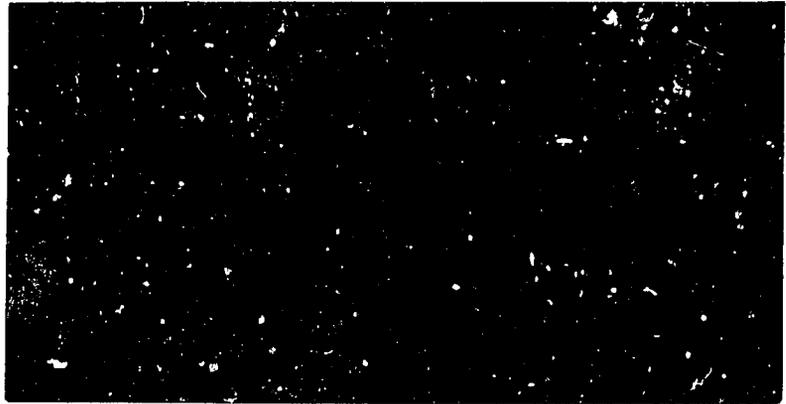


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**THE REGIONAL STRUCTURE OF DISTRIBUTION
OF MUTTON IN CUSCO, PERU**

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THE REGIONAL STRUCTURE OF DISTRIBUTION
OF MUTTON IN CUSCO, PERU

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LA ESTRUCTURA REGIONAL DE LA DISTRIBUCION
DE CARNE DE OVINO EN CUSCO, PERU

Este informe se basa principalmente en datos recogidos en los camales de la ciudad del Cusco. Los datos abarcan el periodo 1976-1979. El objetivo del informe es dar una descripción del sistema de distribución que provee al Cusco con carne de ovino como también de suministrar algunos datos estadísticos relacionados con este proceso.

La ciudad del Cusco se abastece con carne de ovino por medio de un sistema de mercados legal y uno ilegal. El informe da una descripción de los dos sistemas y detalla como estos están relacionados entre sí.

Luego el informe pasa a analizar los lugares de procedencia de la carne legal. Se establece que la gran mayoría de esta carne, el 89 por ciento, proviene de ocho provincias; seis de ellas (Cusco, Chumbivilcas, Paruro, Canchis, Espinar y Canas) en el departamento del Cusco y dos (Cotabambas y Grau) en el departamento de Apurímac. La región comprendida por estas provincias se define como la región de abastecimiento para el Cusco.

El análisis de los datos estadísticos arroja varios resultados interesantes. El número de animales suministrados a los camales oficiales del Cusco disminuyó de 1976 a 1979 pero la proporción de las ovejas producidas en el departamento de Cusco aumentó. El ritmo de abastecimiento varía enormemente en las diferentes temporadas, casi la mitad de las ovejas suministradas anualmente son beneficiadas durante los meses de mayo, junio,

julio y agosto. Las proporciones de animales de los dos sexos varia durante las diferentes temporadas. Durante casi todos los meses la proporción de carneros a hembras es de dos a uno, pero en los meses de noviembre y diciembre mas de la mitad de las ovejas beneficiadas son hembras.

Las estadísticas de los pesos de las carcasas demuestran dos tendencias. Hay una fuerte variación estacional. En los meses de seca el peso promedio de las carcasas es 28 por ciento menor que el peso promedio durante la temporada de lluvias. La otra tendencia, la cual es probablemente una tendencia de corto plazo, consiste en una disminución significativa en el peso promedio de las carcasas en 1980 en relación a 1979.

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Introduction

This report is largely based on information gathered in the department of Cusco during June and July of 1980.

Most of the research conducted under the auspices of the Small Ruminant Project in Southern Peru has dealt with the structural characteristics of sheep and alpaca production. The projects have in common the aim of understanding small ruminant production in Peru so that productivity and production can be increased, if so desired, in order to make this activity more lucrative for those that engage in it, particularly the small peasants.

The research upon which this report is based tackles the same general problem but from another perspective. It focuses on the regional distribution structure rather than on the production structure. It does so in order to provide some information which might be useful in ascertaining what might be some of the possible consequences of an increase in the production and/or productivity of small ruminants in the region. An understanding of a regional pattern of distribution might be useful in any attempt designed to increase the economic advantages to producers by bettering their position within the marketing system.

The substantive purpose of this project was to establish the general outline or pattern of the distribution of mutton in a region in the southern Peruvian Andes. Since Cusco is the largest city located within the high Andean region of southern Peru, this city was assumed to act as the primal center of the regional distribution network.

There exist two separate but partially overlapping structures of distribution associated with the production of sheep, and alpaca as well. One structure is associated with the marketing of wool while the other centers around the distribution of meat. We decided to analyze the marketing structure of meat for several reasons.

First, one of the primary goals of the Small Ruminant Project is to raise the nutritional standards of the poorer sectors of the rural population. Thus it made sense to concentrate on meat. Secondly, it is much easier to identify the origin of meat than of wool. The latter can be stored or bulked and it is much more difficult to trace its area of origin. Thirdly, meat yields are much more accurate indicators of herd size since each carcass represents one sheep. In the case of wool, the relationship between wool yields and number of animals is much more complex and tenuous. Fourthly, official records on meat distribution and processing are much more accurate and extensive. Finally, there already exists a good and extensive description of the structure of wool production and distribution in southern Peru.

The project, then, opted to concentrate on the description and analysis of the distribution system whereby the city of Cusco is provisioned with mutton. Such a task yields four very important types of information. First, it identifies the range and outline of the production region which supplies the Cusco urban market. Second, it identifies the most important supply centers within this region. Third, it describes the levels of supply and the

volume of sheep being marketed. Lastly, this data can be used to identify two different types of fluctuations in the distributive system: fluctuation between years and fluctuations within years.

In Cusco, the proper place to look for such information is the slaughter house. Basing the project on slaughter house statistics has both its advantages and disadvantages. It is advantageous insofar as there exist fairly reliable and extensive records of the animals that are brought for slaughter. The disadvantage stems from fact that the requirements and costs associated with bringing animals to these official slaughter houses has spawned a parallel illegal structure of meat distribution which bypasses the official slaughter houses. Since records are not kept in these illegal operations it is difficult to obtain information from them. There is, thus, a stream of animals that bypasses the legal distribution channel and which is not detected nor included in any official statistics. There is no reliable manner of gauging the volume or relative importance of the illegal operations.

Bearing this important limitation in mind, the analysis presented here is based mostly on official statistics as a means of developing a reasonably accurate picture of the structure of distribution of mutton in the region surrounding the city of Cusco. At the same time, the data can also be used to develop some notion of regional levels of production.

It is important to bear in mind that the proper interpretation of some of the data is beyond our expertise. Sometimes we speculate on the causes of some of the findings but with the exception of sociological matters we have tried to limit ourselves to presenting the data.

The Slaughter House Data

This data was collected in both of the official slaughter houses that serve the urban population of Cusco. One of them, known as Umanchata, is located within the city of Cusco and processes most of the animals legally slaughtered for urban consumption. The other, called San Jeronimo and located in the village by the same name, is about 8 miles from the Cusco city limits.

Most of the data was collected from a document known as a pase. A pase is a form which accompanies and identifies each lot of animals brought to the slaughter house. From each pase it is theoretically possible to determine, among other things, the type of animals that have been brought, their number, and their district, province and department of origin. In this manner, it is possible to tabulate the species, quantity and origin of all animals brought for slaughter.

Every pase in the files of both slaughter houses was examined. Information on the size and origin of all shipments containing sheep or goats was recorded. This process resulted in the collection of information on 3,949 different shipments of sheep or goats. The earliest of these shipments dated back to 1971 and the most recent to June of 1980. The present report excludes the data on goats and focuses on the shipments of sheep. This data consists of 2,996 shipments totaling 123,212 sheep.

Data on shipments of sheep between 1971 and 1975 is incomplete, this data is only helpful in identifying the production regions which supplied the city of Cusco during this period. The information for the years 1976 through 1979 appears to be complete and thus can be used not only to identify production centers but also to identify the cycles and volume of supply for each of these years. This data consists of 2,317 shipments totaling 92,915 sheep, all subsequent analysis is based on this data. The accuracy of the data was checked by comparing monthly shipment totals, as obtained from the pases, with the monthly records of processed carcasses. Overall, shipment records appear to underestimate the actual volume by approximately 7 percent; we do not know the reason for this.

In addition to the information obtained from the pases additional information was also obtained from the records on processed carcasses. These records yielded information on supply levels, sex ratios, weight, and grading of the carcass for the years 1979 and 1980.

Sheep Population of Southern Peru

As with many of the other official statistics, the various animal census figures presented here are not to be treated as accurate but rather as useful indicators of the general levels of magnitude and directions of various trends.

The overall sheep population in Peru in the last ten years seems to have undergone changes which are partially associated

with the agrarian reform program of the Velasco government. More recent trends are associated with the institutionalization of previous reform programs and the virtual termination of new projects under the program.

In 1960 there were about 17,064,000 sheep in Peru, ten years later their number had decreased to 12,514,000. This decrease has been associated with the implementation of the agrarian reform, which led many livestock producers to reduce drastically their herds because of the fear that the animals would be appropriated. There are indications this trend has been reversed and that the sheep population has been growing in the last five years. A realistic estimate, and one that is used by the Small Ruminant project in Peru, is that presently there are about 13 million sheep. If anything, this figure probably underestimates the actual population.

The spatial distribution of these animals is rather uneven. In rough terms, 15 percent of the animals are located in the Northern region of the country, 39 percent in the center and 46 percent in the South. Thus, the area of Southern Peru, is presumed to contain a population of about 6 million sheep, most of them concentrated in the departments of Apurimac, Cusco, Puno,, Arequipa, and Ayacucho.

Table 1 gives the estimated sheep population for the department of Cusco for selected years. While the figure for 1975 seems inconsistent with the estimates for the other years, the latter are remarkably consistent and show a modest 1.5 percent increase between 1972 and 1979.

Table 1. Total sheep population in the department of Cusco for selected years

<u>Year</u>	<u>Total</u>
1972	1,545,013 ^a
1975	1,208,070 ^b
1977	1,562,800 ^b
1978	1,565,800 ^b
1979	1,568,900 ^b

^aCenso Nacional Agropecuario, 1972-1973

^bRegion Agraria IX, Ministerio de Agricultura y Alimentacion

The sheep population in the department of Puno is by far the largest in the region. In the 1960s, the population was estimated to have reached as high as 7 million animals and to have decreased to 5 million in reaction to the Agrarian Reform program of the early 1970s. The 1978 figures of the Sistema Nacional de Estadísticas Alimentarias show a population of 3,896,510 sheep. This census does not include waqcho herds, thus the 1980 total sheep population is perhaps closer to 5 million animals. The total sheep population of the department of Apurimac was estimated at 509,539 animals by the 1972-73 National Agricultural and Livestock Census.

We calculate that the region composed by the departments of Apurimac, Cusco and Puno presently support between 6 and 7 million sheep. This figure is higher than what is calculated by the figures presented at the beginning of this section and that can be taken to mean that either these figures underestimate the total sheep population in Peru or that they underestimate the percentage of the sheep population which is located in the South, or both.

As might be expected, the herds are not scattered uniformly throughout the southern region. In the case of the department of Apurimac, almost half of the animals are concentrated in the province of Andahuaylas. In the department of Puno, the animals are concentrated in the provinces of Azangaro, Melgar, Lampa and Puno. Together these provinces account for two-thirds of all the sheep in the department. Similarly, the provinces of Chumbivilcas, Canchis, Espinar, Quispicanchi and Canas concentrate nearly two-thirds of all the sheep in the department of Cusco. These provinces, commonly referred to as the high provinces of Cusco, constitute the southern portion of the department and are contiguous to the provinces of Melgar and Lampa in the department of Puno. Table 2 shows the distribution of sheep in the three departments.

The Distribution System

The most significant finding about the distribution system which supplies the city of Cusco with mutton is its division into two sectors: a legal and an illegal marketing channel. These two sectors may be conceived as parallel marketing structures which intersect and overlap at points. Neither sector is devoted exclusively to the distribution of mutton. The legal system handles both mutton and beef, and in terms of actual volume beef is undoubtedly the more important commodity. The illegal sector markets both mutton and alpaca meat. It is our impression that the volume of mutton channelled through this sector is larger than

Table 2. Sheep populations by provinces, for the departments of Apurimac (1972), Cusco (1975) and Puno (1978).

<u>Apurimac (1972)</u>	509,539 ^a
Abancay	39,674
Aymaraes	55,550
Antabamba	36,559
Grao	65,975
Cotabambas	77,673
Andahuaylas	234,108
<u>Cusco (1975)</u>	1,208,070 ^b
Cusco	34,170
Chumbivilcas	168,000
Paruro	55,540
Acomayo	55,695
Canchis	98,099
Espinar	238,410
La Convencion	15,598
Anta	52,339
Quispicanchi	98,507
Canas	172,930
Urubamba	64,337
Paucartambo	86,800
Calca	67,645
<u>Puno (1978)</u>	3,896,510 ^c
Sandia	34,684
Azangaro	917,176
Carabaya	189,800
Chucuito	444,797
Huancane	405,920
Puno	519,801
San Roman	201,019
Lampa	548,380
Melgar	634,933

^aCenso Nacional Agropecuario, 1972-1973

^bRegion Agraria IX, Ministerio de Agricultura y Alimentacion

^cSistema Nacional de Estadísticas Alimentarias

that of alpaca meat. On the basis of circumstantial data we would guess that the illegal sector distributes more mutton than the official sector. We shall first describe the official sector and then, its illegal counterpart.

The Legal Market

The legal distribution system originates at the point of production when the sheep are harvested and prepared for transfer. This occurs in a couple ways. In some cases, the producers harvest their own animals, obtain the necessary documentation at the district capital, and then herd the animals to the slaughter houses in Cusco. In other cases, livestock merchants from Cusco travel to the production sites, buy the animals, obtain the documents and herd the animals to the slaughter houses. There are two or three basic ways in which urban-based merchants obtain animals. Sometimes, they may visit a large production unit, like a cooperative or a large private herd owner, and obtain all of their animals in one purchase from a single producer. What happens more frequently, though, is that they visit various small production sites or communities in a region and accumulate their stock by making several small acquisitions. In other cases, they visit livestock fairs, weekly markets or annual fairs and obtain animals there. In these cases, they either buy large lots in auctions or purchase animals from several producers who have herded their animals to the market site. The frequency of buying trips seems to vary among merchants, some travel once a week whereas others go less frequently, some only once a month. It is

probable that the frequency of trips is related to the availability of working capital. Merchants able to buy large stocks during a single buying trip may travel more infrequently. Merchants with small capitals may find it necessary to travel more often since their stocks are smaller. Most merchants travel weekly.

Regardless of how the stock is constituted, the proper documentation is always procured and the animals are herded to Cusco. Although it is possible that some sheep are trucked to the city, by far the most frequent mode of transfer is simply to herd the animals to the slaughter houses. Such drives may take up to five days. It may be that the Cusco supply region is circumscribed in extension by a maximum distance of a five day drive for the sheep.

The animals are normally herded to Cusco as soon as possible. However, when the size of the stock is very large, say 300 or 400 animals, then its slaughter is spaced over several days or perhaps even weeks. In some cases, the merchant may leave part of his stock behind and deliver his animals to Cusco in smaller lots. Alternatively, all the sheep may be herded to a pasture relatively close to the city and then the animals are slaughtered in several different lots, usually about one hundred per day.

Sheep are processed in the slaughter houses of Cusco one day after they have been delivered. In the interim, they are penned inside the slaughter house for ante-mortum examination. At the main slaughter house, sheep are slaughtered Tuesdays through Saturdays from 0600 until 0900. On most days, the number of sheep

slaughtered varies between 50 and 100 animals. Fees are based on the number of animals slaughtered and are paid by the merchant or producer. After the carcasses are inspected and graded by the resident veterinarian, the merchants are free to sell them. This occurs rather quickly because the meat is not refrigerated and thus must be transferred to the retailers in as short a time as possible. As a general note, it should be added that at no point in the marketing channels of both the legal and illegal sectors is the meat ever refrigerated. Atmospheric conditions in the highlands retard spoilage significantly and the meat may be edible a full week after the animal is butchered.

At this point it is necessary to interject an explanation on the characteristics of the buyer-seller relationships which occur at most levels of the distribution systems, both legal and illegal. As a rule, sellers sell only to established clients and clients buy almost exclusively from established suppliers. The term casera is used reciprocally to denote a person with whom one trades exclusively, or at least preferentially. Casera relationships occur almost at all the levels of the legal and illegal meat marketing structure. The only exception, of course, is at the retail level; but even there, regular customers are given preferential treatment. Livestock merchants usually have caseras at the production sites from whom they expect to be able to obtain animals as well as caseras among the retailers to whom they expect to be able to sell the carcasses. Casera relationships imply a strong sense of reciprocity. In the role of a seller, the casera expects the clients to be loyal and for this loyalty extends them

preferential treatment. As a buyer, the casera expects to be able to rely on the supplier for meat when it is scarce, and in exchange for this trades exclusively with the supplier when meat is abundant.

The term casera also points to another very significant factor, and that is that women predominate in the regional system of distribution of meat. The term is used in its feminine form because with the notable exception of the livestock merchants and those who actually slaughter the animals, most of the buyers and sellers are female. In the case of the illegal sector, the entire business is in the hands of women. In terms of relative numbers, the proportion of men in the distribution system is very small. What is significant is that males control the most highly capitalized segment of the system and, undoubtedly, the most profitable one as well.

After the animals have been slaughtered, the merchant or producer disposes of his stock. The actual manner in which this occurs is complex. The supplier's caseras are retailers who have meat stalls in the central market. There are approximately 170 stalls that sell meat and 56 stalls that sell entrails. Their rental allows the leasee to obtain a permit to purchase meat in the slaughter houses. Thus, having a stall in the central market is a prerequisite for being able to buy legally slaughtered meat at the wholesale level. The rationale for controlling access to the meat from the slaughter houses is ostensibly a hygienic one. The reasoning is that many of the existing stalls do not meet minimum hygienic standards, lack of running water being perhaps the

singlemost important criterion, and thus that there is a constant danger that the meat might become contaminated. Therefore, the ability to operate legally at the retail level is contingent on obtaining a stall in the central market. It is our general impression that all the stalls are usually rented and that it might be difficult to gain entry as a retail butcher in the legal sector.

The retail vendors from the central market go to the slaughter houses to buy meat for their stalls. Normally, they buy their stock from a specific merchant who is their casero. The butchers from the market only buy dressed carcasses. These are sold by weight, and the unit price is determined by the grade of the meat, which is determined by the veterinarian.

The retail butchers represent the top strata of the retail sector. This is a sector which is composed of three types of vendors which not only specialize in different stocks but also differ in the capitalization of their operations and thus, in their economic power. Below the retail butchers are the entrail vendors. They generally obtain their stock directly from the merchants in the slaughter houses and usually establish casera ties with them.

Below the entrail vendors are the head-and-feed vendors who are characterized by very low levels of capitalization. These vendors do not deal directly with the suppliers but obtain their stock at the slaughter houses from or through the entrail vendors, with whom they may establish casera ties. In a few cases, when they buy in large lots, head-and-feet vendors may buy directly from the merchants. Most of the head and feet, though, seem to be

controlled by the entrail vendors, some of whom also sell heads along with the entrails. The greater economic power of the entrail vendors is evidenced by the common practice of pressing head-and-feet vendors into service by having them wash the entrails. In return, the latter receive first choice of the heads and feet and sometimes are also paid for this service by the entrail vendors.

Entrails are bought in sets, each set consists of an animal's tripe, intestines, heart, liver and lungs. However, sometimes a set will also include the head, we will refer to these sets as full sets. Price is determined by the size and condition of the animal. The sets are taken to special stalls in the central market and there the various organs are sold separately. The intestines are cut up and divided into four or five equal lengths and each pile is sold separately. Entrail vendors are under the same official control as the butchers, but their level of capitalization and profit is lower than that of butchers.

Head-and-feet vendors do not have stalls in the market and most of them sell their stock in the street, especially along one particular street which leads to the market. Their degree of capitalization is extremely low as is their profit margin. They really operate at the margins of the legal sector and represent a linkage to the illegal market because many of them also sell the heads of illegally slaughtered sheep.

There is one additional set of economic actors who are linked to the legal sector at the level of the slaughter house. These are a small number of entrepreneurs who buy the hides of the slaughtered

animals. Usually, one or two such buyers will purchase all the hides from a day's slaughter. These hides are then shorn and the wool is sold to various local firms that make articles of low grade wool, such as cheap blankets, mattresses and rugs. The shorn skins are resold to one of the two or three tanneries in town.

The legally slaughtered sheep then, is distributed to several outlets, the edible parts going to three different types of retailers. In most cases, these retailers make their purchases on credit and only pay after having disposed of their merchandise. There are great differences in the scale of operations, not only between the various types of retailers but also within the same type. Some retailers have considerably larger stocks than others. It would seem that the two most important determining factors of the size of the stock are the amount of available credit and the capability of disposing of the stock before it spoils.

The Illegal Market

The operation of the illegal sector is highly conditioned by the general levels of supply. As a rule, during times of meat scarcity, usually the summer months, it assumes greater importance since its price levels reflect more accurately shifts in supply. Given the rather inelastic levels of demand, decreased supplies affect prices directly and the illegal sector becomes more profitable, thus, more animals are channeled through it.

As its legal counterpart, the illegal system originates at the production site. However, given its nature, it has a more

fluid and variable structure. It is much more influenced by situational factors. For instance, it operates differently when animal production occurs close to the city than when the production site is more remote from the urban market. What seems to happen is that where the production site is near Cusco, meaning when it is possible to visit the site and return to Cusco in the same day, the retail customers travel to the production areas and purchase illegally slaughtered meat either directly from the producer or from a vendor. Usually, these transactions take place during the weekly markets. In these cases, the animals are slaughtered at the point of production, or close to it, and the meat is transported to town by the consumers.

However, most of the volume of illegal meat seems to originate in regions that are relatively far from Cusco, usually more than a day's truck ride. In these cases, intermediaries equivalent to the livestock merchants of the legal sector, specialize in transporting the meat from the points of production to the urban market. Most of these suppliers travel weekly to the production regions, usually each supplier returning to the same place because much of the stock is obtained from casera sellers. Since these visits generally coincide with the weekly markets at the production sites, most suppliers bring meat to Cusco on a fixed schedule. Most of the illegal mutton arrives in town on Mondays, Tuesdays, Fridays and Saturdays.

There are two basic ways in which these suppliers procure their stock. Some bring the necessary capital with them and simply buy the meat, others bring merchandise with them which they sell at

the market and then use the proceeds from these sales to purchase the meat. Suppliers who bring capital, usually use money advanced by their customers, this is done most often in times of meat scarcity when the customers want to ensure that they will obtain meat. The suppliers, in turn, may also advance money to their caseras for similar reasons. Apart from ensuring supply, cash advances are also used when customers have specific requests, at such times the suppliers fill the orders of their customers rather than simply buying stock.

Other suppliers engage in a circular market pattern. They transport to the production sites, which are normally at high elevations and poorly suited for agriculture, fruits and products from the temperate regions of the department. The most important of these items are bananas, oranges, tangerines, pomegranates, avocados and coca leaves. They sell these goods at the local weekly market and when they have disposed of their merchandise they utilize their earnings to buy the meat. As with most of the suppliers, they tend to buy from established sources but at times they also buy meat that is offered for general sale at the market.

The suppliers buy dressed carcasses and sets of entrails. In the illegal sector, the animals are slaughtered at the production site and only the meat is transported to Cusco. This is different from the legal market where the merchants take the live animals to the city. Transporting the meat is probably more cost efficient and it is certainly much more difficult to detect. The meat is normally wrapped up in cloth and then put in boxes or in large sacks. The bundles are then placed in trucks and transported to

Cusco. These trucks conveniently arrive in Cusco very early in the morning and usually are able to avoid detection by the police. Small amounts of meat also arrive in the city by bus and by train, packaged in the same manner.

It is extremely difficult to get an even rough estimate of how much illegal mutton arrives in Cusco each week. The stocks brought by the suppliers vary greatly in size. Some may bring as many as forty or fifty carcasses whereas others bring less than half a dozen. The same variability occurs with entrails, with some women bringing as many as fifty sets. As a very imprecise estimate, we would guess that a rather typical shipment might have about ten carcasses and a similar number of sets of entrails.

When the merchandise arrives in Cusco it is met by the illegal meat retailers as well as by some of the butchers from the central market. The meat is sold immediately and the clients leave with their purchases which are taken to the meat stalls to be sold that same day. When meat is scarce there is much rivalry in getting the meat, even before it is off the truck. Clients who have advanced money to the supplier get first choice. The butchers from the central market who buy illegal meat do it for two reasons. Sometimes they are unable to obtain sufficient stocks from the slaughter houses and thus resort to illegal meat which they then mix with the supplies bought legally. Sometimes they are also able to make a better profit by dealing in illegal meat. This is another example of how the two marketing sectors overlap and it becomes difficult to differentiate legal and illegal meat.

As might be expected, casera relationships are much more stronger in the illegal sector. This is due to the more delicate

nature of the activity. By only selling to well known clients the suppliers minimize the chance of having to risk exposure by trading with strangers. It is only at the retail level that illegal meat is sold or traded to the general public. Even then, the meat is hidden and the vendor must be suspicious of all strangers since anyone might turn out to be policeman or might expose them to the police.

The division between meat vendors, entrail vendors, and head and feed vendors also exists in the illegal sector, although here some vendors combine these functions. Generally, the stalls of the illegal retailers are found close to the market area, with each type of vendor grouped together. The most visible difference between the legal and illegal stalls is the predominance of mutton in the former and of heads and feet in the latter. This difference reflects the diverse economic status of the respective customers. The clientele of the stalls in the center market is mostly made up of mestizos who can afford to buy the meat, whereas the customers of the street stalls are Indian peasants who can only afford the cheapest parts of the animal. However, mestizo customers are not restricted to the legal market, many of them also buy illegal meat, usually from a casera. In fact, very little of the illegal meat actually seems to reach the stalls, much of it must be sold before the vendor has a chance to take it to her stall.

An indicator of the variability in the level of capitalization of these retail vendors is provided by the head and feet vendors. On an average day some of them may have a stock which consists of only two or three heads for sale, while others

may have more than two dozen heads. There exists similar variations among the entrail and meat vendors.

The Region of Supply

Traditionally, mutton has been supplied to the city of Cusco from three departments: Cusco, Apurimac and Puno. In fact, the slaughter house records do not contain a single case for animals coming from any other department. If we apportion the 1976-1979 data in terms of the department of origin of the animals, we obtain the following breakdown:

72.3	percent	originated	in	the	department	of	Cusco
19.7	"	"	"	"	"	"	" Apurimac
8.0	"	"	"	"	"	"	" Puno

As we shall see later, this synchronic synopsis is a bit misleading as the relative importance of the three departments has been changing considerably in the last few years. In fact, in 1979 there was not a single shipment from the department of Puno. Therefore, for the purposes of this report, the actual region of supply will be considered to be situated within the departments of Apurimac and Cusco.

When we look at the shipments from Apurimac we see that the animals originated in 4 of the 6 provinces of this department. The table below gives a breakdown of the percentage of animals from each province:

Table 3. Percentage of animals by province of origin for shipments from the department of Apurimac during 1976-1979

Abancay	2.1 percent
Grau	21.6
Antabamba	0.4
Cotabambas	75.8

The provinces not represented are Andahuaylas and Aymaraes. In essence, then, all the eastern region of the department of Apurimac shipped animals to the city of Cusco. However, when we look at the percentage of animals that each province provided, we see that 97 percent of all the sheep originated in two provinces, Grau and Cotabambas, and that the latter accounted by itself for about 76 percent of the sheep. We shall see later that Cotabambas appears to be increasing its share of all sheep exported from Apurimac to Cusco at the same time that the absolute levels of supply from that department are decreasing. At any rate, the provinces of Grau and Cotabambas must be included within the region of supply for the city of Cusco, since together they supplied 19 percent of all the sheep supplied in 1976 through 1979.

There are twelve provinces in the department of Cusco that supplied animals to the capital, leaving La Convencion as the only province not shipping any animals to the city of Cusco. The table below shows the relative contribution of each province to the total volume of sheep originating in the department of Cusco.

Table 4. Percentage of animals by province of origin for shipments from the department of Cusco during 1976-1979

Cusco	23.3 percent
Chumbivilcas	18.1
Paruro	29.0
Acomayo	0.2
Canchis	5.7
Espinar	10.4
Quispicanchi	1.7
Anta	1.5
Canas	9.7
Urabamba	0.1
Calca	0.1
Paucartambo	0.2

On the basis of these figures, it would appear that the provinces of Cusco, Chumbivilcas, Paruro, Canchis, Espinar and Canas constitute the region of supply within the department of Cusco for the city of Cusco. Together, they provided almost 96 percent of all the sheep from the department and 69.6 percent of all the animals in our data.

Thus, the data indicates that the region of supply of mutton for the city of Cusco is comprised of eight provinces which together supplied 88.8 percent of all the animals in our data.

Figure 1 shows the southern region of Peru. The shaded area represents the Cusco supply region. We can only speculate about the factors which combine to circumscribe the area to its present configuration. The northern limits of the region correspond roughly with a change in ecological zones. The region north of the city of Cusco slopes downward and becomes warmer. This area is used more intensively for agriculture. Animals raised in

this region have complex economic functions and are rarely shipped to the slaughter houses of Cusco. It is more likely that these sheep are butchered locally and that the meat is consumed either locally or is introduced illegally into the city of Cusco for public sale.

The western, southern and eastern boundaries of the supply region do not appear to coincide with any ecological or topographical features. Rather, they appear to be determined by marketing factors. About 400 km south of the city of Cusco is the city of Arequipa. The latter is the largest city in southern Peru (about 400,000 inhabitants) and is roughly two and a half times larger than Cusco. Arequipa represents a much stronger source of demand for mutton and apparently this market draws a sizeable number of sheep from the southern production zones of the department of Cusco. Apparently, much of the sheep production in the department of Puno is also destined for this market.

In addition to its higher levels of demand, the Arequipa market is reportedly more profitable for livestock producers. The prices paid to producers are apparently higher than those in Cusco. So, it appears that producers are willing to transport their animals over longer distances because their increased transportation costs are offset by higher market prices.

It is perhaps best to conceptualize the ranges of the regions of supply for the cities of Cusco and Arequipa as partly overlapping. It is very probable that the southernmost production zones within the Cusco supply region also ship animals to Arequipa. This would suggest that the configuration of the

supply regions are imprecise and that they probably fluctuate through time. The region of supply that we have outlined represents the configuration of the zones which have supplied sheep to Cusco during the period from 1976 through 1979.

The surface area of this supply region is approximately 22,463 square kilometers. This figure can be misleading because the rugged Andean topography of the region results in an actual surface area in excess of this figure. At the same time, the surface available to animals is much more restricted because in the lower elevations the land is devoted primarily to agriculture, while the highest elevations do not support sheep production. We do not have any data which indicates the actual acreage devoted either totally or partially to livestock production within the supply region. Table 5 gives the surface area for each of the provinces in the supply region.

Table 5. Surface area of the Cusco supply region by province

Cotabambas	2,426 Km ²
Grao	2,011
Cusco	553
Chumbivilcas	5,344
Paruro	1,929
Canchis	4,178
Espinar	4,418
Canas	<u>1,604</u>
TOTAL	22,463

On the basis of the 1972 animal census, we calculate the sheep population of the supply region at that time at about 1,154,628 animals. If we use the 1.5 percent increase factor between 1972 and 1979 that we derived earlier, then we obtain a current animal

population of about 1,171,950 sheep. Table 6 gives the animal population by province in 1972.

Table 6. Sheep population of the Cusco supply region by province (1972)

Cotabambas	77,673
Grao	36,559
Cusco	33,241
Chumbivilcas	265,827
Paruro	66,476
Canchis	135,055
Espinar	344,015
Canas	<u>195,782</u>
TOTAL	1,154,628

A question arises at this point, it concerns the similarities or differences in sheep populations between the provinces within the supply region and those outside it. If, for ease of comparison, we take only those provinces in the supply region which are located within the department of Cusco and compare them with data for the department as a whole, we obtain an interesting difference.

While the Cusco provinces of the supply region occupy 23.6 percent of the departmental land, they produce approximately two-thirds of its sheep, 63.5 percent in 1972 and 67.3 percent in 1975. However, when we compare the percentage of sheep produced in the supply region with the total number of animals produced and shipped to Cusco, we find that the provinces in the supply region are highly overrepresented. The provinces of Cusco outside of the supply region produce a third of the sheep in the department but appear to withhold them in large numbers from the official urban

market. This suggests that sheep raising in the supply region may be much more of a commodity production while in the other provinces of the department it takes more the form of subsistence production.

The human population of the supply region is heavily concentrated in the province of Cusco. In 1972, the population of the city of Cusco was estimated at 120,000 inhabitants. Sicuani, the next largest urban center in the supply region, only had a population of 13,000 in the same year. Population density decreases sharply outside of the departmental capital.

As can be seen, the region is rather densely populated, especially for a region devoted primarily to agricultural and livestock production. With the exception of the province of Cusco, the majority of this population is rural. The total rural

Table 7. Size and density of human population in Cusco supply region by province (1972).

	<u>Population Size</u>	<u>Density per Km²</u>
Cotabambas	40,438	16.7
Grao	27,776	13.8
Cusco	142,031	256.8
Chumbivilcas	58,472	10.9
Paruro	31,806	16.5
Canchis	75,786	18.1
Espinar	41,524	9.4
Canas	<u>31,298</u>	<u>19.5</u>
TOTAL	449,124	20.0

population of the supply region in 1972 was 258,230 inhabitants, about 57.5 percent of the population. If we exclude the province of Cusco and its overwhelmingly urban sector, the rural segment of

the supply region constitutes about 80.5 percent of the population. A rather large portion of this population is probably involved to some degree in the production of sheep.

We mentioned earlier that the distribution systems for mutton and wool are different though interrelated. Since both systems are connected to the production of the same animal it is not surprising that the supply region that we have delineated in connection with the distribution of meat should overlap in large part with the production region associated with the supply of wool. In outlining the production region which is associated with the marketing of wool in southern Peru, a study identifies a production area which is labelled the Sicuani region and which is comprised of the provinces of Canas, Canchis, Espinar and Chumbivilcas; provinces which are also part of our Cusco region of supply.

This is an instructive reminder that although we are treating the region of supply as a production zone for mutton, it is more correct to view it as sheep production area. Sheep must be viewed as a product which is sequentially associated with two different distribution systems. During an initial phase, sheep yield wool. This commodity is likely to be placed in a regional wool marketing system, such as the system centered on the market town of Sicuani. During a second phase, sheep yield meat, a commodity which is placed in the regional meat marketing system, such as the system centered on the capital city of Cusco.

Centers of Supply

Province Level

The Cusco supply region contributed a total of 82,495 sheep to the official Cusco urban market in the period from 1976 through 1979. This represents 88.8 percent of the total number of sheep slaughtered in that market. Table 8 indicates the number of animals from each province of the supply region as well as each province's percentage of the total output of the supply region and of the total number of sheep slaughtered.

From this table we can see that the various provinces can be divided into two groups. One group, consisting of Grau, Canchis, Espinar and Canas supplied a relatively small percentage of the supply regions output. The other group, composed of Cotabambas, Cusco, Chumbivilcas and Paruro, represents a region which supplied approximately three-quarters of all the sheep remitted by the

Table 8. Total number of animals from the Cusco supply region by province and as percentages of total supply region output and of total number of sheep slaughtered (1976-1979).

	Number	Percentage of supply region total	Percentage of total sheep slaughtered
Cotabambas	13,905	16.9	15.0
Grau	3,962	4.8	4.3
Cusco	15,660	19.0	16.9
Chumbivilcas	12,139	14.7	13.1
Paruro	19,497	23.6	21.0
Canchis	3,836	4.6	4.1
Espinar	7,010	8.5	7.0
Canas	<u>6,486</u>	7.9	7.0
TOTAL	82,495		

Cusco supply region. Clearly, these provinces are the most important supply centers within the region. It is not easy to explain why these provinces supplied such relatively large numbers of animals to the official Cusco urban market. They contained only 38.5 percent of the total sheep population of the supply region in 1972. Thus, there is no simple relationship between the size of the herds and the number of animals marketed. In fact, the province of Paruro, which was the single most important supplier, supplying 23.6 percent of the total output of the region, only had 5.6 percent of the sheep. The same type of inconsistency is also true for the province of Cusco.

The inconsistencies can be partly understood if we look at the relationship between herd sizes and slaughter sizes a bit more closely. In the case of Paruro, in 1972 the province had 66,476 sheep, a 1975 census yielded 55,540 animals. In 1976, this province sent 5,572 sheep to the Cusco market. This results in a harvest rate of about 10 percent, this is a rather low rate even for the Andes. The rates for the other high supply provinces are even lower: 7.8 percent for Cusco, 7.2 percent for Cotabambas and a much lower 1.7 percent for Chumbivilcas. These provinces could apparently easily increase the number of animals harvested and marketed in the official Cusco urban market. The rates for the other provinces in the supply region are even lower, they average less than .5 percent.

It is clear that the different levels of supply in the provinces within the supply region have little direct relationship to the levels of their sheep populations. It would seem that they

supply of sheep for the official urban market of Cusco is very elastic and that the levels of supply could be easily increased by the producers without necessitating an increase in the animal population.

Since the aggregate herd size of the department of Cusco has only increased by about 1.5 percent between 1972 and 1979, it must be assumed that harvest sizes are much greater than those that are generated by the slaughter house statistics and that even in the most important of the supply centers, the majority of the animals that are harvested each year are destined for demands other than the legal Cusco urban market. There appear to be three other sources of demand for sheep produced within the Cusco supply region: local demand at the point of production as well as other rural regions, demand from other urban markets such as Arequipa, and demand from illegal markets.

Thus, the lack of a relationship between a province's animal population and the number of animals it supplies to the Cusco legal urban market can be understood when it is remembered that there coexist other sources of demand. It is our impression that urban demand from Arequipa and the illegal demand from Cusco take up most of the animals that are harvested but withheld from the official markets of Cusco.

A more satisfactory explanation of the process which apportions the animals to these alternate demand structures requires field research at the point of production. A better understanding of these dynamics in the Cusco supply region

necessitates a study of the structures of production and distribution in the provinces of Cusco, Paruro, Cotabambas and Chumbivilcas.

It is important to note that the province with the most sheep in the department of Cusco is not one of the high supply provinces. Espinar, which in 1972 had about 30 percent of all the sheep in the supply region, only contributed 8.5 percent of the region's supply of sheep to the Cusco legal market during the period 1976-1979. There is some reason to suggest that much of the illegal mutton which is sold in the city of Cusco originates in the province of Espinar. Other information also suggests that many of the sheep harvested in this province are sent to the Arequipa market. Field research in this province would provide some valuable information about the calculus which occurs in marketing the sheep to the various points of demand

District Level

When we shift the level of analysis from provinces to districts, we see that the pattern of high supply centers is not as uniform as it might have been expected from the province level data. During 1976-1979, eighty different districts marketed sheep to Cusco's slaughter houses. The volume of these shipments ranged from a high of 11,026 sheep (district of Cusco) to a mere 3 animals (district of Circa).

Perhaps the most striking characteristic of the data at the district level are the pronounced differences between districts

within the same province. In almost every province represented in the data, there is one district which accounts for half of the animals shipped from the province, in a few cases this figure is much higher. Only in the case of the province of Cotabambas are the proportions for the various districts fairly similar.

There is no readily apparent explanation for this pattern. In the case of some of the districts, the explanation may be evident, but in the case of others, only field research will uncover the dynamics which result in one district accounting for a disproportionate share of the animals shipped from the province.

The district of Cusco provided 70.4 percent of all the animals supplied by the province of Cusco during 1976-1979. In fact, this district provided more animals than any other district during the four-year period, providing 11.9 percent of all the animals. The pre-eminence of this district is easy to understand, since the district contains within it the city of Cusco, thus, one would expect that its livestock production would be overwhelmingly directed towards meeting the urban demand. We will suggest later, however, that the figures for the district of Cusco may be inaccurate. The pre-eminence of other districts is less easy to understand. Table 9 shows this pattern of district primacy by listing the contribution of the most important district in each province.

There is little relationship between the number of sheep that a district produces and the number that it distributes to the legal Cusco market. Thus, the leading role which a district might have in its province as a supplier of mutton cannot be accounted by the

size of its sheep population. In some cases, it is possible that the data itself is inaccurate. For example, according to the 1975 animal census, the district of Cusco had 3,300 sheep. The Table 9. Percentage of sheep supplied by the leading district of each province and the percentage of the provinces' sheep produced in these districts (1976-1979).

<u>District</u>	<u>Province</u>	<u>Percentage of animals shipped</u>	<u>Percentage of animals produced</u>
Tambobamba	Cotabambas ¹	29.2	34.3
Progreso	Grao ¹	82.0	16.4
Cusco	Cusco ¹	70.4	9.7
Livitaca	Chumbivilcas ¹	61.1	14.9
Accha	Paruro ¹	47.7	19.8
Sicuaní	Canchis ¹	84.0	30.8
Copraque	Espinar ¹	89.4	24.5
Checca	Canas ¹	66.0	18.4
Mosollacta	Acamayo	100.0	5.4
Ocongate	Quispicanchi	64.4	26.1
Anta	Anta	79.1	15.0
Maras	Urubamba	100.0	21.8
Calca	Calca	100.0	16.6
Paucartambo	Paucartambo	45.4	36.6
Curahausi	Abancay	74.6	19.7
Oropesa	Antabamba	100.0	13.9
Nunoa	Melgar	59.1	-----
San Jose	Azangaro	64.4	-----

¹Provinces constituting the Cusco supply region.

slaughter house records show that in the four-year period of 1976-1979 the district supplied 11,026 animals. One must conclude either that the census underestimated significantly the actual sheep population or that the slaughtered sheep that are identified as originating in the district of Cusco were actually raised

elsewhere. We tend to favor the second explanation, it is rather doubtful that the district of Cusco could support many more sheep than that are indicated by the census. We suspect that the sheep were produced elsewhere, sold to Cusco-based livestock merchants who then reported them as raised in the district of Cusco when taking them to the slaughter houses. We have no knowledge if this procedure yields some sort of advantage either to the producers or to the merchants.

This pattern of district primacy does not appear to correspond with any geographical advantages for the districts, either in production or distribution. Some of the districts are located in relatively remote areas and their locations do not appear to offer competitive advantages in transportation or ease of access to the Cusco market.

It is probable that if we were able to identify and measure the supply streams to the illegal Cusco mutton market and add them to the streams identified by the slaughter house records, that we might find a closer relationship between the districts' animal populations and the volume of meat exported to the city of Cusco. However, this would still leave unexplained the pattern of one district dominating the official output of its province. The answer is probably to be found in the nature of the linkages which connect the rural producers with the urban slaughter houses.

In the case of other primal districts, a similar process may be taking place. Perhaps one district serves as a bulking point for each province and thus much of the province's production is concentrated in one district from where it is marketed to Cusco and

is identified as produced in the bulking center. Another hypothesis might be that specific districts develop exclusive marketing links with the Cusco market and thus enjoy an advantageous position in marketing their sheep.

The distribution of the high supply districts is even more puzzling when we compare these districts with a list of districts which according to the 1975 census had the largest sheep populations in their provinces. Table 10 shows that only 5 of the 16 provinces for which we have data were simultaneously the district with the largest sheep population and the district which exported most sheep to the Cusco legal market. It is interesting to note that the districts of Ccorcca, Chincheros and Pisac are extremely close to the city of Cusco and yet were insignificant as suppliers of legal mutton. Their combined contribution during the four year period was a mere 2.2 percent of the total number of animals slaughtered, and these animals were all from Ccorcca. It is very possible that the animals from these districts are marketed exclusively through illegal channels, either by the urban retail consumers coming to the districts and purchasing the meat at the points of production or close to them, or by the meat being illegally introduced into the city.

In the case of the other districts, we must assume either that most of the meat is marketed through illegal means or that it is destined to other centers of demand. We have little basis for estimating whether the illegal market would be capable of handling the relatively large number of animals that would have to be processed if the bulk of the unaccounted production is indeed channelled through this market.

Table 11 identifies 21 districts which supplied at least one percent of the legally slaughtered sheep in Cusco during 1976-1979. These districts represent a quarter of all the districts

Table 10. Percentage of province's sheep population found in the district with most animals (1975) and percentage of that district's share of the total sheep supplied to the Cusco legal market (1976-1979).

<u>District</u>	<u>Province</u>	<u>Percentage of Province Population</u>	<u>Percentage of Animals slaughtered</u>
Tambobamba ²	Cotabambas ¹	34.3	29.2
Chuquibambillas	Grao ¹	20.9	0.0
Ccorcca	Cusco ¹	31.0	12.9
Colquermarca	Chumbivilcas ¹	17.9	2.6
Accha ²	Paruro ¹	19.8	47.7
Sicuaní ²	Canchis ¹	30.8	84.0
Yauri	Espinar ¹	25.3	2.6
Kunturkanki	Canas ¹	18.8	5.3
Acopia	Acomayo	34.1	0.0
Ocongate ²	Quispicanchi	26.1	64.4
Huarocondo	Anta	23.2	.4
Chincheros	Urubamba	37.0	0.0
Pisac	Calca	23.9	0.0
Paucartambo ²	Paucartambo	36.6	45.4
Lambrama	Abancay	31.4	2.9
Antabamba	Antabamba	41.6	0.0
Melgar	-	-	-
Azangaro	-	-	-

¹Provinces constituting the Cusco supply region.

²Leading supply districts of their provinces.

Table 11. Number of animals supplied and percentage of total sheep slaughtered in the legal Cusco market by district (1976-1979) .

<u>Province</u>	<u>District</u>	<u>Percentage</u>
Cusco ¹	Cusco	11.9
Paruro ¹	Accha	10.0
Chumbivilcas ¹	Livitaca	8.0
Espinar ¹	Coporaque	6.8
Canas ¹	Checca	4.6
Cotabambas ¹	Tambobamba	4.4
Melgar	Nunoa	4.4
Cotabambas ¹	Mara	4.3
Paruro ¹	Omacha	3.8
Canchis ¹	Sicuani	3.5
Grao ¹	Progreso	3.5
Paruro ¹	Ccapi	3.4
Cotabambas ¹	Haquira	2.9
Cotabambas ¹	Cotabambas	2.8
Cusco ¹	Ccorcca	2.2
Chumbivilcas ¹	Velille	2.2
Paruro ¹	Paruro	2.2
Melgar	Santa Rosa	2.1
Chumbivilcas ¹	Ccapacmarca	1.9
Cusco ¹	San Jeronimo	1.4
Canas ¹	Pampamarca	<u>1.2</u>
		87.5

¹Provinces in the Cusco supply region.

which supplied animals, and together they accounted for about 87.5 percent of all the animals. Two trends are very evident from the table. The first is that almost all of the districts are located in provinces of the Cusco supply region. The second is that with the exception of the top three or four districts, the contribution of these districts is fairly uniform.

When we look at the spatial distribution of these districts, no clear pattern emerges. The districts are located south of Cusco, in a fan shaped region which has the city at its apex and which extends for approximately 130 km. in a 45 degree arc. This region does not correspond with any major topographical features and can best be characterized as highly accented terrain, containing most of the Andean vertical zonation ecosystems.

The majority of the districts are located near to major rivers, such as the Apurimac, Velille and Santo Tomas. Presumably, the sheep are driven to Cusco along trails which follow the courses of the major rivers. This would facilitate not only the transport of the animals by providing relatively flat trails, but would also facilitate considerably the problem of providing water for the livestock.

The high supply districts nearest and farthest from the city of Cusco are not located along major rivers. Districts close to the capital presumably are able to drive their animals directly to the city in a day or so, whereas the most distant high supply districts, Santa Rosa and Nunoa, shipped their animals by train. In both cases, the animals were not driven for days on trails and thus the location of the districts appear not to correspond to the more general pattern.

The hypothesis that the location of most of the high supply districts is determined by their proximity to the major regional trails, and that these trails are roughly parallel to the major rivers, does not explain why many other districts which are similarly located, do not contribute sheep to the Cusco

slaughter houses. We suspect that it might be the case that the districts which our data identifies as high supply districts may in some cases act as bulking centers for animals produced in other neighboring districts. These sheep become identified as produced in the high supply districts, and thus, their actual supply becomes overstated and that of their neighbors understated.

The last point to be made about the general distribution of the high supply districts is that they appear to be little influenced by the regional road and rail transportation network. For example, the major transportation axis of the region, the Cusco-Puno highway, seems to exert little if any influence on the distribution pattern. Apparently, few live sheep are ever shipped to Cusco by truck and only the sheep from Puno are shipped by rail.

The Areas of Supply for the Illegal Market

We do not have any systematic data on the production areas which supply most of the meat to the illegal urban market, but we do have some fragmentary information.

Most of the illegal mutton that is channelled by suppliers comes from the provinces of Canas, Chumbivilcas, Espinar, and Canchis in the department of Cusco; and from the provinces of Melgar and Azangaro in the department of Puno. We did not receive reports of illegal meat coming from the department of Apurimac but we cannot discount this region as a potential source of illegal meat.

We can see that there is great overlap between the provinces which supply legal and illegal meat, we would expect that to be the

case. All the provinces listed above are included within the Cusco supply region. The main difference in the supply regions of the two sectors is the continuing importance of the department of Puno as a supplier of illegal meat as recently as 1980. This department ceased supplying significant stocks of legal mutton to Cusco after 1978.

In terms of the relative importance of the various provinces, it appears that the largest volume of illegal meat comes from the province of Espinar. In an informal census of the head and feet vendors, 53 percent of the heads were identified as originating in this province. The rest of the stock was reported as coming primarily from the provinces of Canas and Melgar.

This distribution is rather different from the picture that we obtained in the legal market. The provinces which seem to be important in the illegal sector are relatively unimportant in the legal market. Thus, whereas the province of Espinar is a very prominent producer for the illegal market, its contributions to the official sector are rather marginal. We are not sure what characteristics of location or production lead to these differential rates of participation. One factor may simply be distance. The province of Espinar may just be too far from the city of Cusco to send its sheep to the urban slaughter houses. If this is the case, then it is much more practical to transport the meat, and this automatically would lead to participation in the illegal sector. We should also note that Espinar's role as an important supplier of mutton in the illegal market is much more in accord with its importance as a sheep producer.

Although data at the district level is even more fragmentary, a pattern seems to emerge and that is that the most of the provinces' supplies to the illegal market are channelled primarily through only one or two of their districts. Thus, most of the illegal meat from the province of Espinar is identified as coming from the district of Yauri, that of Canas from the district of Yanaoca, and that of Melgar from the districts of Santa Rosa and Ayaviri. It is very likely that the capitals of these districts act as bulking centers for the regional production and that the meat is concentrated there because these centers are serviced by transport which links them directly with Cusco. Significantly, these districts do not appear to play an important role in the legal market.

Levels of Supply

Between the years 1976-1979 approximately 92,915 sheep were processed in the official slaughter houses of Cusco. This yields an annual average of about 23,229 animals.

Table 12 shows the number of sheep supplied by each of the three departments. The numbers are clearly insignificant when compared to the herd sizes estimated for these departments. For example, the figure for the department of Cusco represents less than 5 percent of the estimated departmental herd size.

Table 13 shows the same figures at the province level. Clearly, some provinces send few of their sheep to the legal markets of Cusco while others send considerable numbers. However, in no case can it be said that the great majority of a province's

Table 12. Total sheep supplied to the official slaughter houses of Cusco and their annual average by department (1976-1979).

<u>Department</u>	<u>Number</u>	<u>Annual Average</u>
Cusco	67,179	16,795
Apurimac	18,334	4,584
Puno	7,189	1,797
TOTAL	92,915	23,779

annual sheep harvest was destined for these markets. When we look at the district level data, in table 14, we see the same pattern. In very few cases does a district send a large part of its potential harvest to the legal market.

As we mentioned before, some of the data may be suspect. The annual average for the district of Cusco is only slightly less than the census figure for the total sheep population, 3,300 animals, for the district in 1975. For most of the other districts, however, the numbers are far below the estimated harvest potentials for the districts' herds. Table 15 shows a comparison between the annual average and the herd size of selected districts.

We have to assume that the annual harvest potential of these districts is much higher than the percentage figures show for legally marketed sheep. Consumption at the point of production cannot possibly account for the remainder of the sheep that we calculate must be harvested. The bulk of these animals must either enter the illegal marketing channels or be directed towards other legal markets. We suspect that in most cases, the larger number is destined for illegal markets. We have no explanation for the unusually large percentage for the district of Accha. As in other

cases, we suspect the reliability of the figures rather than believing that this district represents such a deviant case.

Table 13. Total sheep supplied to the official slaughter houses of Cusco and their annual average, by province (1976-1979).

<u>Province</u>	<u>Number</u>	<u>Annual Average</u>
Paruro	19,497	4,874
Cusco	15,660	3,915
Cotabambas	13,905	3,476
Chumbivilcas	12,139	3,035
Espinar	7,010	1,753
Melgar	6,987	1,747
Canas	6,486	1,622
Graú	3,962	991
Canchis	3,836	959
Quispicanchi	1,139	285
Anta	1,016	255
Abancay	382	96
Azangaro	202	51
Paucartambo	132	33
Acomayo	109	27
Antabamba	85	21
Urubamba	57	14
Calca	37	9

Table 14. Total sheep supplied to the official slaughter houses of Cusco and their annual average, for districts supplying at least one percent of the total sheep supply (1976-1979).

<u>District</u>	<u>Number</u>	<u>Annual Average</u>
Cusco	11,026	2,757
Accha	9,305	2,326
Livitaca	7,417	1,854
Coporaque	6,274	1,569
Checca	4,280	1,070
Nunoa	4,129	1,032
Tambobamba	4,059	1,015
Mara	4,012	1,003
Omacha	3,542	886
Progreso	3,249	812
Sicuaní	3,224	806
Ccapi	3,169	792
Haquira	2,656	664
Cotabambas	2,643	661
Velille	2,090	523
Ccorcca	2,025	506
Paruro	2,019	505
Santa Rosa	1,908	477
Ccapacmarca	1,797	449
San Jeronimo	1,264	316
Pampamarca	1,101	275

TABLE 15. Annual average of sheep supplied to the official slaughter houses of Cusco for the years 1976-1979 as a percentage of herd size as estimated in 1977-1978 census, for selected districts.

<u>District</u>	<u>Annual Average</u>	<u>Herd Size</u>	<u>Percentage</u>
Accha	2,326	4,091	56.9
Livitaca	1,854	39,767	4.7
Coporaque	1,569	45,913	3.4
Checca	1,070	35,431	3.0
Omacha	886	9,414	9.4
Sicuani	806	23,947	3.4
Velille	523	39,767	1.3
Ccapacmarca	449	12,482	3.6
Pampamarca	275	3,766	7.3

Fluctuations In Supply

Annual Fluctuations (1976-1979)

The aggregate figures for the levels of supply are really not very helpful for understanding the distribution system of mutton. A look at the fluctuations in supply yields a more interesting picture of the dynamics of this distributive system. Table 16 shows the trend in supply between 1976 and 1979 for the three departments.

Table 16. Total sheep supplied to the official slaughter houses of Cusco, by year and by department.

<u>Department</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Cusco	16,075	17,973	16,613	16,518
Apurimac	5,328	6,032	3,936	3,038
Puno	3,968	2,856	356	0
TOTAL	25,371	26,870	20,905	19,556

Several facts are evident in this table. First, the total number sheep declined after 1977. The number of sheep supplied in 1979 was only 77 percent of that supplied in 1976. The animal census figures do not seem to show corresponding declines in herd sizes. Secondly, the year of 1977 seems to have been an important peak supply year. It is improbable that the high number of sheep marketed in this year were large enough to significantly decrease some herds in the next few years, thus reducing the sizes of the harvests. We are not sure what incentives spurred the high levels in 1977, but one strong possibility is that this action may have followed significant increases in the price of mutton, however, other factors may have also influenced such a spurt in supplies.

Droughts may have depressed animal production in 1976 and 1977, thus reducing the availability of sheep in later years. Such an occurrence would have impacted on the legal markets more strongly, since during times of meat scarcity the prices for mutton in the illegal market respond more swiftly and drastically to the decreased levels of supply, increasing the profitability of this sector. The expected result is that the proportion of animals channelled to this market increases, depressing even further the numbers of animals available for the official market.

Each of the three departments shows a different trend. From providing 15.6 percent of the total sheep in 1976, the Puno's share fell to zero in 1979. We have good reasons to suspect that as the difference in the prices for mutton paid in Cusco and Arequipa increased, the latter market has become increasingly more lucrative and has absorbed an increasingly larger share of the

animals produced in Puno. Presumably, almost all of the animals which are now produced in Puno and harvested for urban markets, are destined for Arequipa.

A similar but weaker trend is found in the figures for the department of Apurimac. Clearly, the department was not as important a supplier in 1979 as it has been in 1976. Although its contribution to the total supply fell only from 21 to 15 percent, the number of animals that it supplied was almost halved. Since there is no reason to suspect that the herds in Apurimac decreased between 1976 and 1979, one would have to conclude, once again, that the animals were being destined to more profitable markets.

The relative stability of the supply levels from the department of Cusco seem to reflect the stability the departmental herds. Presumably, producers in this department have a lesser degree of flexibility in choosing between the various marketing options. Their closer proximity to the urban market of Cusco may make other markets less attractive, thus regularizing their supplies to the capital. Perhaps, we can generalize that under present conditions; a relatively invariant aggregate herd size, a significant gap between official and unofficial meat prices, and a public monopoly on meat processing, that the levels of supply from the department to the legal markets of its capital is not likely to exceed 5 percent of the herd size, or roughly no more than 20,000 sheep per year. We suspect that increased levels in demand will be reflected more accurately in the illegal market and that in such cases this sector will receive increased shares of the animals.

Table 17 shows the data at the province level. The general decline in supplies that was clear in the previous table is

Table 17. Total sheep supplied to the official slaughter houses of Cusco, by year and by province.

<u>Province</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Cusco	2,652	3,106	4,983	4,919
Chumbivilcas	2,813	4,800	1,779	2,747
Paruro	5,572	4,976	4,305	4,644
Acomayo	109	0	0	0
Canchis	1,171	1,103	740	822
Espinar	1,728	1,454	2,150	1,678
Quispicanchi	444	425	129	141
Anta	141	369	459	47
Canas	1,412	1,640	1,973	1,461
Urubamba	0	57	0	0
Calca	0	0	37	0
Paucartambo	0	23	50	59
Abancay	63	18	65	236
Grao	1,913	1,172	678	199
Antabamba	0	34	20	31
Cotabambas	3,352	4,808	3,173	2,572
Melgar	3,838	2,793	356	0
Azangaro	130	72	0	0

obscured when we disaggregate the data to the province level.

However, this data shows an interesting thing and that is that the relative stability of supplies from the province of Cusco. In fact, this Province increased its supply by 74 percent between 1976 and 1979, it is the only province in the entire sample to do so. This finding would tend to bolster the explanation which we offered above concerning the calculus of supply for the department of Cusco.

If it is correct, as we presume, that livestock production in the vicinity of the city of Cusco is geared to meet the urban demand, then we might expect that livestock raised primarily for this market would be slaughtered in large numbers when supply levels are low and prices are correspondingly higher in the official markets. The realization of greater profits should induce larger harvest sizes among producers oriented almost exclusively to the urban market, but this profit potential would have less of a direct impact on producers engaged in mixed production systems where subsistence and other non-market factors enter into the calculus for determining harvest sizes.

No other crucial trends are discernable from the province level data, except that most of the provinces show a clear drop in their levels of supply. It is interesting to note that both of the provinces of Puno show similar declines, thus indicating perhaps that the department as a whole may have been responding to shifts in markets. The provinces in Apurimac show a rather mixed trend and the only conclusion that might be drawn is that producers in this department may be responding to different factors, thus producers in Grau may have largely reoriented their marketing targets whereas those in Cotabambas have by and large continued to send substantial numbers of animals to Cusco.

When we look at the district level data in Table 18, we see that the increase in supply that was evidenced in the province of

Table 18. Total sheep supplied to the official slaughter houses of Cusco, by year and by district, for districts supplying at least one percent of total supply.

<u>District</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Cusco	1,512	1,734	3,770	4,010
Accha	2,562	2,509	2,107	2,127
Livitaca	1,268	2,740	1,170	2,239
Coporaque	1,528	1,357	1,926	1,463
Checca	940	909	1,526	905
Nunoa	2,157	1,736	236	0
Tambobamba	1,223	1,312	799	725
Mara	544	1,705	950	813
Omacha	1,178	703	563	1,098
Progreso	1,689	927	633	0
Sicuani	991	1,009	596	628
Ccapi	768	897	699	805
Haqira	596	954	678	428
Cotabambas	881	555	678	572
Veille	423	1,066	524	16
Ccorcca	574	370	689	392
Paruro	709	402	622	286
Santa Rosa	1,035	753	120	0
Ccapamarca	649	829	38	281
San Jeronimo	341	559	133	231
Pampamarca	94	597	117	293

Cusco is in fact accounted singlehandedly by the district of Cusco. This district supplied in 1979 more than two and a half times as many sheep as it had in 1976. The other two districts within the province of Cusco which are listed in the table, Ccorcca and San Jeronimo, show a decline in their levels of supply. In all, only five districts show increases in supply and of these, only the districts of Cusco and Livitaca increased supply significantly, the latter increasing supply by about 75 percent.

We have no explanation for the increase from Livitaca. We would have predicted that sheep from this district would have been diverted increasingly to the Arequipa markets. As far as the district of Cusco, we can reasonably assume that the figures are inaccurate. It is very unlikely that this district could have harvested 4010 sheep in 1979. As already postulated, it is most likely that these animals were purchased by urban merchants in the other provinces and then moved to temporary feeding pastures in the district of Cusco, from there they were most probably transferred to the slaughter houses, incorrectly identified as raised within the district.

The district level data shows that the declines in supply are generally distributed throughout most of the supply region. None of the decreases per district are drastic but they do show a

general trend of decreasing supplies. It must be remembered that the levels of supply for most of the districts are really minimal when compared with the estimated herd sizes of these districts. This makes it implausible to suppose that the dwindling supplies resulted from the efforts of producers to increase herd sizes. In most cases, the expected number of culls would easily exceed the supply levels of the districts.

Fluctuations within the annual cycle

We can now look at the fluctuations in supply which occurred throughout the annual cycles. This will show how levels of supply shift significantly at different times of the year. The most

important factor which affects the levels of supply throughout the year is the change in seasons between the dry and wet periods. Figure 2 shows the changes in supply levels for each month of the four year period.

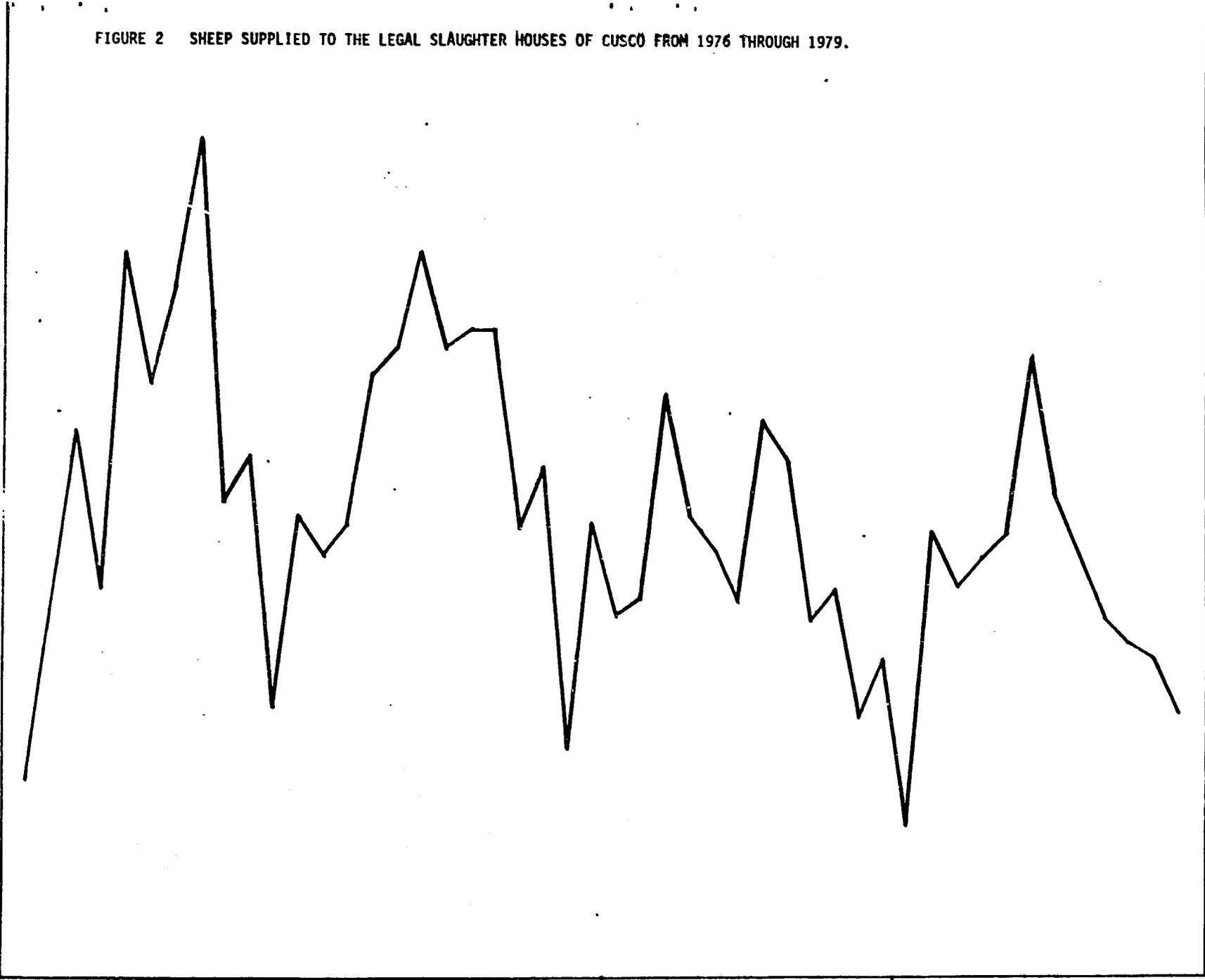
We can see in the graph that the pattern of monthly fluctuations is not very similar for each of the four years. However, some regularities are observable. Generally, the season of high supply coincides with the winter season. This is the dry season and the carrying capacity of the pastures is at its lowest levels. The sheep are slaughtered at the onset of the dry season for two related reasons. The first reason is that herd sizes are generally at their greatest and the available pastures deteriorate rapidly with the demise of the rainy season, thus the herds are harvested at this time. Secondly, the sheep are normally slaughtered before they begin to lose weight, as they invariably do in the dry winter season. The length and severity of the dry season probably determines the number of animals which are harvested during the course of winter. It is our conjecture that much of the differences in the yearly patterns can be explained in terms of the climatological conditions which prevailed during these years.

In general, the graph shows that the season of high supply starts around March and ends approximately in September. The beginning of summer, the rainy season, signals a decrease in supply; this is the time when most of the shearing takes place. The pattern of monthly fluctuation during the summers appears to be much more regular than that in the winter months.

4000
3500
3000
2500
2000
1500
1000
500
0

FIGURE 2 SHEEP SUPPLIED TO THE LEGAL SLAUGHTER HOUSES OF CUSCO FROM 1976 THROUGH 1979.

J F M A M J J A S O N D | J F M A M J J A S O N D | J F M A M J J A S O N D | J F M A M J J A S O N D
1976 | 1977 | 1978 | 1979



If we look at Table 19 we can see the percentages of the annual supply of sheep which were slaughtered during the winter and summer months.

Table 19. Percentage of annual supply of sheep that were slaughtered during the dry months (May, June, July, August) and during the wet months (January, February, November, December), by year.

<u>Season</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Dry months	47.0	41.4	37.7	42.3
Wet months	21.0	24.4	26.4	25.3

In general, during the months of May, June, July and August, the city of Cusco receives about 42 percent of its annual supply of legal mutton. Although there are some fluctuations from year to year, it seems that these figures are relatively stable. However, when we look at the wet season we see that the percentages are even more stable. There is remarkably little fluctuation in the share of the annual harvest which is supplied during the summer months. The average figure for the four years is about 24 percent. There is roughly twice as much legal mutton available in the winter than in the summer, and annual variations from this ratio are due much more to fluctuations in the winter supplies.

This suggests that the share of animals marketed in the dry season is much more influenced by seasonal factors, such as the periodicity, severity, and duration of the dry season. Therefore, it would seem that the rationalization of supplies is much more difficult task during these months. It is difficult to tell whether these figures are representative of the seasonal fluctuations for the entire regional sheep harvests or if they indicate only the behavior of legal levels of supply.

Table 20 indicates the percentage of provincial annual supplies marketed during the dry months. There appear differences both between provinces and between years, most but not all of the variations appear to be unsystematic. Clearly, not all the provinces market most of their sheep during the winter months. The province of Canas, for example, with the exception of 1977, seems to market only about a quarter of its legal harvest during this season. On the other hand, the province of Canchis, with the exception of 1978, appears to market well over half of its sheep during the winter. We have no explanation for these differences.

Neither do we have a satisfactory explanation for the differences between years. They may occur either in response to environmental stress factors or market conditions. Our assumption is that the unusually high supply percentages in a given year for a given province would implicate local environmental factors. Long prolonged dry seasons, in essence

Table 20. Percentage of total year's supply of legal sheep which was supplied during the dry months (May, June, July, August), by province of the Cusco supply region.

<u>Province</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Cusco	38.3	30.8	37.4	41.6
Chumbivilcas	46.3	35.9	50.1	49.8
Paruro	51.0	37.6	34.2	34.8
Canchis	52.7	74.6	37.2	61.7
Espinar	34.0	48.4	44.4	40.9
Canas	23.4	49.3	22.7	27.5
Grao	54.8	42.2	58.3	59.3
Cotabambas	38.7	38.9	31.2	52.8

droughts, would result in unusually large winter harvests,

conversely, unusually low levels might indicate mild dry seasons and thus the absence of environmental stress factors. This might allow producers to rationalize their annual harvests, or perhaps even to shift them somewhat to the summer months when supplies are generally lower and prices are correspondingly higher.

The Economics of Distribution

It is difficult to obtain precise statistics on the economics of either the legal or illegal sectors. This is so because prices tend to change seasonally and also because under the recent strong inflationary trends in the country there is a steady increase in prices which makes it difficult to do any diachronic comparisons. The information offered here is based on the price structure operating in July 1980, at that time the exchange rate was S/290 per U.S. dollar.

The most explicit, if not entirely accurate, recent attempt at costing out the price of mutton is provided by one of the government agency involved in food procurement and distribution (ORDESA). The calculations are based on May 1980 prices and, naturally, are meant to apply to the legal sector.

The cost breakdown is based on an average price of S/4,792 per live sheep. This price seems reasonably accurate. In July 1980 the average price was loosely pegged at somewhere around S/5,000. However such a price would seem to apply mostly to the better animals since we did have reports of live sheep being bought for as little as S/3,000. In these cases, we suspect that the animals are

rather marginal, perhaps old ewes. The ORDESA analysis assumes an average live weight of 28 kilos per animal, we have no basis for evaluating the accuracy of this assumption. These assumptions lead to a price of S/171 per kilo of live weight.

The analysis then goes on to estimate that additional costs to the wholesaler per head amount to S/150, yielding an average total expenditure per head of S/4,942. Granting the wholesaler a 7 percent return on his investment, the analysis arrives at a wholesale cost figure of S/5,288 per animal. However, the retail meat vendor does not defray the entire cost of the animal since the hides and entrails are sold separately. The report calculates the price of the hides to average about S/700 and that of the entrails at S/1,000. Thus, S/1,700 of the total wholesale cost is met from these two items. This leaves S/3,588 which is recuperated through the sale of the carcass.

The report assumes that the average sheep dresses out to about 12 kilos, or about 45 percent of estimated live weight. On the basis of the information that we present in the next section, we think that a weight of 12 kilos for the average dressed carcass is reasonably accurate. The analysis thus arrives at the average price of S/300 per kilo for mutton at the wholesale level.

This is the price which the retail butchers supposedly pay for the carcasses that they buy at the slaughter houses. The analysis further assumes that overhead costs to the retailer amount to S/1.00 per kilo of meat, thus increasing the total cost of meat to the retailer to S/301 per kilo. Estimating a return on investment of 10 per cent, the report arrives at a retail price of

S/330 per kilo, and indeed that is the price which the municipality tried, though rather unsuccessfully, to impose as the official retail price of mutton in the central market. These calculations yield approximately a S/350 profit per carcass to the retailer.

We can compare these calculations with information obtained from other sources. We have very little information on the prices for live sheep. These prices vary principally according to the sex and age of the animal. Young males are usually most expensive while old ewes fetch the lowest prices. There appears to be considerable variability in the prices paid for live animals. The price range seems to span from a low of about S/3,500 to a high of S/5,000. We suspect that most of the variability is induced by the cheaper animals and that most of the healthy adult males go for close to S/5,000, there seems to be much less fluctuation in the prices of the more desirable animals.

It must be remembered that the price of live animals is only directly relevant in the legal sector. Since the illegal market deals only with the carcasses and entrails, the actual price of live animals is not a direct determinant of the price structure within this sector. We suspect that in most cases the animals are slaughtered by the producers, this means that the actual price calculus is based much more on levels of demand and indirectly on the prices in the legal sector.

Both sectors handle carcasses but whereas in the illegal market carcasses change hands twice, between the producer and the supplier, and between the supplier and the retailer, in the legal sector they change hands sold only once, from the wholesaler to the retailer.

Illegal suppliers buy the carcasses at the points of production either by weight or by carcass. We are not sure what dictates which method is used or if there are systematic reasons for doing it either way. It does seem that purchasing the meat per unit weight is the more common method. When this is done, prices are calculated per pound. The price per pound paid by suppliers varies considerably, reports range from S/130 to S/170 per pound. We suspect that most of the carcasses bought during July 1980 were bought for around S/160 per pound. Assuming that the average carcass weighs approximately 12 kilos (26.4 lbs.), we can calculate that the wholesalers were paying approximately S/4,224 per carcass.

This figure is a bit higher than the prices reportedly paid by suppliers when they buy per carcass rather than by weight. In such cases, the reported prices paid varied between S/3,000 and S/4,000. It may be that the larger carcasses are bought by weight and the smaller one by unit. What is perhaps even more probable is that in actual practice the two methods are used interchangeably and that in most cases neither method is used exclusively.

We do not have independent information on the prices paid by the retailers for the carcasses purchased in the slaughter houses. The official report calculates an average wholesale price of S/136 per pound. If this was essentially accurate for May 1980, then by July the average price had probably risen to close to S/150 per pound, making a 12 kilo carcass worth about S/.3960. We can compare this figure with the prices paid by their illegal counterparts at the equivalent level of distribution.

We have several reports on the prices charged by the suppliers to the illegal retailers in Cusco. The prices ranged from S/160 to S/190 per pound; most of the carcasses sold for between S/170 and S/180 per pound. This would make a 12 kilo carcass worth about S/4,620. Thus, it seems that at this level, the illegal meat is more expensive. As a very tentative figure, we may calculate an average price differential of about S/25 per pound.

The official policy sought to control the retail price of mutton, but this was not very successful. In May 1980 the official retail price was S/150 per pound, by July 1980 it had been increased to S/181 per pound. However, it was very difficult to actually buy mutton in the central market for that price. The actual prices varied between S/190 and S/200 per pound.

The price structure in the illegal market was very close to the official price levels. We received information of illegal mutton selling from as low as S/163 per pound to as much as S/200. It seemed that most of this meat was retailing for between S/180 and S/200 per pound. It would seem, therefore, that for the retailers there is more profit to be made in the legal market, however, since overhead costs are higher in this sector, it is not clear exactly how much more profitable it really is, if at all.

We can next look at the economics of the distribution of entrails. As in the case of carcasses, illegal entrails undergo two transactions before reaching the consumer, while they do so only once in the legal market.

Suppliers to the illegal market buy a full set of entrails, the edible internal organs plus the head and the feet, for between

S/800 and S/900. Sometimes they only buy the organs or they buy the heads or the feet separately. The set of organs is bought for around S/400. Heads, when bought separately, normally cost about S/300, while the set of four feet range from S/70 to S/100. If the individual parts are costed together, they add up to only S/800 and thus it would seem that buying the full set may not only not be more economical but may even be more expensive. We have no explanation for this anomaly. It may be that there are significant differences in the quality of entrails sold in full sets and those sold separately.

Suppliers sell the full set of entrails to the illegal retailers for anywhere from S/750 to S/1,200, depending on the size and age of the animal. The most common wholesale prices ranged between S/900 and S/1,000. These prices correspond closely to the price range found in the slaughter houses. There, the entrail vendors from the central market pay between S/800 and S/1,000 for the full set of entrails and about S/400 for the entrails alone.

When selling the heads and feet separately, the illegal suppliers charge S/100 for the set of four feet and an average of S/400 per head. The slaughter house prices are the same for the feet but heads appear to be more expensive, ranging from S/450 to S/500. We have no certain explanation for this difference. However, a likely possibility is that there exists a strong inelastic demand for legal heads by the city's restaurants and hotels. The heads are used in making a typical regional dish and the restaurants probably buy up most of the heads in the slaughter

houses, thus boosting their price. It may also be that in the long run the prices are the same. On the whole, the price structure for entrails is rather similar in the two sectors.

Most of our data on entrails at the retail level is related to the illegal sector since this sector seems to handle the majority of the entrails offered to retail customers. Heads, at the retail level, vary in price from S/400 to S/600. There appear to be no systematic price differences in the two sectors. Thus, at times the central market sells heads for as low as S/400 while the illegal vendors are selling them for S/500. Tripe is retailed for around S/200 to S/250, the lungs and the liver are sold together for S/250, while the feet are retailed for S/30 each.

Taken together, the retail value of the full set of entrails averages to S/1,020. If we assume the average wholesale cost to be S/950, then the retailer realizes an average of S/70 per set, or 7.4 percent return on her investment.

It would seem that overall, the illegal sector is more profitable for the producers but less so for the suppliers and retailers. The margin for profit seems narrower in this sector. The profitability of the retailers in the central market is enhanced by the fact that they do not sell at the official prices but charge whatever the market will bear at the time.

The other characteristic to be pointed out is that many of the transactions take place on credit, especially between the wholesalers and retailers. Payment usually takes place 3 to 5 days after the purchase. This lapse allows the retailers to sell their stock and make their payments before the wholesaler leaves on the

next buying trip, usually a weekly event. In this manner, the wholesalers are able to leave with capital in hand and are not forced to extend credit during those periods when they have need of their capital. The prevalence of credit transactions also serves to cement the casera relationships which develop between the two groups.

Carcass Characteristics

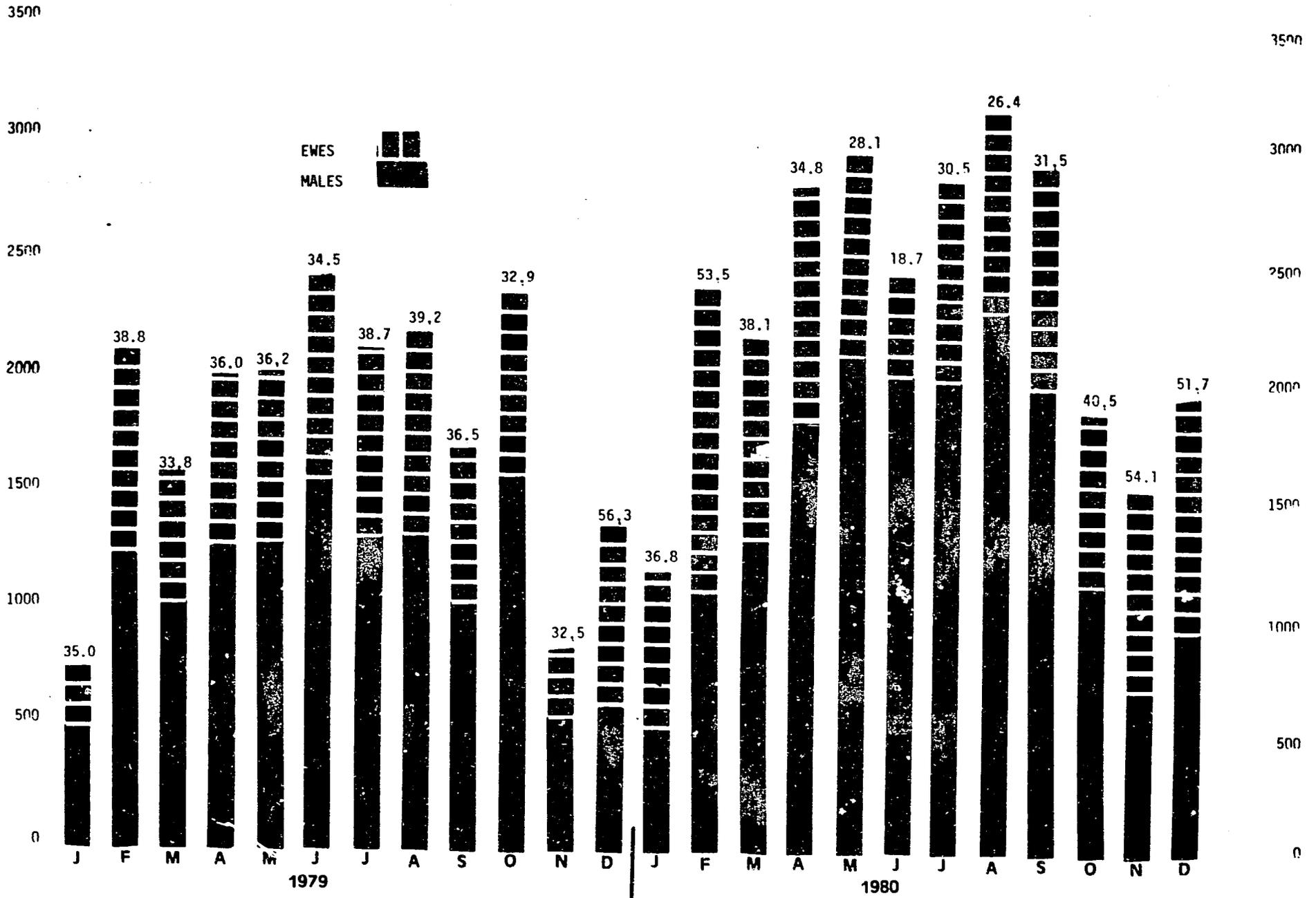
Sex Ratio

We were able to collect some additional information from the slaughter house records. This information was gleaned from the statistics on the volume and selected characteristics of carcasses. These records span a two year period, 1979 and 1980. Where this data overlaps with the information obtained from the pases, namely the year of 1979, there is little agreement between the two sources of information, although theoretically they should agree. We cannot explain this discrepancy. The difference can be appreciated by comparing the patterns of supply for 1979 in Figures 2 and 3.

Figure 3 makes apparent a reversal of the trend of decreasing supplies which is documented in figure 2 for the years 1976 through 1979. Clearly, the number of sheep slaughtered in 1980, as inferred from the number of carcasses, is higher than in previous years. The number of carcasses processed in 1980 was 31 percent higher than in 1979.

Figure 3 shows the sex ratio of the carcasses as well as their levels of supply. The number at the top of each bar gives the

FIGURE 3 SHEEP SUPPLIED TO THE LEGAL SLAUGHTER HOUSES OF CUSCO IN 1979 AND 1980, BY SEX.

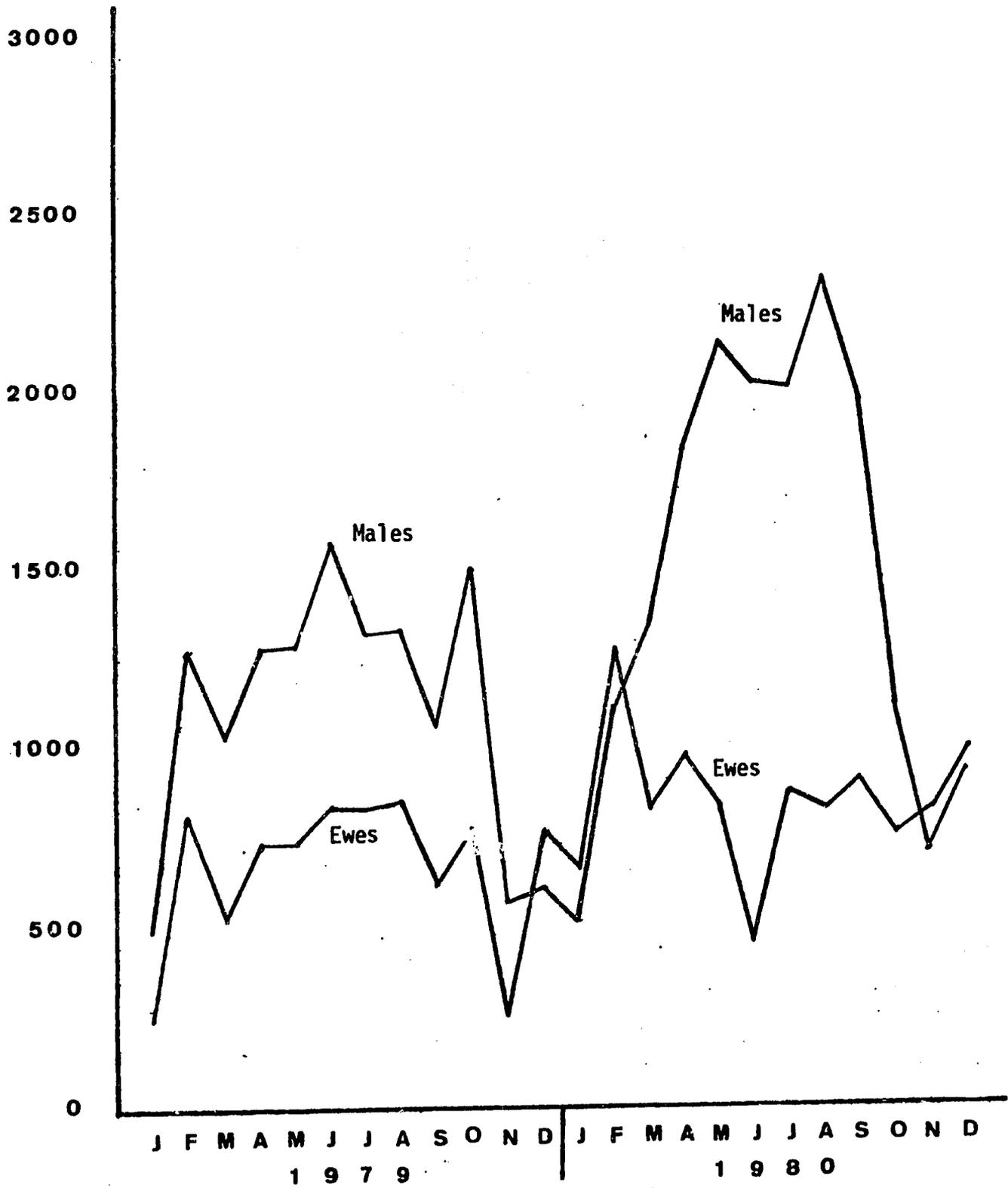


percentage of ewes. For most of the annual cycle, males clearly outnumber ewes. However, during a brief period, ewes are more numerous. During the dry winter season the sex ratio is about three to four males for every ewe, this is also the time when supply levels are at their highest. With the beginning of the rainy season, however, total levels of supply decrease considerably while the percentage of ewes almost doubles and the sex ratio becomes almost equal.

Figure 4 presents the same information in a different manner and allows us to determine some of the dynamics which lead to the seasonal changes in sex ratios. The most evident overall feature is the much greater variability in the supply levels of males. Although the levels of ewes also fluctuate, they are much more consistent throughout the annual cycle. Thus it becomes evident that the changes in sex ratio of the harvested animals are due largely to fluctuations in the numbers of males. The preponderance of ewe carcasses in the rainy season is due to the decrease of male carcasses.

The question then is, why are males kept from market during this season while ewes are harvested at close to average levels? We think that part of the answer is to be found in the differential reactions of males and ewes to changes in pasture conditions. It appears to be the case, and we will expand on this below that male animals react more drastically to changes in the quality of the pastures. They seem to be able to benefit more, both in absolute and relative terms, from summer pastures. It is therefore our guess that with the arrival of the rains producers retain their

Figure 4 Carcasses processed monthly in the slaughter houses of Cusco during 1979 - 1980, by sex.



male animals, which at this time are at their lowest weights, and wait to fatten them up before sending them to market in the winter season. Since ewes do not appear to be as affected by changes in pasture, the producers continue harvesting them and even increase slightly their supply. When the males have regained their weight, then they are harvested once again in larger numbers, thus restoring the more normal sex ratio of the carcasses.

Carcass Weights

We also obtained information on the monthly average weight of the carcasses for the same two year period. Table 21 lists the monthly averages for ewe and male carcasses as well as for the total monthly supply. We can see that the differences in total average weight range from a high of 13.95 kilos to a low of 10.01 kilos. This represents a 28 percent drop in weight. The other noticeable trend is the progressive decrease in average weight during the 24 month period. The average weight for all carcasses in 1979 was 12.15 kilos, in 1980 it had decreased to 10.97 kilos. We would assume that this decrease was caused primarily by environmental stress factors, lack of rain, to be more precise.

Figure 5 illustrates the behavior of the average carcass monthly weights for the two year period. The most striking feature in the graph is the continued long term decrease in weight. In fact, the highest levels in 1980 were generally lower than the low levels of 1979. We can see clearly how the seasonal fluctuations were overshadowed by the long term trend. We believe that the data shows the drastic effects of environmental stressors on Andean

Table 21. Monthly weight averages for dressed carcasses
in the slaughter houses of Cusco during 1979
and 1980, by sex.

	Males	Ewes	Total
J 1979	12.93	11.10	12.29
F	13.16	11.08	12.35
M	-	-	12.34
A	14.88	12.29	13.95
M	13.92	11.81	13.15
J	13.26	11.39	12.61
J	12.24	11.15	11.82
A	11.17	11.36	11.25
S	11.96	10.98	11.61
O	11.91	11.01	11.62
N	12.17	11.11	11.83
D	11.86	10.28	10.97
J 1980	12.14	10.00	10.92
F	11.08	10.72	10.89
M	11.82	11.07	11.53
A	11.90	11.02	11.59
M	11.93	10.96	11.68
J	11.85	10.92	11.68
J	11.59	10.70	11.32
A	10.86	10.32	10.72
S	11.17	10.15	10.85
O	10.53	10.07	10.35
N	10.08	10.23	10.16
D	10.02	10.00	10.01
	1979 \bar{X} 12.67	\bar{X} 11.23	\bar{X} 12.15
	1980 \bar{X} 11.24	\bar{X} 10.51	\bar{X} 10.97
	Total \bar{X} 11.93	\bar{X} 10.86	\bar{X} 11.56

Figure 5 Average carcass weight in kilograms of animals processed in slaughter houses of Cusco during 1979 - 1980.



livestock production. Since most of the sheep do not have access to reserve pastures during the dry season, the depletion of the winter pastures leads to losses in weight. The onset of a drought results in the type of livestock weight deterioration which is documented in the graph. If we look back at Figure 3, we can see that the producers responded to this stress by harvesting large numbers of animals. Most probably, this was done in an effort to reduce the pressure on the dry pastures and thus stem weight losses in the remaining animals.

When we look separately at the weight of male and ewe carcasses we see that the weights of the males fluctuate much more. Male carcasses ranged in monthly average weight from 14.88 kilos to 10.02 kilos, a difference of 4.86 kilos, while ewe carcass weights ranged only from 12.29 to 10.00 kilos, a 2.29 kilos difference. We take this to imply that male animals are much more affected by changes in pasture quality while the ewes gain less weight in the rainy months but appear to lose less in the dry season.

In 1979 male carcasses averaged 12.67 kilos while those from the ewes averaged 11.23 kilos. This would make male carcasses to be on the average about 13 percent heavier. In 1980, the respective average weights were 11.25 and 10.51 kilos, making the males only about 7 percent heavier, a significant drop from the 1979 weight differentials. Clearly, the male animals lost proportionately more weight. It would appear that weight differences are maximized during times of good pastures, with males perhaps weighing as much as 15 percent more, while during

times of poor pastures the weight differences shrink to almost zero. When we look at the differences between 1979 and 1980 we see that while in 1980 males lost an average of about 11 percent of their average weight in 1979, ewes only lost about 6 percent.

Figure 6 shows the independent behavior of male and ewe carcasses during the 24 month period. It is very evident that male weights fluctuated much more and that the general deterioration in weight affected them more severely. The graph also shows how weights rebounded somewhat with the onset of the rainy season in 1979 but also indicates that both groups failed to reach in 1980 the weight levels of 1979. Nevertheless, the weight of ewe carcasses was much closer to previous levels than that of the males.

Carcass Grades

Age and sex of the animals appear to be the primary determinants of carcass grades. Young males are usually graded as top grade carcasses while old ewes are invariably graded as second grade carcasses. In less clear cut cases, the age of the animal is considered as the most important characteristics. A secondary determinant of carcass grading is fat content and coloration. First grade carcasses require a minimum fat content and white coloration. Yellowish fat is taken to indicate an old animal.

Table 22 shows a seasonal variation in the quality of the carcasses. Whereas nearly half of the carcasses are graded as top grade in the winter months, less than a fifth are similarly graded in the middle of the summer. These variations probably reflect

Figure 6 Average carcass weight in kilograms of animals processed in slaughter houses of Cusco during 1979 - 1980, by sex.

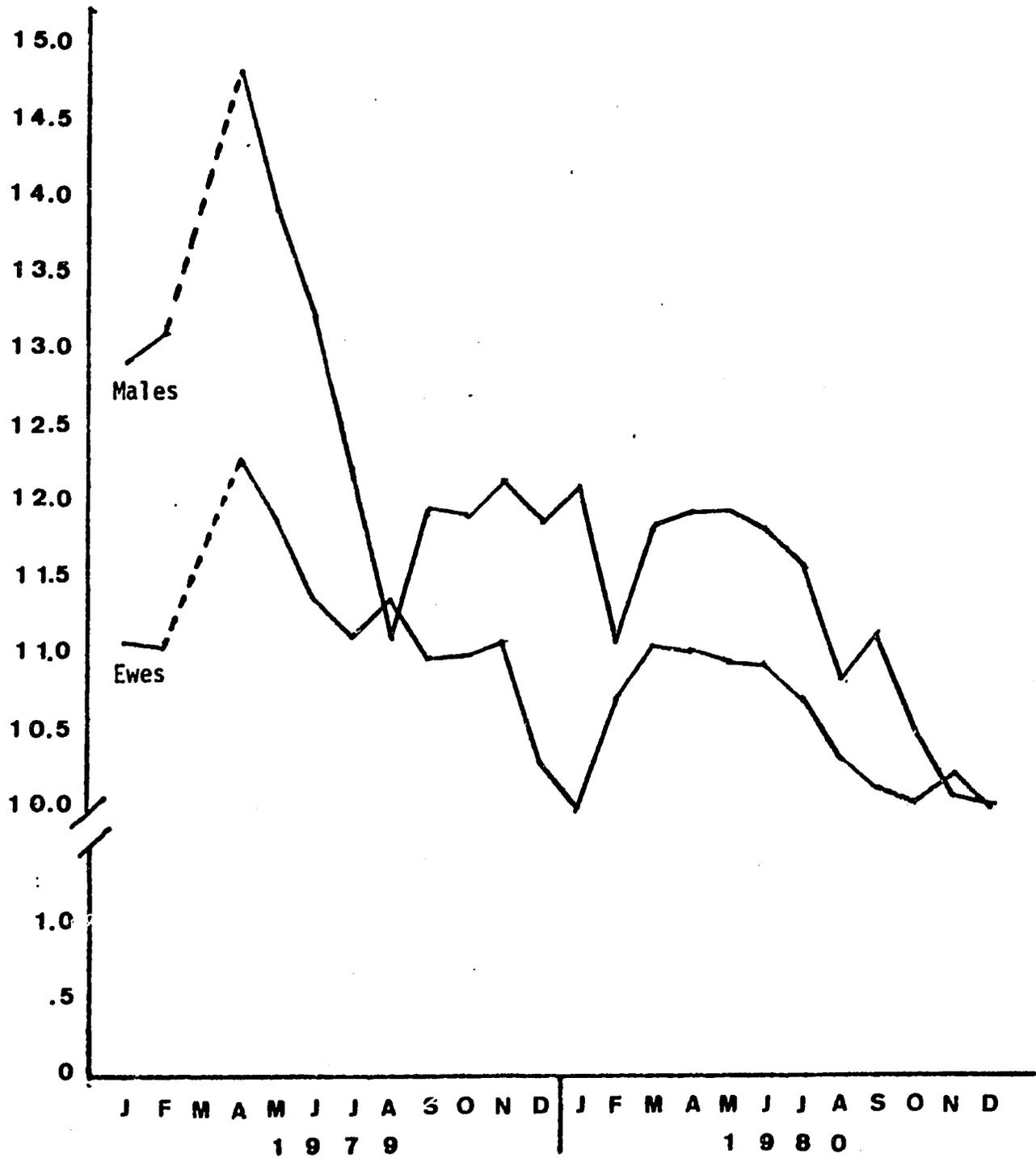


Table 22. Average monthly weight of top grade and second grade carcasses and percentage of first grade carcasses in the slaughter houses of Cusco during 1979 and 1980

	Percentage top grade	Average weight of top grade	Average weight of second grade
J 1979	14.9	14.77	11.90
F	20.7	14.35	11.83
M	32.2	13.79	11.68
A	25.4	15.41	13.45
M	21.6	15.09	12.62
J	31.1	14.35	11.83
J	30.7	13.06	-1.30
A	43.6	12.00	10.67
S	31.1	12.69	11.12
O	21.0	12.44	11.40
N	31.4	12.65	11.45
D	16.6	11.21	10.92
J 1980	13.3	12.07	10.75
F	23.3	11.72	10.67
M	32.0	12.18	11.23
A	43.3	12.11	11.19
M	53.8	12.22	11.01
J	66.0	11.97	11.11
J	53.6	11.89	10.66
A	53.4	11.22	10.15
S	44.6	11.59	10.26
O	25.1	11.07	10.10
N	19.3	10.51	10.08
D	15.5	9.92	10.00

both seasonal changes in pasture conditions as well as changes in the sex composition of the harvests. There is clearly a relationship between the proportion of males and the proportion of top grade carcasses.

It is interesting to note that the seasonal variations in the percentage of top grade carcasses was not affected by the overall deterioration in carcass weights. Thus, even though average monthly weights for top grade carcasses dropped in 1980, this did not affect their percentage distribution throughout the year. One explanation might be that the requirements for rating top grade carcasses were relaxed that year; otherwise, we would have expected a much higher percentage of second grade carcasses in 1980.

The changes in the average monthly weights of top and second grade carcasses appear to reflect both the long term deterioration in weight as well as the different sex composition of the grades. Clearly, second grade carcasses are lighter in weight and we suspect that this is largely due to the fact that most of these carcasses come from ewes.