	0.3	99.0
Planta Lechera Cusco	20.0	-	100.0	20.0	-	100.0
Planta Lechera Sullana	20.0	5.0	75.0	20.0	4.8	76.0
Planta Lechera Trujillo	20.0	-	100.0	20.0	-	100.0
Inderlac S.A	20.0	12.0	40.0	20.0	7.0	65.0
Luis Martin S.A	12.0	2.3	79.0	6.0	2.3	63.0
La Molina	7.0	1.1	84.0	8.0	1.1	86.0
El Escorial S.A	12.0	9.0	25.0	12.0	1.2	90.0
Proderlac	6.0	6.0	0.0	10.0	2.4	76.0
Total	1,356.0	602.0	56.0	1,885.0	804.1	57.0

Note: Processing Plants with Fluid Milk Lines.
Source: Agro-industry Office, Ministry of Agriculture.

APPENDIX B

6. Where is your permanent residence ?

- a. In the farm ☐ 1
- b. Near to the farm ☐ 2
- c. City/Town ☐ 3

7a. Sex of the producer.

- a. Male ☐ 1
- b. Female ☐ 2

7b. How old are you? _ _ years.

8. What is your level of education ? _

- a. No education. ☐ 1
- b. Primary education ☐ 2
- c. High School ☐ 3
- d. College ☐ 4

9. What was the last approved year ? ____ year

Part IV. Agricultural Land:

10. Besides the dairy farm area, are you operating
agricultural land ? :

- a. Yes ☐ 1
- b. No ☐ 2

---> If No go to question # 38.

11. What is the total agricultural area?: _ _ Has

+ From this total how many Hectares (Has) are:

12. Irrigated _ _ _ _ Has.

13. Non-irrigated? _ _ _ _ Has.

14. Do you have a hired manager ?

- a. Yes ☐ 1
- b. No ☐ 2

+ The next questions are referring to the type of tenancy and number of hectares.

15. Owned land: _ _ _ _ _ Has.
 16. Beneficiary of land reform. _ _ _ _ _ Has.
 17. Provisional possession: _ _ _ _ _ Has.
 18. Rented land: _ _ _ _ _ Has.
 19. Other type: _ _ _ _ _ Has.

+ Area and crop harvested in the last campaign 1990-1991.

20. Corn _ _ _ _ _ Has.
 21. Alfalfa _ _ _ _ _ Has.
 22. Corn green chop _ _ _ _ _ Has.
 23. Lentil _ _ _ _ _ Has.
 24. Asparagus _ _ _ _ _ Has.
 25. Fruit trees _ _ _ _ _ Has.
 26. Sorghum _ _ _ _ _ Has.
 27. Rice _ _ _ _ _ Has.
 28. Onions _ _ _ _ _ Has.
 29. Talla _ _ _ _ _ Has.
 30. Beans _ _ _ _ _ Has.
 31. Tomatoes _ _ _ _ _ Has.
 32. Cucumbers _ _ _ _ _ Has.
 33. Cultivated grasses _ _ _ _ _ Has.
 34. Cassava _ _ _ _ _ Has.
 35. Sweet potatoes _ _ _ _ _ Has.
 36. Sugar cane _ _ _ _ _ Has.
 37. Others _ _ _ _ _ Has. specify

Part V. Dairy Stock and Milk Production:

38. Total : _ _ _ _ _ Heads.
39. Cows: _ _ _ _ _ Units.
40. Heifers: _ _ _ _ _ Units.
41. Female calves _ _ _ _ _ Units
42. Bulls : _ _ _ _ _ Units
43. Young bulls _ _ _ _ _ Units
44. Male calves _ _ _ _ _ Units
45. How many years are you operating your farm? _ _ years
46. How many cows are in milk production ? _ _ _ _ cows.
47. How many cows are dry ? _ _ _ _ cows.
48. How long is the period of lactation ? _ _ months.
49. What is the month of highest milk production ?
50. What is the month of lowest milk production ?
- + Please tell us about your milk production.
51. Number of cows milking yesterday ? _ _ _ _ cows.
52. Total milk production : _ _ _ _ _liters.
53. Milk sold : _ _ _ _ _ liters.
54. For Cheese and butter production _ _liters
55. For calves feeding _ _ _ _liters.
56. For autoconsumption _ _ _ _liters.
57. Spoiled milk _ _ _ _liters.
58. Others uses _ _ _ _liters.

Part VI. Management Practices and Milking Facilities:

59. What is the system of cattle's raising?

- a. Extensive ☐ 1
- b. Intensive ☐ 2
- c. Mixed ☐ 3

+ What are the forages most used in cows feeding?

60. First forage source:

61. Second forage source:

62. Third forage source:

+ What forages are most used to feed the rest of herd:

63. First forage source:

64. Second forage source:

65. Third forage source:.....

66. Do you feed your cows with concentrates ?

- a. Yes ☐ 1
- b. No ☐ 2

--->If No Go to question # 72

67. Are the cows feeding according their production?

- a. Yes ☐ 1
- b. No ☐ 2

68. Do you prepare your own concentrate?

- a. Yes ☐ 1
- b. No ☐ 2

---> If No go to question # 72

+ Would you mention three ingredients more used ?

69. First ingredient:

70. Second ingredient:.....

71. Third ingredient:

72. Do you use A.I. in your herd ?

a. Yes ☐ 1

b. No ☐ 2

73. What percentage of your herds is under A.I.? _ _ _ %

74. What system of milking do you use ?

a. Manual ☐ 1

b. Mechanic ☐ 2

75. What type of milking facilities do you have?

a. Herringbone ☐ 1

b. Pipe line ☐ 2

c. Mange ☐ 3

d. Stockyard ☐ 4

+ How many workers are working in your dairy farm ?

76a. Permanent workers:.....

76b. Eventual workers:..... .

77. Do you have Veterinary assistance ?

a. Yes ☐ 1

b. No ☐ 2

Part VII. Marketing System:

78. What type of container is most used to transport your milk ?

a. Cans ☐ 1

b. Bulk tank ☐ 2

79. Do you cool your milk before sell it?

a. Yes ☐ 1

b. No ☐ 2

---> If No go to question # 81

80. What type of cooling system do you use ?

a. Tank cooler ☐ 1

b. Curtains ☐ 2

c. Immersion ☐ 3

81. Do you sell milk to dairy processor ?

a. Yes ☐ 1

b. No ☐ 2

---> If No go to question # 89

82. How many liters of milk do you sell ? _ _ _ _ _

83. What is the price per liter ? _ _ _ Soles.

84. How often do you sell to dairy processor ?

a. Daily ☐ 1

b. Every Other ☐ 2

c. Twice a Week ☐ 3

85. How often do you receive your milk payment ?

a. Daily ☐ 1

b. Weekly ☐ 2

c. Twice a Month ☐ 3

d. Monthly ☐ 4

86. Where do you deliver your milk ?

a. Dairy plant ☐ 1

b. At the farm ☐ 2

---> Go to question # 89

87. Travel time in vehicle _ _ minutes.

88. Travel time in animal _ _ minutes.

89. Do you sell your milk directly to wholesaler?

a. Yes ☐ 1

b. No ☐ 2

---> If not go to question # 97

90. How many liters of milk do you sell ? _ _ _ _ liters.

91. What is the price per liter of milk ? - - - - soles.

92. How often do you sell your milk to wholesaler ?

a. Daily ☐ 1

b. Every other day ☐ 2

c. Twice a week ☐ 3

93. How often do you receive your milk payment ?

a. Daily ☐ 1

b. Weekly ☐ 2

c. Twice a Month ☐ 3

d. Monthly ☐ 4

94. Where do you deliver your milk ?

a. At the wholesaler ☐ 1

b. At the farm ☐ 2

---> Go to question # 97.

95. Travel time in vehicle ? _ _ _ _ minutes.

96. Travel time in animal ? _ _ _ _ minutes.

97. Do you sell milk to retailers ?

a. Yes ☐ 1

b. No ☐ 2

----> If not go to question # 105

98. How many liters of milk do you sell ? _ _ _ _ liters.

99. What is the price per liter of milk? _ _ _ soles.

100. How often do you sell your milk to retailers ?

a. Daily ☐ 1

b. Every other day ☐ 2

c. Twice a Week ☐ 3

101. How often do you receive your milk payment ?

a. Daily ☐ 1

b. Weekly ☐ 2

c. Twice ☐ 3

d. Monthly ☐ 4

102. Where do you deliver your milk ?

a. At the retailer ☐ 1

b. At the farm ☐ 2

----> Go to question # 105

103. Travel time in vehicle _ _ _ _ minutes

104. Travel time in animal _ _ _ _ minutes.

105. Do you sell your milk to consumers?.

a. Yes ☐ 1

b. No ☐ 2

----> If no go to question # 111.

106. How many liters do you sell ? _ _ _ _ liters.

107. What is the price per liter of milk ? _ _ _ soles.

108. Where do you deliver your milk ?

a. At the consumer ☐ 1

b. At the farm ☐ 2

---> Go to question # 111

109. Travel time in vehicle _ _ _ _ minutes.

110. Travel time in animal _ _ _ _ minutes.

111. Date of the current price of milk? Mo\day (_ __) 112.

How is the dairy plant price determined ?

a. By the government ☐ 1

b. By the dairy processor ☐ 2

c. By negotiation process ☐ 3

d. I set the price ☐ 4

e. Other reason ☐ 5

113. What is the main reason for selling milk to dairy plant?

a. Offer the best price ☐ 1

b. Buy my whole production ☐ 2

c. Offer technical assistance ☐ 3

d. Give money in advance ☐ 4

e. supply own plant ☐ 5

f. Other reason not listed ☐ 6

114. How is the Wholesaler price determined?

- a. I fixed the milk price ☐ 1
- b. By negotiation process ☐ 2
- c. By the wholesaler ☐ 3
- d. Other ☐ 4

115. What is the main reason for selling milk to wholesaler?

- a. Offer the best price ☐ 1
- b. Buy the whole production ☐ 2
- c. Buy regularly ☐ 3
- d. An additional labor ☐ 4
- e. No vehicle ☐ 5
- f. No other alternative ☐ 6

116. How is the retailer price determined ?

- a. I fixes the price ☐ 1
- b. By negotiation process ☐ 2
- c. By retailer ☐ 3
- d. By FONGAL ☐ 4

117. What is the main reason do you sell milk to retailers ?

- a. Offer the best price ☐ 1
- b. Buy the whole production ☐ 2
- c. Buy regularly ☐ 3
- d. No time ☐ 4
- e. No other alternative ☐ 5

Part VIII. Source of Income and Financial status

118. Did you receive a loan last year ?

- a. No ☐ 1 ---> If no go to question # 121.
- b. Agrarian bank ☐ 2
- c. Commercial bank ☐ 3
- d. Wholesaler ☐ 4
- e. Private lender ☐ 5

119. In what activities did you spend most of the loan ?

- a. Crops ☐ 1
- b. Dairy installations ☐ 2
- c. Buying cows and/or heifers ☐ 3
- d. Buying inputs ☐ 4
- e. Maintenance equipment ☐ 5
- f. Both 1 and 2 ☐ 6

120. What percentage of your assets represent your loan ?

- a. Less than 10% ☐ 1
- b. From 11% to 20% ☐ 2
- c. From 21% to 45% ☐ 3
- d. From 46% to 60% ☐ 4
- e. More 61% ☐ 5

121. Reason for no request or denial a loan ?

- a. No request ☐ 1
- b. High interest rate ☐ 2
- c. No collateral ☐ 3
- d. Work with my own money ☐ 4
- e. No available loans ☐ 5

+ Of your total income could you please tell us the percentage that come from ?

122a. The dairy activity _ _ _ %

122b. The Crops _ _ _ %

122c. Other non agricultural activities _ _ _ %

123. Will you increase herd in the next twelve months?

a. Yes ☐ 1

b. No ☐ 2

---> If No go to question # 125

124. What is the main reason for your expansion ?

a. Form of survival ☐ 1

b. Profitable activity ☐ 2

c. Improving market ☐ 3

d. Available credits ☐ 4

e. Recover original population ☐ 5

f. Milk processing activities ☐ 6

g. To capitalize ☐ 7

h. Selling Young bulls and heifers ☐ 8

125. Reasons for no increase your herd ?

a. No profitable activity ☐ 1

b. I do not have time ☐ 2

c. I have debts ☐ 3

e. Low milk price ☐ 4

f. I do not have capital ☐ 5

g. I do not have land ☐ 6

h. No governmental support ☐ 7

126. What area of you dairy activity needs to improve ?

- | | | |
|----------------------------|--------------------------|---|
| a. Marketing | ☐ | 1 |
| b. Cost of production | ☐ | 2 |
| c. Milk productivity | ☐ | 3 |
| d. Investment in equipment | ☐ | 4 |
| e. Finance area | ☐ | 5 |
| f. Cattle breeding | ☐ | 6 |
| g. Forage base | ☐ | 7 |
| h. Title of land | ☐ | 8 |
| i. Installations | ☐ | 9 |

127. What is your opinion about the government dairy policy?

- | | | |
|---------------|--------------------------|---|
| a. Approve | ☐ | 1 |
| b. Disapprove | ☐ | 2 |
| c. No opinion | ☐ | 3 |

Part IX. Installations and Machinery.

+ We would like to know if you have the following installations ? Check with X

- | | |
|------------------------|--------------------------|
| 128. Warehouse | ☐ |
| 129. Trench silo | ☐ |
| 130. Underground silo | ☐ |
| 131. Molasses tank | ☐ |
| 132. Feed bunk | ☐ |
| 133. Mange of concrete | ☐ |
| 134. Tubular well | ☐ |
| 135. Pool | ☐ |
| 136. Maternity barn | ☐ |

- | | |
|--------------------------------|--------------------------|
| 137. Milking parlor | ☐ |
| 138. Others | ☐ |
| + Machinery | |
| 139. Owned harvester | ☐ |
| 140. Rented harvester | ☐ |
| 141. Owned threshing | ☐ |
| 142. Rented threshing | ☐ |
| 143. Owned combine | ☐ |
| 144. Rented combine | ☐ |
| 145. Owned stationary chopper | ☐ |
| 146. Rented stationary chopper | ☐ |
| 147. Owned mixer | ☐ |
| 148. Rented mixer | ☐ |
| 149. Owned mill | ☐ |
| 150. Rented mill | ☐ |
| 151. Owned tractor | ☐ |
| 152. Rented tractor | ☐ |
| 153. Owned truck | ☐ |
| 154. Rented truck | ☐ |
| 155. Owned station wagon | ☐ |
| 156. Rented station wagon | ☐ |
| 157. Owned milking equipment | ☐ |
| 158. Rented milking equipment | ☐ |
| 159. Owned power generator | ☐ |
| 160. Rented power generator | ☐ |
| 161. Owned water pump | ☐ |

- 162. Rented water pump ☐
- 163. Other owned machineries ☐
- 164. Others rented machineries ☐

VITA

Jorge Alfredo Huarachi was born in Lima, Peru on June 22, 1953. He graduated from Salesian School of Lima in December 1970. In January of 1971, he entered the National Agrarian University at Lima-Peru. In 1976, he received a Bachelor of Science degree in Animal Science. In January 1982, he entered Business School-ESAN at Lima-Peru, and began study toward a Master's degree. In 1984, he received the Master of Business Administration degree. In August 1990, he entered the University of Tennessee at Knoxville and began study toward a Master of Science degree in Agricultural Economics. He received the Master of Science degree in Agricultural Economics in May 1993.