MICRO-LEVEL SMALL RUMINANT TRANSACTION ANALYSIS AND LIVESTOCK POLICY IN SENEGAL

BY

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A PLAN B PAPER

Submitted to Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Agricultural Economics Department

1993

ABSTRACT

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This study uses one year (1989-90) of household survey data covering all livestock transactions and input expenditures to examine the equity impacts of the Senegalese livestock policy and the factors affecting purchases and sales of small ruminants in three study zones of the Senegalese Peanut Bassin. It also explores the potential for market development through more production and sales of small ruminants.

The study found that a price depressing policy on small ruminants hurts richer households more than poorer households and that the two income groups of households have the same strategy of purchase and sale of small ruminants. The major cause of small ruminant income disparities are the relatively low productivity of the poorer households. The study also found that ethnic group is an important variable to consider when analyzing factors affecting small ruminants production and marketing. Overgrazing limits any production technique based on increasing livestock numbers when feeding is mainly based on the natural grazing lands. Intensification / semi intensification of livestock and improvement of credit programs and small ruminant health have been recommended.

To my parents,

who provided support

and encouragement

ACKNOWLEDGEMENTS

I wish to acknowledge the contributions of many individuals and institutions to the realization of this study. Thanks are due to Dr. Michael T. Weber, my major Professor for his guidance throughout my course work and for his critical reading of the thesis.

I am very grateful to Dr. Reardon, my thesis adviser for his guidance and supervision of the analysis and writing of this thesis.

I also thank Dr. Chris Vanderpool to serve on my thesis committee and for his useful suggestions for extensions of this work.

My special thanks go to Dr Valery Kelly who graciously offered her assistance at all stages of this work.

I am grateful to the US Agency for International Development and the Senegalese Agricultural Research Institute (ISRA). The USAID provided the funds for my Masters program. The ISRA/IFPRI project also funded by the USAID allowed me to use their data in this thesis.

Finally, I would like to thank my friends and colleague students for their support.

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CHAPTER I

INTRODUCTION

1.1 Objectives and Scope

The objectives this thesis are to assess the equity impacts of both the current Senegalese livestock policy and the factors affecting small ruminant purchases and sales (partners, reasons and period). Another objective is to study the potential for market development through more production and sales. We will look at these issues by exploring livestock ownership patterns and their relation to key household economic characteristics. The analysis will also take the perspective of how much different income groups of producers sell and purchase small ruminants, and when, and why, and how a price depressing policy might affect their income. The data set used to prepare this thesis is drawn from a household-level survey covering all livestock transactions and input expenditures in 1989, in three study zones located in the Peanut Bassin.

Preferential attention will be given to the small ruminants as they are more evenly distributed, and perhaps more important to the poor in the agropastoral area. The Senegalese population is 90% muslim and increases at a rate of 3%. It is a custom that each year on average each adult and able muslim has to sacrifice a small ruminant (preferably a sheep), and the perception of the government of Senegal (GOS) is that

such demand for small ruminants can be met only through imports. Therefore, the potential for expanding the local market has been relatively neglected.

In the pastoral zone where pastoralists already face overgrazing problems (Le Houérou,1987), the traditional production systems based on the increase of livestock numbers have already reached their limits of sustainability. Whereas the agropastoral zone which has received little attention, due to its potential for intensification and integration of livestock and cropping (Plan d'action de l'èlevage, 1988), is more likely to present a higher potential for market expansion through more production and sales.

In summary the justification of the focus on small ruminants is their higher importance to the poor relative to cattle, and the problem associated with meeting their demand each year at Tabaski, while the focus on the agropastoral zone is due to its potential for intensification and integration between livestock and crop production. After assessing the general relationship between ownership and household socioeconomic characteristics in the second chapter for both cattle and small ruminant, the remaining chapters will be devoted to small ruminants.

1.2 Policy Issues

1. In terms of the livestock production and marketing, the GOS has always been more interested in the final stages than in the production stages. To date, the main objectives of the policy initiatives have been to stabilize the consumer price of meat through parastatals,

especially SERAS (Societe d'Exploitation des Resources Animales) and SODESP (Societe de Development de l'Elevage dans la zone Sylvopastorale). The strategy adopted by the GOS is to increase the supply of sheep in urban markets particularly in Dakar by:

(i) facilitating the imports of sheep from neighboring countries of Mali, Mauritania and recently Niger, by opening the borders and removing the import head taxes two to three months before and one month after Tabaski to allow traders to liquidate or return their unsold small ruminants;

(ii) each year the two parastatals SODESP and SERAS are each assigned according to their possibilities an objective of selling live sheep in the market of Dakar during Tabaski. They are allowed to use the National Broadcasting Company to inform consumers about locations and prices. These two parastatals sometimes try to achieve their mission by buying dear and selling cheap with disastrous financial results.

(iii) another alternative used by the GOS but which is not specific to Tabaski or small ruminants is financing farmers organized into G.I.E[1] (Groupement d'Interet Economique) through the National Bank of Agricultural Credit (CNCAS). Most G.I.E have a program known as "Operation Tabaski" under which they

[1]The G.I.E are governed by the law 84-37 May 11th, 1984 created for the fulfillment of the senegalese NPA (New Agricultural Policy) which emphasizes the limitation of state intervention in rural development. They are voluntarily owned by members (who must have the same profession) and operated for them and by them in a non profit basis. The number of G.I.E involved in livestock transactions were 280 in 1988.

fatten and sell sheep during Tabaski. In 1988 the CNCAS interest rate was 13.5 % for all G.I.E., much lower than that of the informal credit which can exceed 100% (Holtzman et al, 1988).

Another illustration of the consumer oriented policy is the GOS pricing policies. Up to 1987 the prices of meat were determined by the Ministry of Commerce in conjunction with the Ministry of Rural Development. Since 1987, the meat market have been liberalized, however, the price stabilization mission of the two parastatals has remained unchanged:

> In case of sharp price increases the government will take the following measure: SODESP and SERAS will by order of a government official use their stock in the Ranch of Dolly to bring the price to an acceptable level, by directly supplying the required quantity of meat where the sharp increases have been observed (Plan d'action de l'élevage, 1988 pp-33).

Whether or not SERAS and SODESP can achieve this mission in a long term basis is a matter of speculation, but what is sure is that the liberalization of the market doesn't mean that the government has abandoned its consumer oriented policy. Through a program called "against expensive meat" SERAS supplies meat in Dakar at relatively low prices. Traders facing competitors like SERAS and SODESP that benefit from government subsidies are likely to lower the price they accept to pay at the producer level, and this will not help stimulate local supply. Assuming the relatively high cost of this policy, one may ask the following questions: are there other alternatives? Would selected incentive and expansion of ownership (where the carrying capacity of the

grazing lands, food concentrates or fodders allows it) further develop the domestic livestock market allowing, import substitution?

2. The import policy has not been a complete success since sharp price increases during festival periods are still major concerns. For example each year there is a sharp increase in prices on the marketing system for sheep at the moslem holiday Tabaski (LY, 1985). However, despite these price increases at Tabaski, there is still a depressing effect of the pricing policy since prices would have gone up higher without the current program. An important question is: what are the equity effects of this price depressing policy among rural households?

Most of these policies are based on conventional wisdom rather than a thorough diagnostic. Their objective is to prevent seasonal price increases of live small ruminants through imports, without addressing the question of local potentialities in the supply of small ruminants, or to stabilize the consumer price of meat without addressing what it may cost to the rural smallholder.

1.3 Perceptions about Ownership and Marketing of Cattle and Small Ruminants by Agropastoralists[2]

There are many perceptions about mixed farmer behavior. For example a common perception is that when the crop harvest is good, mixed farmers purchase livestock as a form of saving and investment. Another

[2]These perceptions are what the author believes to be the general view of the livestock service about cattle and small ruminant marketing in the agropastoral zone.

assumption is that such farmers then sell these assets in case of distress: for example a shortfall in agricultural production or immediate cash needs. A related assumption is that farmers who purchase for quick resale or who raise "mouton de case" will sell when the market is favorable.

Perceptions about ownership of cattle:

Household level small and large ruminants herds are thought to be much smaller among agropastoralists as compared to the pastoral zone.

When the groundnut and other crops harvests are good, agropastoralists practice traditional fattening i.e they would buy thin cattle at low prices to feed them with their agricultural by-products (peanut hay) available through most of the year. It is also perceived that agropastoralists acquire cattle as an investment and saving strategy in order to diversify income sources that would assist the household in coping with instability in cropping income.

Perceptions about the marketing of cattle:

Agropastoralists who practice fattening are believed to sell animals in village markets when the market is favorable for higher quality fattened beef. This is because agropastoralists have

begun at this time to run out of feed supplies, and there are few high quality animals coming on the market from pastoralists.

Those who practice a strategy of saving or investment tend to sell their animals to compensate shortfalls in cropping, i.e. to pay for food or other expenditures such as inputs, selling mostly in bad years.

Perceptions about ownership of small ruminants:

When the harvest is good, investment is made in small ruminants. That is, it is common that small ruminants are purchased and fed for six to nine months for quick resale.

Usually a certain number of small ruminants are also raised to utilize unsaleable feed and home wastes. Offtake is sold as "mouton de case" or used for home consumption during ceremonies.

Perception about marketing of small ruminants:

As with cattle, it is thought that agropastoralsits who invest in small ruminants tend to sell animals when crop harvests and / or other income earning strategies are not good enough to cover their cash needs.

Agropastoralists who purchased small ruminants to fatten and for quick resale tend to sell when the market is favorable (generally at Tabaski or other ceremonies).

Agropastoralists who raise 'mouton de case' sell during Tabaski or other ceremonies at village markets or they may also consume these themselves during the ceremonies.

High income agropastoralists can afford to wait until the market is favorable to sell their animal, while low income households tend to sell their animals to meet immediate household cash outlay needs.

Perceptions about agropastoralists' consumption of meat:

It is believed that agropastoralists consume meat only during religious or traditional ceremonies.

In summary, according to common perceptions, the quality of the harvest year is an important factor that influences the acquisition and disposal of livestock ruminants. Agropastoralists acquire livestock when the harvest is good and sell these in case of shortfall in agricultural production or when the market is favorable to them. For the poor livestock is a cash reserve ready to be used in case of distress.

1.4 General Perceptions about the Traditional Livestock Marketing System

These perceptions are beyond the scope of this thesis, they are evoked here only to give the reader a more complete picture of the perceived common view of government about the marketing of livestock and meat.

Most of the general perceptions question the efficiency and the equity aspect of the traditional marketing system (Stryker, 1975). Traditionally concerns in the Sahel are:

-perceived excessive number of middlemen increasing distribution costs,

- no relation between prices over time and space resulting from the poor market information and the inadequate communication and transportation facilities,

- exploitation of consumers and producers by merchants who possess superior knowledge and the possibility of collusion among merchants.

The general perceptions about the traditional marketing system illustrate how theses concerns still persist in Senegal despite many studies (Staatz, 1979; Ariza-Nino,1980; Ndione, 1985) that identify the efficiency of the traditional marketing system.

> The obstacles to livestock production and marketing are not only the herders' behavior and the climate, the low producer prices and the market system imperfections, which result from the fact that prices are imposed from the upstream of the subsector, are among the main obstacles to livestock production. . . . Moreover, having no access to market information on the one hand, and with the active solidarity among intermediaries on the other, the herder accepts the prices which he is offered, only on the strength of a handshake, as is the custom (Plan d'action de l'élevage, 1988 pp 26-17).

The general broad policy issues this thesis will inform are therefore:

(i) the equity aspect of the potential price depression policy on rural households,

(ii) the potential for the market development through more production and more sales.

1.5 Research Questions

The first research questions is intended to address the equity aspect of a price depressing policy on rural households. The second is aimed at exploring the factors of market development through more production and sales.

1. Are poor households hurt more than rich households by a price depressing policy? Are they hurt in absolute term and/or in relative term? The importance of livestock results in part in its socioeconomic role as a source of employment especially for people living in the drier areas. In Senegal livestock production tends to be dominated by the informal sector and therefore one can expect that it has a substantial contribution to the income of the poorer sections of the population and that depressing its price would affect net sellers of small ruminants regardless of when they sell.

Since poor households may use livestock as an insurance mechanism to cope with income instability, they may sell their animals only to meet immediate needs at periods when market are not favorable. This is another equity aspect not necessarily related to the price depressing

policy but that makes the poor more vulnerable to it. This issue is important to consider especially in rural credit programs. The equity problem incorporates an incentive problem as well, since if poor households don't profit from livestock production they will not have the incentive to develop improved livestock husbandry.

2. Would increasing animal production, hence ownership stocks further develop supplies for the market? Such a question would seem inappropriate in a situation where livestock production depends only on the natural communal grazing lands, and where there are already overstocking problems, like in many Sahelian countries[3].

   In the Senegalese agropastoral areas however, it has been argued that the agricultural by-products are under-used and that integration of livestock and crop production should go beyond the traditional pair of oxen for animal traction (Plan d'action de l'elevage, 1988).

1.6 Hypotheses

The following set of hypotheses will contribute to answering the research questions. They are based on the literature and the general perceptions about agropastoralists' patterns of ownership and marketing of livestock in the agropastoral system.

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[3]The carrying capacity for the Sahel region has been estimated at one Tropical Livestock Unit (TLU) per 12 ha. The overall overstocking was similarly estimated at 30% with heavy local overstocking and some local understocking as well (Lehouérou,1987).

List of Hypotheses:

1. Livestock ownership and sales are positively related.
2. Livestock ownership and general income level are positively related.
3. Livestock ownership and cropping income are positively related.
4. Livestock ownership and off-farm income are positively related.
5. Lower income households tend to sell their livestock in order to buy food while richer households tend to sell for other reasons.
6. Period of sales and income group are positively related.

Justification of the Hypotheses

The first hypothesis is related to the second research question and is intended to help assess the potential for market improvement through more production and sales. The importance of this hypothesis lies on the traditional view that owners of livestock, especially cattle, are reluctant to reduce their stocks, regardless of market incentive. This view illustrated by Stenfield's observations in Zimbabwe:

> Cattle provides security for the misfortunes of life and for old age. At the same time they pay dividends in the form of offspring. It appears that farmers are not interested in reducing their cattle numbers by selling because cattle are regarded as an investment. When their external value (market value) rises farmers regard this as an additional security as well as a form of increased wealth. Thus, they do not respond to price incentive in the desired way Steinfield, 1988).

The next three hypotheses are related to livestock and cropping interactions, and therefore to the second research question. In a lesser degree they relate also to the first research question, since they incorporate an equity aspect. The interactions between cropping and livestock production have been characterized as symbiotic (Fall, 1986; Jankhe, 1982). Livestock provides the manure and animal power while cropping provides the by-products such as peanut hay and cotton seed used as animal feed. Livestock, especially small ruminants are also used as a reserve of cash (Steinfield, 1988). In relation to this symbiotic interactions it is expected that those who own more livestock are those who produce more grains, and if livestock plays the role of an asset as suggested (Steinfield, 1988) and (Jankhe, 1982), those who own them tend to belong to the richer households.

The next hypotheses are related to the second research question, as they are mainly based on the behavioral perceptions about cattle and small ruminant ownership and marketing. Poor households are likely to devote the bulk of their earnings, including livestock, to buy food while richer household, more food secure, can afford the risk to invest in other economic activities. In small villages, communication and transport facilities are generally poor and under such conditions market information is generally poor. Moreover, the number of traders may be very low, giving room to monopsonistic behavior (Stryker, 1975). Poor farmers are likely to live in those villages and are also likely to sell their animals in the relatively small local markets to meet their immediate needs. Finally, richer households can afford to wait until the market is favorable to sell their livestock while poor households

who face immediate cash outlay needs are more likely to sell at periods when the market is not as favorable.

The picture that emerges from these hypotheses is one of an underdeveloped market where the poorer households are at greater disadvantage, victims of their own strategy i.e selling their animals mainly to buy food at periods and place[4] where the market may not be as favorable as possible. In contrast richer households own and sell more livestock and produce more grain, gaining from the positive interactions between cropping and livestock, and from the opportunity to invest in other economic activities.

1.7 Factual Questions

These questions are intended to tackle respectively the above research questions. The research questions are broken into factual questions and their answering will help test the above hypotheses. They are given below in the order of the above research questions.

1. What are the household net small ruminant income? What part is this of general household income? How is it affected by a price change? When do households sell? Do they sell for food? Where do they sell? We expect the answer to these questions to differ by income groups.

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[4] A maintained hypothesis is that poorer households are more likely to sell their livestock at non-village markets while richer households are more likely to sell their livestock at village markets. This issue will not be explored further since the difference in place of sales by income groups cannot be tested given the way the way sample was constructed.

2. Are livestock offtake rates positively correlated with ownership? Is ownership correlated with general income? With cropping income? With off-farm income?

The variables necessary to investigate the above research issues are set out in the next section.

1.8 Data Used

The data set used in this thesis is drawn from the ISRA/IFPRI data set. This is from a detailed household-level survey covering all aspects of food consumption, expenditure and income for 360 rural households and 70 urban households in 12 study zones throughout the Peanut Bassin. Household income includes the revenues from the following activities: own crops, livestock, agricultural wages, commerce, services, transports, food preparation, gatherings, handicrafts, gifts/transfers, remittances from household members or migration. The ISRA/IFPRI data set survey covers two years (1988-90). The analysis in this thesis is limited to three study zones (Niakhar, Colobane and Passi) among the 12 study zones, and uses only one year of data: October 1989 through September 1990. Unlike analysis in the ISRA/IFPRI survey, the livestock income definition used in this thesis includes the value of change in inventory.

The variables necessary to investigate the research issues we mentioned above were grouped in three questionnaires, dealing respectively with livestock transactions, input expenditures into livestock husbandry and livestock inventories (Fall, Valery and Reardon,

1989). Before describing these variables it is important to define the basic sampling unit: the rural household.

1.8.1 Definition of the Basic Sampling Unit

The ISRA/IFPRI definition of the household was the following:

> The family agriculture enterprise is the production unit made up of all members of a family group who share meals. It is the responsibility of the elder male (household head) to supply the food for these meals. He contributes part of his production in return for labor provided by the other family members. The remainder of the available working time is freely apportioned to cultivation of other family plots, also managed by the household head, but for which the production is individually owned (Kelly and Reardon, 1989, p.46).

1.8.2 Variables Related to Livestock Transactions

The objective of the transaction questionnaire was to collect data on all transactions by all members of the household. The term transaction includes all actions where an animal is delivered from one party to another, with the major variables of interest being:

1) Outflows: deaths, sales, gifts given, loan-in-kind given, entrustment;
2) Inflows: births, purchases, gifts received, receipt in entrustment;
3) Other variables: reasons, places, partners sources of funding (for purchase) period of transactions, modalities (credit or not, time to reimbursement etc..), values and all costs associated with transactions.

1.8.3 Variables Related to Input Expenditures

The objective of the questionnaire was to collect data on all expenditures on inputs into the activity of animal husbandry by all members of the households. The major variables of interest should permit analysis to characterize the type of transactions, the product, the value of the exchange for that product over the recall period, the reason and the source of funding. Among the variables collected are: the objectives of the expenditures, the type of product modalities of payment, number of units purchased, source of funding etc...

1.8.4 Variables Related to Inventories

Due to the traditional reluctance of farmer to reveal their livestock inventories, this questionnaire was introduced during the second year of the project. Its objective was the census of the livestock holdings of all household members. The inflows and outflows of the transaction questionnaire allowed us to retrace the earlier holdings and their evolutions.

1.8.5 The Sample[5]

The choice of sampling technique used in the project IFPRI/ISRA was based on three factors: cost, time, precision and reliability of results. These factors, in addition to the absence of systematic national sampling frame led to the choice of a multi-stage sampling approach. Multistage sampling is similar to cluster sampling but only a

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[5]The description of the sampling technique is drawn heavily from (Kelly and Reardon,1989).

sample of the elements in each cluster are randomly selected as respondents. The steps of the sampling procedure were the following:

1. The target population was divided into 11 zones corresponding to the subdivision of Senegal in eleven agro-climatic zones, the main distinctive characteristics were soil type, rainfall, patterns agricultural technologies and crop cultivated. Due to resource constraints, six of the eleven zones covering the majority of the rainfed area were retained for inclusion in the study.
2. Zones that were not homogeneous were stratified further into sub-zones. At this stage the project was interested in agroclimatic as well as socioeconomic factors such as ethnic groups, infrastructure and a range of economic activities.
3. Villages within each study zone were selected in a reasoned fashion in an effort to assure a sample reflecting the general socio-economic characteristics of the zones. One of the selected villages was a market village. The remaining 2 villages were located at varying distances from the market village.
4. The sampling units (rural agricultural household) were then randomly selected.

1.8.6 Description of the Study Zones[6]

As mentioned in the previous section, the choice of the study zones were not primarily guided by livestock production activities. However, factors such as ethnic group, infrastructure, range of economic activities and climate that influence cropping are likely to influence livestock holding and / or ownership as well. Therefore, in this analysis the same subdivision of the agroclimatic zones into study-zones was used.

All the three study-zones included in this analysis are located in the Peanut Bassin (see Figure 1.1). For all the zones of the Peanut Bassin, sales of animals and animal products were declared the most important non-cropping income sources. In second place was income from petty commerce.

As for the role of livestock, most villages declared that the first means to redress household income deficits was to sell animals, especially small stocks except for Colobane where it was declared as important as petty commerce.

In term of infrastructure and institutional presence, all three study zones present some similarities, although some differences may exist in term of percentage of respondents who declare the presence of such characteristics. As shown in Table 1.1, the main distinctive characteristics for the three study zones are the socioeconomic characteristics (such as the ethnic composition and the population density) and the climate. Two of the study zones, Colobane and Niakhar

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[6] The description of the study zones is drawn from village reconnaissance document conducted in 1989.

belong to the Central Peanut Bassin where rainfall ranges 500 to 700. Passi belongs to the South Western Peanut Bassin where rainfall ranges between 800 and 1000 mm. In general as one moves from north to south, the rainfall as well as the duration of the rainy season increases.

Table 1.1 Demographic Characteristics of the Study-zones

Ethnic Groups & Density	Colobane	Passi	Niakhar
Wolof (%)	82	26	-
Fulani (%)	-	4	-
Serer (%)	18	59	100
Manding (%)	-	-	-
Other (%)	-	11	-
Density (cap/km^2)	42	146	117

Source: Adapted from the ISRA/IFPRI.
Note: Data cover October 1989 through September 1990.

1.9 Layout

Chapter II describes, for agropastoralists in the zone of Colobane Niakhar and Passi, small and large ruminants ownership patterns and their relationships to other household key socioeconomic characteristics such as grain production, non farm activities and household income.

Chapter III estimates the net income associated with small ruminant transactions (purchases for fattening, purchases for quick resales, sales from stock ...) and production in the zones of Colobane, Niakhar and Passi. It also evaluates the equity impacts of the price depressing policy on small ruminants.

Figure 1 Study zones covered by the ISRA/IFPRI survey

Chapter IV describes household level purchases and sales patterns of small ruminants for agropastoralists' households in the zone of Colobane, Niakhar and Passi. It also identifies associated factors such as reasons, partners and periods of trade. Relationship between ownership and sales are also evaluated.

Chapter V uses insights from this analysis to inform policy concerns associated with expanding small ruminant production and marketing in Senegal.

CHAPTER II

OWNERSHIP PATTERNS AND THEIR RELATIONSHIP TO OTHER HOUSEHOLD SOCIOECONOMIC CHARACTERISTICS

This chapter discusses livestock ownership patterns and their relationship to key household characteristics such as total revenue, crop revenue and off-farm income. It explores the potential for market development through more production and the importance of livestock as a production factor among income groups. The first section analyzes livestock ownership in term of ownership per household and distribution of livestock over households. In a second section, livestock ownership will be correlated to total household revenue, household crop revenue, and the off-farm income.

2.1 Characteristics of Livestock Ownership

The average herd size per household shows the relative importance of livestock as a production factor. Since livestock, due to their interactions with cropping are an important asset in an agropastoral system, their distribution over households is an important issue for agricultural policies concerned with equity issues. Livestock accumulation is also a potential obstacle to productivity when there is

imbalance between the carrying capacity[7] of the grazing lands and livestock numbers.

2.1.1 Proportion of Income Group of Households Owning Specific Types of Livestock

Per income group[8] in each study zone, the proportion of households that owns small ruminant or cattle is shown respectively in Tables 2.1 and 2.2. In all study zones, the proportion of households owning small ruminants is higher than the proportion of households owning cattle. The two tables show that the percentage of ownership is quite different for the different species. The fraction of households owning cattle is significantly lower in Colobane than in any of the two other zones.

In all zones, the proportion of richer households owning cattle is higher than the proportion of poorer households owning cattle. While for small ruminant the proportion of poorer households owners is as

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[7]The carrying capacity of a grazing land is the number of animal units the grazing land can support in a sustainable way. In the Sahelian Region it is usually expressed as the number of hectares necessary to feed a 250 kg Zebu kept at maintenance (Tropical Livestock Unit). The carrying capacity is therefore function of the quality of the grazing land itself, the management, the climate, the intensity of use etc... If the carrying capacity is exceeded (i.e lower than the stocking rate), there is overgrazing and this usually leads to the degradation of the pastures and the reduction of the carrying capacity.

[8]In each zone, households are ranked in ascending order of their total income and then divided into two groups. The first half is the first bicile or poorest bicile, the second half is the richest bicile. For the poorest households incomes per capita range between 1646 and 46251, 1837 and 19649, and 11859 and 34179 respectively in Colobane, Niakhar and Passi, for richer households these ranges are 46897 and 140597, 11428 and 22097 and 34795 and 195848 respectively in Colobane, Niakhar and Passi.

important as that of richer household owners in Colobane, and even higher than that of richer households in Passi. Overall, information in the two tables shows that small ruminants are more important for the poor than are cattle.

Table 2.1 Percentage of Households Owning Small Ruminant per Income Group

Groups	Niakhar n=34	Colobane n=33	Passi n=27
Poorer households	88	88	100
Richer households	100	88	86
Combined	94	88	96

Source: FPRI/ISRA survey.
Note: Data cover October 1989 through September 1990.

Table 2.2 Percentage of Households Owning Cattle per Income Group

Groups	Niakhar n=34	Colobane n=33	Passi n=27
Poorer households	65	6	46
Richer households	71	29	52
Combined	69	18	49

Source: FPRI/ISRA survey.
Note: Data cover October 1989 through September 1990.

2.1.2 Livestock Holdings per Household and Stocking Rates

Overgrazing is a major threat to livestock development in Senegal since land is communally owned and livestock privately owned (Plan

d'action de l'élevage, 1988). The conflict of interest that arises in such a situation has been called "tragedies of the commons" by (Hardin, 1977 p.20) cited in (Sandford, 1983). The "tragedy of the commons" argument is that: in a communally owned land, each individual seeks to maximize short-term gain by increasing the numbers of own livestock since he/she will receive the full benefit while the costs will be shared by all the users. The outcome is uncontrolled stocking rates and therefore poor performance in production since overstocking means less available pastoral resources, reduced growth and production and increased mortality (Steinfield, 1988).

Table 2.3 and 2.4 give for each zone, respectively, the average household herd size of a of small ruminant and cattle. Niakhar has a remarkably very high size of cattle holding per household relative to the other zones. Colobane has the lowest herd size for cattle and has the lowest ownership per capita for both cattle and small ruminants.

Table 2.3 Average Number of Small Ruminants Held per Household

Zones	Number of Observations	Mean	Variation Coefficient in %
Niakhar	34	7.0	100
Colobane	33	8.0	120
Passi	27	8.7	160

Source: IFPRI/ISRA Survey 1993.
Note: Data cover October 1989 through September 1990. The above averages are for all of the households.

Table 2.4 Average Number of Cattle Held per Household

Zones	Number of observations	Mean	Variation coefficient in %
Niakhar	34	8.7	160
Colobane	33	1.3	325
Passi	27	3.9	140

Source: IFPRI/ISRA Survey 1993.
Note: Data cover October 1989 through September 1990. The above averages are for all of the households.

Table 2.5 shows that Colobane which is the most arid zone and has the lowest human density, has surprisingly the lower average size of livestock held per household. The stocking rate which can be expressed as the number of hectares available per Tropical Livestock Unit (ha/TLU) was estimated by multiplying the number of TLU per capita by the population density. The result is 11ha/TLU for Colobane, 1ha/TLU for Niakhar and 2ha/TLU for Passi. The carrying capacity of the different study zones is not known but, the overall carrying capacity of the grazing lands in the Sahel is estimated at 12ha/TLU (Léhouérou,1987) and the carrying capacity of the Ranch of Dolly[9] (somewhat located in the same area) is estimated at 6 to 8ha /TLU. Therefore, relying on the recommended stocking rates and the sample stocking rates, one may conclude that there is already heavy overgrazing in Passi and Niakhar.

[9]The Ranch of Dolly is located half in the sylvo-pastoral zone half in the Peanut Bassin, it covers 90000 ha of protected pastures. Its normal carrying capacity is estimated at 6 ha/TLU i.e a full capacity of 15000 TLU i.e recently fell to 8 ha/TLU.

This generally forbids any extensive production technique based on numerical productivity if feeding is primarily based on the natural grazing lands.

Table 2.5 Average Number of Livestock (cattle and small ruminant) Held per Household and Expressed in Tropical livestock unit (TLU)

Zones	Number of observations	Mean in (TLU)	Variation coefficient in %
Niakhar	34	8.8	180
Colobane	33	2.2	140
Passi	27	4.6	110

Source: IFPRI/ISRA survey.
Note: Data cover October 1989 through September 1990. The above averages are for all of the households. A TLU is a 250kg Zebu kept at maintenance. The conversion rates are: cattle .81 and small stocks .15 (Lehouérou,1987).

2.1.3 Household Distribution of Livestock

Tables 2.6 and 2.7 give the household distribution for cattle and small stocks respectively. The number of non-owners of cattle is 81% in Colobane, 48% in Passi and 31% in Niakhar. The tables show that cattle distribution is uneven for all three study zones especially in Colobane where less than 20% of the households own all the cattle population. Small ruminant distribution is less uneven in all three study zones.

Table 2.6 Cattle Distribution by Household and by study zone

Head per household	Niakhar	Colobane	Passi
	% of households		
00	31.4	81.8	48.1
1-2	20.0	6.1	11.1
3-4	8.6	3.0	7.4
5-6	5.7	0.0	7.4
7-8	5.7	6.1	7.4
9-10	0.0	0.0	3.7
11-15	11.4	0.0	11.1
16-20	2.9	0.0	0.0
21-30	5.8	0.0	3.7
31-40	0.0	3.0	0.0
40-55	8.7	0.0	0.0
Total	100	100	100

Source: IFPRI/ ISRA Survey.
Note: Data cover October 1989 through September 1990.

As a measure of unevenness of cattle and small ruminants distribution among all households and among household owners, Gini-coefficents have been calculated. The results are given in Tables 2.8 and 2.9 and they show that cattle are unevenly distributed whether household size is taken into account or not, while small ruminants are more evenly distributed in all three study zones. There appears to be no significant difference in distribution of small ruminants among households across zones. For Passi and Niakhar the degree of unevenness of cattle is almost the same, and the Gini-coefficients for owners of cattle show that the higher coefficients in Colobane are mainly due to the large number of non-owners.

Table 2.7 Small Ruminant Distribution by Household and by Study Zone

Head per household	Niakhar	Colobane	Passi
	% of households		
00	5.7	12.1	7.4
1-2	14.3	21.2	14.8
3-4	22.8	21.3	11.1
5-6	22.8	3.0	14.8
7-8	14.3	6.1	14.8
9-10	8.6	6.0	7.4
11-15	2.9	12.1	7.4
16-20	2.9	6.1	0.0
21-30	2.9	9.0	18.4
31-40	2.9	3.0	3.7
Total	100	100	100

Source: ISRA/IFPRI Survey.
Note: Data cover October 1989 through September 1990.

Table 2.8 Gini-coefficients of Cattle and Small Ruminant Distribution among all Households

Ownership patterns	Niakhar n=35	Colobane n=33	Passi n=27
Cattle	.705	.909	.683
Small ruminants	.470	.579	.500
Cattle/capita	.698	.921	.648
Small ruminant/capita	.457	.536	.419

Source: IFPRI/ISRA survey 1993.
Note: Data cover October 1989 through September 1990.

Table 2.9 Gini-coefficients of Cattle and Small Ruminant Distribution among Household Owners

Ownership patterns	Niakhar n=35	Colobane n=33	Passi n=27
Cattle[a] per household	.569	.500	.389
Small ruminants[b] per household	.438	.520	.468
Cattle/capita	.540	.566	.322
Small ruminant/capita	.406	.471	.373

Source: IFPRI/ISRA survey 1993.
Note: Data cover October 1989 through September 1990.

[a] n = 23 for Niakhar, 6 for Colobane adn 14 for Passi.
[b] n = 32 for Niakhar, 29 for Colobane and 25 for Passi.

Referring to results obtained from other countries, Gobbins and Prankred (1983) and FAO (1986) [cited in (Steinfield, 1987)] have concluded that unfavorable conditions are connected with a higher percentage of non-owners of cattle. In Zimbabwe, (Steinfield, 1987) reached the conclusion that areas more suited for cropping allow for easier accumulation of cattle. This may explain why Colobane which is located in a less favorable area has a higher number of non-owners of cattle than the two other zones. Also given the social value attached to cattle (Schneider, 1984; Dichie and O'Rourke, 1984) the unevenness of their distribution may reflect in a given zone the prevailing social inequalities.

2.2 Relationship between Selected Household Characteristics and Livestock Ownership

We showed in the previous section that cattle distribution is uneven, and that small ruminant distribution is also uneven but to a

lesser extent. Since the grazing lands are open to all without any limit to herd size, there must be household socioeconomic factors that influence the patterns of ownership and distribution of cattle and small ruminants. The results of the correlation between selected factors with cattle and small ruminant ownership are given in Table 2.10.

2.2.1 Household Total Revenue

In Colobane there is a positive and significant relationship between total revenue per adult equivalent and cattle ownership per capita. In Contrast there is no evidence of association between small ruminant ownership per capita and total revenue. For the other zones, there is no indication of correlation between total revenue and both cattle and small ruminant ownership.

2.2.2 Crop Revenue

In all three study zones, the crop revenue per adult equivalent is positively correlated with small ruminant ownership per capita. In contrast it is only in Niakhar where there is a statistically significant positive correlation between crop income and cattle ownership.

2.2.3 Off-farm Income

In the three zones, the sample correlation coefficient between household off-farm income and ownership of cattle and small ruminant were negative or near zero, indicating no evidence of association between off-farm income and both cattle and small ruminants ownership.

Table 2.10 Correlation between small ruminants and cattle ownership and household socioeconomic characteristics

Part A: Zone of Colobane

Ownership per capita	Total revenue per AE	Crop income per AE	Off-farm income per AE
Cattle	.4873**	.2771	-.0529
Small ruminant	.2346	.3020*	.0631

Part B: Zone of Niakhar

Ownership per capita	Total revenue per AE	Crop income per AE	Off-farm income per AE
Cattle	.2844	.3773*	-.2182
Small ruminants	.2424	.3926*	-.1495

Part C: Zone of Passi

Ownership per capita	Total revenue per AE	Crop income per AE	Off-farm income per AE
Cattle	-.0978	-.0301	-.1529
Small ruminants	.1605	.5139**	-.1659

Source: IFPRI/ISRA survey.
Note: Data cover October 1989 through September 1990.

* Significant at 5%
** Significant at 1%

2.2.4 Discussion of the Results

In Passi the exceptionally high death rates for cattle and small ruminants, respectively 10% and 46% in the year 1989, might explain the fact that neither cattle nor small ruminant ownership was positively related to household total revenue since deaths were counted as costs, and those who owned more cattle and small ruminants in 1989 incurred high costs. Moreover, the level of integration between livestock and crop production in Passi may not be as developed as in the other zones.

In all the three study zones the off-farm income is not positively related to livestock ownership. This may be explained by the fact that mixed farmers who practice off-farm activities have little labor available for livestock activities and / or that these activities provide them a secure source of cash so that they don't need to invest in livestock.

The positive correlation between quantitative variables, such as revenue from cropping and total revenue, with livestock ownership are explained by positive interactions (including the role of cash reserve played by livestock) between livestock and cropping, especially for cattle. The symbiotic interactions between cropping and livestock in a mixed farming system have retained the attention of many researchers in the eighties (Jankhe, 1982; Fall, 1985; Steinfield, 1987) who support a close symbiotic relationship. According to Jankhe (1982), the functions of livestock in a mixed farming system includes:

-the output function (subsistence, income and nutrition),
-the input function (crop input and farm integration),
-the asset and security function,
-social and cultural functions.

As a farmer puts it during a survey conducted in Southern Senegal by Fall (1985): "If you don't have animal to tether at night in your crop fields, you will not harvest enough cereals."

It appears the output function is only one among the numerous roles of livestock. Cattle, due to their long production cycle are more suitable to play the asset role: 3 to 4 years are needed for cattle offtake to begin. Small ruminants, due their ability to produce a return rapidly and the fact that they are disposed of more easily constitute a reserve for cash needs (Steinfield, 1988). The major offtake for meat from small ruminants is between 9 and 15 months while for cattle offtake does not begin before three to 4 years of age (Wilson, 1988). Therefore, the positive correlation between crop revenue and small ruminant ownership in all three study zones confirms the role of cash reserve played by the small ruminants. The non association between total revenue per capita (which is annual) and ownership per capita does not contradict the asset function of cattle since the process of cattle accumulation is a long process.

2.3 Summary

This chapter described household ownership of cattle and small ruminants before relating them to household key socioeconomic characteristics such as off-farm income, crop income and household total revenue. It stemmed from the analysis that cattle are unevenly distributed while small ruminants are more evenly distributed among households and more important for the lower income household in term of the proportion of poor households owning them.

A significant positive linear relationship between off-farm income and livestock holding was not found in any of the three zones. In all three study zones there is strong evidence of linear association between household level crop income per adult equivalent and small ruminant ownership per capita. A significant positive linear association between household total revenue per adult equivalent and cattle ownership per capita was found only in Colobane. Relying on recommended stocking rates, there appears to be heavy overstocking in Passi and Niakhar. This limits any production technique based on increasing livestock numbers on natural grazing lands.

CHAPTER III

INCOME ASSOCIATED WITH SMALL RUMINANT PRODUCTION AND TRANSACTIONS IN THE STUDY ZONES OF NIAKHAR, COLOBANE AND PASSI

This chapter estimates and analyzes the income associated with small ruminant production and transactions and evaluates the impacts of a price depressing policy on different income groups of rural households in the zones of Niakhar, Passi and colobane, all located in the Senegalese Peanut Bassin.

3.1 Farm Household Small Ruminant Income

This section estimates and analyzes the income associated with small ruminant activities. Some production aspects such as offtake and death rates and input use are also discussed.

3.1.1 Definition of Small Ruminant Income

A statement of annual household small ruminant income is presented in Table 3.1. In each zone the households are ranked into biciles according to their total net revenue per capita. Gross household small ruminant income is defined as the sum of 3 components: sales and consumption[10] of small ruminants and value of change in inventory (negative or positive). Expenses are purchases of live animals,

[10]Includes both consumption from purchases and home consumption.

Table 3.1 Statement of net annual income (in fcfa) associated with small ruminants for the typical household

	Niakhar	Colobane	Passi
	Part A: Poorest biciles		
	n=16	n=16	n=13
[a]SOURCES OF REVENUE			
SR sales	15944	36562	10057
[b]Consumption	0	12639	8711
[c]Valuing of change in inventory	-7325	3583	-33897
Gross Revenue	8619	52784	-15063
[a]EXPENSES			
SR purchases	7487	36134	7753
Feed	298	2090	1033
Drugs	31	84	1566
Hired labor	0	1170	0
Other maintenance exp	1237	836	733
Transaction costs	0	0	0
Total expenses	9052	40314	11085
NET INCOME	-434	12470	-26148
NET INCOME PER SR HEAD	-2298	6442	-294
	Part B: Richest biciles		
	n=16	n=17	n=14
[a]SOURCES OF REVENUES			
SR sales	3062	50455	13692
Consumption	2126	22885	8625
Value of change in inventory	10444	45439	2685
Gross Revenue	15632	118779	25002
[a]EXPENSES			
SR purchases	7362	9477	6678
Feed	32	3533	4043
Drugs	288	228	562
Hired labor	0	2849	0
Other maintenance exp	2877	4786	1011
Transaction costs	0	2300	0
Total expenses	10559	23440	12294
NET INCOME	5073	97339	12708
NET INCOME PER SR HEAD	537	21663	3806

Source: ISRA/IFPRI survey.
Note: Data cover October 1989 through September 1990. SR=small ruminant.

[a]All figures are unweighted averages and are calculated from all observations.
[b]Consumption includes consumption from stock and small ruminants purchased for consumption and actually consumed.
[c]For value of change in inventory see Appendix A.

maintenance costs and costs associated with the transactions. Although in-kind transfers/ gifts were collected, they were insignificant (Kelly et al, 1992) and were not included as income components.

The pricing procedure applied to evaluate components which did not involve cash transactions, as well as the method used to estimate change in inventory are discussed in appendix A. Manure and milk are not included in the income statement, however, the exclusion of these two components for small ruminant will not affect much the estimates since small ruminants are not typically raised for milk in the agropastoral areas and their manure is not of common use.

3.1.2 Analysis of the of Small Ruminant Income

Looking at Tables 3.1 to 3.4, the overall picture which emerges is one of an underdeveloped[11] market except in Colobane: the value of purchase and sales of small ruminants in both income groups and the offtake rates are higher in Colobane than in the two other zones. The average net small ruminant income per household and the average net income per small ruminant head are higher among mixed farmers in Colobane than among mixed farmers in Niakhar and Passi. This indicates clearly that small ruminant production is more profitable in Colobane than in the other zones.

One of the reasons of the better performances of Colobane is certainly its relatively low stocking rate compared to Niakhar and Passi

[11]Our judgement of the degree of market development is mainly based on the commercial offtake rate. Passi and Niakhar have a commercial offtake rate lower than the national estimate which was 24% in 1988 and which is already low. Quantity sold and purchased in both zones (See table 3.1).

where the stocking rates are already higher than the recommended stocking rates, and this means less pastoral resources available, low production and high death rates.

The importance of small ruminant consumption is different among income groups and among zones. The consumption of small ruminant is higher in Colobane than in the two other zones. Except in Passi, the value of small ruminant consumption is higher in the richest biciles, it is particularly low in Niakhar where it is zero for the poorest bicile. This is also related to the predominance of the ethnic group Serer, who are typically non-muslim, and who traditionally prefer hog to sheep for religious ceremonies. Although the market is underdeveloped, in Niakhar and Passi in both poorer and richer biciles, there is no indication of subsistence orientation of small ruminant production. Even in the poorest biciles, small ruminant consumption is far lower than small ruminant sales. Likewise, commercial offtakes are higher than subsistence offtakes in all three study zones.

In the already low net small ruminant income, only a small proportion is realized as cash revenues. Except in Niakhar, the net cash income which can be defined as revenues from sales less cash expenses is higher for the richest biciles. This means that poorer households have less opportunity to put the necessary inputs (vaccines and other drugs and live animals) into livestock husbandry.

Contrary to the traditional perception that farmers usually don't consent to put inputs into livestock production, results in Table 3.2

Table 3.2 Cash Availability and Input Expenditures

	Niakhar n=32	Colobane n=33	Passi n=27
Part A: [a]Net cash income (in FCFA)			
Poorest bicile	6891	-3752	-1028
Richest bicile	-7497	27015	1398
Part B: [b]Maintenance expenses as a proportion of cash earnings			
Poorest bicile	.23	-1	-3.24
Richest bicile	-.43	.44	4
Part C: [c]Expenses per small ruminant head (in FCFA)			
Poorest bicile	206	1029	393
Richest bicile	616	1488	942

Source: IFPRI/ISRA Survey 1993.

[a]Revenue from sales less cash expenses (transaction costs, feed, drugs, hired labor and other inputs).
[b]Maintenance expenses are purchased feed, drugs, hired labor and other maintenance expenses. Unpaid family labor is excluded.
[c]Maintenance expenses divided by the number of the small ruminants in the herd at the beginning of the year.

show that the proportion of cash input besides live animals, into small ruminant production is quite large relative to the amount of cash revenues generated. Even households for which the cash income was negative consented to pay for maintenance costs. In 1989, the net cash income was negative in the poorest biciles for Passi and Colobane and in the richest bicile for Niakhar, showing that farmers had to spend a certain proportion of their cash earnings from other income sources into small ruminant enterprises. The fact that the harvest year 1989 was exceptionally good for cropping may explain why farmers accepted to put input into small ruminant production despite the low cash revenues generated.

A sound credit program might solve the farmer's liquidity problems and allow them to optimize input use, unfortunately most of the credit programs have focused on cash crops and had little impact on livestock production. In the Peanut Bassin Gaye (1988) found that only 3% of the members of the cooperatives had livestock as a main activity. The issue of rural credit programs will be discussed further in the fifth chapter.

In all three study-zones the maintenance costs per head of small ruminant are higher in the richest biciles. The net income per head of small ruminant is also higher in the richest biciles in all zones and is higher in Colobane than in the two other zones. Results in Tables 3.1 and 3.2 suggest that farmers who put more inputs into small ruminant activities have a higher net revenue per unit of animal raised. This is most likely because they can afford to buy vaccines for disease prevention and concentrates to complement the natural forage. The negative change in inventories found only in the poorest biciles, is an

illustration of the advantage the richer households have over the poorest. In the next chapter we will explore marketing advantages richer households may have over the poorer households.

3.1.3 Some Production Parameters

Table 3.3 provides some production parameters that explain the poor performance of small ruminant production in Niakhar and Passi. Those indicate clearly that ownership is not the single factor explaining differences in small ruminant income. The offtake rate expressed as a percentage can be defined as the number of livestock disposed of by sales, consumption or both as a proportion of animals in the herd (Sandford, 1983). Here we used two types of offtake rates: sales from stocks only and sales from stock and home consumption[12], both expressed as a percentage of the household holding at the beginning of the year. In Niakhar and Passi, both rates were lower than the mortality rate indicating very poor performances. The exceptionally high small ruminant death rate (46%) in Passi is to be related to contagious diseases. The high death rates explains why negative inventory changes were associated with low sales in both zones. The large difference between offtake and death rates among the three study zones indicates that these parameters account for an important proportion of the income variation among study zones.

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[12] Animals are said to be from the household stock if they were in the herd at the beginning of the harvest year 1989 or if they are born into the household stocks, by opposition to animal received as gifts or purchased for different reasons during the harvest year 1989.

Table 3.3 Production Parameters

Productivity criteria	Niakhar n=32	Colobane n=33	Passi n=27
Average household holding	7.0	8.0	8.7
Offtake rate (% of holding)			
Sales only	9	34	14
Sales and subsistence	10	43	24
Death rate (% of herd)	16	7	46

Source: IFPRI/ISRA Survey.
Note: The unit of management is the household holding. Averages have been calculated for all households.

As a comparison to other results, the national offtake rate which is the number of estimated slaughters over the estimated livestock numbers was 24% for small ruminants in 1988 (Direction de l'elevage, 1988). Results obtained for the Sahelian region, are also given in Table 3.4. Thus, it can be seen that the poor production performances in Niakhar and Passi reflect the traditional pattern of low animal production in the Sahel, while the fairly good performances of Colobane indicate that there is a potential for improvement. This is also shown by the large differences in offtake and death rates between the three study zones. Since the study zones have a different ethnic composition the ethnic group may influence the variation in small ruminant income. This issue is discussed in the next section.

Table 3.4 Mean Production Parameters in Sahel Stock

Parameters	Sheep	Goats
Number of animals/herd	103	60
Mortality in young (to 1 year)	25	35
Mortality in adult	10	10
[a]Offtake (%) of herd	24	28

Source: Adapted from (Wilson, 1982,1984; Wilson and Wagenaar 1983; Wilson et al;ILCA 1981) [cited in Lehouérou (1987)].

Note: The unit of management is the herd, it may include many household holdings.

[a]Includes sales and subsistence.

3.1.4 The Effect Ethnic group on Small Ruminant Production and Transactions

The objective of this section is to determine whether ethnic group is a critical variable in explaining some of the variation in household small ruminant production and income shown above. This is important because in Passi and Niakhar the Serer are respectively 59% and 100% of the sample population, while in Colobane the Wolof are 86% of the sample population. For purposes of analysis the variable ethnic group has been divided into two groups, the Serer and the other ethnic groups or non-Serer, mainly Wolof (89%). Moreover, all zones have been combined. A hypothesis is that livestock production and income and marketing strategies are different among Serer and non-Serer in the Peanut Bassin. This section provides a comparison of small ruminant and cattle

ownership, small ruminant income and some production parameters among the two ethnic groups.

Results in Table 3.5 show that the Serer and non-Serer have approximately the same holdings for small ruminant but the Serer have higher cattle holding than the non-Serer. For all production performance criteria, the non-Serer have better results than the Serer. The small ruminant offtake rate is higher for non-Serer, this might be related to the lower death rate. The average household holding (cattle and small stocks) expressed in TLU is higher for the Serer explaining that the Serer have more tendency to accumulate livestock than the non-Serer who have smaller holdings. Since the non-Serer have smaller holdings, the feed and labor requirement as well as the need for maintenance expenses are easier to meet. Moreover, since they sell relatively more, they have more cash available per small ruminant head to cover the so-called needs. For the Serer, the small ruminant death rate is higher than the offtake rate while for non-Serer the offtake rate is more than twice the death rate. Consequently, the net SR income as well as the net cash SR income per small ruminant head are higher for the non-Serer. For all groups, the high variation of these figures indicate that individual management is an important contributor to the difference in SR income.

Table 3.5 Comparison between Small Ruminant Production and Marketing among Serer and non-Serer

	Serer			Non-Serer		
	n	Mean	Variation Coefficient in %	n	Mean	Variation Coefficient in %
Cattle holding per household	54	6.8	174	38	1.8	180
SR Holding per household	54	8.2	100	38	7.9	117
Cattle & SR holding in TLU per hh	54	6.8	147	38	2.7	118
Net SR income (CFA per SR head)	52	50	998	33	12984	159
Net cash income (FCFA per SR head)	52	-497	-722	33	538	1461
Maintenance (CFA per SR head)	52	601	198	33	1056	100
Offtake rate (% of hh SR holding)	53	18	128	34	49	106
Death rate (% of hh SR holding)	53	27	177	34	17	218

Source: IFPRI/ISRA survey.
Note: Data cover October 1989 through September 1990.
All figures are unweighted averages. Differences by group (Serer and Non-serer) were tested using the Kruskal-Wallis test. Differences by group are significant for all figures except for small ruminant holding.

The Kruskal-Wallis test indicates that except average small ruminant holding, differences by group for all the figures in the table are statistically significant. Therefore, there is some evidence that the performances in small ruminant activities are higher for non-Serer than for Serer. Thus, the ethnic group is an important factor to consider when examining factors that affect small ruminant income. An important issue is the role of small ruminant activity among the two groups. A hypothesis is that livestock is produced for the market for the non-Serer while it is accumulated and sold only in case of distress for the Serer. However, to investigate this issue in an area characterized by instability, it would be more appropriate that the analysis cover a sampling of good years and bad years.

3.2 Effects of Price Depressing policy on Different Income Groups of Households

The analytical question is: are poorer households more affected by a price depressing policy than richer households? It is clear that a pricing policy which aims at depressing a consumer price tends to transfer income from producers to consumers, however, this issue is beyond the scope of this thesis. The purpose of this section is to discuss the equity effects of a price depressing policy among different income groups of rural households. As we showed earlier in the second chapter small ruminants are more evenly distributed among households and more important to the poor than cattle. Therefore, individuals and households with different income sources may be affected differently by a price depressing policy on small ruminants.

3.2.1 Conceptual Framework

Earlier in the first chapter, we evoked the potential effects of the government policy, the main goal of which is to stabilize the consumer price of meat and avoid the seasonal price increases around Tabaski. This price depressing policy has its overwhelming impacts 1 to 2 months before Tabaski, a period when the price of sheep can be more than four times their usual prices. Our assumption here is that a 50% decrease of the consumer price associated at the producer level with a decrease of the same magnitude in the current sale and purchase prices of small ruminants, all else being constant i.e maintenance costs and costs associated with the transactions being constant. The welfare impact of such a policy depends on the share of small ruminant income in total household revenue i.e. small ruminant production and consumption over income groups and over zones.

3.2.2 Results of the Simulation

Table 3.6 gives the share of small ruminant income per capita in household total revenue per capita. In Niakhar and Passi, the share of small ruminant income in total revenue is negative for the poorest biciles. In all the three study zones the share of small ruminant income in the total household income is higher for the richest income groups. This is most likely related to the advantage they have over the poorest groups at the production level.

The effect of the price depressing policy on different income groups are shown in Table 3.7. In the poorest biciles the 50% price depressing policy increases average net small ruminant income per capita

Table 3.6 Share of Small Ruminant Income in Total Household Revenue in 1989

	Niakhar	Colobane	Passi
[a]Average total income per capita (FCFA per capita)			
Poorest bicile	10412	29649	19870
Richest bicile	35819	73718	78922
[b]Average net small ruminant income (FCFA per capita)			
Poorest bicile	-1072	500	-1607
Richest bicile	588	7355	1264
[c]Share of average small ruminant income in total household income per capita			
Poorest bicile	-.10	.02	-.08
Richest bicile	.02	.10	.02

Source: IFPRI/ISRA survey.

[a]Include all revenues regardless of their origin.
[b]Net small ruminant income (See table 3.1) is obtained by using the following formula: Sales + consumption + value of change in inventory - purchases - maintenance costs - transaction costs.
[c]Average net SR income per capita over average total in income per capita.

by 39% in Niakhar and 43% in Passi and decreases it by 89% in Colobane. For the richest biciles the average net small ruminant income is decreased by 79% in Niakhar, 56% in Colobane and 66% in Passi. Since on average the typical household of both income groups is not net purchaser (See Table 3.1) and maintenances and transaction costs are held constant, the increase in average household net small ruminant income for poorer households is mainly due to the reduction of income loss through death. But in Colobane where poorer households have better performances their net small ruminant income per capita is decreased relatively more than that of richer households.

The last part of Table 3.7 gives the effect of a 50% reduction on the sale and purchase price of small ruminant on the household total revenue per capita. For the poorest households, the policy would increase total revenue per capita in Niakhar and Passi respectively by 4 and 3%, and decreases it by 2% in Colobane. For the richest households total revenue per capita is decreased by 2% in Niakhar, 5% in Colobane and 1% in Passi. Overall the price depressing policy hurts richer households more than poorer households. The poorer households have so poor production performances in Niakhar and Passi (where death rates were higher than offtake rates), that a price depressing policy would increase their net small income per capita, not because they are net purchaser of small ruminants but because the policy decreases the value of their loss through animal deaths.

Table 3.7 Effect of a 50% Decrease in the Sale and Purchase Prices of Small Ruminants.

	Niakhar	Colobane	Passi
[a]Average net small ruminant income after reduction (FCFA per capita)			
Poorest bicile	-656	54	911
Richest bicile	122	3244	426
[b]Percentage decrease in small ruminant income per capita after reduction			
Poorest bicile	-39	89	-43
Richest bicile	79	56	66
[c]Percentage decrease in total income per capita household income per capita			
Poorest bicile	-4	2	-3
Richest bicile	2	5	1

Source: IFPRI/ISRA 1993.

[a]Net SR income after price reduction is obtained by using the following formula: .5 sales + .5 consumption + .5 value of inventory change -.5 purchases - maintenance costs - transaction costs.
[b](Net SR before - net Sr after)*100/Net SR before.
[c]Obtained by multiplying share of small ruminant income in total revenue by percentage decrease of SR income after the price reduction.

3.3 Summary

This chapter estimated and analyzed the net income associated with small ruminants transactions. The small ruminant market is underdeveloped and the poorer households are at greater disadvantage in term of production. Although both income groups of farmers consent to put inputs into small ruminant activities, poorer households have lower maintenances expenses per head of small ruminant because they have lower cash revenues available. Consequently they have a lower net income per small ruminant raised.

Regarding the equity effects of the price depressing policy, richer households are hurt more than poorer households. The production performances are so poor for the poorest households that the hypothesized price depressing policy would result in an increase in the net small ruminant per capita in Niakhar and Passi. A price reduction would certainly kill the incentive to produce small ruminants for both income groups, and therefore, limit the expansion of the small ruminant market.

CHAPTER IV

FACTORS AFFECTING PURCHASES AND SALES PATTERNS OF SMALL RUMINANTS BY DIFFERENT INCOME GROUPS OF MIXED FARMERS IN THE ZONES OF COLOBANE, NIAKHAR AND PASSI

This chapter is intended to assess the equity impacts of factors such as reasons, partners and periods of sales and purchase of small ruminant and to explore the potential for market development through more sales. Although purchases are not directly related to the analytical questions, decision about purchases and sales are usually dependent. They may even be closely related, especially when farmers sell small ruminants in order to purchase other small ruminants or when they purchase for ordinary animal husbandry or for resale.

One may object that one year analysis in an area characterized by instability in weather and marketing conditions might be misleading. In fact, the year 1989, which is the focus of the analysis, was a typically good cropping year, and the behavior of farmers may vary depending on the quality of the harvest year. Data about 1988 which was a bad cropping year have been collected, but they didn't cover the whole year, and therefore are not fully comparable to 1989. As an attempt to determine the strategy of mixed farmers according to the quality of the crop harvest year, a comparison of the share of net livestock transaction on total income will be given at the end of the chapter.

4.1 Sales

The questions related to the reasons, partners and period of sales are evaluated by testing the corresponding hypotheses. Then the above factors are described for the two income groups.

4.1.1 Association between Reasons for Sales and income Group

The analytical question is: do different income groups of rural households sell in order to buy food? And the hypothesis is poorer households sell animals in order to buy food while richer households sell for other reasons. The hypothesis is tested in the three different zones using the crosstabulation procedure. Reasons for selling were divided into two categories:

1) food purchases
2) other economic activities, purchases of agricultural inputs and so forth in the other.

The results are given in Table 4.1 and the description are in Table 4.2. The null hypothesis of no linear association between reason of transaction and income group is not rejected for Colobane and Niakhar. In Colobane, due to their substantial contribution to the revenue of both income groups of rural households, small ruminants are not regarded as a cash reserve to help farmers cope with instabilities in cropping, but, as a profitable activity for both income groups of rural households. In Passi, the differences in reasons of transaction by income groups are significant at the 1% level, indicating that poorer households are more likely to sell for food than richer households.

Table 4.1 Crosstabulation: Reasons for Selling Small Ruminant by Income Groups

Income Groups	To Purchase Food	Other Reasons	Total	Combined
	[a]Part A: Colobane (n=90)			
Poorer households	26.3	73.7	100.0	42.2
Richer households	28.8	71.2	100.0	57.8
Combined	27.8	72.2	100.0	100.0
	[b]Part B: Niakhar (n=21)			
Poorer households	11.8	88.2	100.0	81.0
Richer households	0.0	100.0	100.0	19.0
Combined	9.5	90.5	100.0	100.0
	[c]Part C: Passi (n=38)			
Poorer households	55.6	44.4	100.0	47.4
Richer households	10.0	90.0	100.0	52.6
Combined	31.6	68.4	100.0	100.0

Source: IFPRI/ISRA survey 1993.
Note: For poorer households in Colobane, 26.3% of the cases of sales were for food and 73% were for other reasons. The number of cases of sales by poor households represent 42.2 of total number of cases of sales. For richer households, 28.8% of the case of sales were for food and 71.2 were for other reasons. The number of cases of sales by richer households represent 57.8% of the total number of cases of sales. Combined, the total number of cases of sales for food represent 27.8% of the total number of cases of sales the and the number of cases of sales for other reason represent the other 72.2%. Since there is more than 5% chance that the distribution of reasons would differ as much as they do among income groups if they did not differ in the whole population, these differences are not statistically significant. For other zones the table should be read the same way.

[a] Difference by income groups are not statistically significant in the zone of Colobane.
[b] Since in the 2 X 2 table there were cells with expected frequency less than 5, the Fisher's exact test was used. It indicated that difference in reason of sales by income group was not statistically significant in Niakhar.
[c] Differences by income groups are statistically significant in the zone of Passi.

Table 4.2 Percentage of Total Value of Small Ruminant Sales by Zone, Income Group and Reason for Transactions

	Niakhar		Mbar-Colobane		Passi	
	Income Group		Income Group		Income Group	
	Poorer Households	Richer Households	Poorer Households	Richer Households	Poorer Households	Richer Households
Total value (in 1000cfa)	255.1	49.0	585.0	857.8	118.8	208.6
Max (in 1000cfa)	48.5	16.0	55.0	55.0	8.3	30.0
Min (in 1000cfa)	1.5	6.0	4.0	4.0	4.0	2.0
Std (in 1000cfa)	14.9	4.5	11.1	10.6	1.2	8.2
Mean (in 1000cfa)	15.0	12.3	15.4	16.5	6.6	10.4
# of valid cases	17	4	38	52	18	20
To purchase food	32%	-	16%	18%	57%	9%
To repay debt	-	-	10%	20%	11%	-
To finance ceremony	-	-	-	2%	16%	21%
Agricultural input or labor	4%	-	-	1%	-	-
To pay for other livestock costs/ investment	3%	-	7%	13%	-	3%
Finance other economic activities	-	-	31%	23%	-	-
Finance voyage other than migration	27%	-	2%	2%	-	6%
Other	34%	100%	34%	20%	16%	59%
Missing	-	-	-	2%	-	2%

Source: ISRA/IFPRI survey 1993.
Note: Data cover September 1989 to October 1990.

Results in Table 4.2 show that in all three study zones, the rural households of both income groups devoted a significant proportion of their earnings from small ruminant sales to finance other economic activities such as purchases of other livestock, purchases of agricultural inputs or labor and commerce and so forth. Higher income households devote a higher share of their small ruminant income to those activities. This necessity to sell small ruminant in order to buy inputs for cropping implies that there is credit market failure, and that access to inputs is limited by stockholding which is positively correlated with general income for cattle in Colobane, and cropping income for all the three study zones.

4.1.2 Association between Partners of Trade and Income Groups

We would expect that in areas where the small ruminant market is underdeveloped inter-household transactions would be more frequent. Two major categories of partners can be distinguished: other households, including eventually the village trader (Inter-household transactions), local or ambulant trader. Results in Table 4.3 indicate that in both income groups almost all transactions were done with the small local or ambulant traders, therefore no statistics could be computed with the crosstabulation procedure. Therefore there is no indication of differences of trade partners by income groups in all the three study zones.

Table 4.3 Percentage of Total Value of Small Ruminant Sales by Zone, Income Group and Partners of Trade

	Niakhar		Mbar-Colobane		Passi	
	Income Group		Income Group		Income Group	
	Poorer Households	Richer Households	Poorer Households	Richer Households	Poorer Households	Richer Households
Total value (in 1000cfa)	255.1	49.0	585.0	857.8	118.8	208.6
Max (in 1000cfa)	48.5	16.0	55.0	55.0	8.3	30.0
Min (in 1000cfa)	1.5	6.0	4.0	4.0	4.0	2.0
Std (in 1000cfa)	14.9	4.5	11.1	10.6	1.2	8.2
Mean (in 1000cfa)	15.0	12.3	15.4	16.5	6.6	10.4
# of valid cases	17	4	38	52	18	20
Village trader	-	-	1%	-	-	-
Small local or ambulant trader	100%	100%	96%	87%	75%	100%
Inter household village transportation	-	-	3%	5%	25%	-
Other	-	-	-	7%	-	-

Source: ISRA/IFPRI survey 1993.
Note: Data cover October 1989 to September 1990.

4.1.3 Association between Period of Sales and Income Groups

The period of transaction is a very important factor: households selling for food may be obliged to do so at certain periods when market may be less favorable. Three periods are considered here: the rainy season, the early dry season and late dry season. The rainy season usually covers July, August and September the nine other months correspond with the dry season which is divided into two periods: the early dry season (October through December) and the late dry season (January through June).

The importance of these three periods lies in the difference in forage and agricultural by-products availability and the degree of depletion of the household's food and cash reserves. Since the traditional production systems are closely dependent on the natural grazing lands and the rainfall, the rainy season can be considered as the favorable period during which forage and water are abundant. In the early dry season forage becomes rarer but agricultural by-products such as peanut hay, cotton seed are still available. The late dry season is the most difficult period in term of animal production, it is also the period when farmers, usually deplete food stocks from the last harvest. During the harvest year 1989, Tabaski was on the third of July, therefore, the period between the last two months of the late dry season and the beginning of rainy season corresponded with increased demand for live small ruminants.

The analytical question is when do different income groups of households sell small ruminants? The hypothesis of linear association between periods of sale and income groups is tested using the

crosstabulation procedure. In all three study zones, late and early dry season were combined for statistical robustness. Results in Table 4.4 indicate that in all the three zones, differences in periods of sale by income groups are not statistically significant.

Table 4.5 gives the percentage of the total value of sales by period of transaction. In all three study zones, the major sale periods are: the rainy season and the late dry season, but there seems to be no indication of difference in period of sales by income groups. Therefore, the two income groups of farmers have the same strategy, selling mostly in the rainy season, and the late dry season which corresponds usually with the depletion of their cash and food reserve.

4.1.4 Association between Ownership and Sales

The analytical question is: do those who own more animals sell more of them? The hypothesis is: ownership and sale are positively related. A correlation between ownership and sale may simply indicate that those who own more sell more in absolute term, which might seem obvious. An alternative is to make a correlation between ownership and offtake rate. Table 4.6 gives the result of the correlation between ownership expressed as the number of small ruminants at the beginning of the harvest year 1989 with the variable sales (sales from stock and resale) and the offtake rate expressed as a percentage (number of small ruminants disposed of by sales as a proportion of the beginning inventory). The results indicate that in absolute term those who more sell more, in all three study zones. In relative terms, the hypothesis of linear relationship between ownership and offtake rate was rejected in all three study zones.

Table 4.4 Crosstabulation: period of small ruminant sales by income groups

Income Groups	Rainy Season	Dry Season	Total	Combined
	Part A: Zone of Colobane (n=90)			
Poorer households	31.6	68.4	100.0	42.2
Richer households	48.1	51.9	100.0	57.8
Combined	41.1	58.9	100.0	100.0
	Part B: Zone of Niakhar (n=21)			
Poorer households	29.4	70.6	100.0	81.0
Richer households	75.0	25.0	100.0	19.0
Combined	38.1	61.9	100.0	100.0
	Part C: Zone of Passi (n=38)			
Poorer households	27.8	72.2	100.0	47.4
Richer households	45.0	55.0	100.0	52.6
Combined	36.8	63.2	100.0	100.0

Source: IFPRI/ISRA survey 1993.
Note Data cover October 1989 through September 1990.
For poorer households in Colobane 31.6% of the cases of sales were in the rainy season and 68.4% in the dry season.The number of cases of sales by poor households represent 42.2 of total number of cases of sales. For richer households 48.1% of the case of sales were in the rainy season and 51.9 were in the dry season. The number of cases of sales by richer households represent 57.8% of the total number of cases of sales. Combined, the total number of cases of sales in the rainy season represent 41.1% of the total number of cases of sales and the number of cases of sales in the dry season represent the other 58.9%. Since there is more than 5% chance that the distribution of period of sales would differ as much as they do among income groups if they did not differ in the whole population, these differences are not statistically significant. This conclusion is valid for all the other study zones.

Table 4.5 Percentage of total value of small ruminant sales by zone, income group and period of transaction

	Niakhar		Mbar-Colobane		Passi	
	Income Group		Income Group		Income Group	
	Poorer Households	Richer Households	Poorer Households	Richer Households	Poorer Households	Richer Households
Total value (in 1000cfa)	255.1	49.0	585.0	857.8	118.8	208.6
Mean (in 1000cfa)	15.0	12.3	15.4	16.5	6.6	10.4
Max (in 1000cfa)	48.5	16.0	55.0	55.0	8.3	30.0
Min (in 1000cfa)	1.5	6.0	4.0	4.0	4.0	2.0
std (in 1000cfa)	14.9	4.5	11.1	10.6	1.2	8.2
# of valid cases	17	4	38	52	18	20
Period of transaction						
Rainy season	40%	88%	23%	54%	24%	45%
Early dry season	5%	-	2%	4%	17%	19%
Late dry season	55%	12%	75%	43%	59%	36%

Source: ISRA/IFPRI survey 1993.
Note: Data cover October 1989 through September 1990.

Table 4.6 Correlation between Ownership and Sales of Small Ruminants

Zones	Number of SR Sold	Offtake Rate
Colobane	.5155*	.0396
Niakhar	.3619**	-.0720
Passi	.5755*	.0670

Source: IFPRI/ISRA 1993.
Note: In the zones of Colobane, Passi and Niakhar, there is strong evidence of association between ownership and number of animals sold, but not between ownership and offtake rate indicating that those who own more sell more but no in relative terms.

*Significance at less than 1%.
**Significant at 5%.

4.2 Purchases

In 1989, mixed farmers in the zone of colobane and Niakhar purchased live small ruminants more than they sold. This is most likely related to the good quality of the crop harvest year 1989. Purchases are as important as sales and, both may even be closely related in a decision making process by which farmers acquire and dispose of their small ruminants depending on factors such as the quality of the harvest and the instability of the economic environment. In order to understand the farmers strategy and prescribe relevant policy recommendations about equity aspects of policy and the potential for market expansion, there is need to analyze the reasons, places, and periods of purchase as well as the intermediaries involved and see whether these are related to income groups.

4.2.1 Association between Reasons for Purchases and Income Group

In term of the ultimate objective of the transaction there are two major categories of reasons for purchasing animals: saving/investment, fattening and quick resale on one hand and consumption during a ceremony and ordinary home consumption on the other hand. For the first category the ultimate objective is sale, for the second it is consumption. Table 4.7 indicates that in all three zones the hypothesis of linear association between the above reasons and income groups was rejected, therefore, there is no evidence of association between reasons of purchase and income groups.

Table 4.8 shows that in each zone the total value of purchase is nearly the same for both income groups. Among zones, the percentages of total value of purchase by reason is approximately the same for Niakhar and Passi. We showed earlier in the third chapter that small ruminant production is more profitable in the zone of Colobane where farmers have more incentive to produce small ruminants. The reasons for purchasing animals confirm this finding: for Colobane the major reasons for purchase were resale and saving investment, while for Passi and Niakhar where there is less incentive to produce small ruminant, the main reason for purchase was for consumption. Table 4.9 shows that the two income groups of farmers devote almost the same percentage of the total value of purchase to small ruminant consumption in a given zone. In all zones purchased small ruminants are exclusively consumed at ceremonies for both income groups.

Table 4.7 Crosstabulation: Reasons for Small Ruminant Purchase by Income Groups

Income Groups	Husbandry & Resale	Consumption & Other	Total	Combined
	Part A: Colobane (n=95)			
Poorer households	55.3	44.7	100.0	40.0
Richer households	61.4	38.6	100.0	60.0
Combined	58.9	41.1	100.0	100.0
	Part B: Niakhar (n=23)			
Poorer households	15.4	84.6	100.0	56.5
Richer households	30.0	70.0	100.0	43.5
Combined	21.7	78.3	100.0	100.0
	Part C: Passi (n=20)			
Poorer households	30.0	70.0	100.0	50.0
Richer households	50.0	50.0	100.0	50.0
Combined	40.0	60.0	100.0	100.0

Source: IFPRI/ISRA survey 1993.
Note: Data cover October 1989 through September 1990.
For Poorer households in Colobane 55.3% of the cases purchases are for husbandry and resale and 44.7% for consumption and other reasons. The number of cases of purchases by poor households accounts for 40% of the total number of cases of purchases. For richer households 61.4% of the case of purchases are for husbandry and resale and 38.6% are for consumption and other reasons. The number cases of purchases by richer households accounts for 60% of the total number of cases of purchase. Combined, the total number of cases of purchases for husbandry and resale accounts for 58.9% of the total number of cases of purchases and the number of cases of purchases for consumption and other represents the other 41.1%. Since there is more than 5% chance that the distribution of reasons of purchases would differ as much as they do among income groups if they did not differ in the whole population, these differences are not statistically significant. This conclusion is valid for all the other study zones.

Table 4.8 Percentage of Total Value of Small Ruminant Purchases by Zone, Income Group and Reason of Transaction

	Niakhar		Mbar-Colobane		Passi	
	Income Group		Income Group		Income Group	
	Poorer Households	Richer Households	Poorer Households	Richer Households	Poorer Households	Richer Households
Total value (in 1000cfa)	144.7	120.3	617.2	695.3	136.8	120.0
Max (in 1000cfa)	25.0	30.0	65.0	52.0	35.0	23.5
Min (in 1000cfa)	2.9	2.5	1.2	2.7	5.0	5.5
Std (in 1000cfa)	8.1	8.0	14.2	8.8	9.9	7.2
Mean (in 1000cfa)	11.1	12.0	17.0	12.2	13.7	12.0
# of valid cases	13	10	37	57	10	10
To repay debt	5%	-	-	-	-	-
Other	12%	-	-	3%	-	-
Fattening	14%	27%	-	-	-	-
Normal animal husbandry saving/investment	-	2%	5%	73%	26%	28%
Purchase for quick resale	4%	-	70%	-	-	-
Purchase for ordinary home consumption	-	-	-	1%	-	-
Purchase for consumption during a ceremony	64%	71%	24%	23%	74%	72%
Purchase for gift	-	-	1%	-	-	-

Source: ISRA/IFPRI survey 1993.
Note: Data cover October 1989 to September 1990.

Table 4.9 Percentage of total Value of Small Ruminant Purchases by Zone, Income Group and Partners of trade

	Niakhar		Mbar-Colobane		Passi	
	Income Group		Income Group		Income Group	
	Poorer Households	Richer Households	Poorer Households	Richer Households	Poorer Households	Richer Households
Total value (in 1000cfa)	144.7	120.3	647.2	695.3	136.8	120.0
Max (in 1000 cfa)	25.0	30.0	65.0	52.0	35.0	23.5
Min (in 1000 cfa)	2.9	2.5	1.2	2.7	5.0	5.5
Std (in 1000 cfa)	8.1	8.0	14.2	8.8	9.9	7.2
Mean (in 1000 cfa)	11.1	12.0	17.0	12.2	13.7	12.0
# of valid cases	13	10	38	57	10	10
Small local or ambulant trader	100%	100%	76%	78%	78%	95%
Inter household village transaction	-	-	24%	22%	-	5%
Other	-	-	-	-	22	-

Source: IFPRI/ISRA survey 1993.
Note: Data cover October 1989 through September 1990.

4.2.2 Association between Income Group and Partners of Trade

As for sales, the major trade partner is the small local or ambulant trader. In Niakhar for both income groups all purchases are done with them. In Passi, the share of small local or mobil trader in the total value of purchase was 95% richer households and 78% for poorer households. In Colobane, besides the small local or mobil trader, there are the inter households transactions which represent 24% for poorer households and 22% for richer households. In all the three study zones there is no indication of difference in trade partners by income group.

4.2.3 Association between Periods of Purchase and Income Group

As for sale, there are three major periods: the rainy season, the early dry season and the late dry season. In all zones, the last two periods have been combined for statistical robustness. The results of the tests are given in Table 4.10 and the description in Table 4.11. They indicate that differences in periods of purchases by income groups are not statistically significant. Since this was true for sale, there is strong evidence that the mixed farmers, regardless of their income status have the same strategy of purchase and sales of small ruminants.

Table 4.10 Crosstabulation: Period of Small Ruminant Purchase by Income Group

	Rainy Season	Dry Season	Total	Combined
	Part A: Zone of Colobane (n=95)			
Poorer households	36.8	63.2	100.0	40.0
Richer households	35.1	64.9	100.0	60.0
Combined	35.8	64.2	100.0	100.0
	Part B: Zone of Niakhar (n=23)			
Poorer households	61.5	38.5	100.0	56.5
Richer households	50.0	50.0	100.0	43.5
Combined	56.5	43.5	100.0	100.0
	Part C: Zone of Passi (n=20)			
Poorer households	30.0	70.0	100.0	50.0
Richer households	40.0	60.0	100.0	50.0
Combined	35.0	65.0	100.0	100.0

Source: IFPR/ISRA survey.
Note: Data cover October 1989 through September 1990.
For pooer households in Colobane 36.8% of the cases purchased are in the rainy season, 63.2% in the dry season. The number of cases of purchases by poor households accounts for 40% of the total number of cases of purchases. For richer households 35.1% of the cases of purchases are in the rainy season 64.9% in the dry season. The number of cases of purchases by richer households accounts for 60% of the total number of cases of purchases. Combined, the total number of cases of purchases in the rainy season accounts for 35.8% of the total number of cases of purchases and the number of cases of purchases in the dry season accounts for 64.2%. Since there is more than 5% chance that the distribution reason of purchases would differ as much as they do among income groups if they did not differ in the whole population, these differences are not statistically significant. This conclusion is valid for all the other study zones.

Table 4.11 Percentage of Total Value of Small Ruminant Purchases by Zone, Income Group and Period of Transaction

	Niakhar		Mbar-Colobane		Passi	
	Income Group		Income Group		Income Group	
	Poorer Households	Richer Households	Poorer Households	Richer Households	Poorer Households	Richer Households
Total value (in 1000cfa)	144.7	120.3	647.2	695.3	136.8	120.0
Mean (in 1000 cfa)	11.1	12.0	17.0	12.2	13.7	12.0
Max (in 1000 cfa)	25.0	30.0	65.0	52.0	35.0	23.5
Min (in 1000 cfa)	2.9	2.5	1.2	2.7	5.0	5.5
std (in 1000 cfa)	8.1	8.0	14.2	8.8	9.9	7.2
# of valid cases	13	10	38	57	10	10
Period of transaction						
Rainy season	60%	46%	28%	35%	42%	67%
Early dry season	-	9%	5%	7%	-	-
Late dry season	40%	45%	67%	57%	58%	33%

Source: IFPRI/ISRA survey 1993.
Note: Data cover October 1989 through September 1990.

4.3 Good Year versus Bad Year

Another potential interesting factor is the quality of the harvest year. In an area characterized by instability in both the economic environment and climate, livestock may play a role of security and insurance to compensate shortfalls in cropping and other economic activities. The harvest year 1988 was a very bad year for cropping not only was rainfall lower but locusts attacks diminished harvests in Niakhar and Colobane. Table 4.12 gives the results of the comparison between of the share of net livestock transactions on total income between the harvest years 1988 and 1989.

Table 4.12 Comparison of net livestock transaction between harvest year 88-89 and 89-90

	Niakhar		Colobane		Passi	
Harvest Year	88-89	89-90	88-89	89-90	88-89	89-90
Income (in FCFA per capita)	23390	27695	29160	50850	35680	53085
Share livestock in income per capita	5	3	20	4	4	3

Source: Adapted from Reardon et al., 1992.
Note: For harvest year 88-89, livestock data cover only February 89 through September 89 for Niakhar and Colobane, and January 89 through September 89 for Passi. For harvest 89-90 livestock data cover September 89 through October 89, i.e., a year for all three studies.

4.4 Summary

In this chapter, sales and purchases of small ruminant were described in term of reasons, periods and partners of sales and purchases for different income groups of households. Then we tried to

answer the related analytical questions by testing the corresponding hypotheses (whenever the quality of the data allowed it), using the crosstabulation procedure. Finally, the relationship between sales and ownership was determined by correlating ownership with number of animals sold and offtake rates.

Reasons of sales and purchase

In 1989, there was strong evidence of difference in reasons for sales by income group in Passi where poorer households are more likely to sell for food than richer Households. In contrast, in Colobane and Niakhar an association between income groups and reason for sales was not found. For purchase there was no difference in reason by income group in all the three study zones.

Partners

In all zones, there was no indication of difference in trade partners by income groups, although no hypothesis was tested.

Periods

Periods of sales or periods of purchases and income group are not associated in all three study zones. In all three study zones sales and purchases are grouped in the rainy season and late dry season for both income groups.

Relationship between ownership and sales.

The correlation between ownership and number of animals sold indicate that in the three study zones, households who own more small ruminants sold more but not in relative term.

It stems from the analysis that there is no difference in marketing strategy by income groups in the three study zones. Even in Passi where the poorer household are more likely to sell small ruminants for food than richer households, the differences in period of sale by income group was not statistically significant. A concentration of ownership also does not seem to be a solution for market expansion since in all three study zones, those who own more small ruminant didn't sell relatively more.

CHAPTER V

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Problem Setting and Research Objectives

The aim of this study has been to assess the equity impacts of both the Senegalese livestock policy and the factors affecting purchases and sales of small ruminants. It was also to assess the potential for market development through more production and more sales of small ruminants, within mixed farming systems in the Peanut Bassin. This has been done by determining the relative importance of livestock to different income groups of rural households, and then relating household socioeconomic characteristics such as total revenue, crop income and off-farm income to livestock ownership. Then the rest of the analysis has focused on small ruminants as they have been identified as more important to the poor in term of distribution than cattle.

A comparative approach has been used to analyze the small ruminant income of different income groups of rural households in three study zones (Niakhar, Colobane and Passi) and to assess how their welfare is affected by a price depressing policy on small ruminants. The effect of ethnic group on small ruminant production and transactions has also been evaluated. Finally factors (periods, location, partners, place) that might affect the purchases and sales of small ruminant have been analyzed.

5.2 Principal research findings

Two groups of constraints have been identified: these are marketing constraints and production constraints, since they have been already discussed in previous chapters, they will be summarized briefly.

5.2.1 Production

One basic measure of productivity is the offtake rate. There are many definitions of offtake rate, the one we used here includes subsistence and sales. Traditionally the offtake rates have been considered very low, both for cattle and small ruminants in the Sahel. The reason given by officials to explain these low offtake rates are various, but in many cases it is related to the conservatism and "lack of interest" of producers (Raikes, 1981) to sell livestock. Looking back at poor production performance documented in chapter III, one may doubt any validity of this assertion, since it is clear that high mortality rates in Niakhar and Passi can preclude more sales. Although the ethnic group Serer has poorer production performance, there is no indication that this is related to their tendency to accumulate small ruminants because they have nearly the same average small ruminant holding as the other ethnic group, in contrast for cattle they have higher holding than the other ethnic group which may affect the resources they devote to small ruminant activities.

Overgrazing is another factor that contributes to low offtake. We mentioned in the third chapter that an almost inevitable outcome when land is communally owned and livestock privately owned, is overgrazing. Another reason for livestock accumulation is the attitude of farmers

towards uncertainty: large herds have higher probability to withstand droughts and diseases and therefore to be reconstituted after a disaster (Raikes, 1981).

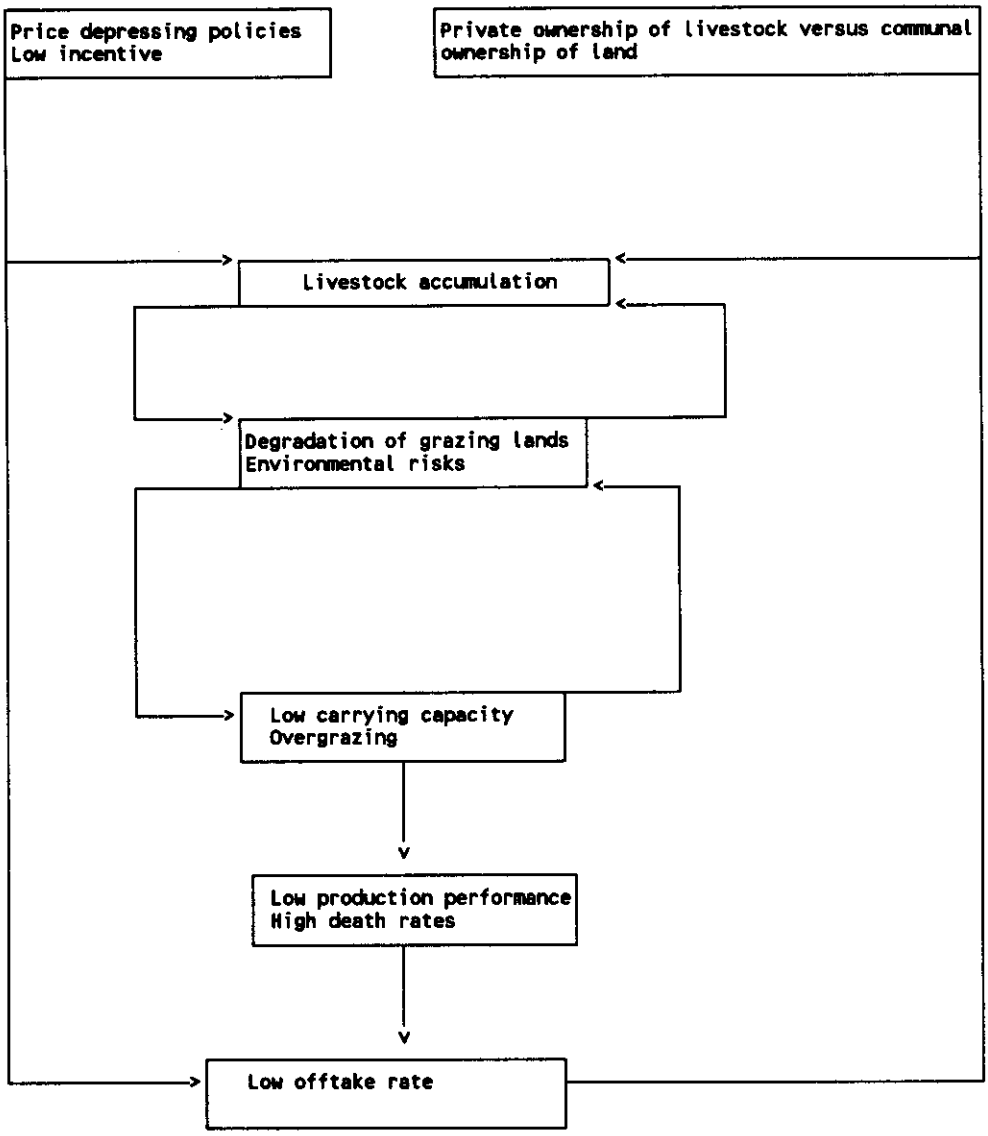
> The motive of herd accumulation seem obvious enough once one considers the situation in which most herders find themselves. On the one hand they are herding cattle and other stock on an open range, grazed in common and subject to unpredictable and unpreventable disasters every year. Since they are not able to control a large number of diseases and since the range conditions, at almost any time, require considerable hardiness from the stock, their opportunity for upgrading are strictly limited. The labor requirements of extra cattle are very small as are the costs of purchased inputs (Raikes, 1981).

Moreover, we showed earlier that the main objectives of the policy initiatives were price stabilization. This means that administrations themselves have contributed indirectly to the low offtake. Therefore, many factors other than conservatism and seeming owner irrationality explain the low offtake rates.

Figure 5.1 suggests that low offtake rates may be explained by the production conditions and the economic environment under which farmers operate. This is illustrated by the findings. The relatively high offtake rate observed in the zone of Colobane is due the lower small ruminant death rates, higher incentive for farmers, lower stocking rate than in the zones of Niakhar and Passi where death rates are higher than offtake rates.

A corollary of the low offtake rates is the low level of non-labor input use. In all zones cash incomes generated by small ruminants is particularly low, this results in the low quantities of non-labor inputs used per unit. Poorer farmers' value of non-labor input expenditures is 1/3 of the richer farmers' in Niakhar, this ratio was 1/2 in Passi and

Figure 5.1 Combined Effects of some Factors Affecting the Offtake Rate



2/3 in Colobane. This suggests that poor households are less likely to take advantage of the seasonal price increase since at ceremonies like Tabaski the high quality fattened sheep (which requires high quality feed and concentrates) are preferred. A price depressing policy would certainly reduced their cash earning and further decrease their level of input expenditures.

5.2.2 Marketing

We have seen that a price depressing policy hurts richer households more than poorer households, and that factors affecting the purchase and sales of small ruminants are not different among income groups. More generally, we can say that poorer households and richer households have the same strategy of purchases and sales of small ruminants. Therefore, as far as small ruminants are concerned, the major cause of income disparities turns out to be the relatively low productivity of poorer households due to their low level of input use and therefore the higher vulnerability of their stock to diseases and other disasters.

Figure 5.1 shows that marketing constraints are not independent from production constraints, in fact they are closely related. The traditional perception that farmers are not interested in selling is confronted with the question are they able to respond to price incentive? We have found that ownership and offtake rate are not correlated. The likely reasons are given in Figure 5.1. which shows that price incentive is not the only factor that affect offtake rate. Various other factors such as overstocking, pasture degradation, death

rates that might act alone or combined, clearly affect the farmers ability to respond to price incentive. The variation of small ruminant income among zones is mainly due to difference in productivity rather in producer price. The overall poor performance of Passi and Niakhar are to be related to the high stocking rate. Therefore, low offtake rates are not necessarily explained by unwillingness to sell. In order to expand the small ruminant market the first step should be to assist farmers to be able to respond to market incentives.

5.3 Recommendations

Most of the following sections will focus on improving the production and marketing of small ruminant. The findings suggest that feeding, credit, animal health and incentive are factors necessary to develop small ruminant production and marketing. Therefore, there is need to add production oriented policies to complement the current consumer oriented policies.

5.3.1 Intensification / Semi-intensification

According to Jankhe (1982), demand for livestock is growing and apparently cannot be met by supply from the prevailing traditional production systems. The improvement of productivity is therefore crucial to self-sufficiency in small ruminant products. As shown in previous sections, in order to improve productivity it is necessary to either control the number of animals in the grazing lands or to produce fodder or other animal feed. The former relates to the general subject of pastoral management, although crucial to livestock development it is beyond the scope of this thesis. The latter relates to intensification.

Intensification and semi intensification are alternatives to the prevailing extensive production systems which have reached their limit of sustainability in most areas (Plan d'action de l'élevage, 1988). An extensive production system is a system where livestock graze throughout natural pastures. In Senegal, pastures are communally owned and their productivity depends exclusively on rainfall. Therefore they are subject to environmental risks: droughts and overgrazing. In contrast, in an intensive production system livestock are hand-fed throughout the year (Holtzman, 1982). A semi-intensive system includes intensive and extensive production. Cultivated fodder, agricultural by-products and concentrates are the major resources available for intensification.

Cultivated fodder

Through programs of fodder cultivation many exotic species of fodder have been introduced in Senegal: *Brachiaria ruziziensis*, *Panicum maximum* and *Stylosanthes Guyanensis* (Granier, 1983). However, their impacts on livestock production have been very limited. The failure of these attempts to introduce exotic varieties of fodder are given by (Lhoste, 1987):

-Non availability or prohibitive costs of the seeds,

-Complicated cultural technique or incompatibility with the farmers' production technique,

-lack of adaptation of the species to the conditions of the farm, etc...

Elsewhere, in Kenya for example one cause of failure of the fodder cultivation program was the lack of adjustment to the seasonal labor requirement (Raikes, 1981). All these failures suggest that the

technology development extension approach was not effective, and that local conditions have to be more effectively considered.

It is important to always take into account the farmers' agroclimatic and socioeconomic conditions for the successful adoption of any technological component (Byerlee, 1987), although this is well known it has been difficult to implement in most fodder cultivation programs in Senegal. The farming system research approach with on-farm trials seems to be an appropriate method which take into account farmers constraints.

Agricultural by-products

The potential for intensification in Senegal is illustrated by the availability of agricultural by-products. The value of the total annual production is above 20 billion FCFA in 1988 (plan d'action de l'elevage,1988). The major products are groundnut hay, groundnut hulls and more concentrated products such as groundnut cake, cotton cake cotton grain etc... Some by-products are not known by farmers and others are simply wasted (Plan d'action de l'elevage,1988).

Table 5.1 Some Agricultural By-products in 1000 tons

Groundnut Hay	Groundnut Cake	Cotton Cake	Molasses	Wheat Wastes	Rice Wastes
1500	300	5	30	23	3

Source: Adapted from the plan d'action de l'elevage 1988.

Some of the agricultural by-products such as groundnut cake and molasse are not locally profitable as animal feed if we consider their opportunity costs or alternative uses. These are mainly exported, only less than 10% of the production of groundnut cake and molasse is available in the local market. This suggests that for intensification to work the price of sheep and other livestock may have to rise at a certain level, which in turn may require sound import and export policies[13]. There is need also, as proposed in the plan d'action to lift taxes on imported animal feed.

> Conscious development efforts are apparently required in addition to general economic conditions to establish an intensive livestock production industry based on the feeding of by-products. (Jankhe, 1982).

5.3.2 Animal Health

The high death rates discussed in chapter III suggest that something needs to be done in the field of small ruminant health. Each year, a growing number of small ruminants die (Plan d'action de l'elevage, 1988). Therefore research on small ruminant health is potentially a high payoff investment. For farmers organized into G.I.E or other associations, training program for auxiliaries in animal health and the creation of local veterinary pharmacies should be considered.

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[13] A study of the prevailing intensive and semi-intensive production systems in 1987 (Plan d'Action de l'Elevage 1988) revealed that non of them was profitable if the whole sale price of beef was less than 800 FCFA per kilo. At the same time the liberalization of meat imports resulted in an invasion of the EEC's highly subsidized meat, sold at 400 CFA in Dakar, while the producer price of these meat were 1100 FCFA in Europe. Finally the government was obliged to impose an import tax on meat.

5.3.3 Farmer Associations and Credit Programs

There has always been credit programs directed toward the farmers. They have always been associated with cooperatives. Successive failures of these programs have led to their suspension by the government in 1980 and their reorganization in 1983.

Up to 1983 most of these organizations were mainly oriented toward cash crops (mainly peanut). The real focus on livestock began only with the G.I.E. in 1984. The access to credit by farmers organized into G.I.E has been, however, very limited.

As shown with the small ruminant income statement, farmers need assistance in order to face cash needs since the cash revenues generated by small ruminant activities are very low. This would help optimize input use (animal feed, concentrates and drugs vaccines). It is clear that whenever farmers face basic needs such as food, they cannot be expected to devote significant proportions of their income to input expenditures. Credit programs should take into account this factor. Credit programs might allow farmers to buy large amount of cereals preferably when prices are low. Another importance of credits is that they allow the farmers to avoid untimely sales relative to the market and to their production techniques.

Although the joint and several guarantee is crucial to the success of a cooperative in that it gives access to credit to the less fortunate, there should be a way to reward farmers who make efforts to reimburse their debts, otherwise no individual will be motivated in reimbursing their share of the cooperative credit if they know already

that other individuals won't repay. This has been one of the causes of failure of the cooperatives before the reform in 1983 (Sarr, 1988).

Another criticism against the CNCA (Caisse Nationale de credit Agricole) is that they give more emphasis to short-term credit. In 1988, only the members of AGROPOV (Association des Groupement de Producteurs d'Ovins), a cooperative sponsored by a parastatal, were provided medium-term credit. The medium-term credit is crucial to livestock development because it takes into account the biological lag that characterizes livestock husbandry and allows farmers to reconstitute their stocks. Stock reconstitution is very important because it affects the farmers' attitude toward risk, as shown in the above sections when farmers face uncertainty about their ability to reconstitute their stock, they tend to accumulate livestock which contributes to the environment degradation.

The New Agricultural Policy in Senegal has never dealt with marketing constraints. For example traders have not been encouraged to create G.I.E. Perhaps, this is justified by the fear of their potential monopsonistic behavior. But there should be a way to give them access to formal credit, otherwise they too will face liquidity problems or the need to pay high interest rates in the informal credit market. In both cases, this will tend to lower the price they would accept to offer to pay at the producer level.

APPENDIXES

A: ESTIMATING INVENTORIES AND VALUING IN-KIND COMPONENTS

A Estimation of change in inventory

Since 1989 was the only year completely covered by the survey, the income statements are given for that year. The harvest year 89 begins the first October 89 and ends 30th September 90. The October 89 inventory and the september 90 inventory had to be estimated. The censuses were conducted on May 1990 for Colobane and Niakhar and June 1990 for Passi.

To estimate the net change in inventory we used the following approach

October 89 inventory = Census inventory - Net inflow before census

September 90 inventory= Census Inventory + Net inflow after census

Net inflow before inventory= inflow before inventory - outflow before inventory

Net inflow after inventory = inflow after inventory - outflow after inventory

Change in inventory= september 90 inventory - october 89 inventory.

Those who have been involved in livestock censuses in developing countries are familiar with the difficulties of determining livestock inventories due the reluctance of producers to reveal the size of their

herd since it provides a base for the calculation of the head taxes (Eicher and Baker, 1982). Although in Senegal the head taxes have been abolished since 1970 this doesn't seem to affect the traditional suspicion on the extension agents.

The estimation is based on the assumption that all transactions have been surveyed. If October 89 or September 90 inventory was negative which is not possible it was attributed to the fact that the census inventory was underestimated. For example when September 90 inventory is negative it means that outflows between the census and September 90 are higher than inflows + census inventory which is not possible. To minimize the gaps between the real inventory and estimated inventory the absolute value of the negative inventory was added to the census inventory and the estimates were computed again. Therefore the change in inventories calculated can be considered a lower estimate.

B Valuing in-kind components

Gifts received were valued at the average purchase price for similar items. Gifts given out were valued with the average sale prices. Although these transactions were valued they were not included as income. Home consumption was valued using the average sale price. To value the change in inventory the animals involved in the 1989 transactions were divided into categories matching animal categories in the inventory. Animal categories are characterized by factors such as race, age and sexe that influence the market value and the economic life of the animal. Within a category, prices are likely to vary only

slightly. In Senegal for example 8 small ruminants (4 for goats and 4 for sheep) and 10 cattle categories are used. The categories used here are somewhat different due to the nature of the survey and the data requirement. For example we didn't use age groups for small ruminant, instead sex and type of small ruminant (goat or sheep) were used. The average sales price per category for the year 1989 were then used to value the beginning and ending inventories.

Beginning and ending inventories were valued with the same annual average sales prices, since monthly sales tended to be very low, thus it was quite impossible to have an average sale price per category and per month. The average prices of the different categories used are given in the table below.

Table A1. Average Sale Price (in FCFA) of Animals Categories Used to Estimate the Value of Change in Inventories

Small Ruminant Type	Sex	Niakhar	Colobane	Passi
		(Average Sale Price)		
Sheep	Male	27625	20388	17500
Sheep	Female	6000	8430	6666
Goat	Male	13285	6200	6235
Goat	Female	6548	5875	6611

Source: ISRA/IFPRI.
Note: Data cover October 1989 through September 1990.

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