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## ABSTRACT

### Economic Comparative Advantage and Incentives in Livestock Production and Trade in West Africa's Central Corridor

by

Jeffrey Metzger and Andy Cook with Ashley Timmer

January 1994

This three volume study evaluates the economic value of ruminant livestock production (cattle, sheep and goats) and the prospects for livestock trade in West Africa's central corridor: Mali, Burkina Faso, Ghana and Côte d'Ivoire. It finds that despite poor performance in the recent past, the prospects for the ruminant livestock sector of the central corridor are good.

The report identifies a number of issues confronting regional livestock trade, including:

- competition from agriculture for resources as rural populations increase;
- competition from cheap extra-regional sources of red meat; and
- until January 1994, overvaluation of the Sahel's currency.

Several components of a strategy for the sector are suggested, including:

- measures to reduce market taxation of livestock marketing, simplify administrative procedures, and discourage collection of illegal fees by public authorities;
- measures to improve market efficiency and reduce the number of links between the producer and the final consumer;
- investments in feed supplementation, animal health and management to increase productivity; and
- steps to improve and differentiate product quality and differentiation. the economic value of ruminant livestock production and the prospects for livestock trade in West Africa's central corridor: Mali, Burkina Faso, Ghana and Côte d'Ivoire.

The study is part of a series of research sponsored by USAID to examine prospects for regional integration in West Africa. Also see *Regional Economic Integration in West Africa: Potential for Agricultural Trade as an Engine of Growth in the Subregion and Exchange Rate Policy and Implications for Agricultural Market Integration in West Africa*, both by J. Dirck Stryker and B. Lynn Salinger.

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RESOURCES AND DEVELOPMENT**

**ECONOMIC COMPARATIVE ADVANTAGE AND  
INCENTIVES IN LIVESTOCK PRODUCTION AND TRADE  
IN WEST AFRICA'S CENTRAL CORRIDOR**

Volume 1  
Principal Report

January 1994

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## Preface

This study has been sponsored by the Office of Sahel and West African Affairs of the United States Agency for International Development as part of the Consulting in the Analysis of Economic Reform Project (PDC-0095-Z-00-9053-00). The work for this report was undertaken between September 1992 and August 1993.

In addition to the principal investigators, Jeffrey Metzler and Andy Cook, the study team included Kwaku Owusu Baah, of the University of Ghana at Legon, Dr Mody Bakar Barry of Centre Ivoirien de Recherche Economique et Social (Abidjan), Boucoum Kolado of the Malian Ministry of Agriculture (Bamako), and Dr Zerbo Kassoum of the Faculty of Economic Sciences at the University of Ouagadougou (Ouagadougou). The four country consultants collected the primary data used in the scenario analyses of the report and prepared the country reports presented in Volume II of this study.

The study team would like to express its appreciation to USAID for sponsoring this "unsolicited" research. Furthermore, it thanks officials of each of the national governments, the Club du Sahel, the Comité Inter-état pour la Lutte Contre la Secheresse du Sahel, as well as the many private individuals who cooperated with by providing information and guidance to the study team. The principal investigators also thank each of the country consultants for their enthusiasm and valuable contributions towards the completion of this study, and the AIRD research assistants: Ashley Timmer for helping with the computer modeling and analysis efforts and Elaine Tinsley for editing and production of this report.

A final note: since the completion of this document in December 1993, the CFA franc was devalued as called for by the policy conclusions of this analysis. However, because the economic analysis was based upon real rather than nominal exchange rates, the results of the analysis remain valid. Moreover, since this devaluation has removed a major policy obstacle to the sector, realization of the economic potential identified for livestock in the central corridor is all the more feasible.

## EXECUTIVE SUMMARY

### ECONOMIC COMPARATIVE ADVANTAGE AND INCENTIVES IN LIVESTOCK PRODUCTION AND TRADE IN WEST AFRICA'S CENTRAL CORRIDOR

This study is part of a series of research efforts sponsored by USAID to examine prospects for regional integration in West Africa. Ruminant livestock is particularly important because it is the principal regionally traded agricultural commodity. Moreover, despite relatively stagnant production in the last decade, livestock production and marketing still account for an important component of the Sahelian countries' gross domestic product.

A number of issues confront efforts to promote regional integration. Traditional livestock production in the region suffers from increasing competition from agriculture for resources as rural populations increase. Overvaluation of the Sahel's currency (the CFA franc) has contributed to an erosion of competitiveness in its principal coastal markets. Competition from cheap extra-regional sources of red meat have further weakened the Sahelian livestock industry. These problems have raised fundamental questions about the economic viability of West African livestock production. Some fear that because of the factors noted above, the Sahel is losing competitiveness in its traditional market in coastal West Africa.

A perception of declining competitiveness has spawned proposals to protect the regional livestock industry through national and regional trade measures. However, a common regional strategy to protect the sector from world markets must accommodate different interests of the livestock exporting countries of the Sahel and the meat and livestock importing countries on the coast. It must also address policies which impede a regional livestock market, including legal and illegal taxation of intra-regional movement of animals.

## OBJECTIVES AND APPROACH

In light of these issues, the objectives of this study are to evaluate the region's comparative advantage in livestock production, the impact of public incentives on production and marketing, and the prospects for regional livestock sector policy coordination to improve the health of the regional livestock economy.

The study focuses on the ruminant livestock sector in Mali, Burkina Faso, Côte d'Ivoire and Ghana, which lie in what has been called West Africa's *central corridor* for livestock trade. Ruminant livestock - cattle, sheep and goats - move in this corridor from Mali and Burkina Faso, which are surplus producers, to Côte d'Ivoire and Ghana, which are deficit producers.

The study examines recent trends in production, consumption and trade in the central corridor to determine important forces operating on the sector. It then applies Domestic

Resource Cost and Effective Protection methods to measure profitability, protection, and comparative advantage for scenarios linking specific production systems with alternative marketing and processing channels. In the context of these results, the study also examines projections of supply and demand for livestock products in the region through the year 2005 in order to reach long run recommendations for national and regional public policy.

To a large extent, the study analyses are built on data from previous research. However, little information is available on a number of issues, particularly with respect to livestock production costs. Therefore, the study uses modeling techniques to simulate herd production based on secondary data from such sources as national Livestock Services, international research institutes and various production projects in the region. In addition, current information on factor opportunity costs, market prices and transaction margins have been gathered by local consultants in each country through rapid survey methods.

## **TRENDS IN CONSUMPTION AND PRODUCTION**

### **Red meat**

Overall, the livestock market of the central corridor of West Africa has stagnated over the past decade. Per capita consumption of livestock products has fallen in all four countries of the central corridor in comparison to the peak levels of the 1970s because of the declining per capita purchasing power of the population. On the other hand, population growth has sustained gradual growth of overall demand for livestock products.

Observers of Côte d'Ivoire and Ghana voice concerns that, in both countries, demand for Sahelian livestock is drying up. Against a background of increasing domestic production, imported meat has partially replaced meat derived from Sahelian animals in Côte d'Ivoire, where imports increased from negligible to appreciable values in the mid-70s and became the most important source of red meat in 1988. In Ghana, livestock imports from the Sahel have also been displaced, but by local production, rather than red meat imports.

An increase in meat imports to Côte d'Ivoire followed a significant drop in livestock imports from the Sahel after massive distress sales during the first half of the 1968-74 drought. The reduced Sahelian livestock supply also coincided with low prices on the world market for red meat and a strong Ivorian economy based largely on buoyant cocoa prices. Together, these factors induced significant inflows of meat from the world market, initially mostly from South America.

This trend reversed in the early 1980s when depreciation of the CFA franc in the early 1980s impaired Ivorian purchasing power and brought a reduction in meat imports. Drought once more increased the supply of Sahelian animals on the Ivorian market during 1984-85. However, herd rebuilding following the drought shrank Sahelian supply again. This effect, combined with increasing subsidies on European Community meat exports, caused Ivorians to sharply increase their consumption of animal protein from the EC.

Meanwhile, over the eighties and early nineties, production growth in the region has stagnated. This stagnation may be explained in large part by increasingly severe pasture biomass constraints. Increasing human populations across the region and the consequent expansion of agriculture into formerly pastoral areas have reduced the pasture resource base. Moreover, rapidly growing human populations in the Sahel have raised demand within the Sahel for livestock products, thereby further reducing the exportable surplus. Finally, productivity of West African livestock has not improved perceptibly over the past two decades and lies well below current norms in other parts of the world. Public sector attempts to improve productivity through a variety of animal production, animal health, and range management interventions have proven largely unsuccessful.

### **Milk**

Milk production in West Africa has fallen further behind population growth than in any other region in sub-Saharan Africa. By 1988, production per West African inhabitant had fallen to scarcely 60 percent of its 1966 level, while imports increased nearly six-fold. However, most import growth took place in the period up to 1977 and, in fact, during the 1977-88 period West African imports from the world market dropped at an average annual rate of 1.6 percent.

Commercial imports of dairy products have penetrated more quickly and deeply into the central corridor than meat imports, although important differences exist in milk consumption patterns among the four countries. As would be expected, the Sahelian countries have much lower imports than the coastal countries due to the larger size of their domestic herds. However both Mali and Burkina Faso have become significant net importers since the drought of the early seventies. Also, all countries but Côte d'Ivoire received significant contributions of milk as food aid during the early 1980s although this assistance has fallen off since the 1988. Meanwhile, Ghana's per capita consumption levels are one tenth those of the other three countries.

## **THE ECONOMIC BASIS FOR RUMINANT PRODUCTION**

The economic analysis has suggested that despite stagnation, there exists a strong comparative advantage for Sahelian livestock production in competition with world markets for meat exports to coastal West Africa, and for delivery of dairy products to local populations within the Sahel.

Moreover, higher productivity in Sahelian production systems in comparison to coastal systems is approximately offset by lower costs associated with shorter marketing chains from coastal producing zones to common consumption centers. Thus traditional systems throughout the central corridor have approximately the same degree of advantage in competing with imports from world markets in coastal cities. Only relatively intensive peri-urban dairy production shows weak economic profitability in competition with world markets.

The analysis shows that marketing costs for live animals have fallen as a component of final product costs over time and are relatively consistent across modes and countries. Trekking remains the least expensive form of transport in Sahelian countries, but has lost market share to trucking because of convenience, security and a narrowing of cost differences.

Fattening in small private schemes appears to provide positive economic value added, although marginal benefits are lower than for production without fattening. Therefore, fattening under such schemes represents an attractive area for investment to increase meat production on the intensive margin as demand for meat products increases.

The possibility of exporting red meat beyond the traditional coastal market may exist. However, such a scheme is dependent on lowering the costs of air transport to more distant markets, improving the value of the product sold and meeting health and sanitation restrictions on world markets. These requirements are not likely to be met in the near future but provide long-run objectives for developing the region's livestock industry.

The comparative advantage for ruminant livestock as a substitute for world import is robust, even with substantial increases in labor or capital costs, or significant reductions in productivity or world meat prices. However, they rest on the assumption of no economic costs to range, pasture, fallow and crop residue biomass, although other direct or implicit costs in obtaining access to these feed sources, such as grazing fees or exchanges for manure or milk, have been incorporated in the analysis. This assumption reflects the lack of a market for these low quality feed sources (except in urban areas).

The analysis uses historically low, but unsubsidized world prices to evaluate the economic reference price for livestock products. This assumption does not reflect the reality of heavily subsidized European meat currently entering West African markets. However, these subsidies are not expected to persist in the intermediate future due to the fiscal burden of continuing the subsidies in Europe, on the one hand, and the likelihood that under GATT, these subsidies will be discontinued, on the other. Yet even if current subsidy levels are incorporated into the analysis, most production systems remain weakly competitive.

## **THE IMPACT OF NATIONAL POLICIES ON THE REGIONAL LIVESTOCK SECTOR**

The past decade has witnessed a retrenchment of public initiatives in the livestock sector which has been manifested by the reduction, liquidation or sale of most of the large meat production, marketing and transformation parastatals that all four governments had established during the previous decade. Simultaneously, large livestock development projects have nearly vanished as donors have become disenchanted with their typically poor performance. Lastly, all four governments have taken measures to liberalize the functioning of livestock input and product markets, and to spur private sector actors to play a greater role in these markets.

In this context, remaining policies affecting the sector are composed primarily of border taxes on livestock products and a combination of minor subsidies on inputs to production and taxation of livestock marketing. The analysis has demonstrated that taxes in transport and marketing represent the most important policy impact on livestock sector costs. They are only minimally offset by subsidies in all countries on animal vaccinations. Overall, these input taxes make up between ten and twenty percent of total production and marketing costs. A component of these taxes is illegal taxation which typically is applied to live animals traded in the corridor. The analysis has demonstrated that these taxes are not strongly significant in changing the incentives to trade, although they may alter the routes and modes of transport used.

Border policies affecting livestock product prices are of two sorts. Borders between the countries in the region have relatively low or nonexistent levels of taxation for animals leaving the Sahel and entering the coastal countries. On the other hand, Ghana and Côte d'Ivoire have relatively high border taxation protecting their markets from world prices. These policy differences result in Sahelian country production receiving much less protection than coastal country production from policies of their respective countries. From a regional perspective, however, coastal country policies also protect the products of Sahelian countries that are sold in coastal markets and, as a result, there is a relatively consistent regional level of official protection for livestock systems of all countries. This illustrates the important benefit to Sahelian countries of coastal country border tariffs.

Coastal countries do not benefit in a similar way from Sahelian policies, and therefore they have much less at stake in maintaining unrestricted livestock trade in the region. To date, due to other links of trade, currency, language, history and political ties, Côte d'Ivoire has been willing to allow relatively unrestricted intra-regional trade, while sustaining moderate border protection against world markets to protect its own livestock industry. In contrast, Ghana has shown much less interest in promoting regional trade. The current health quarantine policy for live animals, for example, serves as an effective prohibition of official trade because of the high transaction costs involved. These restrictions have not caused more tension only because, given the relative currency overvaluation in the CFA zone, financial incentives to trade livestock to Ghana have not existed.

For the CFA zone countries, the overvalued exchange rate has the most important negative effect on levels of protection for ruminant livestock. This disincentive is only partly offset by tariff measures to protect coastal markets, such that when both are taken into account effective protection levels for selling ruminant livestock to both Accra and Abidjan are negative. Given these results, the analysis concludes that the cumulative effect of all public policies, inclusive of overvaluation and product protection policies, and taxation or subsidization of input costs, is to discourage West African production of livestock. Sahelian systems are penalized more strongly by this problem because of higher tradeable costs, principally for fuel and vehicles used in transport necessary to take their animals to coastal markets.

## **PROSPECTS FOR CENTRAL CORRIDOR MARKETS FOR LIVESTOCK PRODUCTS**

Projections of supply and demand have illustrated, even in the most pessimistic scenarios, a rapid rise in demand for ruminant livestock in all four countries due to rapid rates of population growth. Moreover, under all except hypotheses of negative income growth, demand will outstrip regional growth in production for ruminant livestock products even assuming that substantial gains in productivity can be achieved. These conclusions clearly demonstrate that there is no long-term threat of the coastal market for Sahelian livestock demand drying up.

On the contrary, based on past trends, projections suggest that unless Sahelian countries can raise productivity in livestock production significantly, within several decades they may be unable to meet their own internal demand for livestock products.

While the analysis does not concentrate on non-ruminant livestock products, these have the potential to accommodate much of the unmet protein demand created by rising populations and income. In particular, poultry and pig production can be expanded with few constraints assuming that regional and world trade in feed inputs are not restricted.

Thus, despite the inevitability of rapidly increasing demand for livestock products in the region, the prospects for livestock trade within the corridor are poor if current trends continue. This can only be reversed if cattle and small ruminant surpluses in the Sahel can be increased.

## **POTENTIAL FOR RUMINANT LIVESTOCK PRODUCTION AND MARKETING**

While projections of past trend performance do not predict sufficient production growth to meet expected increases in demand for the central corridor region, the analyses of comparative advantage suggest a natural advantage for regionally produced ruminant livestock in coastal markets. This comparative advantage suggests that there is still significant potential to raise livestock sector production economically, particularly in the semi-arid and sub-humid zones. In these zones, production growth can come at the extensive margin from increasing herd numbers, or at the intensive margin by raising herd productivity through the use of commercial inputs. Improving market efficiency may also increase opportunities.

### **The expansion of livestock production**

The evaluation of different types of livestock producing systems found in the central corridor illustrates a continuum in the process of herd growth potential. Biomass availability will allow for considerable growth in herd size in all but the arid zones of the corridor, while disease and poor feed quality effectively rule out herd growth in humid areas. However, in the remaining semi-arid and sub-humid zones, considerable potential for herd growth exists.

Livestock herd growth is occurring in the semi-arid and sub-humid zones primarily in association with agriculture. These mixed farming systems offer a more diversified use of resources, and therefore a more secure livelihood. Livestock can contribute to this association through animal traction, manure, and the generation of a cashflow to finance agricultural investments. In turn, animal production benefits from crop byproducts production, access to fallow lands, and reduced disease threats in areas kept cleared for agriculture. A second and related trend in herd growth is the movement of herd concentrations southward as the limited resource base in the arid zones is increasingly constrained. As a consequence, livestock numbers have risen in the semi-arid and sub-humid zones. Two severe droughts in the last two decades have accelerated this movement into southern zones for survival and many have not returned north.

The analytical results of the study suggest that transitions to sedentarization, and settlement of the wetter semi-arid and sub-humid environments need not reduce the economic viability of livestock production. However, this conclusion is based on a static analysis of current conditions in these zones and does not capture the impact of changes which may accompany this transition. For example, disease threats, particularly trypanosomiasis, must be reduced before livestock can be sustainably produced in the more humid areas at arid-zone levels of productivity. However, without public support, livestock herd growth cannot be expected to outpace the level that can be accommodated in conjunction with agricultural expansion in the sub-humid zone. Labor resources may also become more constraining with increasing integration of livestock and crop agriculture. Under certain conditions a labor constraint may lead to further livestock integration with farming through animal traction, while in others it may result in greater specialization in livestock rearing. Environmental problems associated with increasing animal densities, such as soil erosion due to the denuding of land with overgrazing, and water contamination from animal use will also inevitably occur. However, given the high economic value of systems which are already practiced in these zones, the prospects are good that herd growth in the semi-arid and sub-humid zones will continue to retain a net economic benefit, despite these extra costs.

### **Intensification**

Production "intensification" as defined in this study concerns the use of commercial inputs, primarily feeds, in livestock production. This process represents another strategy for increasing the potential of the livestock sector in the central corridor. The analysis suggests that with feed intensification the margin of comparative advantage is reduced and that increasing reliance on commercial feeds will eventually eliminate any comparative advantage. On the other hand, the results also demonstrate that feed intensification can substantially increase the net economic benefit to the livestock sector under certain conditions for fattening, dairying, or if it results in improvements in overall herd productivity.

## **Market reorientations**

Costs of marketing animals from areas of surplus in the northern part of the central corridor to consumer markets in the south are an important component of total livestock product costs. The predominant mode of transport has undergone a complete transition from trekking to trucking in the last two decades, while rail remains an economically feasible alternative in Burkina Faso, although problems with access to and reliability of service have reduced its use. Unit transport costs appear to be fairly competitive across routes and modes, although within Burkina Faso and Ghana costs are higher than in Mali and Côte d'Ivoire because of greater explicit and implicit taxation of transport. This suggests that costs in marketing to Accra can be reduced if various official and illegal taxes imposed on the trade of live animals were lowered. Also, an increase in the volume of animals marketed from the Sahel to Accra may further reduce costs as economies of scale develop.

Aside from the marginal cost savings to marketing, another option for raising the potential for meat sales is to seek new markets for these products. However, this strategy must rely on a differentiation of products to take advantage of the price premium placed on certain cuts of meat. Exporting carcass meat to Middle Eastern markets shows only weak potential for economic profitability, even if health restrictions are ignored. With greater product differentiation and more competitive transport costs, meat exports could become more attractive, but market entry would still depend on the ability of the region to meet foreign market health standards. However this is not likely in the near future without large additional expenses.

## **A STRATEGY FOR THE SECTOR**

This study has suggested that demand for livestock products will increasingly exceed the central corridor region's ability to produce them. At the same time, ruminant production has been shown to hold a strong competitive edge against world trade. Ironically, the overall effect of policies affecting ruminant livestock has been shown to penalize production and trade in livestock, both at a national and regional level. Under these conditions, projections for production growth are low, and are expected to derive primarily from gradual expansion of herd numbers into higher rainfall areas, with increasing integration with crop agriculture. This situation calls for a regional strategy to promote more rapid livestock production through measures to redress negative effective protection from the sector, encourage more rapid stock increases and promote higher herd productivity. Several components of this strategy which have been raised in this report are addressed below.

### **Common regional protection**

Distortions to common border protection currently exist because of the CFA franc overvaluation with respect to foreign currencies. Thus, although Ivorian and Ghanaian official protection levels are roughly equivalent for red meat, market prices, compared at official exchange rates, are higher in Côte d'Ivoire due to its greater dependence on taxed imports from

world markets. On the other hand, because Ghana imports little meat, its internal market is largely unaffected by border protection such that internal meat prices are relatively low. As a result, the region supplies little livestock to the Ghanaian market, finding The Ivoirien market more lucrative.

A common border policy is required to create a consistent level of protection from world markets for livestock products of the region. This protective barrier has been shown to be important because of the practice of the EC and other world exporters to "dump" livestock products on world markets. This barrier be consistent across countries if distortions in intra-regional trade are to be removed.

### **Devaluation**

In this context, the most important policy response to promote the livestock sector of the region is to rectify the distortions caused by the overvalued CFA franc. Direct devaluation would produce the most direct correction of this problem, although to do so may be politically infeasible. Short of actual devaluation, the best hope for the Sahelian countries is to continue to rely on border protection by coastal countries. This scheme is feasible if further border protection is acceptable to the coastal countries. However, increasing border protection or devaluation will raise costs to consumers and with it their protests.

### **Unrestricted intra-regional trade**

Direct and indirect taxation of livestock marketing from interior zones of production to coastal consumption points represent more than 10% of total costs and over 30% of marketing costs. Measures are needed in all countries to reduce market taxation, simplify procedures, and discourage collection of illegal fees by public authorities. Already initiatives are being taken under the "Sikasso initiative", and a multi donor sponsored action plan to take these measures. In addition, consideration should be given to reducing the high indirect taxation of livestock marketing resulting from taxation of transport fuel and vehicles.

### **Increase market efficiency**

Given high unit transport costs, the multiple stages and intermediaries in Sahelian livestock marketing, and the long distances between production and consumption points for animals, both Sahelian countries should take further measures to improve market efficiency. With increasing use of trucks, changes in the structure and conduct of livestock marketing should be anticipated and promoted. These changes will ultimately reduce the number of links between producer and final consumer, and in so doing, reduce market margins. To facilitate these changes, market infrastructure designed to accommodate the special needs of trucked animals may be needed. More importantly, policies which slow trucking transit times should be

eliminated. In addition, Burkina Faso should examine how to better use the railway to Côte d'Ivoire to provide a more competitive transport alternative to the coast.

### **Promote rational input use**

Commercial feed use has been shown to be minimal in most ruminant production systems, but shows promise as a supplement for increasing herd performance, milk production and for fattening. Policies affecting feed prices are going to become increasingly important as intensification proceeds. Introduction of these feeds will increase producer dependence on markets and will raise production costs. However, subsidies for commercial feed use to promote production can encourage overstocking of range lands and eventually stimulate production beyond economically or environmentally beneficial levels. With increasing integration of livestock and crop production, a number of additional inputs will become more important (eg. additional medications, insecticides, enclosures/pens etc.). Given the novelty of many of these technologies to traditional production systems, public assistance in the rational use of these relatively new inputs will be needed.

More broadly, with the progression of livestock-crop integration, and of increasingly intensive livestock production, a need to develop new techniques of production adapted to the particular conditions in each region will be required. Some specific production issues which have not been adequately examined in this study include optimal use of crop byproducts in ruminant production; cost effective control of trypanosomiasis; and management options to address labor and land conflicts between livestock and agriculture. Public investments in research and extension will be required to address these and other issues which will occur on the extensive and intensive margins where this production growth will occur.

### **Promote product differentiation**

The analysis illustrates the disadvantage faced by regional livestock in competing with low-quality meat imports. It has been suggested that locally-produced livestock products be better differentiated in marketing so that higher prices can be obtained in more lucrative markets for the high quality portion of these products. This would require identification of prospective markets, investment in the processes and training necessary to supply differentiated products, and promotion of these products. In the case of red meat in particular, establishment of production/slaughtering schemes which will meet the necessary health standards to penetrate prospective markets would also be necessary. This process of differentiation should create opportunities for other value-added activities in meat and milk sectors, including canning, drying or freezing meat, and manufacturing milk derivative products. Such schemes will require significant private investments and may not be immediately feasible. However, small steps to improve and differentiate product quality will create conditions in which greater value can be obtained from the livestock sector's product.

## **FINAL REMARKS**

Despite poor performance in the recent past, the prospects for the ruminant livestock sector of the central corridor in West Africa are good. Rapidly growing demand for livestock products will create an opportunity for expansion of the sector, and economic analyses suggest that it can competitively meet this challenge, although the resources to do so will come less from traditional pastoral systems and increasingly from agricultural zones in the semi-arid and sub-humid tropics.

However, growth of herd numbers in these regions must be accompanied by productivity increases if regional livestock is to retain its share of the regional meat market. Productivity growth will require investments to improve feed supplementation, animal health and management. These investments are only likely to be made if the disincentives of current policies are removed. Most importantly, the negative protection afforded by currency overvaluation in the CFA franc zone must be redressed. In turn, these requirements challenge the donor community to assist in reinvigorating livestock production in the region through investments to raise productivity, and through sponsorship of reforms to correct current negative protection.

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# CHAPTER I

## INTRODUCTION

### I. BACKGROUND

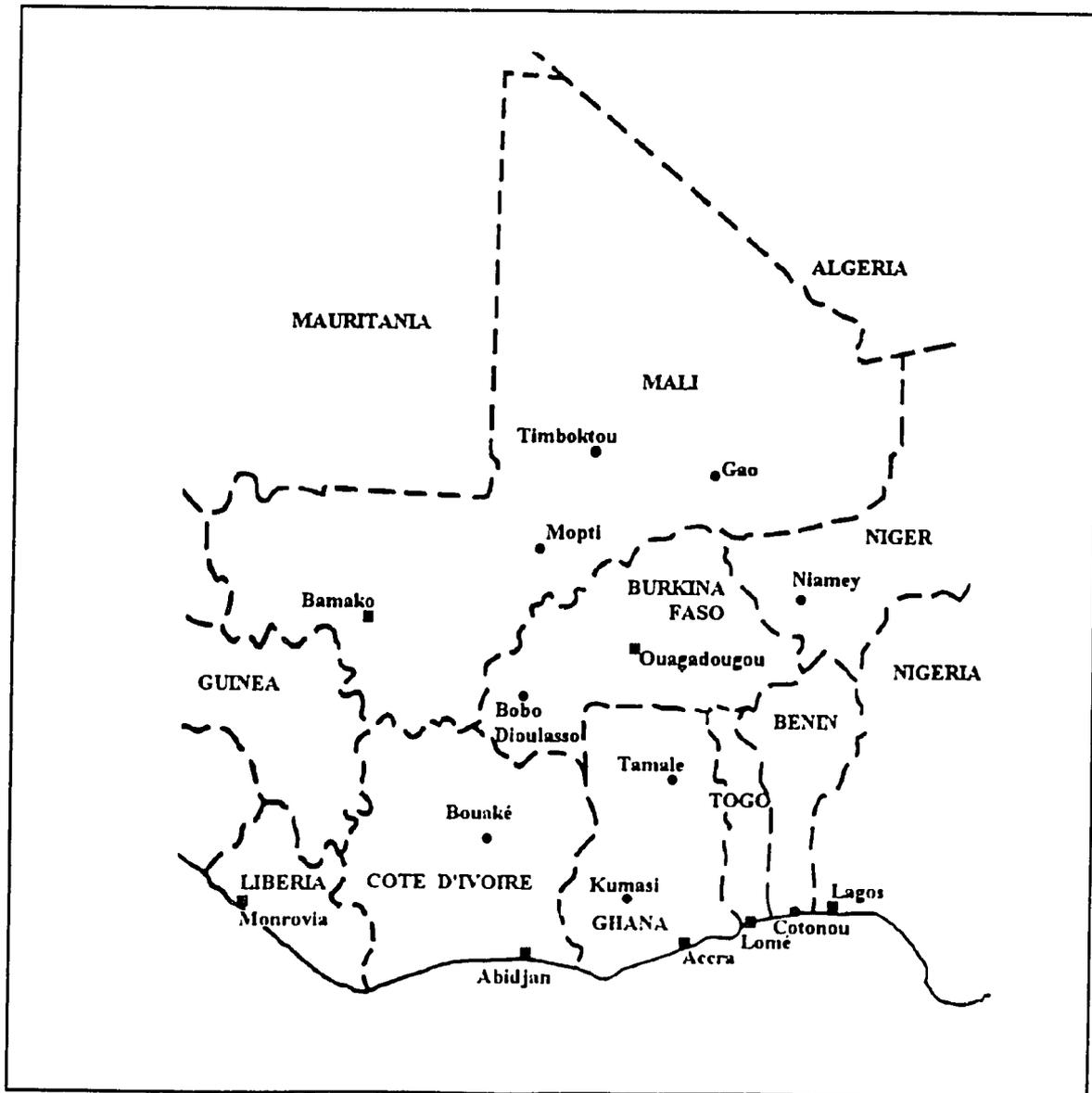
This study has its origins in a 1991 meeting in Washington sponsored by the Club du Sahel and USAID's Regional Office for the Sahel which focused on donor activities in livestock in the region. Participants came to this meeting recognizing the importance of the livestock sector to the Sahelian countries' economies, but aware that past attempts to promote it, primarily through regional development projects and assistance to national livestock services, have had little impact. The meeting took place in a wider West African economic perspective, the development focus having shifted from a mid-1980s post-drought emphasis on aid to promote economic recovery in the Sahel to plans to integrate its economic development to the adjacent coastal countries through market linkages and regional policy coordination.

Participants raised questions about the economics of the West African livestock sector and there was a general sense of confusion about how to best increase the sector's efficiency in West Africa. Some participants voiced fears that the Sahel is losing its traditional market for livestock in coastal West Africa, placing its future in doubt. They attributed this loss to rising production costs due to competition from agriculture for factors of production, an erosion of demand for livestock products in coastal countries due to income stagnation and substitution into other protein sources, and a loss of market share to subsidized world market suppliers. Furthermore, given different interests of the livestock exporting countries of the Sahel and the meat and livestock importing countries on the coast, the prospect for a common regional strategy to protect the sector from world markets was questioned.

A number of organizations showed an interest in promoting regional West African livestock trade. The World Bank and USAID are promoting an "Action Plan" to improve the efficiency in livestock trade from the Sahel to Côte d'Ivoire, the French are sponsoring a study on trade policy and protection in all coastal West African countries, the African Development Bank has created a working group entitled *CINERGIE* to promote regional trade, and through the "Sikasso Initiative", governments of the region are sponsoring joint initiatives to promote trade in a range of agricultural commodities, including livestock. However, none of these efforts have focused on the underlying competitiveness, or "comparative advantage" of livestock production in the region, or on the implications of policies which may distort private incentives away from that "advantage". This study seeks to address these issues.

## II. OBJECTIVES AND APPROACH

The current study examines the economic value of production and trade of ruminant livestock in four countries in central West Africa, and the impact of public policies on these activities. The countries — Mali, Burkina Faso, Côte d'Ivoire and Ghana — lie in what has been called West Africa's *central corridor* for livestock trade. Ruminant livestock — cattle, sheep and goats — move in this corridor from Mali and Burkina Faso, which are surplus producers, to Côte d'Ivoire and Ghana, which are deficit producers. (See map 1)



Map 1 Countries of the Central Corridor of West Africa

The central corridor's livestock sector comprises a range of different production systems based principally on ruminants, but also including pigs and poultry. The products of each system are sold in a number of important markets in the region. The analysis of this study isolates a number of interesting scenarios of production and marketing and asks of them three key questions:

- What are the incentives to actors (producers, traders, etc) to pursue this scenario?
- How competitive is this scenario in comparison to alternatives for producing or importing the same products?
- How do government policies in the countries involved affect the scenario?

Comparisons of answers across scenarios will reveal the prospects for economic actors pursuing different technologies and strategies for production and marketing in the region. In particular, the analysis will answer questions concerning the economic competitiveness of Sahelian ruminant production systems in coastal markets in competition with imports. And it will also assess the extent to which government policies benefit the sector and the consuming populations in the region. In the context of these results, the study also examines the prospects for supply and demand for livestock products in the region in order to reach long run recommendations for national and regional public policy.

The analysis draws upon a number of works which appraise different aspects of livestock production and marketing in the central corridor.<sup>1</sup> In the area of livestock and livestock product trade, the most important of these include: Kulibaba and Holtzman's 1990 work on marketing and trade from Mali and Burkina Faso to Côte d'Ivoire; and Sarniguet's (late-80s), Ancey's (1991) and Coste et al.'s (1993) studies on the impact of meat imports on regional livestock trade. In the area of livestock production, Mayer's work (1989) on the productivity of ruminant livestock in Burkina Faso; Disset's reports throughout the 1980s on production and marketing of small ruminants in Côte d'Ivoire; Wagenaar, Diallo and Sayer's 1988 report on cattle production in the inland Niger delta; and Shapouri and Rosen's 1991 synopsis of sub-Saharan dairy trends have all been important sources for data used in the analysis. In addition, Delgado's research at Tenkodogo (1979), Milleville et al. in the Oudalan (1982), and Swift et al. in central Niger (1984), have been relied on for understanding Sahelian livestock systems. For guidance on livestock sector and regional issues, the report has relied on McIntire, Bourzat and Pingali's work on crop-livestock interaction in sub-Saharan Africa (1992); Winrock International's report on animal agriculture in sub-Saharan Africa (1992); recent World Bank sector studies for all four countries; and Salinger and Stryker's 1993 report on West African regional integration.

To complement and augment these sources, this study also used four national consultants, one from each of the countries investigated, to collect current information on livestock production and marketing costs, national policies affecting the sector, and trends in livestock production, consumption and trade.

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<sup>1</sup> Complete references for these and other sources used in the study are found in the Bibliography.

### **III. ORGANIZATION OF THE STUDY**

The study has been organized into three components. This volume comprises the principal report. It is accompanied by Volume II, which contains the reports of the country consultants, and Volume III which contains annexes of tables and detailed analyses which support Volumes I and II.

Chapter II of this volume provides a historical perspective on consumption and trade trends in the central corridor countries, and production trends and issues in the livestock sector of the region. This perspective provides a context for the analyses which follow. Chapter III examines ruminant livestock production and marketing systems in the region and defines the scenarios analyzed by the study. Chapter IV provides the financial and economic analyses of the chosen scenarios, and applies these results to the specific issues of production and trade raised in Chapter II. Chapter V examines public policies affecting the livestock sectors in each country and assesses the impact of both national and regional policies on the same scenarios. In the context of conclusions concerning comparative advantage, Chapter VI examines the trends in supply and demand for livestock products in world markets, and discusses projections of these made through the year 2000. Finally, Chapter VII synthesizes the results of the study, draws conclusions and makes recommendations.

## CHAPTER II

### THE CONTEXT OF LIVESTOCK PRODUCTION AND TRADE

#### I. OVERVIEW OF SUPPLY AND DEMAND FOR RUMINANT PRODUCTS IN THE CENTRAL CORRIDOR

The four countries in the central corridor differ in a number of respects germane to this study, as shown in table 2-1. In 1990, more than three-quarters of the corridor's ruminant population of 11.5 million TLU<sup>2</sup> were found in the two Sahelian countries, Mali (43%) and Burkina Faso (34%). In contrast, of a total human population of 44.3 million inhabitants, fully 60 percent lived in the livestock-deficit coastal countries, Ghana (34%) and Côte d'Ivoire (27%). The distribution of the urban population shows an even greater polarization: Ghanaians account for 41 percent of those living in cities and towns, and a further 38 percent live in Côte d'Ivoire. Moreover, inhabitants of the coastal countries enjoyed an average 1990 income of 550 US\$ per capita, 1.8 times that of the Sahelian countries. These statistics go a long way towards explaining the strength and direction of flow of the livestock trade in the central corridor, since livestock product consumption per capita increases with urbanization and income. A historical review of this trade is provided in this section for meat and dairy products, which dominate other livestock products in value.

Table 2.1  
1990 SUMMARY DATA FOR CENTRAL CORRIDOR COUNTRIES

	Human population (millions) a	Ruminant population (millions TLU) b	Ruminants per capita (TLU/capita) c	GNP per capita (US \$) d	Urban population (millions) e
Burkina Faso	9.0	3.90	0.43	330	0.81
Côte d'Ivoire	11.9	1.11	0.09	750	4.56
Ghana	14.9	1.57	0.11	390	4.91
Mali	8.5	4.95	0.58	270	1.62
Central corridor	44.3	11.53	0.26	440	11.90

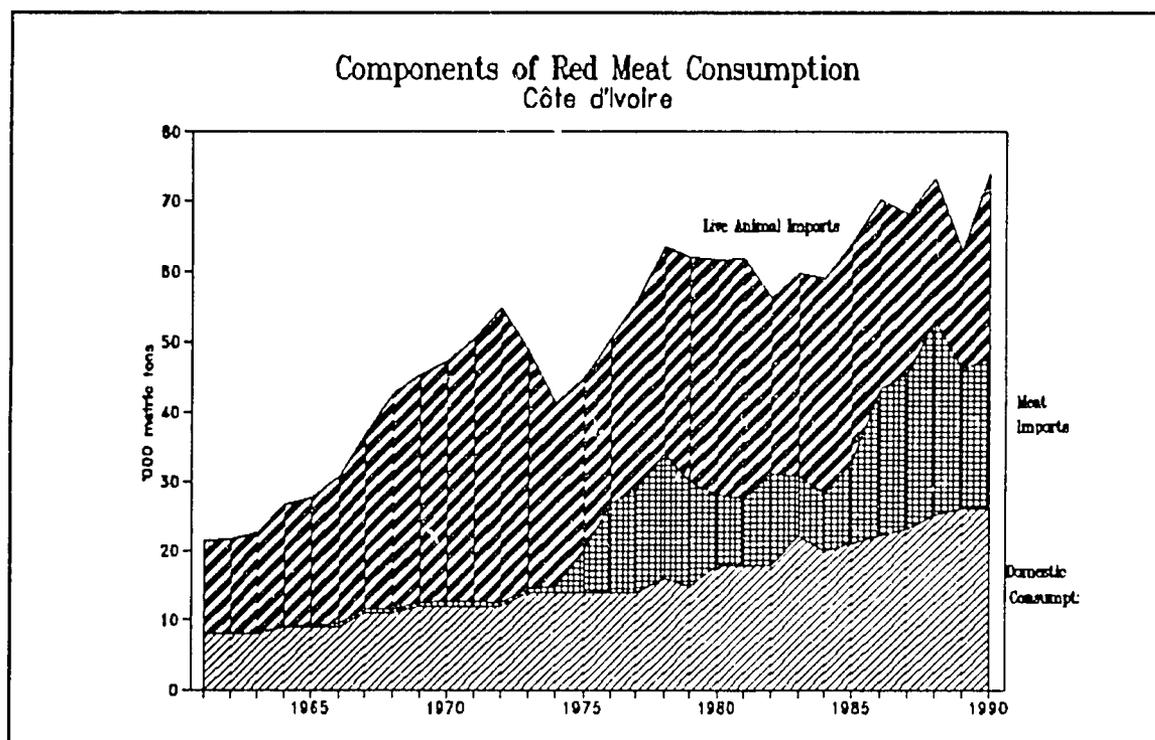
Sources: a,d,e: World Bank, *World Development Report 1992*, pp. 218, 222, 278  
b. Various sources collected in Ancy V. 1991, *Image régional...*  
c. Derived from previous two columns

<sup>2</sup> The "tropical livestock unit" (TLU) exists to allow a summation of ruminants by weight, rather than by numbers. It represents 250 kilograms of live ruminant.

## A. Red meat market trends

### 1. Coastal countries

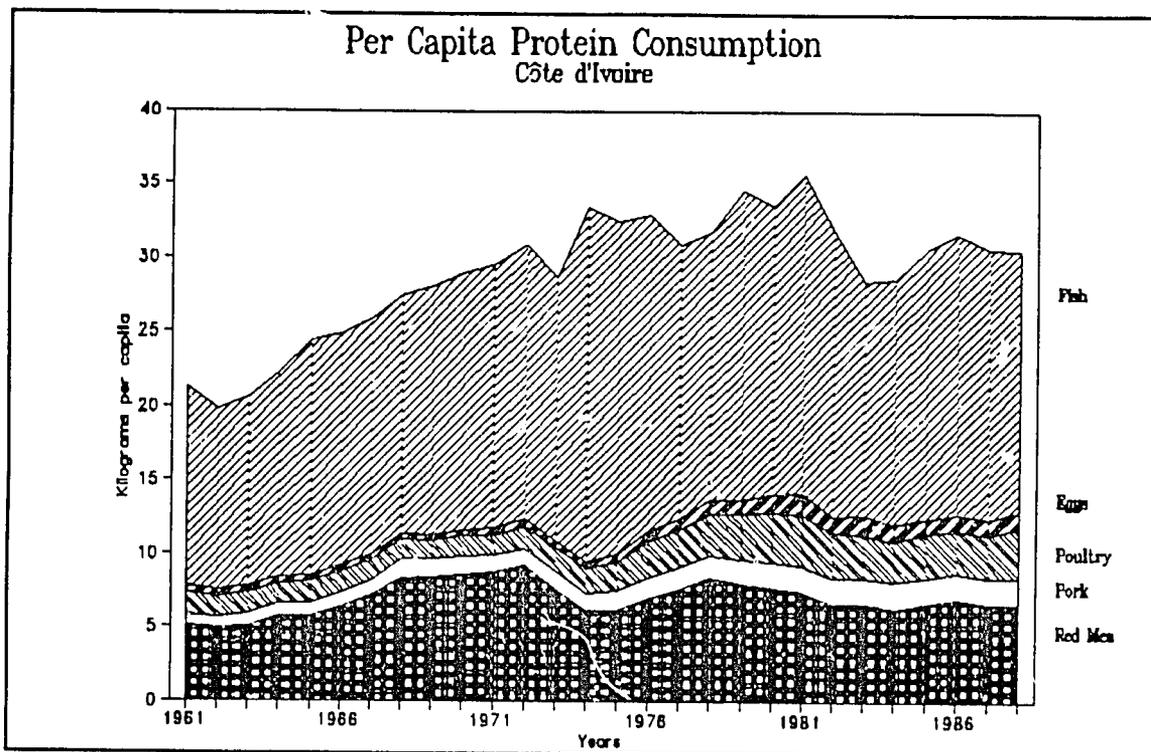
Observers of Côte d'Ivoire and Ghana voice concerns that, in both countries, demand for Sahelian livestock is drying up. The reasons they advance to support this view are that declining incomes lead to an overall reduction in the demand for animal protein, and that meat imports and other sources of protein, principally fish, are displacing meat derived from Sahelian ruminants.



Graph 1

Graph 1 illustrates the trends in the sources of red meat consumed in Côte d'Ivoire for 1961-90.<sup>3</sup> Against a background of increasing domestic production, the graph does indeed indicate a displacement of Sahelian animals by imported meat, beginning in the mid-1970s. The increase in meat imports follows a significant drop in imports from the Sahel after massive distress sales during the first half of the 1968-74 drought. The reduced Sahelian livestock supply coincided with low prices on the world market for red meat and a strong Ivorian economy based largely on buoyant cocoa prices. Together, these factors induced significant inflows of meat from the world market, initially mostly from South America. The depreciation of the French franc in the early 1980s required a corresponding fall in the value

<sup>3</sup> Data for all graphs presented in this section are from the FAO AGROSTAT database (v. 1990). Annex A presents the data used in these graphs.



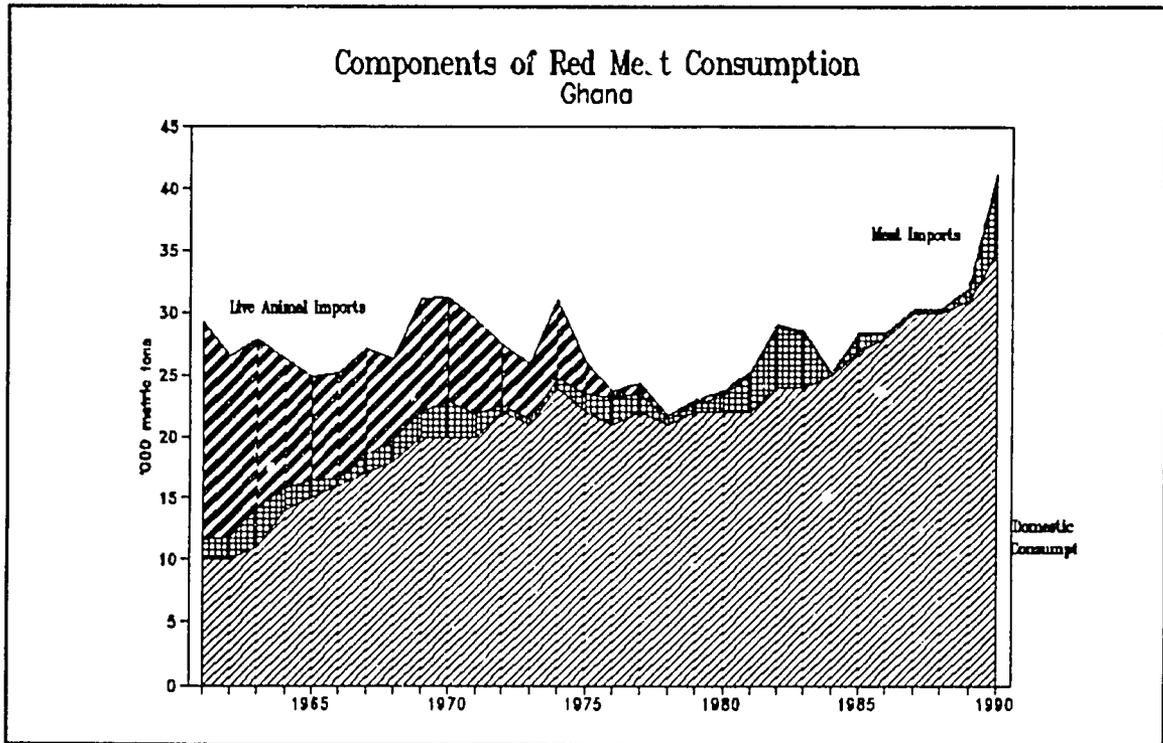
Graph 2

of the CFA franc (FCFA), impairing Ivorian purchasing power and bringing about a reduction in meat imports during this period. Drought once more increased the supply of Sahelian animals on the Ivorian market during 1984-85. Massive destocking allowed Ivorians to replace world market meat with relatively cheap Sahelian meat during this period, reducing imports from the world market to their lowest level since 1975. However, during the period of post-drought herd rebuilding the Sahelian contribution to supply shrank. This effect combined with increasing subsidies on European Community meat exports (leading to a 60 percent drop in nominal EC prices FOB from 1982 to 1987) caused EC meat to sharply increase its role in Ivorian consumption of animal protein.<sup>4</sup> Note, finally, that after steady growth from a low initial level, Ivorian domestic production has recently stagnated.

Graph 2 presents the breakdown of Ivorian consumption per capita of all animal protein over approximately the same period. Note that, in this wider context, fish has always accounted for at least half of consumption, that red meat consumption per capita in 1988 does not differ significantly from the levels of 1967, 1974 or 1981 and that, on a per capita basis, the collective contribution from eggs, poultry and pork has approximately doubled over the period.

<sup>4</sup> Veronique Ancey, *L'impact des viandes extra-Africaines en Côte d'Ivoire sur les échanges régionaux de bétail Africain*, dissertation for the D.E.A., under the direction of Jean Coussy, Ecole des Hautes Etudes en Sciences Sociales, Juin 25, 1991.

Graphs 3 and 4 repeat graphs 1 and 2, but for Ghana. Graph 3 suggests four observations. First of all, it suggests that domestic production has increased almost monotonically since 1961, although with a long sluggish period from 1968 to 1980. These data which are from the FAO are substantiated by Ghana's livestock service statistics on herd size, but are disputed by some who suggest that growth has been more stagnant.

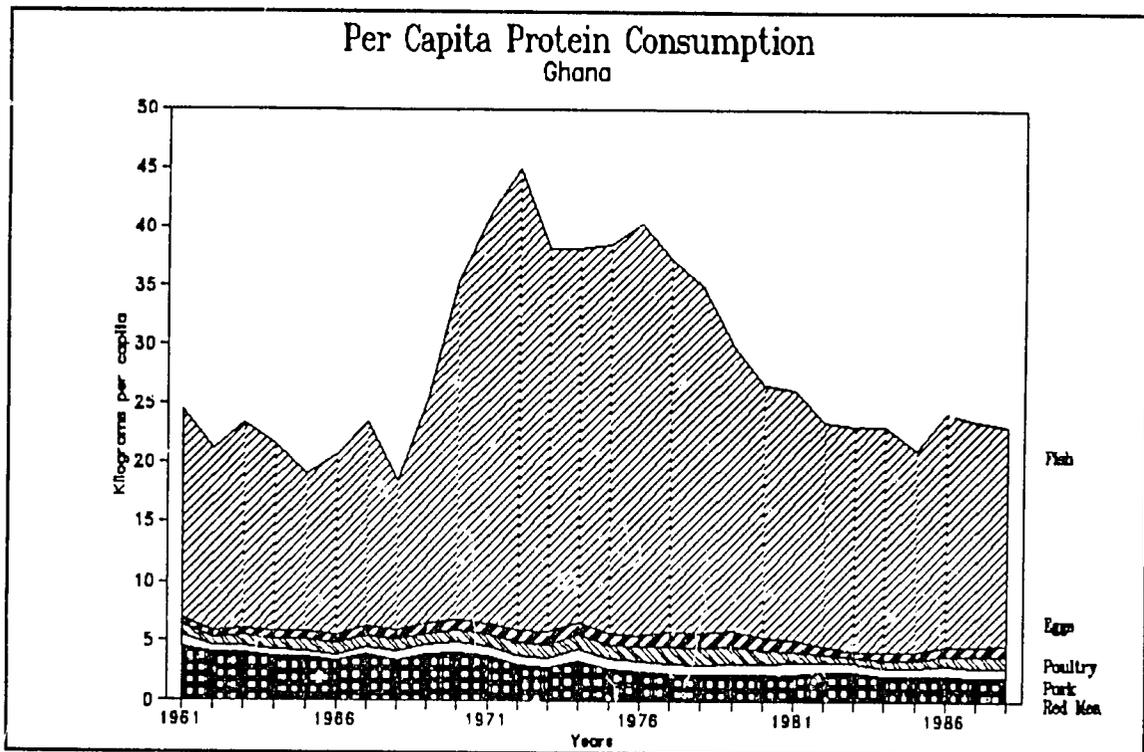


Graph 3

Secondly, meat imports have never accounted for a large portion of Ghanaian red meat consumption. However, data for the first nine months of 1992 suggested an annual level of imports of 21,000 T for that year<sup>5</sup>, a remarkable increase from the 1990 level shown on the graph. Thirdly, according to these data, after destocking during the 1968-74 drought, Sahelian trade ruminants ceased almost completely to enter Ghana.<sup>6</sup> Fourthly, the absolute scale of Ghanaian red meat consumption exceeded that in Côte d'Ivoire by 20 percent in 1961 but fell short of it by 40 percent in 1990. Taking into account the fact that Ghana's population is nearly 50 percent greater than the Côte d'Ivoire, this translates in per capita terms to Ghanaians enjoying about 80 percent of the Ivorian level of red meat

<sup>5</sup> The Livestock Service's breakdown for January to September 1992: 16,000 tons of frozen beef, in addition to 4,357 tons of poultry and poultry parts and 1,547 tons of pig's feet.

<sup>6</sup> This finding is called into question, however, by Kwaku Baah's data which suggests current annual informal imports from the Sahel of around 45,000 head of cattle alone, or about 5,600 tons carcass-equivalent, approximately the level in 1974. (See Baah's report in Volume II.)



**Graph 4**

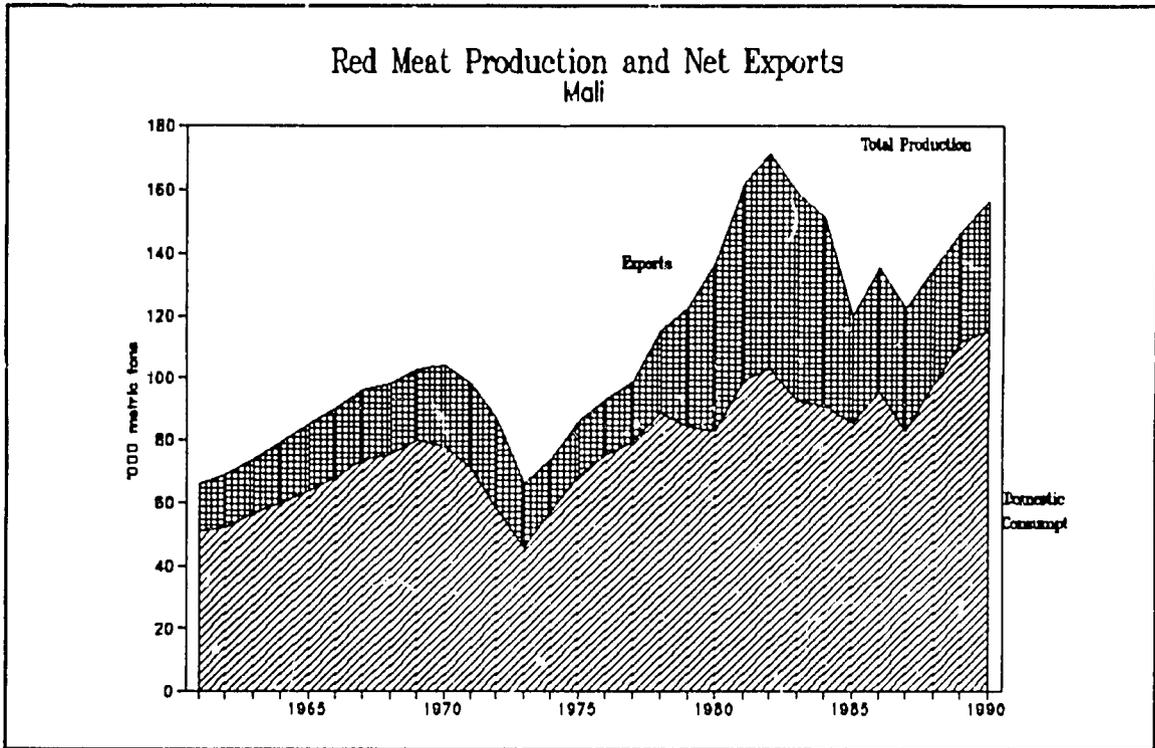
consumption in 1961, but only about 40 percent in 1990.

However, graph 4 immediately shows that red meat accounts for even less in Ghanaian animal protein consumption than it does in Côte d'Ivoire, with fish accounting for between five and ten times as much as red meat from 1961 to 1990. Indeed, while the level of per capita protein consumption has been of the same order of magnitude in the two countries, consumption trends have been entirely different. Graph 4 also shows the importance of the egg, poultry and pork sectors, which have not increased significantly over the period.

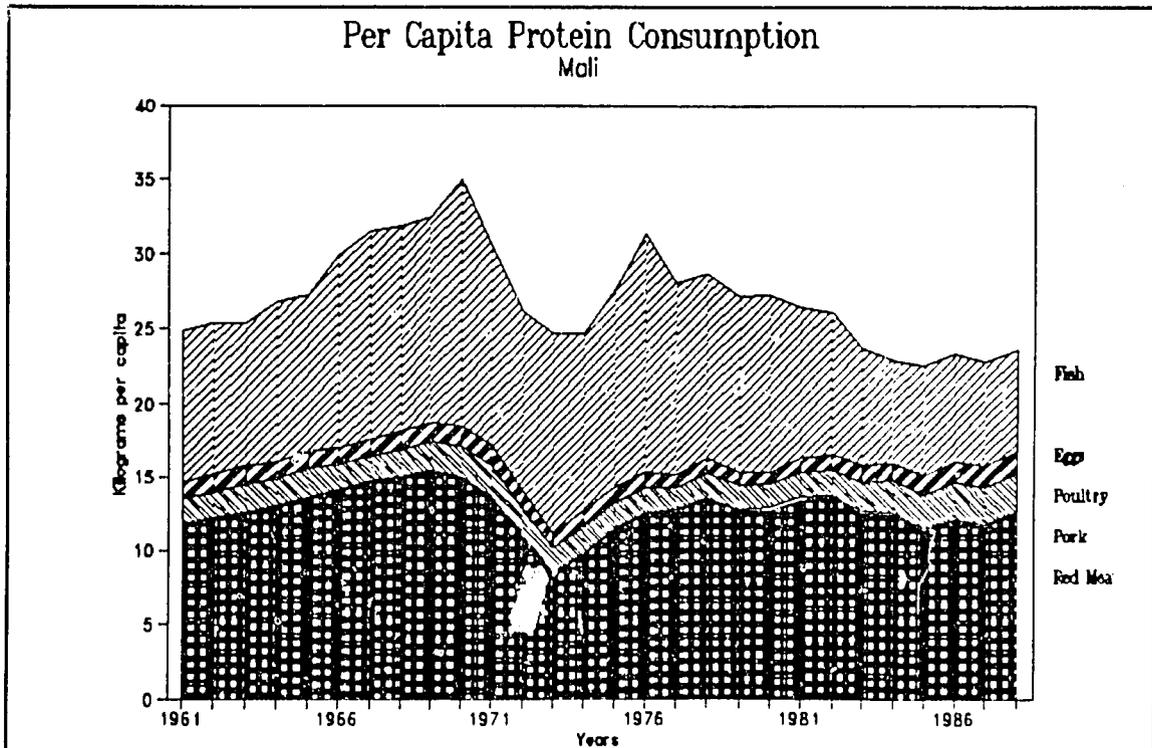
## 2. Sahelian countries

Graph 5 charts the evolution of Mali's red meat production over the same period. The domestic market consumes at least 60 percent of this meat and traders export the rest, primarily to Côte d'Ivoire.<sup>7</sup> Note the effect of drought between 1968 and 1974 and again in the early 1980s. The impact of the first drought lowered increases in production until 1970, when net production reached a plateau and domestic consumption fell as Malian purchasing

<sup>7</sup> Up to the mid-60s, traders may have sold an appreciable proportion in Ghana (through Upper Volta) and, from 1974-84, traders in the east of the country may have taken significant numbers to Nigeria (through Niger and Upper Volta). Nonetheless, Côte d'Ivoire has probably always absorbed the majority of Mali's exports.



**Graph 5**

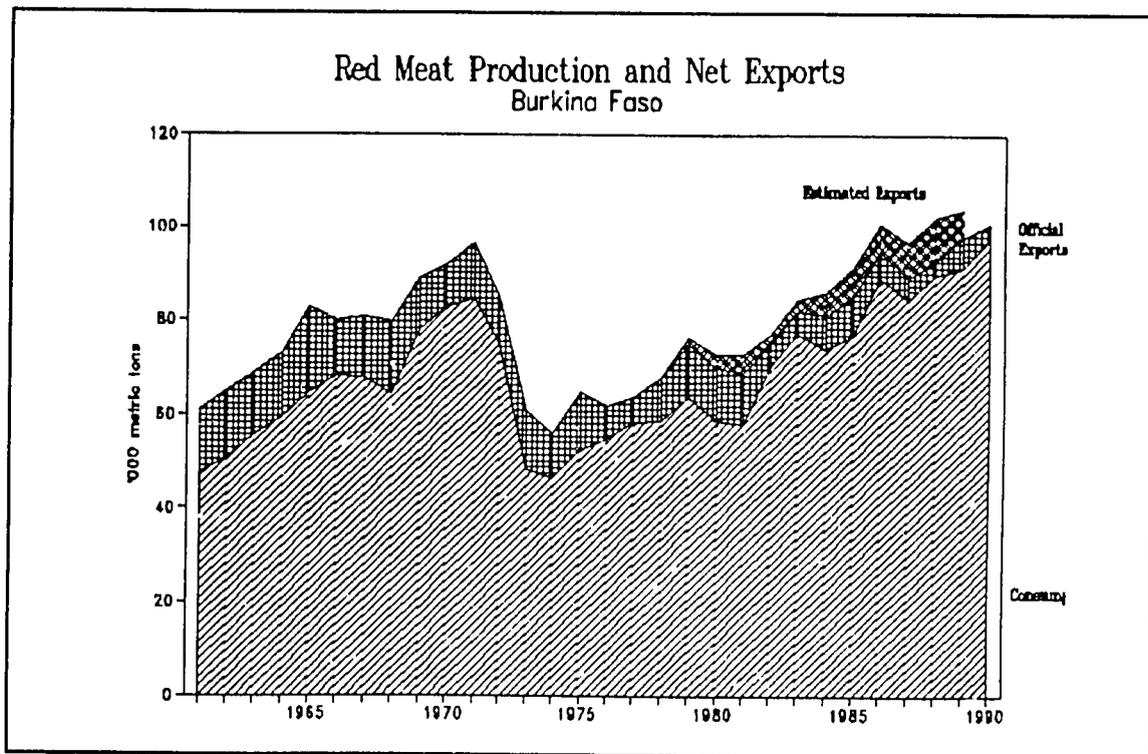


**Graph 6**

power dropped due to the overall effect of the drought. Many animals that could have been exported died on the range, being too weak to survive the trek to consumption markets in an era when trucks were less commonplace. Production continued to drop until mid-1974.

After the drought, herders reconstituting their herds found relatively high prices in the marketplace which helped all but those with the smallest herds. Increased demand due to the Nigerian oil boom contributed to these high prices. Higher prices also redirected part of the flow of trade animals away from Côte d'Ivoire. However, by the early 1980s, prices dropped as the Nigerian spending spree fizzled out and drought set in. Recovery from this second drought has taken place in less propitious circumstances. In particular, livestock prices have been lower due to the absence of a formidable growth spurt like that of Nigeria in the 1970s, and to the dumping of EC meat in coastal countries (see discussion below).

Graph 6 gives evidence of the relatively greater role played by red meat in animal protein consumption in Mali than on the coast. However, fish, primarily from the Niger River, contributes almost as much as red meat to the Malian diet. In a predominantly Muslim country the low consumption of pork is not surprising. Poultry and egg sectors have expanded in recent years to a level which rivals that of Côte d'Ivoire and significantly exceeds that of Ghana. Despite its different composition, overall consumption of animal protein is around the same level as that in the coastal countries.

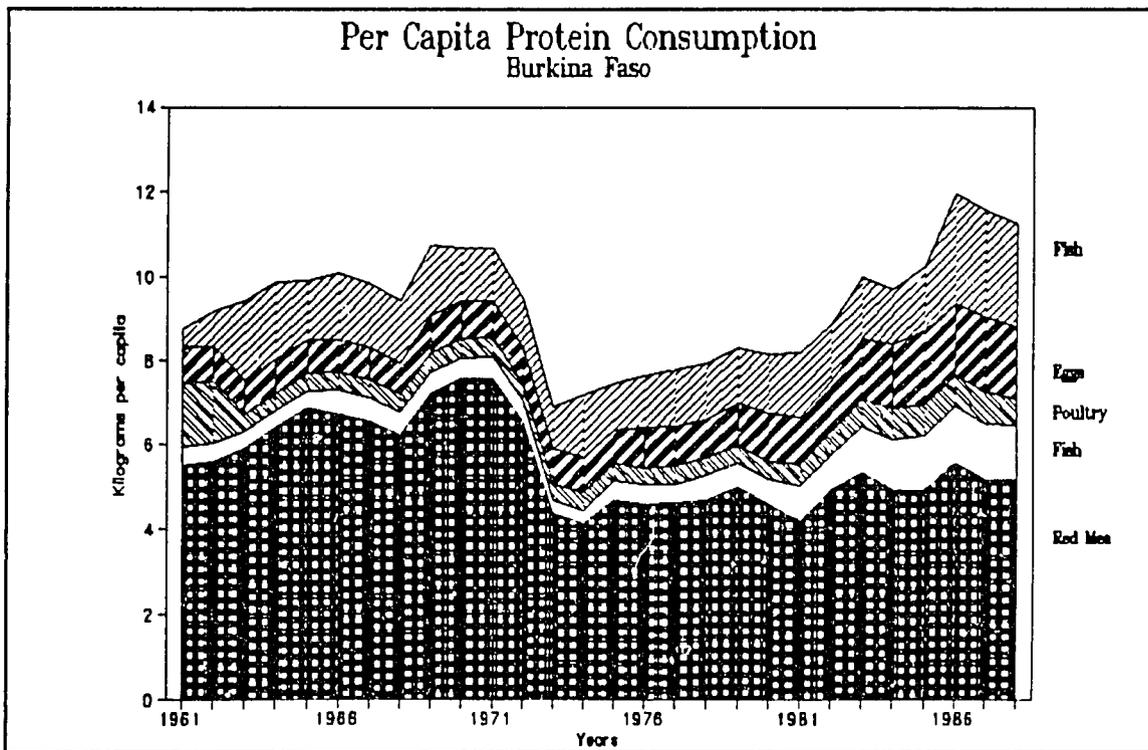


**Graph 7**

Graph 7 shows trends in Burkina Faso's productions and exports of red meat. Of particular interest is the contrast in the effects of the two droughts: the first, in the early

1970s reduced production by 40 percent over two years; the second, from 1983 to 1985, had almost no effect on numbers due mostly to the influx of Malian animals during this period. Production rose from 55,000 tons at the end of the first drought to double that level by the end of the 1980s, albeit with some deviations. Exports have oscillated between 10 and 20 percent of production over the period.

A comparison of Graph 8 with the per capita consumption graphs for other countries confirms that Burkinabè consumption of protein from animal sources only reaches about half that in the other three countries. Without a coast or a major river, Burkinabè fish consumption is much lower than any of the other countries. This is the major factor explaining the difference in total animal protein consumption. Red meat dominates protein consumption, accounting for about half of consumption in 1988. However, this amount is down from its 1970 share of two-thirds. Pork consumption has grown over the years, particularly since the early 1970s. However, the most impressive growth has been in eggs. Surprisingly, poultry meat has not shown the same increase in importance.



Graph 8

Although the four countries of the central corridor can be divided into the net producers and the net consumers of red meat, Graphs 1 to 8 indicate other characteristics which do not fall into this simple Sahelian-coastal dichotomy. Consumption of animal protein (excluding dairy) in Burkina Faso equals approximately half that in the other three countries, largely due to an absence of fish in the diet. Production of pork, poultry and eggs has grown steadily in Côte d'Ivoire, variably in Burkina Faso and very little in Ghana and

Mali.<sup>8</sup> Red meat imports have always formed a component of Ghanaian meat consumption and have not grown much over the years, but in Côte d'Ivoire they increased from negligible to appreciable values in the mid-1970s and became the most important source of red meat in 1988. Production of red meat in Mali has grown but fluctuated greatly, while in Ghana, Côte d'Ivoire, and Burkina Faso it has increased fairly smoothly.

## B. Dairy products

Graph 9 shows that domestic milk production in West Africa has fallen further behind population growth than in any other region in sub-Saharan Africa.<sup>9</sup> The major drop in West African production took place during the 1968-74 drought. Graph 9 displays only a hint of recovery during the post-drought years of the late 1970s, and by the early 1980s -- even before the 1983-85 drought -- a monotonically downward trend set in. By 1988, production per West African inhabitant had fallen to scarcely 60 percent of its 1966 level. Shapouri and Rosen note that due to stagnant or falling production "[b]etween 1961 and 1988, sub-Saharan Africa's dairy imports increased nearly six-fold, growing at an annual rate of 6.5 percent".<sup>10</sup> However, most of this growth took place in the period up to 1977 and, in fact, during the 1977-88 period West African imports from the world market dropped at an average annual rate of 1.6 percent.

Despite this drop in imports during the 1977-88 period, West Africa had a 42 percent dependency rate (imports as a percentage of consumption), higher than either Southern Africa (36 percent) or East Africa (6 percent). Food aid accounts for part of these dairy imports.

Graphs 10 to 13 depict the structure of consumption of dairy products in the central corridor by country from 1961 to 1988.<sup>11</sup> The proportion accounted for by domestic production varies with the size of the national herd, so it features prominently for the Sahelian countries and much less so for the coastal countries. Imports are composed primarily of powdered milk.

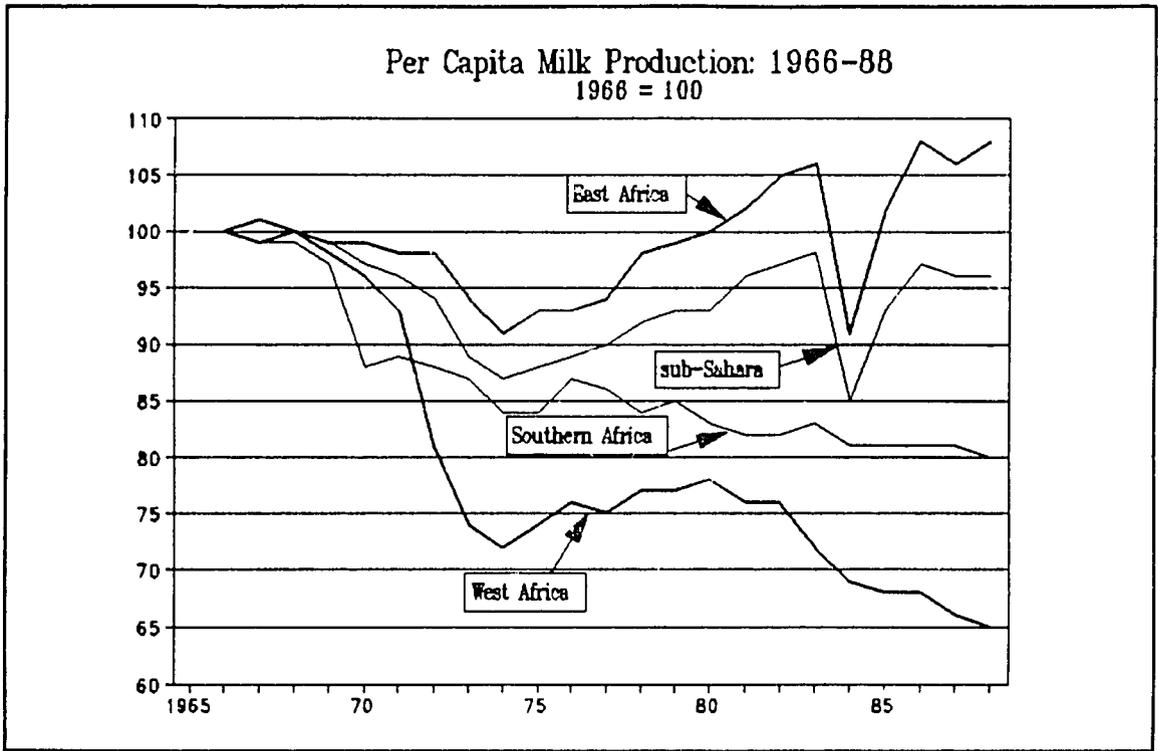
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<sup>8</sup> In Mali only the poultry sector is considered because a large part of the population is Islamic and does not eat pork.

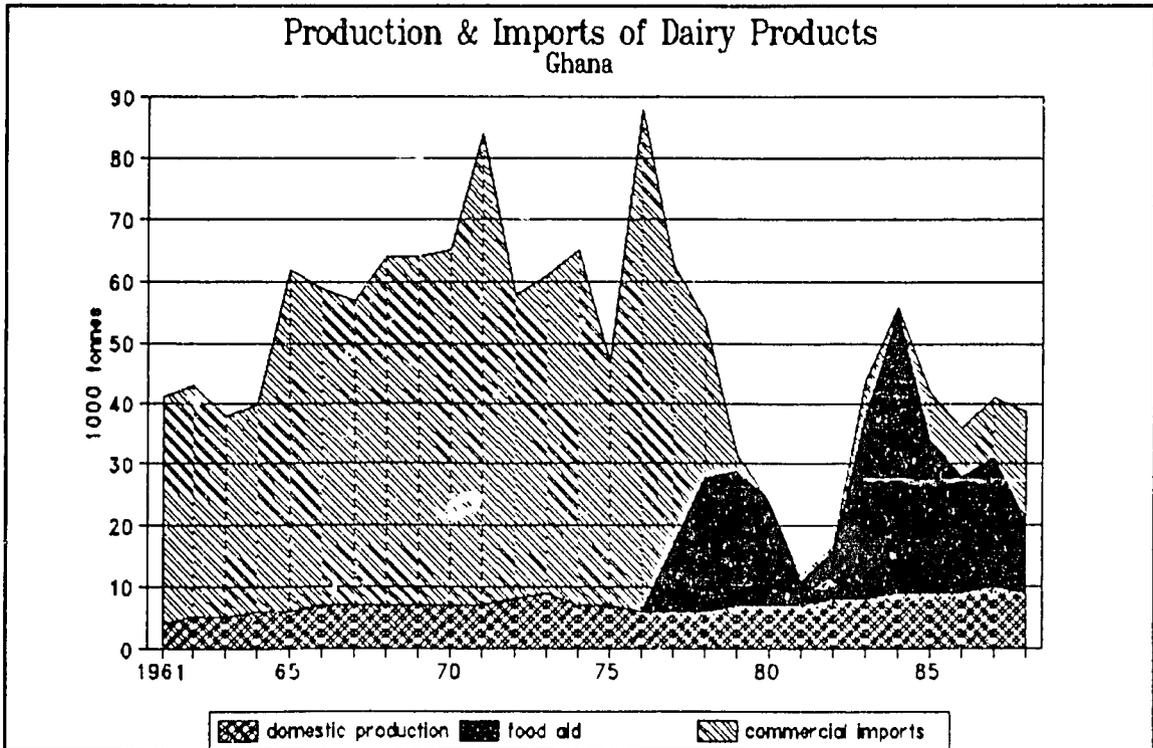
<sup>9</sup> Dairy production data and Graph 9 are from Shahla Shapouri and Stacey Rosen, *Dairy Imports in Sub-Saharan Africa and the Welfare Implications of Import Policies*, USDA/ERS Staff Report #AGES 9142. August, 1991 pp.32-43.

<sup>10</sup> Shapouri and Rosen 1991, pp.iii.

<sup>11</sup> Shapouri and Rosen cite as "unavailable" the food aid flows until 1977. For the purposes of these graphs we assume that no food aid existed prior to then. Imports are net, minus any modest exports or re-exports.



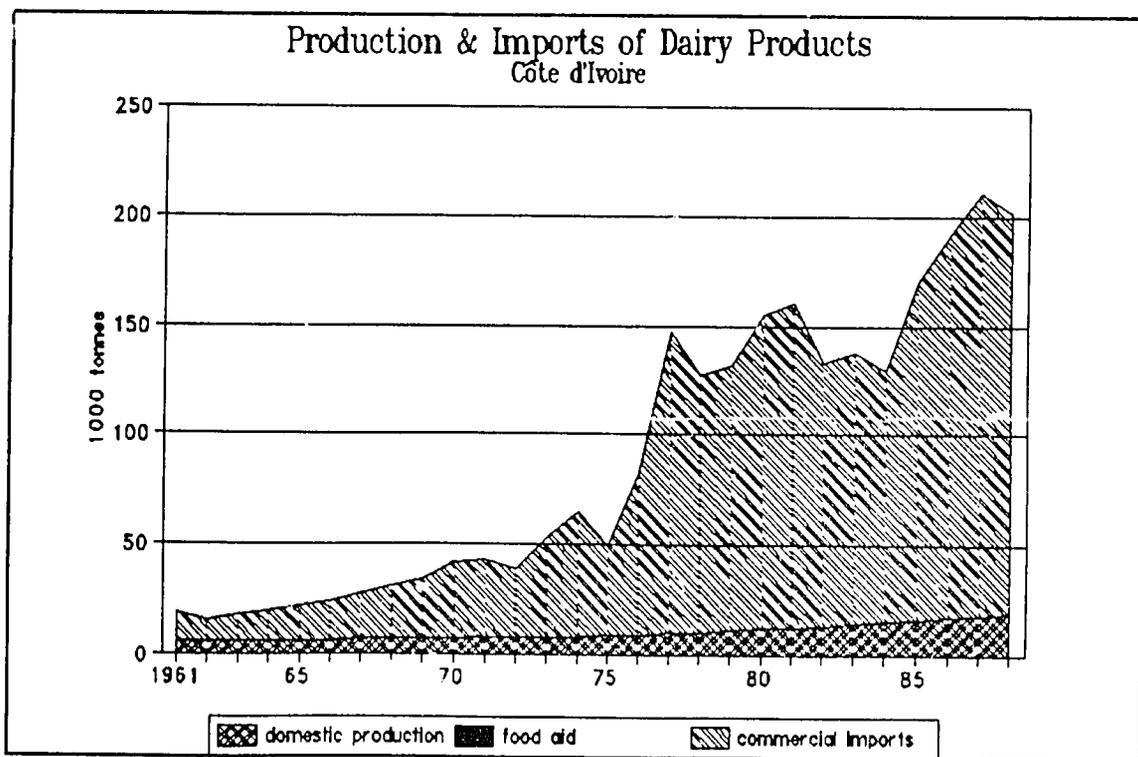
**Graph 9**



**Graph 10**

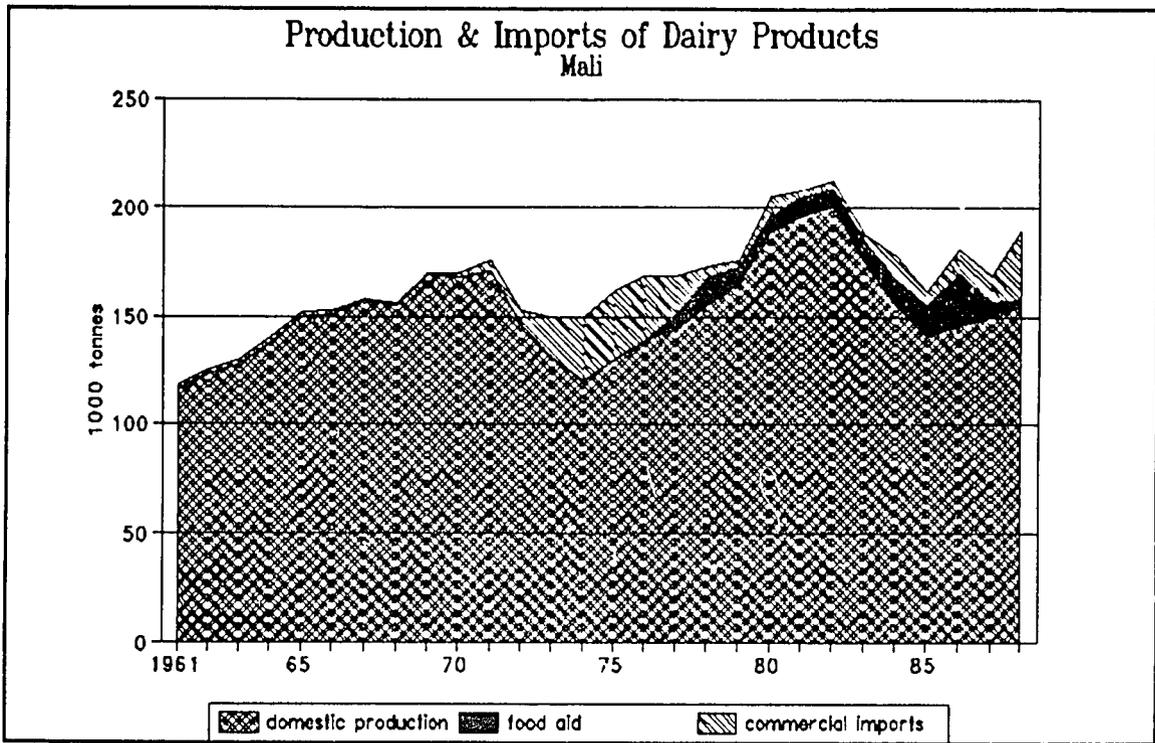
Ghana began the period with a dependency rate of about 90 percent which persisted until the mid-70s when its economy began to unravel. Its commercial dairy imports then crashed from 80,000 tons to almost zero between 1976 and 1980. Food aid replaced part of this but in 1981 domestic production actually provided more than half of Ghana's dairy consumption. Food aid grew substantially in the early 80s but then fell as commercial imports increased and overtook food aid as the largest dairy source in 1988. Ghana has almost always consumed less dairy produce than any of the other countries, despite having the highest population. At the nadir, in 1981, in the depths of economic crisis, its dairy consumption amounted to a tenth of that in the other countries.

Côte d'Ivoire started with more modest imports than Ghana, absolutely and relative to its domestic production. However, since then its import growth soared such that by the end of the period and without ever having received food aid, its consumption level was five times higher than Ghana's. Due to its relative affluence and absence of famine, Côte d'Ivoire did not qualify for food aid. By contrast, over half the dairy imports to the other countries were food aid.

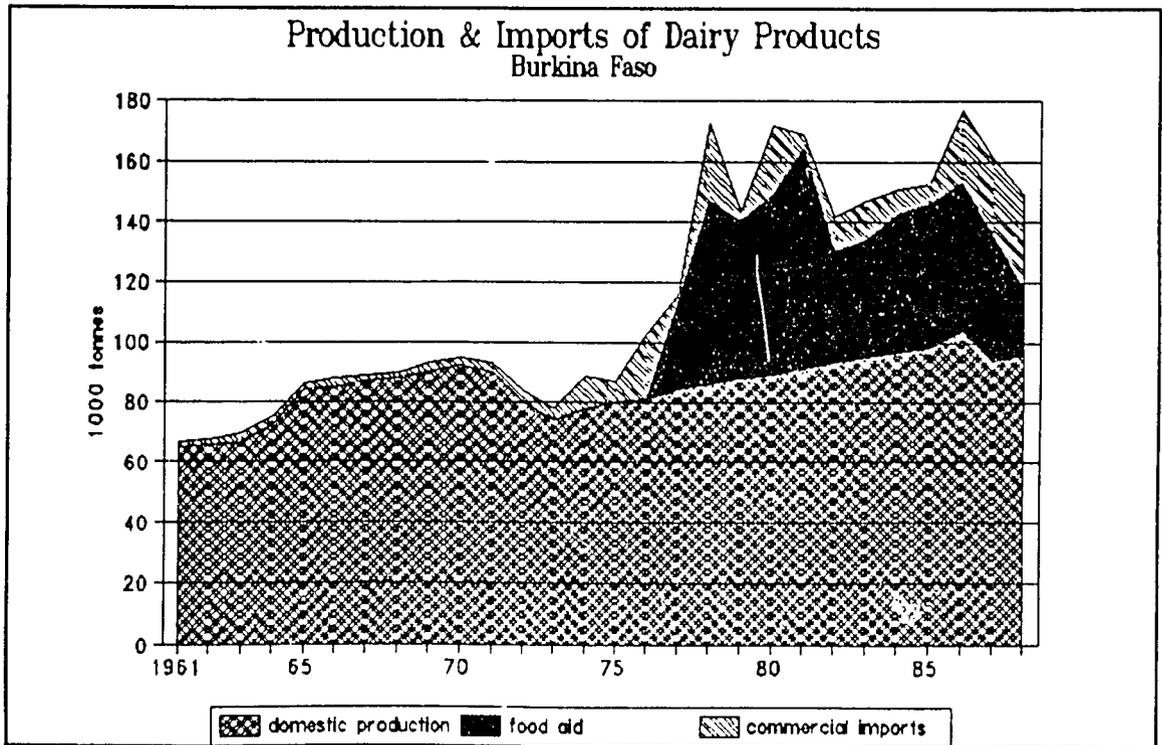


Graph 11

The graph for Mali clearly illustrates the effect of the two droughts on its domestic production. Commercial imports compensate for the reduction in domestic production caused by the first drought. Ironically, food aid became important only after herd recovery was well under way and continued through a period of unprecedented high domestic production around 1980, though in modest quantities relative to total consumption. During and after the



**Graph 12**



**Graph 13**

second drought food aid increased. Then, as herd reconstitution was taking hold in 1988, it attenuated and commercial imports took up the slack.

The graph for Burkina Faso displays a similar history, but with several noticeable differences. Firstly, the level of domestic production is approximately half that in Mali. Secondly, the negative effects of drought on domestic production are much less pronounced. Indeed, the 1985 blip in domestic production indicates that the country benefitted from Malian herds moving south to escape the worst of the 1983-85 drought. Thirdly, food aid played a major role between 1978 and 1985.

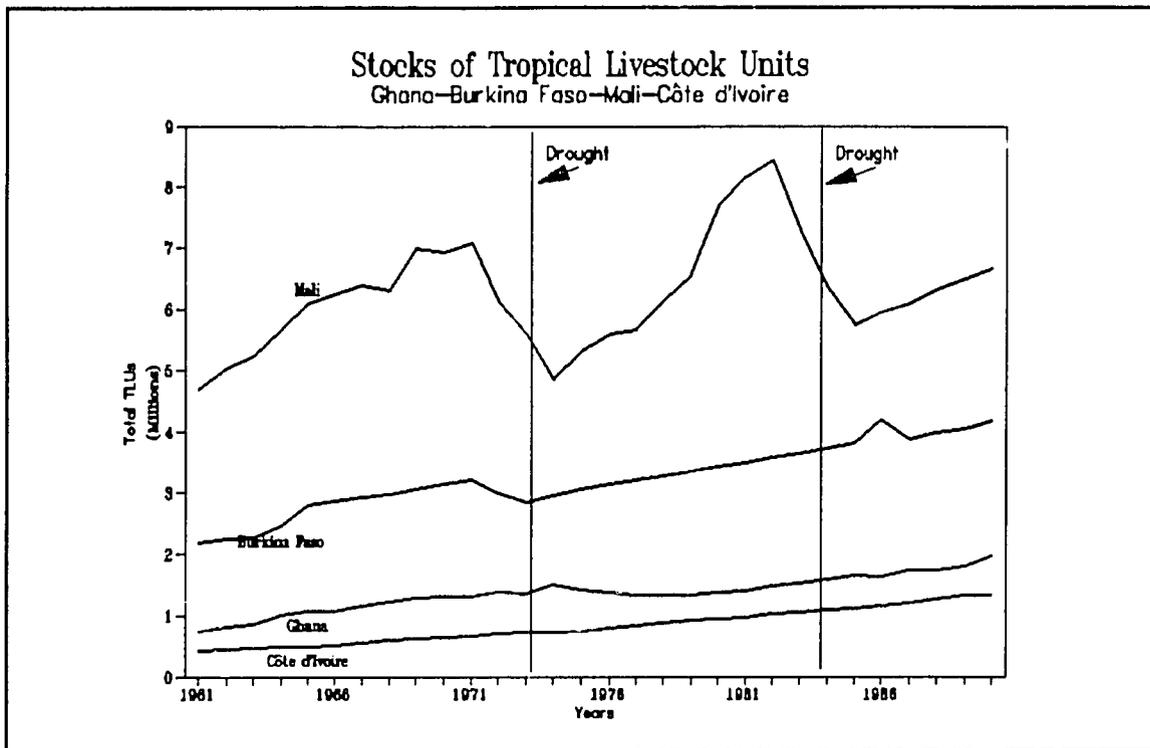
Commercial imports of dairy products have penetrated more quickly and deeper into West Africa than have meat imports. Dairy products were flowing into coastal West Africa in significant quantities at least as far back as 1961. Moreover, although in 1961 Sahel dairy imports took place on a very small scale, by the mid-1970s overseas supplies were meeting at least ten percent of consumption needs in West Africa's prime milk producing area.

## II. ANIMAL PRODUCTION AND MARKETING TRENDS

### A. Growth of herds

Graph 14 displays the size of the four countries' ruminant herds, allowing a comparison of their size and profiles over time. It converts all ruminant herds into *tropical livestock units* (TLUs) of 250 kg liveweight so that they may be added together. Côte d'Ivoire's herd has grown steadily over the three decades. Relatively steady growth, but with a significant stagnation in the late seventies and early eighties also best describes the evolution of Burkina Faso's and Ghana's national herds. Mali, a truly Sahelian country, displays a profile dominated by droughts, as was noted above. During these droughts it lost animals, particularly to Burkina Faso and Côte d'Ivoire. Burkina Faso also lost animals during the droughts but gains from Mali more or less compensated for these. Coastal countries, particularly Côte d'Ivoire were net gainers from migration due to Sahelian drought.

The herd size in the pastoral zone showed net increases until around 1970. Since then, however, a sawtooth pattern of herd growth to a plateau level punctuated by decimation and destocking during droughts has characterized herd population trends. In addition to drought, the variability of production may be explained by increasingly severe pasture biomass constraints which have reduced the ability of pastoral herds to absorb climatic shocks. The biomass constraint is not only due to increasing total herd numbers but also to increasing human populations across the region and the consequent expansion of agriculture into formerly pastoral areas.



Graph 14

### B. Drought impact

Since 1968, the effects of drought have partially hidden the secular stagnation. Low rainfall, and heavily populated rangelands led to heavy losses in the 1968-74 and 1983-85 periods. After each, animal numbers have grown again towards the maximum sustainable sizes for the diminishing range. Some drought effects on herds appear to have been more permanent, however. Cattle suffered in disproportion during the 1968-74 drought. Livestock raisers remaining in the Sahel took note and the reconstituted herds contained a lower proportion of cattle and a higher proportion of camels and small ruminants.

Changes in animal ownership also appear to have occurred as a result of recent droughts. Investors from non-herding backgrounds took advantage of cheap cattle and sheep during the rapid destocking at the height of the droughts to form herds and flocks. With little practical knowledge of animal production, the first wave of these investors tended to prefer to entrust their herds to hired herders, often from the Fulani ethnic group, who followed the traditional transhumant grazing cycle. However, some newcomers have since become increasingly interested in more intensive animal production.

### C. Shifting herd concentrations

As part of the mitigation of the effects of drought, many herders also moved to more southerly, higher rainfall areas. However, many of these never returned to their former

northerly grazing areas because of the increasing competition for biomass in the arid zone. As a result a southern movement of the center of gravity of the regional herd has occurred. For example, the arid zone of Mali has seen its share of the national cattle herd fall from 37% in 1965 to 7% in 1985, while the sudanian zone has increased its share from 7% to 16% during the same period. Mali has also lost some animals to Burkina Faso and to the sudanian zone in northern Côte d'Ivoire. As animals have moved south, however, they have encountered more disease problems which has also created a further obstacle to improving animal productivity.

#### **D. Livestock productivity**

No strong evidence exists to contradict the assertions that average productivity of West African livestock, as measured by animal production parameters, (i) has remained constant for the last century and (ii) lies well below current norms in other parts of the world. Despite low productivity values per animal, productivity *per hectare* compares well with its Western counterparts, due to its high level of labor inputs per head. Nonetheless, growth rates, fertility, carcass weights and milk yields of the average animal differ imperceptibly from her progenitors twenty generations ago.<sup>12</sup> Public sector attempts to improve productivity through a variety of animal production, animal health, and range management interventions have proven largely unsuccessful. Moreover, ranching efforts throughout the Sahel have repeatedly demonstrated that modern capital intensive approaches to ruminant production in West Africa are less economic than traditional labor intensive methods that have been adapted through millennia of experience.<sup>13</sup>

Unchanging values of these parameters do not mean that veterinary campaigns since the 1930s to vaccinate ruminants, particularly cattle, against infectious diseases have had no effect on livestock *numbers*. Indeed, herds grew appreciably as a result of these campaigns until the end of the 1960s. Since then, no significant improvement has been made in reducing mortality in the past two decades.

#### **E. Intensification of livestock feeding**

In response to the biomass constraints, a strategy which does promise to allow herd number and productivity increases is to increase use of commercial feeds. However, this "intensification" of livestock production has been slow to develop. Traditionally, ruminant livestock throughout the Sahel have depended almost solely on pasture and locally available

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<sup>12</sup> A. Anteneh, "Trends in sub-Saharan Africa's livestock industries," in D. L. Hawksworth Ed., Advancing Agricultural Production in Africa, (Proceedings of the CAB conference, Arusha, Feb. 1984); John McClintock, "Factors affecting output levels from African livestock sectors: An analysis of available data," (ILCA, Addis Ababa, Ethiopia. 1984); and FAO data.

<sup>13</sup> Cf. Sedes "Annexe élevage n° 612: politiques de sauvegarde et de reconstitution du cheptel", Etude du secteur agricole du Niger: bilan-diagnostique-phase I, (September 1987).

crop byproducts for feed. Supplementary feeds for ruminants in the Sahel consist largely of bulky, local agricultural byproducts of relatively low nutritional value such as cereal straw and other crop residues. Marketing these products is generally unprofitable because of their low nutrient value per unit weight.

Agro-industrial byproducts are more attractive as commercial feeds because they are generally higher in nutrients. However, feed markets remain small and thin in the Sahel because few purchased feeds are used in ruminant production except for fattening prior to sale and to sustain animals at the end of the dry season and in extreme drought.

On the other hand, agro-industrial byproducts are more actively traded and used in some coastal countries. In the sub-humid and humid zones, growing out and fattening of animals has traditionally been practiced as a mixed farm enterprise. In one form, young males are purchased and kept for several years for animal traction and in the process raised to sale weight. Another common practice is to buy thin animals from pastoral herds after the harvest when animal prices are low, and the farmer has excess capital. These animals are fattened on crop residues for four or five months and sold in the spring prior to the planting season. These sales provide cash to finance the next crop season costs.

More efficient use of commercial feeds in the Sahel may be accelerated by range degradation, sedentariness of pastoral populations, and changes in crop production systems, including the expansion of irrigation, intensification of cash crops and the introduction of forage crops.

#### **F. Improving efficiency of livestock marketing**

In contrast to production stagnation, livestock markets have undergone considerable changes in the past twenty years. The costs of moving livestock long distances of up to 1,500 kilometers from surplus production zones in the Sahel to large urban consumption areas to the south has been an important constraint on the competitiveness of Sahelian livestock in coastal markets. Trade animals have traditionally trekked from surplus producing to net consuming zones. Trekking incurs risk of disease and loss of weight, though the effects vary with the pace at which the animals are moved, the route taken and the season chosen. From the middle of this century, railways offered another option for north-south transport along a single axis from Ouagadougou to Abidjan. Since 1980, however, improved road networks and increased numbers of trucks have led to the dominance of road transport of livestock in coastal countries.

Within Mali and Burkina Faso the dominant mode of animal transport remains trekking. However, trucking has overtaken trekking for animals officially exported from Burkina Faso to Côte d'Ivoire: by 1988, more officially-recorded trade livestock crossed the border in trucks (38 percent) than on the hoof (35 percent); the remainder entered by rail (27 percent). Those who bring their animals into Côte d'Ivoire by truck or train do not unload them until they reach their final destination. Those who trek them find it increasingly

worthwhile to load them onto trains or into trucks as they head south.<sup>14</sup> Indeed, the Ivorian government has formally banned trekking animals south of Bouaké.

Most trade livestock crossing the border from Burkina Faso to Ghana still do so clandestinely on hoof to avoid the costly quarantine process which Ghana imposes. But immediately after crossing the border, the traders load the animals onto trucks for movement, even for modest distances in Ghana. The Ghanaian railway network does not stretch to the north of the country and its role in livestock transport is insignificant.

### **G. Increasing market prospects through greater product differentiation and quality**

Most meat imported from outside West Africa to Ghana and Côte d'Ivoire is of an inferior quality compared to the product of animals from the central corridor. Ironically, the lack of differentiation of meat quality in West African markets prevents this region from taking advantage of its superior product. Rather than differentiating quality, West African butchers typically homogenize product quality by combining high and low quality pieces of meat, gristle and fat into equivalently priced meat bundles. Most meat is marketed this way because, given their low incomes, the great majority of coastal West African consumers considers price before any other factors in weighing protein sources, while quality remains a secondary consideration.

This situation raises the possibility that additional returns can be obtained for West Africa's livestock by targeting its high quality products to upscale markets, while only its low quality products would compete with low quality imports. One scenario of such a strategy would be for the Sahel to export chilled meat to European and Middle Eastern markets which place a premium on quality. Several unsuccessful attempts have been already made to export to central and north Africa and the Middle East. On the other hand, some eastern and southern African countries and Madagascar do export chilled and frozen meat to Europe.<sup>15</sup> This trade is profitable despite the fact that the European Community subsidizes meat exports, because African meat exported to Europe consists of choice cuts of lean Zebu meat which receives a premium on the European market. The potential may exist, therefore, for West Africa to seek similar market opportunities.

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<sup>14</sup> N. Kulibaba and J. Holtzman, *Livestock marketing and trade in the Mali/Burkina Faso - Côte d'Ivoire corridor: draft*, prepared for USAID's AMIS Project (Bethesda: Abt, 1990), pp.40-43.

<sup>15</sup> Burkina Faso, Ministère de l'Industrie, du Commerce et des Mines, Office National du Commerce Extérieur, *Symposium national sur les problèmes de commercialisation du bétail et de la viande Burkinabè à l'étranger: document final* (Ouagadougou, 26-27 septembre, 1991), pp. 124-131.

### III. ECONOMIC ISSUES CONFRONTING THE LIVESTOCK SECTOR

The preceding discussion has illustrated that since the mid-seventies, world markets have competed successfully with Sahelian beef in providing meat to urban consumers in some large coastal consumption centers of West Africa. Over the course of the 1980s this competition has been increasingly due to the European Community's dumping of cheap meat on the world market as it attempted to decrease the size of its dairy herd. In addition, the overvaluation of many West African currencies has served to encourage imports of livestock products at the expense of regional production. These imports have significantly eroded the market for Sahelian red meat.

The potential for continued EC dumping of livestock products in West Africa raises the question of whether West Africa should construct a common protective policy to offset the negative effects of dumping on the regional livestock sector. On the one hand, sporadic dumping by foreign livestock exporters may justify protection of the regional livestock sector to avoid the costs of price fluctuations in these markets. This appears to be the logic behind a recommendation in the Sikasso Initiative's *Organization of a regional cattle and meat market* to apply a uniform import tariff for meat products throughout West Africa.<sup>16</sup> On the other hand, longer term dumping may reflect an opportunity to provide cheap meat to consumers.

The discussion has raised a number of important issues on which the future competitiveness of the region's ruminant livestock industry depends. These issues, which are summarized in the form of questions below, will be addressed in the three chapters which follow.

- Can traditional systems remain competitive as relative factor costs change with increasing population and the attendant pressures on the resource base?
- Can the use of commercial feeds to "intensify" production systems be economically introduced?
- Is fattening to add value to the animal product an attractive alternative?
- Are there ways to raise efficiency in the transport and marketing of the region's livestock in order to retain competitiveness?
- Could greater product differentiation through slaughter and export from the Sahel allow West African livestock to compete in an export market?
- Could coordinated regional trade policies improve the protection provided to livestock production in the various countries of the region?

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<sup>16</sup> Conference of the Ministers of Agriculture of West and Central Africa, *Organization of a regional cattle and meat market*, mimeograph, section C, no date.

- Are the prospects for future demand of livestock products attractive for livestock production investment in the region in the intermediate future?

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## CHAPTER III

### PRODUCTION AND MARKETING SCENARIOS FOR RUMINANT LIVESTOCK IN THE CENTRAL CORRIDOR

This chapter provides a description of the livestock production and marketing scenarios evaluated by the study. This study uses "scenario" to mean the entire process of livestock production, marketing of livestock products and (where appropriate) their transformation into final products.<sup>17</sup> The first two sections deal with production systems, identifying them, and then presenting the approach and principal assumptions used to assess their costs. The third section reviews market routes used by livestock in West Africa's central corridor and presents the specific market chains examined in the study analysis.

#### I. IDENTIFICATION AND COMPARATIVE DESCRIPTION OF PRODUCTION LIVESTOCK SYSTEMS

To examine the economic value of livestock production in the central corridor, 11 cattle and 8 small ruminant production systems from 10 locations in the central corridor were selected for detailed analysis. In making this selection, an attempt was made to identify representative systems on the basis of aggregate production data and the descriptive analyses of the national livestock sectors provided in the national consultants' reports. Systems were also included which hold potential for future growth, either because they appear to underexploit their resource base or because they use innovative management or technology. Map 3.1 identifies the location of each system and Table 3.1 summarizes the salient features of each selected production. A more complete description of each system is provided in the respective country studies which follow in Volume II of this study.

##### A. Transhumant pastoral and agro-pastoral systems

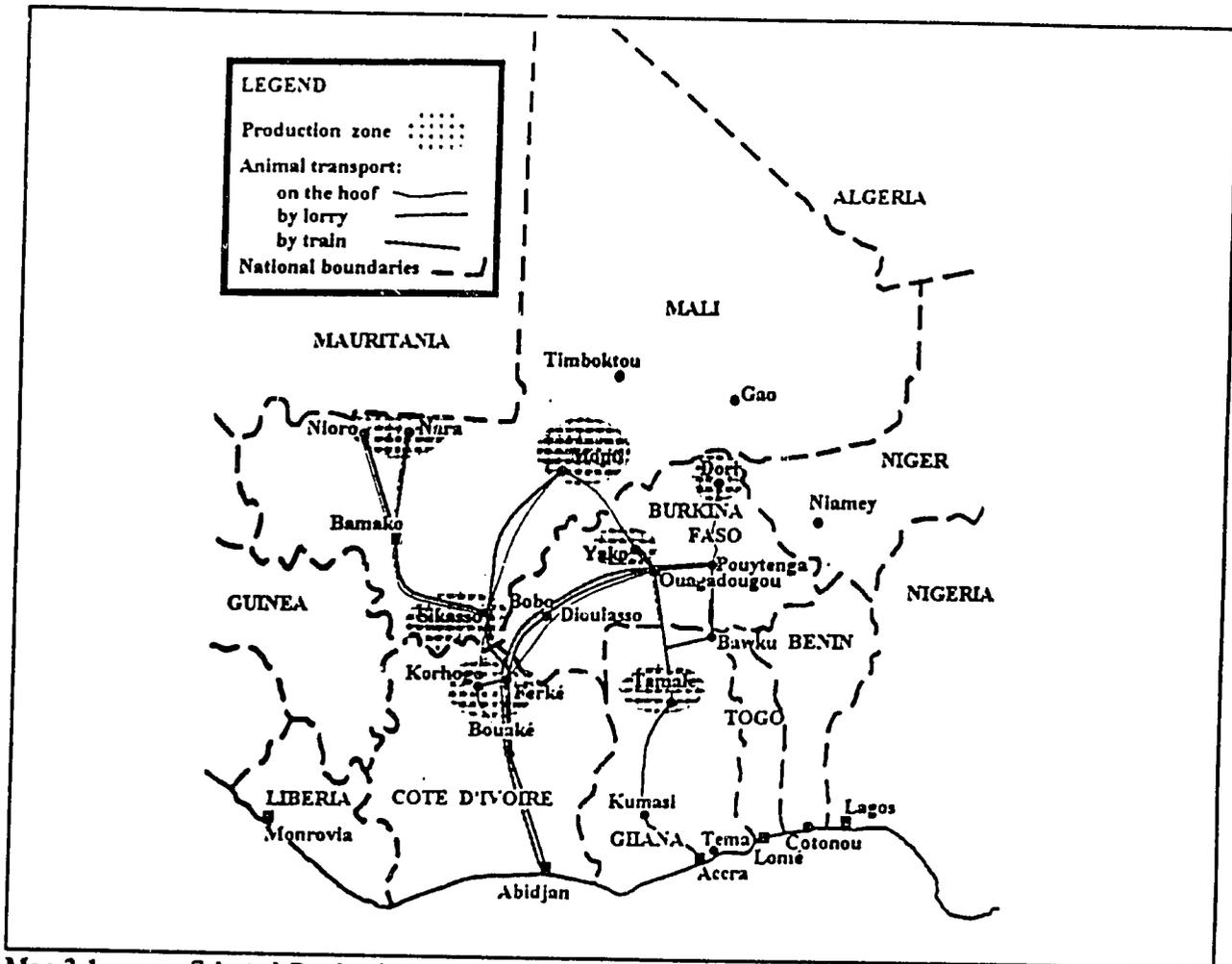
Transhumant livestock systems are those in which the herd production unit moves seasonally in a relatively consistent pattern to take advantage of range availability. Systems are referred to as pastoral if most of the unit's livelihood is derived from the livestock herd. Agro-pastoral systems are those in which a significant share of the production unit's income comes from both livestock and agricultural activities.

As Tables 3.1 and 3.2 illustrate, the study includes four transhumant pastoral or agro-pastoral systems. Three of these, at Nara and Mopti in Mali, and at Dori in Burkina Faso, lie

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<sup>17</sup> In this sense "scenario" has the same meaning that *filière* has in French.

in the semi-arid zone of the Sahel, where rainfall is between 300 and 600 mm and is highly variable. Together, these systems represent "typical" Sahelian livestock production. Analyses were conducted of cattle and sheep herds in these systems. The fourth transhumant cattle system, found in northern Côte d'Ivoire near Korhogo, lies in a sub-humid climatic zone where rainfall is higher and vegetation is much more dense. Transhumant herding is possible because of government efforts to clear pasture land of the disease-carrying tsetse fly.



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**Table 3-1**  
**COMPARISON OF PRINCIPAL CHARACTERISTICS OF CATTLE PRODUCTION SYSTEMS**

Location	Rainfall (mm)	Breed	Management type	Feed source	Labor use	Agriculture	Commercial feed inputs	Health inputs	Fixed inputs
<b>BURKINA FASO</b>									
Dori	450	zebu	transhumant pastoral some fattening	open range, village pasture crop byproduct, commercial feeds	family, hired	dryland millet	salt, cotton seed, hay, c.s. cake, bran	vaccines, pesticides	--
Yako	600	zebu	sedentary agro-pastoral some fattening	pasture, crop byproducts minor commercial feeds for fattening	family	dryland millet, sorghum	salt, cotton seed	trypano prophylactic, pesticides	trough, manger, corral
Pouytenga	600	zebu	fattening	commercial feeds, crop byproduct	family, hired	dryland millet, sorghum	salt, cotton seed, hay, c.s. cake, molasses, bran	vaccines, pesticides	trough, manger, corral
<b>MALI</b>									
Nara	350	zebu	transhumant agro-pastoral some fattening	open range, village pasture crop byproduct, commercial feeds for fattening	family, hired	dryland millet	salt, mixed feed	vaccines, pesticides, trypano prophylactic	--
Mopti	300	zebu	transhumant agro-pastoral	open range, flood plain	family, hired	irrigated rice, dryland, millet, flood recession sorghum	salt, mixed feed	vaccines, pesticides trypano prophylactic, rice bran	--
Sikasso	1000	zebu	sedentary agricultural	village pasture, crop by- product, commercial feeds	family, hired	dryland maize, rice, sorghum, potatoes	salt, rice, bran, mixed feed	vaccines, pesticides, trypano prophylactic	--
Bamako	600	zebu	sedentary dairy peri-urban	village pasture, commercial feeds	family, hired	dry & irrigated rice, sorghum, maize	salt, minerals, c.s. cake peanut cake	vaccines, pesticides trypano prophylaxis	trough, corral

Table 3.1 (continued)

Location	Rainfall (mm)	Breed	Management type	Feed source	Labor use	Agriculture	Commercial feed inputs	Health inputs	Fixed inputs
<b>COTE D'IVOIRE</b>									
Tahouara Korhogo	1000	zebu	transhumant (T0)	village pasture, crop byproduct	family, hired	rice, cotton, peanut, maize vegetables	salt	vaccines, trypano prophylactic	mixed feed storage
Korhogo	1000	cross	traditional (S0) sedentary agricultural	village pasture, crop byproduct	hired	rice, cotton, peanut, maize vegetables	salt	vaccines, pesticides	--
Sohouo Korhogo	1000	cross	improved (S3) sedentary agricultural	village pasture, crop byproduct, commercial feeds	hired	rice, cotton, peanut, maize mixed feed vegetables	salt	vaccines, pesticides	corral, well, feed storage
<b>GHANA</b>									
Kpong Tamale Tamale	1500	WASH	sedentary byproduct	village pasture, crop	family	peanut, guinea corn, vegetables, corn	salt	vaccines pens	corral, crush
Accra Plains Accra	1000	zebu cross	sedentary dairy peri-urban	village pasture, commercial feeds	family, hired	dry & irrig. maize, rice sorghum	salt, minerals, silage, hay, molasses block, copra cake, manioc, maize, bran	vaccines, dewormer	crush pens, drinking pans

Table 3.2

**COMPARISON OF PRINCIPAL CHARACTERISTICS OF  
SMALL RUMINANT PRODUCTION SYSTEMS**

Location	Rainfall (mm)	Breed	Management type	Feed source	Labor use	Agriculture	Commercial feed inputs	Health inputs	Fixed inputs
<b>BURKINA FASO</b>									
Dori	450	sahel. "Peul" sheep	transhumant, pastoral	open range, village pasture crop byproduct, commercial feeds for fattening	hired	dryland millet	salt, c.s. cake, cotton seed, bran	vaccines	--
Yako	600	"Mossi" sheep	sedentary agro-pastoral	pasture, crop byproduct, minor commercial feeds for fattening	family	dryland millet, sorghum	salt, c.s. cake, cotton seed	trypano prophylactic, pesticides	trough, man- ger, corral, hanger
Pouytenga	600	sahel. "Peul" sheep	fattening	commercial feeds, crop byproduct	family	dryland millet, sorghum	salt, cotton seed, bran, c.s. cake, molasses, hay	vaccines, pesticides	trough, man- ger, hanger
<b>MALI</b>									
Nara	350	sahel. "Peul" sheep	transhumant agro-pastoral little fattening	open range, village pasture crop byproduct	family, hired	dryland millet	salt	--	--
Mopti	300	macina sheep	transhumant agro-pastoral	open range, flood plains	family, hired	irrigated rice, flood sorghum, coarse grains	salt, bourgou hay, mixed feeds	vaccines, trypano prophylactic	enclosure, hanger, house
Sikasso	1000	D'jal- lonke sheep	sedentary agricultural	village pasture, crop by- product, commercial feeds	family, hired	dryland maize, rice, potatoes, sorghum	salt, rice bran	vaccines, pesticides, trypano prophylactic	--

Table 3.2 (continued)

Location	Rainfall (mm)	Breed	Management type	Feed source	Labor use	Agriculture	Commercial feed inputs	Health inputs	Fixed inputs
<b>COTE D'IVOIRE</b>									
Katanuog Korhogo	1000	D'jal- lonke sheep	transhumant	village pasture, commercial feeds	family	rice, cotton, crop byproducts, vegetables	salt, peanut, maize mixed feed	vaccines, pesticides, trypano prophylactic	stable, herder's house
<b>GHANA</b>									
Kpong- Tamale, Tamale	1500	small short-hair sheep	sedentary agricultural	crop byproduct, maize, guinea corn, cassava, yam peels, corn stover, pito mash	family	vegetables, peanut	salt	--	pens
Akyem Swedru Forest zone	1500	W.A. Dwarf goat	sedentary agricultural	village pasture, open range, crop residue	family	cocoa, maize, rice, yams	--	--	crush pens, drinking pens

In all the Sahelian systems, livestock is herded in a roughly north-south pattern to exploit the protein-rich rangeland pastures to the north during the short rainy season, and southern pastures, cropland residues and fallow land during the long dry season. In sub-humid systems, transhumance is less clearly north-south, but is still dictated by seasonal accessibility to pasture. In none of the systems do animals receive feed supplementation except to fatten a selection of animals before offtake and occasionally for pregnant or lactating females during the hot dry season. Salt supplementation is provided in all cases, while some Dori herds also continue to participate in an annual "cure salé" in which animals are taken to salt ponds for additional mineral supplementation. Health interventions are generally restricted to vaccines and occasional use of anti-parasite drugs and trypanocides. Trypanocides and anti-parasite drugs are much more heavily used in the Korhogo system. None of these systems uses physical infrastructure to pen or house animals.

All transhumant systems include some hired labor to assist in herding. Hired labor typically receives payment in milk, grain and clothing as well as cash. In the Nara and Mopti cases, hired labor is only used seasonally for herding during the transhumance to northern pastures, while in the Korhogo and Dori cases hired labor is permanent. The Korhogo system is unique in that the hired laborer's family travels with the herd, and the herd owners only provide occasional assistance in veterinary treatment of the animals.

The Nara and Dori herds are in areas where dryland cereals (millet and sorghum) are raised. The Dori cattle model is considered a pastoral system because the family does not participate in agriculture to any significant degree. The Nara and Mopti models assume that the herding family also cultivates land, and are therefore classified as agro-pastoral. The Mopti systems are distinct in that the cattle herds and sheep flocks have access to the rich dry-season "bourgou" grasses on the flood plains of the interior delta of the Niger river.

In all four transhumant model cases, the cattle herded are zebu (a breed of *bos indicus*), which are well adapted to the demands of these systems through their ability to walk long distances, to go for long intervals between watering, to gain weight rapidly, and to store fat energy and water for periods when feed and water are scarce. The transhumant sheep models at Nara and Dori suppose the "Sahelian" or "Peul" breed: a large-framed short-haired animal with many characteristics of endurance similar to the zebu mentioned above. At Mopti, the Macina sheep breed is evaluated; it is distinctive because it produces wool and is milked for human consumption.

In the transhumant models, males are typically sold when they reach physical maturity at between two and three years of age. Reproductive females are kept in the herd until they are no longer reproductive, typically at around ten to twelve years of age.<sup>18</sup> Females are also milked and yield from one to three liters of milk per day during lactation, depending on the season.

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<sup>18</sup> See section III below for a description of animal marketing.

Between a quarter and a third of the milk is used for human consumption and the rest is left for the offspring. When herds are in the proximity of villages and marketplaces, women from herding households may sell surplus dairy products during periods when milk production exceeds domestic needs. Most marketed milk is transformed into less perishable dairy products since milk turns quickly in the ambient Sahelian temperatures. The women carry products, such as curdled milk or butter, in calabashes on their heads. Their carrying capacity and the limited number of weekly markets within walking distance limit the marketable volume of excess production.

## B. Sedentary models

Sedentary production refers to systems in which animals are raised in one location and are not moved long distances in search of pasture. Sedentary ruminant livestock raising is examined at Sikasso in Mali, Yako in Burkina Faso, Korhogo in Côte d'Ivoire<sup>9</sup> and Tamale in Ghana. All of these locations lie in the sudanian zone of West Africa which receives between 600 and 1500 mm of rainfall. In all cases, livestock owners are also farmers, raising a variety of rainfed crops, including coarse grains, pulses and tubers. All sedentary livestock depends on crop residues and byproducts for a substantial share of their feed requirements.

Sedentary systems employ a greater share of hired labor because most herds are composed of several owners' animals grouped together for herding. This arrangement reflects the fact that family herds are smaller and that the owners may not have much livestock-raising expertise. Villages will typically create communal herds and hire an individual from a livestock-raising background to tend them. The village herd will sometimes only be constituted for that part of the year when the herd must be moved away from village lands for grazing, generally during the late dry season and planting season.

Animal breeds in sedentary systems are typically smaller, trypano-tolerant breeds. Among cattle these include the *N'dama*, *Baoule* (Korhogo model), *Taurin* and *West African Shorthorn* (WASH - Tamale model) breeds. Hybrid breeds resulting from crosses between the more productive zebu and the more disease-resistant smaller breeds also exist, including most notably the *Sanga* (a zebu-WASH cross). For sheep, the analysis considers the *Mossi* breed at Yako and Sikasso, and the *D'jalonke* breed at Korhogo and Tamale.

Sedentary herds use veterinary products for internal and external parasites for prophylaxis and treatment of trypanosomiasis. Fixed inputs such as corrals, pens, and even animal sheds are found in these zones. The use of these structures reflects the need to control animals more carefully at night because of their proximity to crops, and also to protect them from heavy rains. Where animals are penned, animal pens are typically located in crop fields, and moved

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<sup>9</sup> For Ivorian production systems, this study uses SODEPRA's "(0)" and "(3)" classifications for sedentary systems which are traditional and improved, respectively. These are labeled (S0) and (S3) to distinguish them from the transhumant system (T0) for the same region.

periodically as a means of distributing the manure. The collection of manure for use on crop fields or for sale was only practiced by the peri-urban dairy systems.

The share of milk offtake for consumption or sale in the sedentary cattle models is generally lower than in transhumant systems. This appears to be due to the fact that the animals are primarily smaller breeds which have lower milk productivity, therefore less milk is available for human consumption.

### **C. Dairy systems**

Demand for fresh milk in urban areas has spurred the development of dairying enterprises around some of the larger Sahelian towns of West Africa. In addition, because of a unique sub-humid microclimate on the Accra Plains, dairy herds of zebu crosses have developed in this area to feed the Accra market. These herds have many of the characteristics of the sedentary herds noted above. However, they specialize in milk production, with milk production rates per cow two to three times higher than traditional sedentary cattle. This productivity is achieved by feeding animals higher-valued purchased feeds and fodder, resulting in much higher feeding costs. These systems also have higher labor, medical and fixed capital costs per animal.

## **II. HERD PRODUCTION ANALYSIS**

### **A. Problems of quantification: measurement and units of analysis**

A number of complications confronts economic analyses of livestock production. First of all, the identification of a production unit proves difficult because ownership of animals within a herd is often mixed. Typically, family members distinguish personal ownership in family herds: individual family members may independently determine such important decisions as when to sell or how much to milk an animal. Often, a herd may be comprised of animals of a number of families who may group their stock in order to economize on the costs of guarding and herding. Herds may also include animals which are entrusted from a relative as a loan or gift with certain reciprocal obligations. Lastly, animals may be herded as a business arrangement with a non-relative in return for payment in cash or kind.

Management practices are, in part, a function of the herder's relationship to the animals. Both Swift and Milleville argue that animals which belong to the herder or to members of his clan are more carefully tended than those which are herded under a business contract.<sup>20</sup> To illustrate the choices in labor intensity of management, both authors give the example of watering options: compared to pond water, well water is generally cleaner and healthier for animals but requires that the herder draw the water. Herders will tend to use ponds more often

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<sup>20</sup> Jeremy Swift, et. al., ed., Pastoral Development in Central Niger: Report of the Niger Range and Livestock Project (USAID); Niamey, Niger, (1984); and P. Melleville, J. Combes, and J. Marchal, Systèmes d'Élevage Sahéliens de l'Oudalan: Etude de Cas, ORSTOM, (September 1982).

when they are not herding their own animals. Swift also notes that herders will spend more time in micro-managing grazing if the animals are their own than if they are not. Finally, a herder will tend to milk a cow less heavily if he owns it because he has a greater incentive to protect the health of his own calf.

Despite these differences in management practices, existing data on herd parameters typically do not distinguish performance across categories of ownership but rather represent aggregate parameters for a large number of herds on the basis of only the broadest management practices integrated across a wide range of ecosystems.

Another complication is that a herd may be subdivided during parts of the year for various reasons, including the need to leave milking animals with sedentary family members to provide milk, or the need to remove weak or pregnant animals from herds which will be walking great distances to obtain pasture and water. In addition, a "family herd" may contain animals of different species which, for some activities, may be herded together. Models built for this study include data for species-specific herds, even if part of the herd is separate from the rest for much of the year, and ignore questions of ownership.

Evaluation of herd production costs and product is also complicated for ruminant livestock because production involves multi-year investments in reproductive stock. Births of young and flows of milk depend not only on the proportion of reproductive females in the herd but also on the change in their age distribution over time, because reproductive parameters themselves vary with age. A further problem, which is most extreme in the highly variable climate of the Sahel, stems from the extreme fluctuations in herd productivity from season to season and from year to year, as a function of biomass quality and availability.

Finally, the practical difficulties of studying mobile herds, particularly those which transhume, have meant that study of livestock production has been marginalized in the process of allocating public research and development resources, contributing to the paucity of careful microeconomic studies of livestock production in the region.

## **B. Herd modeling**

In light of the complexity of these systems and the paucity of information on their costs, the analysis uses a computer model to simulate pastoral livestock production. The model analysis is conducted for a species-specific herd which is assumed to reflect the level at which management decisions of herd production are made. Where a herd may be subdivided for part of a year, the combined herd is considered: input and output requirements are aggregated. The herd analysis does not attempt to draw distinctions of ownership within the herd in evaluating production costs. Multi-period modeling (twenty periods) simulates herd growth for a particular species and, on the basis of this growth, provides estimates of input requirements and expected outputs for the entire herd. The model is also capable of examining the effects of variation in animal production parameters due to drought or other sources of uncertainty.

The coefficients of production which are derived from the model are used for financial and economic analysis. These are evaluated per "reproduction unit" (RU); the number of RU in a herd is evaluated as the number of adult females of reproductive age.<sup>21</sup> This unit is defined to reflect the concept of the "Unité Zootechnique" used in French animal husbandry literature. The herd model and the issues it addresses are described in more detail in the workshop handbook created for this study.<sup>22</sup> The details of each model used in the analysis are presented in Annex D of Volume III. Important assumptions and data sources for these models are briefly reviewed below.

## C. Assumptions for evaluating livestock production costs and benefits

### 1. Animal productivity parameters

Animal production parameters used in all ruminant models are based primarily upon secondary research for the breeds in question. The sedentary zebu systems at Yako and Sikasso and the smaller cattle systems (Baoulé and WASH) at Korhogo and Kpong Tamale draw particularly from studies of animal production parameters conducted in Burkina Faso by J. Mayer of IEMVT.<sup>23</sup> For Sikasso, Korhogo and Tamalé, the baseline parameters provided by Mayer were supplemented by information from Kodjo.<sup>24</sup> Complementary data on mortality, animal offtake, milk extraction, inputs, and prices came from rapid reconnaissance field work conducted specifically for this study.

For sheep, production parameters for the "Mossi" breed are taken from a publication of the Burkinabè Ministry of Agriculture and Livestock (based upon the same IEMVT study) for small ruminants in Burkina Faso, while Disset provides the parameters for the D'jalonké<sup>25</sup>, and

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<sup>21</sup> The number of animals in an RU is therefore one adult female and the fraction of adult males and non-reproductive offspring per adult female in the herd.

<sup>22</sup> "Workshop handbook for the study of economic comparative advantage and incentives in livestock production and trade in West Africa's central corridor," prepared by Associates for International Resources and Development, December 5, 1992.

<sup>23</sup> J. F. Mayer, *Le troupeau bovin du Burkina Faso: résultats d'enquêtes*, Institute d'Élevage et de Médecine Vétérinaires des Pays Tropicaux, Ministère de l'Agriculture et de l'Élevage, Burkina Faso (Novembre 1989). The Yako and Sikasso models for sedentary zebu production use data from the 2nd group (sedentary) in the Mayer study, while the Korhogo and Kpong Tamale models for smaller cattle (Baoulé and WASH) are based upon the 3rd group in his study. The fit was much closer for the Yako analysis than for the other systems because this system was included in the survey region for group 2 in Mayer's study.

<sup>24</sup> Véronique Kodjo, *Suivi Statistique du Cheptel Bovin: Performances Zootechniques*, Ministère de la Production Animale, Côte d'Ivoire, Octobre 1990.

<sup>25</sup> *Paramètres zootechniques des petits ruminants*, Ministère de l'Agriculture et de l'Élevage, Burkina Faso, January 1990; and R. Disset, *Élevage ovine: la production ovine et caprine en Côte D'Ivoire*, Ministère de Développement Rural, Cahier #24, February 1986.

Charray et. al. furnish supplemental information in both cases.<sup>26</sup> The West African dwarf goat model also uses data for D'jallonké and Maradi goat breeds reported in Charray.

To assure an approximate fit between the secondary animal productivity data selected to represent each system, and the primary data used for determining input requirements, questions concerning estimates of reproduction, mortality, and offtake were asked of representative respondents for each production system. These provided a check on the results obtained by the herd demography simulations and marginal cost-benefit analyses of offtake decisions.

Table 3.3 summarizes the resultant productivity variables used by the economic analysis for cattle and small ruminant systems. The table shows that herd sizes of the systems modeled varied greatly, with the largest being for cattle in Mopti and the smallest for sheep in the northern Ghana systems at Tamale. These sizes were based upon the systems described by the local consultants, because all inputs and labor costs were associated with these herd sizes. However, because the productivity parameters were borrowed from broad-based surveys measuring average performance over large numbers of herds, the offtake parameters for number of head and meat and milk product per reproductive unit (RU) do not vary significantly as a function of size. Thus the effect of size is captured only in inputs used by herd systems and not in the zootechnical performance of the herds.

The annual number of head offtaken per RU varies between 0.2 and 0.4 for cattle and between 1.0 and 2.0 for small ruminants. This parameter is a function of assumed reproductive and mortality rates by age and sex category and the assumed age of offtake. Generally, reproductive rates (defined for the modeling exercise as the annual number of live offspring per RU) throughout the Sahel range between 50 and 60 percent for cattle and between 90 and 110 percent for sheep. These rates vary with the female's age, increasing from the age of parturition to a plateau level during most of the female's adult life, and then falling gradually as the animal reaches old age. Ages at parturition are between three and four years for cattle and between 20 and 24 months for sheep. Females typically remain reproductive until 10 to 12 years of age for cattle and until 7 to 8 years of age for sheep.

Mortality rates in the more humid zones are generally higher than those in the more arid zones. In addition, mortality rates assumed in all models fall dramatically after the first year of age in all cases. For males, offtake ages ranged between two and four years for cattle and between six and fifteen months for small ruminants. Females of both species in all herds are kept through their reproductive years, being removed or sold after 10 years for cattle and between 7 and 8 years for small ruminants.<sup>27</sup>

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<sup>26</sup> J. Charray et. al., *Les petits ruminants d'Afrique Centrale et d'Afrique de l'Ouest: synthèse des connaissances actuelles*, IEMVT, 1980.

<sup>27</sup> In some systems, where data were available, a proportion of animals in each age cohort was offtaken before attaining the maximum age, reflecting culling for weak, sick or sterile animals.

**Table 3.3**  
**CATTLE PRODUCTIVITY INDICATORS**

		-----CATTLE SYSTEMS-----				-----SMALL RUMINANTS-----			
		<u>Herd Size</u>	<u>Offtake</u>			<u>Herd Size</u>	<u>Offtake</u>		
		RU/herd	Head/ RU	Liveweight/ head (kg)	Milk/RU (l)	RU/herd	Head/ RU	Liveweight/ head (kg)	Milk/RU (l)
<b>MALI</b>									
Nara	Transhumant	44	0.30	276	99	47	1.90	23	18
Mopti	Transhumant	365	0.32	220	97	54	1.16	24	10
Sikasso	Sedentary	122	0.35	221	90	9	2.27	20	0
Bamako	Dairy	116	0.39	251	601				
<b>BURKINA FASO</b>									
Dori	Transhumant	24	0.31	251	128	12	1.76	22	0
Yako	Sedentary	29	0.48	260	95	36	1.26	21	0
<b>COTE D'IVOIRE</b>									
Korho T0	Transhumant	65	0.28	178	112				
Korho S0	Sedentary	65	0.27	165	80				
Korho S3	Sedentary	45	0.34	165	80	53	2.79	32	0
<b>GHANA</b>									
Tamale	Sedentary	3	0.17	167	58	5	1.95	26	0
Accra	Dairy	83	0.40	237	500	6	1.02	25	0

Note: RU = reproductive unit (consisting of one reproductive female and her share of the males and the non-reproductive females of the herd)

Animal weights are clearly higher for Sahelian cattle systems (which use the larger zebu cattle breeds). The same distinction is not evident for the small ruminants despite similarly smaller coastal breeds, apparently because coastal animals are sold at a later age.

The model calculates total and extracted milk production, with the difference being the amount given to offspring. Extracted milk goes to family consumption and sale. Annual extracted milk production rates for this purpose average close to 250 liters for zebu cattle and 200 liters for the smaller trypano-tolerant breeds (WASH, Baoulé, etc.) The dairy herds obtain significantly higher milk offtake, due to the use of feed supplements. Annual offtake in the Bamako herds rose to 600 liters, and to 500 liters in the dairy herds on the Accra Plains.

For nearly all cattle herds, approximately half of milk production was typically reported to be either sold or consumed in the family, while the other half was consumed by young animals. This parameter is well above the 20 to 30 percent rates reported by ILCA on the basis of careful measurement of milk offtake in Sahelian herds. However, for each system reported, offtake levels are maintained, assuming that these amounts are relatively well understood by those managing the herds. However, total production amounts were adjusted to arrive at offtake rates consistent with ILCA research.

## 2. Herd production costs

Production costs for each system have been evaluated on the basis of rapid reconnaissance questions posed to representative herders. These data have been complemented by production-level studies of livestock systems in the central corridor.<sup>28</sup> Tables 3.4 and 3.5 present summary production costs for the evaluated cattle and small ruminant systems. Important components of these costs are discussed below.

Table 3.4  
COMPONENTS OF PRODUCTION COSTS: CATTLE SYSTEMS

SAHELIAN COUNTRIES	MALI (FCFA/RU)				BURKINA FASO (FCFA/RU)	
	Nara Transh.	Mopti Transh.	Sikasso Sedent.	Bamako Dairy	Dori Transh.	Yako Sedent.
Reproductive stock	14471	17473	16019	11120	12577	31167
Labor	9733	2719	5516	15403	12912	9026
Commercial feeds	346	115	1539	19485	1585	429
Other commercial inputs	245	1134	1846	3786	1146	367
Fixed inputs *	71	7	26	24419	121	12
<b>Total production cost</b>	<b>24866</b>	<b>21448</b>	<b>24946</b>	<b>74213</b>	<b>28340</b>	<b>4100</b>
COASTAL COUNTRIES	COTE D'IVOIRE (CFA/RU)			GHANA (cedi/RU)		
	Korho T Transh.	Korho S0 Sedent.	Korho S3 Sedent.	Tamale Sedent.	Accra Dairy	
Reproductive stock	5877	5259	6165	9862	11243	
Labor	5022	4926	7231	5922	16657	
Commercial feeds	0	0	588	0	45088	
Other commercial inputs	869	274	989	0	5452	
Fixed inputs *	137	159	218	0	951	
<b>Total production cost</b>	<b>11905</b>	<b>10618</b>	<b>15191</b>	<b>15784</b>	<b>79391</b>	

<sup>28</sup> Cf. Delgado (1979), Melleville et al. (1982), Wagenaar et al. (1986), and Legast (1990) for semi-arid systems; Kodjo (1990), Gouet (1988) and Gari-Kweku (1992) for sub-humid zone systems; and Debrah (1991) and Praderre (1988) for peri-urban dairy systems.

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**Table 3.5**  
**PRODUCTION COST COMPONENTS: SMALL RUMINANT SYSTEMS**

SAHELIAN COUNTRIES	MALI (FCFA/RU)			BURKINA FASO (FCFA/RU)	
	Nara Transh.	Mopti Transh.	Sikasso Sedent.	Dori Transh.	Yako Sedent.
Reproductive stock	1870	2622	2758	3096	2356
Labor	7067	2092	6526	5147	3799
Commercial feeds	0	20	746	1519	1071
Other commercial inputs	37	657	1541	732	1350
Fixed inputs	113	43	0	335	961
<b>Total production cost</b>	<b>9087</b>	<b>5435</b>	<b>11571</b>	<b>10829</b>	<b>9537</b>

COASTAL COUNTRIES	COTE D'IVOIRE (FCFA/RU)	GHANA (cedi/RU)	
	Korho S3 Sedent.	Tamale Sedent.	Akyem Swedru Sedent. (goat)
Reproductive stock	2083	4438	3587
Labor	8014	8083	6757
Commercial feeds	94	1971	0
Other commercial inputs	1893	3189	0
Fixed inputs	0	1982	210
<b>Total production cost</b>	<b>12085</b>	<b>19663</b>	<b>10554</b>

a. Labor costs

In nearly all systems, labor is the most important cost of livestock raising. Valuing labor is difficult because first, work activities required by livestock have to be differentiated from those required by other activities of the production group, and second, difficulties arise in valuing the opportunity cost of this labor.

Important uses of labor in livestock production include: guarding animals, which is particularly demanding during the rainy season when they must be kept out of crop fields; milking, a task which also reaches its peak in the rainy season when milk offtake is highest; trekking animals between pasture and waterpoints, which becomes increasingly important in the dry season as both resources become more scarce; and raising water from wells, another chore which increases in importance in the dry season when surface water is not available.<sup>29</sup>

Tasks in pastoral systems throughout the Sahel appear to be allocated between members of the herding group largely by sex and age. Large ruminants are herded almost exclusively by men and boys, although women and girls perform milking and care for young calves kept around

<sup>29</sup> In addition, some herders, such as the WoDaaBe of Niger, are reputed for the large amounts of labor devoted to moving animals between biomass sources to improve their diet.

the camp. Boys are used primarily for watching cattle, but men are required when the cattle are moved, particularly during the rainy season when they must be kept out of crop fields. Men also draw water from the wells. Small ruminants are typically tended by children.

In the agricultural zones of the Sahel and throughout the coastal countries, herding labor is often provided seasonally by hired herders to keep herds out of fields during the cropping season. Most hired herders are of pastoral background and typically the village herder is referred to simply as "the Fulani". Herding wages are significantly higher than those for unskilled rural labor because of the herding skills and the hard work required. On the Accra Plains, for example, herders are paid more than double the base agricultural wage. Thus differential appears to reflect the specialized skills that herding requires.

Labor costs are based on an estimation of herders' remuneration in contractual arrangements made between herders and animal owners who either hire herders or who entrust their animals to a herding family for husbandry. Typically these costs are enumerated in terms of payments per head rather than per unit of time, and may be paid in kind, in cash or in some combination of the two. Labor markets are assumed to function well, and therefore market prices for herding labor, are assumed to reflect economic opportunity costs. While this approach simplifies the task of assessing labor costs, it may tend to exaggerate them, since the opportunity cost of labor from one's own family is likely to be less than for hiring labor due to the reduced transaction costs in finding and maintaining employment. Therefore, where information permitted, the opportunity cost for family labor is reduced somewhat from the costs of using hired herding labor.

Overall wage bills per reproductive unit are reported in Tables 3.4 and 3.5 above. They show that this cost is lowest for both cattle and small ruminants in the Mopti systems, reflecting large herd sizes there and resultant economies of scale in using labor in these systems. As would be expected, the highest costs are for the dairy systems, which use labor intensively. With the exception of the improved sedentary system at Korhogo (N3), sedentary systems show somewhat lower labor costs than the transhumant systems in each country, reflecting less labor in moving, guarding and watering animals.

Comparing similar systems across countries, Ghana shows the lowest labor costs, while Burkina Faso shows the highest costs for cattle, but Cote d'Ivoire shows the highest costs for sheep. (Note also that figures in tables 3.4 and 3.5 are not directly comparable because Ghanaian costs are in cedis.) Due to the small number of comparisons made here, these conclusions alone have little significance. However, comparisons of rural wage rates in each country confirm lower labor costs in Ghana and would imply that the highest costs exist in Cote d'Ivoire. No corroborating argument exists for high labor costs in Burkina Faso for cattle production, suggesting that this result is not significant.

#### b. Capital costs

Despite very few purchased inputs and almost no physical infrastructure requirements for most livestock production systems examined in this study, capital costs in livestock production

are large compared to other agricultural activities in West Africa because of the multi-year investments in reproductive animal stock and in raising non-reproductive animals from birth to the optimal age of sale.

Unlike labor markets, capital markets are assumed to be less effective in reflecting the economic value of capital because these markets are known to be highly segmented. Borrowing from a classification by Pearson, et al. (1981), West African capital markets may be differentiated into the formal private sector, the public sector, and the informal sector.<sup>30</sup> The public sector typically provides capital to the agriculture through large infrastructural investments, and through the provision of certain inputs at low, or even negative, real interest rates. For ruminant livestock production, however, direct infrastructural investments are small in comparison to crop agriculture; they include water point development, and Livestock Service facilities and market and slaughterhouse infrastructure. Periodic herd reconstitution programs after major droughts have also received public financing in the Sahel. Foreign donors generally subsidize public capital costs. However, the shadow price of this capital is dependent upon the likelihood of future sources of subsidized credit.

Most informal sector credit is for small amounts and is provided for very short time periods. Interest rates are high, in large part because risks of default and transaction costs are also high. Strong variability in rates suggests the degree to which these markets are narrow and poorly integrated. Stryker et al. estimated real annual rates between 15 and 40 percent for agricultural loans throughout West Africa in the mid 1970's. More recently, in interviews with traders in Niger and Chad in 1990, Cook found nominal rates for cash loans in commerce as high as 5 -12 percent per month and implicit rates of between 3 and 82 percent per month for "commodity credits" in kind. For the animal trade in particular, interest costs ranged between 13 and 36 percent per month with a mean of 20 percent. These very high rates are all for very short term loans (on the order of a month), however, and are not directly translatable into annualized interest rates because interest payments are not compounded, nor even generally increased proportionately as the period of the loan is extended.

Most importantly, livestock producers do not use these commercial loans for herd investments. Rather, most herd capital is financed by credit provided by extended families or close acquaintances, often at low or even negative real interest rates. The opportunity cost of this intra-family capital for herd reconstitution is also significantly lower than market rates or informal commercial loans for two reasons. Firstly, risk and transaction costs are lowered by the security and familiarity resulting from family ties. Moreover, intra-family animal loans are for much longer durations than most commercial loans, so that transaction costs per loan are smaller.

A further moderating effect on livestock sector capital costs may be linkages between this sector and formal private capital markets. Formal private sector capital is inaccessible to traditional livestock producers due to their remoteness and inability to deal with modern banking

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<sup>30</sup> Scott R. Pearson, J. Dirck Stryker, and Charles P. Humphreys, *Rice in West Africa: Policy and Economics*, (Stanford: Stanford University Press, 1981), Annex B.

procedures. Moreover, direct private banking investments in livestock are not common because of the inherent risks, the lack of easily-secured collateral and the difficulty of monitoring production. On the other hand, an indirect flow between this market and the livestock sector does exist through the relatively wealthy business and administrative classes who have access to the formal banking sector, and who also invest in livestock. This investment is documented, by Kodjo who found that over 20 percent of animals in a sample of Ivorian "improved" (N3) sedentary herds were owned by civil servants and by Swift, who found approximately 10 percent of cattle in transhumant Peul (WoDaaBe) households to be of this type.<sup>31</sup>

Peri-urban livestock activities, particularly semi-industrial poultry and pig production, are more likely to receive credit from private banks because they are more easily monitored by banks because they typically use more modern management practices, and have fixed assets which can be used as collateral. In Ghana, for example, the Tamale branch of the Agricultural Development Bank has not granted credits for cattle production in recent years, but it has used cattle as collateral for other loans. Rates obtained by informal interviews with bankers and their customers suggest that private banks' real interest rates range from 10 to 20 percent per annum in the four countries depending upon the duration and size of loans.<sup>32</sup>

Real interest rates in livestock production are assumed to equal 15 percent annually in the herd models. Furthermore, no distinction is made between financial and economic rates because it is assumed that, on the one hand, subsidized public credit is generally not available to livestock producers and, on the other hand, herd owners do not pay taxes on capital gains.

Annualized costs of reproductive stock reflect capital costs in production. These are presented by the production systems in Tables 3.4 and 3.5 above. The cost per reproductive unit is of roughly the same across systems because in all cases it represents the annualized costs of purchasing a cow. However, to the extent that differences in animal prices or reproductive longevity exist, they are reflected in these values. Moreover, the share of capital costs in total costs varies significantly because of variation in other component costs.

### c. Land and feed costs

i. Commercial and non-commercial feeds Grazing constitutes the principal feed source for all ruminant systems evaluated. It consists principally of roughage from pasture, browse and crop residues. Obtaining access to land containing ruminant-digestible biomass is therefore a principal preoccupation of herders. Such land includes open range, fallow lands and harvested

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<sup>31</sup> Kodjo (1990), p. 9; Swift et al. (1984) pp. 320 ff., 580ff. Swift hypothesizes that there may be a trend toward increasing capitalization of livestock herds in central Niger by non-herding groups as pastoralists are increasingly forced to reconstitute their herds with borrowed money.

<sup>32</sup> For example, nominal rates for private loans were 28% in Côte d'Ivoire, between 22% and 35% in Ghana. Meanwhile the World Bank calculates that the real interest rate was 15% for private investment loans in Côte d'Ivoire in 1991. World Bank, *Republic of Côte d'Ivoire: Review of the Livestock Sector*, World Bank Report no. 10756-IVC, (June 25, 1992).

crop lands. In all livestock producing zones of West Africa, there is a surplus of feed biomass in most years, and therefore obtaining access to it costs nothing. However, in the Sahelian zone, drought can result in local, temporary but severe constraints on biomass. More frequently, effective biomass availability is further limited by its distance from water. Moreover, in areas of high population density, levels of biomass per animal may be low and may represent a chronic constraint. Lastly, a dramatic reduction in availability and quality of biomass during the annual dry season causes a recurrent biomass constraint which results in transhumant movements of animals to less densely populated or higher rainfall areas to alleviate this constraint. Under these circumstances, the principal cost of obtaining biomass is simply the cost of moving animals to areas where it is available.

Particularly in the Sahel, where animals face severe dry-season feed constraints each year, the consequences are important for animal productivity. Animals undergo a dramatic seasonal weight loss during this "hungry season", and animal mortality rates rise significantly. Moreover, with the stress of weight loss, reproductive rates fall. To mitigate these effects, in some herding systems weak animals and reproductive females are given feed supplements.

To assess feed costs, the analysis distinguishes between commercial and noncommercial feed sources. The former are commodity feeds for which there is a local market, while the latter are less valuable feed sources for which no commercial value exists locally. In the analyses, commercial feeds are valued at their market price. Quantities are estimated on the basis of herder recall of purchases or allocation from on-farm production for animal use. These data are typically relatively easy to be recalled because of the explicit costs attached and because livestock rearers often use such feeds for a particular reason.

Non-commercial sources of feed, from pasture, browse, crop residues and fallow etc., are assumed in the base case analysis to be available freely and at no cost. However, any herding labor, permits, payments or other exchanges which may be required to obtain access to these feeds are explicitly valued. In addition, feed requirements based upon standard energy and protein requirements for livestock production (inclusive of separate estimates for weight gain and maintenance, gestation, lactation and fattening) are assessed in the herd model. Once the nutritional value of commercial feeds has been deducted, the model determines the approximate total quantities of energy and protein obtained from non-commercial feed. This estimate allows calculation of the maximum cost of non-commercial feeds which each system can support and remain economically (or financially) competitive. Lastly, assigning yields to different land categories yielding various "crops" of pasture, etc. allows the model to estimate stocking rates and thus to verify the assumptions for each system.

Tables 3.4 and 3.5 present costs of commercial feeds per reproductive unit in the base case analyses. (Non-commercial feed costs are assumed to be zero.) Dairy systems show much higher costs than other systems. Overall, feed costs in coastal countries appear to be below those in Sahelian countries, even for the "improved" production systems in Côte d'Ivoire. In most cases, sedentary systems also seem to have lower costs than transhumant systems. However, these costs are a minor component of total production costs.

ii. Feeds for fattening Another use of supplemental feeds is to fatten animals prior to offtake. This practice is more likely in sedentary systems where high energy feeds in the form of crop byproducts may be available on-farm. Typically, if animals are fattened on-farm, only a small number of animals destined for sale are selected for fattening based upon the availability of surplus on-farm sources of supplemental feed.

The analysis does not explicitly evaluate fattening as a separate component of production. Rather, two scenarios of fattening cattle are examined separately as value-adding activities in the market chain. The first is for a large-scale cattle fattening enterprise at Ferkessédougou which was established as a parastatal (although recently its management has been privatized). The second is for small-scale private cattle and sheep fattening operations at Pouytenga. Descriptions of these systems are presented with the analysis in chapter 4.

iii. Externalities: erosion and loss of biodiversity While consumption of non-commercial feeds may cost nothing in the sense that their market value equals zero, this activity may incur hidden costs to society. These "negative externalities" may include soil erosion or loss of biodiversity which may occur with overgrazing. Soil erosion can occur when grazing leaves soils unprotected to the effects of wind and rain. Similarly, selective grazing can potentially deplete a plant species until the population is no longer sustainable.

The impact of livestock on range and soil conditions in the Sahel is controversial, however, with some researchers claiming that, conditions causing animal populations to decline occur before permanent damage is done to rangelands. Moreover, considerable evidence suggests that tillage of arid land soils presents a much more serious threat to rangelands pastures than does overgrazing.

Lacking evidence to evaluate these potential costs, the basecase does not factor them into the economic analysis. However, a sensitivity analysis looks at the cutoff values above which the total cost of biomass cannot rise for each system. These values represent an upper bound for such negative externalities as well.

#### d. Drought effects

In the past two decades two devastating droughts have hit the Sahelian countries, resulting in dramatic reductions in herd sizes, and causing major changes in the livestock sector. At the production level, a number of notable effects are known to result from severe drought. First, the severe shortages of feed biomass result in a number of important changes in animal productivity. Liveweights and milk offtake fall, and mortality rates rise. During the drought reproductive rates also fall due to increased animal stress. Animal offtake from herds is also known to increase both in order to market weakened animals prior to their death, and because animal prices fall and grain prices rise during drought, requiring higher animal sales to obtain grain for the herding family's consumption during a period of very low milk production.

The impact of these effects on the economic value of the herd is clearly negative overall because of reductions in animal productivity. However, because most threatened animals are offtaken before they die, reductions in animal stock numbers exaggerate the economic losses due to drought. Moreover, while market prices fall during droughts in pastoral markets, resulting in large financial losses, these price fluctuations may reflect inabilities of local markets to deal with sudden increases in supply, but not necessarily reflect a reduction in the economic value of the product at its final destination. In fact, the value per kilogram of "meat on the hoof" may not be dramatically affected since coastal markets are now large net world market importers, and so can absorb Sahelian exports by a reduction in world imports without large price reductions. However, as animals lose weight during droughts, a lower proportion of each is potentially edible, so both the price per animal and the price per kilogram-liveweight drops.

The impact of drought has been taken into account in the analysis for the Sahelian herds only. Drought is modeled so as to have four effects on herd performance. First of all, in a drought period, herd offtake is modified to remove all males from the herd except those adults required for reproduction. Older females are also removed at a higher rate until offtake levels equivalent to those recorded in the drought of 1984 are attained. Secondly, mortality rates are doubled for all age groups. Thirdly, milk offtake falls, both because lactation rates fall due to the lack of feed, and because a higher proportion of milk is required to sustain animal offspring since other sources of feed are in shorter supply. A 40 percent reduction is assumed in the analysis. Lastly, animal weights fall due to the lack of feed biomass. This is accommodated in the model by a reduction of the total liveweight of animal offtake by 15 percent, reflecting the average percentage change in carcass weights at the Niamey abattoir for the 1984 and 1973 years with respect to the 1968-1988 weight average.

Based on these assumptions, the impact of drought is estimated by comparing a standard Sahelian zebu herd simulation over 20 years with a modified simulation in which any year has a 0.1 probability of being a drought year. If it is a drought year the effects noted above are introduced for that year. Using a Monte Carlo simulation which incorporates these probabilities, means for offtake numbers, weights of animals at offtake, and milk offtake rates were calculated. The net impact of drought on meat offtake for Sahelian cattle systems was to reduce the present value of meat production by only 4 percent, and to reduce the present value of herd milk offtake by 12 percent. Meat production was less affected because lower weight gain during droughts was in part compensated by higher offtake rates. Milk production on the other hand was negatively affected both by the occasional direct impact of the drought in reducing milk yields, and by the destocking of lactating cows during drought periods. The percentage changes in the net present value of these parameters were used to adjust the base-case parameters to account for drought in the economic analysis for all Sahelian herds.<sup>33</sup>

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<sup>33</sup> Separate analyses were not conducted for each Sahelian herd system because only global information on drought impact was available, so the same assumptions yielding approximately the same effects would have been obtained for each.

#### e. Variable and fixed commercial inputs

In each financial analysis, costs of commercial inputs and services were valued at prices paid by producers in local markets. Economic reference prices for tradeable inputs were based on international prices that had been adjusted by the cost of bringing these inputs to the farmgate. The decomposition tables in Annex G present the assumptions used to calculate farmgate reference prices for important inputs and services.

Of these inputs, the most common inputs are salt, vaccines and medical treatments. Salt is purchased in all cases, but is an insignificant cost. Vaccinations against rinderpest (in cattle) or peste de petit ruminant (in small ruminants), and the pluri-pneumonia (for both) are the most common costs.<sup>34</sup> Vaccines represent a minor financial cost, however, ranging from 15 to 30 FCFA per dose in the CFA zone countries. Similarly, in Ghana, an extremely low nominal fee is charged for vaccines (0.1 to 5 cedi/dose). Compared to these costs, estimates of delivered cost of each vaccine are estimated to be on the order of 100 FCFA. (See analysis in Annex G of Volume III.) The highest veterinary costs are for prophylaxis and treatment of trypanosomiasis. This cost appears in nearly all sedentary ruminant production systems and even in some transhumant systems. In all countries these costs are born directly by the herders.

Fixed inputs are only important in the sedentary systems, where herders use pens or corrals. In addition, the capital recovery of a hut to house the hired herders was found in several coastal systems. Several systems also use troughs and/or mangers for feeding cattle.

### III. OVERVIEW AND ANALYTICAL APPROACH TO RUMINANT MARKETING

#### A. Approach to the market analysis

The ruminants raised in the central corridor -- camels, cattle, sheep and goats -- all find their way to the market. However, cattle and sheep play the most important roles in long-distance trade and, particularly, in international trade from the Sahel to the coast. In a single step or through several smaller markets, they reach an assembly market frequented by long-distance traders who assemble herds for shipment to large population centers, especially Abidjan and Accra. The animals may travel to their destination market on the hoof, in trucks or by train -- or by some combination of these -- and then to the abattoir for slaughter.

Figure 3.1 schematically illustrates the marketing chains for meat and milk from a cattle production system in a Sahelian country. Locally-produced milk competes with reconstituted milk from the world market. Traders take slaughter animals south across the border to a city

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\* Vaccination costs show up not only in the production system costs but also in the marketing costs for stages where animals are moved across borders.

in the coastal country where, upon slaughter, the meat and hide are marketed separately. In this case the meat is an import substitute but the hide is treated as an export.<sup>35</sup>

This study concentrates on north-south flows within the central corridor which account for most current livestock trade. The greatest commercial livestock flow currently takes place across the borders from Mali and Burkina Faso into Côte d'Ivoire. Specific routes have been selected from each of the production zones under study which pass through the appropriate assembly market and on to the coastal cities of final consumption. They include the central corridor's most important arteries for trade livestock and a representative sampling of their feeder routes. Map 3.1, shown earlier in the chapter, shows the principle routes considered.

In both domestic and world market chains, existing marketing flows and transformations have been chosen where feasible. However, occasionally parts of chains have been synthesized from existing data to accommodate missing data or to test hypotheses about marketing possibilities which do not currently exist.

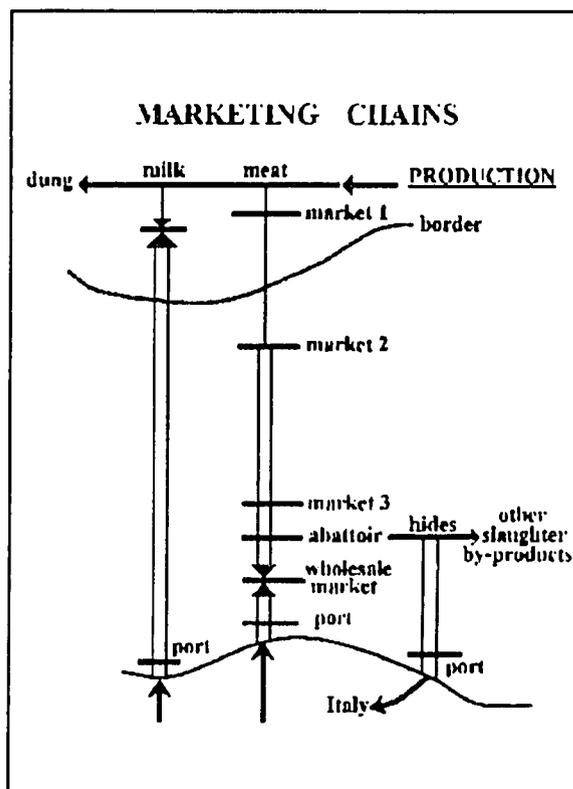


Figure 3.1

The study does not include details of flows between the central corridor and neighboring countries to east and west which are relatively minor. In the past traders exported animals from the eastern parts of Mali and Burkina Faso to Nigeria. However in early 1993, trade animals from Dori, well placed in northeastern Burkina Faso to benefit from the Nigerian and Nigerian markets, flowed southwest within the corridor. Similarly, to the extreme west of Mali, Ancy notes that few traders currently export livestock to Senegal.<sup>36</sup> Finally, Côte d'Ivoire and Ghana receive little livestock from countries other than Mali and Burkina Faso.

Within the central corridor, it seems unlikely that, other than very locally, livestock crosses the border between Côte d'Ivoire and Ghana. At these lower latitudes, long-distance ruminant trade tends to follow strict north-south lines with weak east-west linkages. However, near the coast there exists a series of east-west markets, mostly clandestine, for the re-export of meat. These markets develop in response to differential import regulations between coastal

<sup>35</sup> In the figure, double lines indicate trucking, single lines transport on foot.

<sup>36</sup> Veronique Ancy, *Image régionale de la production et des échanges de bétail dans le couloir central: Mali, Burkina Faso, Côte d'Ivoire* (unpublished document, 1991).

states. Such trade flows vary with changing national policies and include links between Côte d'Ivoire and Ghana. In late 1992 and early 1993, these involved flows of fatty poultry parts from Côte d'Ivoire to Ghana and of live chickens, entire poultry carcasses and eggs in the other direction.<sup>37</sup>

For each route examined by the study, prices and transaction costs were gathered using rapid survey techniques. These were used to update the analyses of several previous studies which have examined livestock marketing in the Sahel to build marketing cost scenarios. (The detailed analyses appear in Volume III, Annex E.) An overview of the characteristic steps and important costs involved in marketing livestock is presented below.

## **B. From the farm gate to the assembly market**

Assembly markets throughout Mali and Burkina Faso and in the north of both Ghana and Côte d'Ivoire feed coastal markets. The cost of bringing animals to an assembly market varies with distance but does normally exceed 1,500 FCFA per head of cattle or 400 FCFA per sheep. Typically the producer or a small trader accompanies them to the weekly market, and this accounts for the bulk of the cost. Animals still mostly travel on foot in the Sahelian countries, but in Ghana and Côte d'Ivoire owners load them into pickups or small trucks for all but the shortest trips to market. Depending on the season and the route, the animals may require purchased fodder and/or water, typically costing 100 to 200 FCFA per head of cattle and about a tenth of this for sheep.<sup>38</sup> Government agents rarely intervene in this initial link in the market chain.

At the assembly market, the owner cedes his animals to a sales broker who receives a commission from the seller if the animal is sold. The commission varies between 50 and 250 CFA francs for sheep and between 500 and 1,000 CFA francs for cattle, except in Burkina Faso where brokers charge 500 FCFA per sheep and up to 1,500 FCFA per head of cattle.<sup>39</sup>

Small costs averaging no more than 250 FCFA per head of cattle and 100 FCFA per sheep may be incurred on items such as: market taxes, payments for vaccinations for Sahelian livestock about to undertake long-distance trade (*taxe de visite sanitaire*); food and lodging for

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<sup>37</sup> J. Coste, et al., *Etude: "Politiques commerce extérieur des produits d'origine animale en Afrique de l'Ouest et du Centre"*, rapport de synthèse, prepared for République Française, Ministère de la Coopération et du Développement and Conseil de l'Entente, Communauté Economique du Bétail et de la Viande through SOLAGRAL/IRAM (mars, 1993), p. 15; and interview with Drs. Taylor, Atuorah and Obinim, Livestock Service.

<sup>38</sup> These averages pertain to the situations in which the drovers judge feed or water necessary. In many situations they make no payments at all for these items.

<sup>39</sup> Costs are in CFA francs. Costs of roughly the same magnitude apply to Ghana unless otherwise stated.

the trader; tips for various services rendered; animal feed or watering; unloading animals (in coastal countries); or a telephone call to check prices in the intended destination market.<sup>40</sup>

The buyer assembling a herd for shipment south may succeed in buying enough animals for his needs in a single market day. More likely he falls short of this goal and must hold the animals purchased until he buys the complement at another market. If so, he incurs holding costs: the capital cost of the animals held, fodder and water costs, and herding/guarding costs.

### **C. Long-distance transport of cattle and sheep to coastal markets**

Livestock traders take cattle and sheep from the assembly market to coastal markets, covering distances ranging from 500 to 1300 kilometers, mostly on a north-south axis. Until the 1970s traders trekked most of their animals along the market chain; since then, animal transport has shifted to truck transport, particularly in coastal countries. In addition, rail transport remains an important option between Ouagadougou and Abidjan. The role of each of these forms of transport is discussed briefly below.<sup>41</sup>

#### **1. Trucking**

Throughout Ghana livestock now moves almost entirely by truck. Trucking also dominates the movement of trade animals in Côte d'Ivoire where trekking south of Bouaké has been outlawed (though some in fact continues). Most animals which enter Côte d'Ivoire in trucks continue to their destination without disembarking. Their predominant destination is the Port Bouet market-abattoir complex in Abidjan's eastern suburbs.

In Sahelian countries the trend toward trucking has been much weaker, though some ruminant shipments from major Sahelian export marketplaces do take place directly to consumption centers in coastal countries. For example, Malian traders exporting sheep from Fatoma in the inland Niger Delta or Nara on the Mauritanian border now use trucks all the way to Abidjan. Likewise, from Pouytenga, a fattening center in eastern Burkina Faso, high-value fattened animals are trucked directly to coastal markets. Sheep hold up against the rigors of trekking less well than cattle, so long-distance traders more often truck sheep than cattle to coastal markets.

Trucking allows livestock traders to turn over their capital rapidly, and truckers may charge relatively low rates for livestock as one of a small number of loads available for backhaul to the coast. However, trucking costs vary widely with immediate supply and demand conditions. Shipments of Sahelian cash crops after the harvest compete with livestock travelling

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<sup>40</sup> Chapter Five, section I.C.1 provides details of market taxes paid; section 5.I.C.2 explains the business taxes which the government levies on market operators.

<sup>41</sup> For analysis of transport costs, see Chapter four Section III.A. Chapter Five section I.C, contains a discussion of marketing bribes.

southward to introduce a seasonal aspect to supply. Demand peaks before Christmas and Tabaské.

Long-distance truck-borne trade to the coast from the Sahel takes place in shipments composed entirely of either cattle or small ruminants. However, sheep move south from Ivorian markets piecemeal, loaded as extra baggage on the top of buses.

From the government's point of view, truck transport has the advantage that it reduces the threat of transmission of infectious animal disease from trade herds to reproductive herds in the zones through which they pass because the two remain quite apart.

## 2. Rail

Two companies, the *Société des Chemins de Fer du Burkina* (SCFB) and the *Société Ivoirienne des Chemins de Fer* (SICF) operate a mostly single-track railway from Ouagadougou to Abidjan.<sup>42</sup> Cattle destined for Côte d'Ivoire accounted for about 60 percent of the tonnage on the Burkinabè rail system in the years leading up to 1991. However, a decreasing number of trade animals now leaves Burkina Faso by train. Total tonnage dropped from 36,000 to 14,000 tons between 1985 and 1990, with a correspondingly steep drop in revenue over this period. Of the cattle transported by rail from Burkina Faso, approximately 44 percent embarked at Ouagadougou, 20 percent at Koudougou and 32 percent at Bobo-Dioulasso.<sup>43</sup> In addition, some Malian, Burkinabè and Ivorian traders load their animals into SICF wagons at the Ivorian border station of Ouangolodougou.

For reasons of hygiene, railway planners may not allocate certain goods to wagons used for livestock, thus limiting the maximum number of wagons assigned to livestock transport. According to SCFB, in times of excess demand, a joint committee of SCFB officials and livestock exporters meets to apportion wagons "in an order determined by their customs documents",<sup>44</sup> although others have observed that in fact an informal bidding process effectively auctions the available wagon space to the highest bidder.<sup>45</sup>

Livestock is moved from Ouagadougou, Bobo-Dioulasso and other stations along the railway line to Abidjan in boxcars. The price of renting an SCBF wagon includes a free return rail ticket for the trader and three half-price one-way tickets for the drovers accompanying the animals in the wagons.<sup>46</sup> SCBF does not own refrigerated wagons for moving fresh or frozen

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<sup>42</sup> Until it was split in 1989, the railway was operated by the *Régie Abidjan-Niger*, a jointly owned and run Ivorian-Burkinabè railway company.

<sup>43</sup> Burkina Faso, Ministère de l'Industrie, (1991), pp. 90-91.

<sup>44</sup> Ibid., p. 91.

<sup>45</sup> Kulibaba and Holtzman, (1990), p.92.

<sup>46</sup> Burkina Faso, Ministère de l'Industrie, (1991), p. 92.

meat but it does rent flatcars on which those wishing to export meat may place a refrigerated container.<sup>47</sup>

### **3. Trekking**

Most trekking occurs in the Sahel, where herds are entrusted to trekking teams which move them along well-defined trekking routes. The drovers are usually Fulani men led by an experienced trek boss who knows distances, grazing and watering opportunities, prevalence of disease, and bribes which he may have to pay along the way.

Some animals are trekked across the border both to Côte d'Ivoire and Ghana simply to avoid border the hassle and cost of border posts. On the other side of the border, they board truck or train to their destinations. Others continue on foot to Ferkessédougou (an industrial feedlot and abattoir) or Bouaké (for slaughter or to find a truck for the rest of the journey to Abidjan). Trekking is no longer practiced in Ghana. Reasons given are the disappearance of trekking routes due to the expansion of agriculture, health hazards, and fear of thefts.

### **4. Animal losses in transit**

A number of types of animal losses occurs in marketing. Some animals may die en route. Once dead, the animal is of limited marketability. Animals also lose weight in transit particularly due to sustained trekking, but also due to dehydration in trucking and rail transit. Trekked animals may also arrive in poor health and trucked animals may arrive injured at their destination, although these can usually be sold to recover some costs.

The analysis incorporates all three types of loss en route in a single category which explicitly takes into account the difference between trekking and other means of shipment, and also the differential risk of trekking in Sahelian and coastal countries, but which thereafter considers all journeys within these categories as susceptible to the same level of loss per kilometer.<sup>48</sup>

## **D. Downstream livestock markets**

Upon arrival at their destination markets, traders pay for unloading, feeding and watering their stock and often for pasturing and guarding them overnight or until sold. Market and municipal taxes, and broker fees, are also incurred when animals are sold to butchers. The butcher may buy on credit guaranteed by the broker. In coastal markets the traders, the sales brokers and the drovers typically have Sahelian roots. At Port Bouet, the cattle market near

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<sup>47</sup> Ibid., p.93.

<sup>48</sup> The following animal loss parameters are used for each market link: trekking in Sahelian countries — 0.5 percent; trekking in coastal countries — 1 percent; trucking and rail transport anywhere — 0.5 percent. Recognizing the greater frailty of sheep and goats in transit, these values double for small ruminants.

Abidjan, there are two separate Malian and Burkinabè channels for livestock arriving at Port Bouet, at least until they are sold to butchers. Each arriving truck is unloaded by a different team according to its provenance and the animals are sold through brokers by the same criterion.

Animals purchased in the markets at Port Bouet (Abidjan) or Ashiaman (Accra) go directly to slaughter. The butcher manages the slaughter operation but does not dirty his hands with the slaughter itself. Slaughter costs a total of around 6,000 FCFA per head of cattle in Abidjan, including an abattoir slaughter fee of 3,500 FCFA and payment of 1,000 FCFA to an apprentice who performs the slaughter. The abattoir fee may be large enough to cover all slaughter costs without requiring subsidies. In Accra, slaughter costs total 6,000 cedis per head of cattle, significantly less than in Abidjan although slaughter fees do not cover all costs of the infrastructure provided.<sup>49</sup>

The wholesale butcher derives four quarters of meat, weighing about 50 percent of the animal's liveweight, from the slaughter, and worth about 650 FCFA per kilogram. He also derives the "fifth quarter" of offal and hide which sell at about another 15 percent of the value of the four quarters. The abattoir may gain some residual benefit from discarded byproducts such as horns, blood or stomach contents.

Yoruba from southwestern Nigeria dominate butchery of "hot meat" in Abidjan. Wholesale butchers are older Yoruba men based in Abidjan whereas retail butchers are young Yoruba men who cycle through Abidjan as a rite of passage and then return to Nigeria. Aspiring butchers of Ivorian nationality resent the foreign domination of butchery in Abidjan, and are trying to break into the business. Correspondingly, in Ghana, Hausa and "Sahelians" dominate butchery and the livestock trade.

The butcher sells most meat to small retailers who may also sell frozen imported meat directly alongside at stalls in various parts of the city, often in a designated section of larger retail markets. Retailers sell most of it on the same day. Retail costs are estimated at 2,500 FCFA per 145 kilogram carcass (17 FCFA per kilogram) in Abidjan, including transport from the abattoir, and in Accra at 2,200 cedis per 100 kilogram carcass (22 cedis per kilogram).

Retail butchers should store meat not sold on the day of slaughter in refrigerators at +4°C. However, to cut costs in Abidjan they tend to store it in space available alongside imported frozen meat stocked in their freezers at -40°C. Low temperatures blacken the meat which by midday the next day sells at a 100 - 150 FCFA per kilogram discount to fresh meat. They sell any of this meat left at the end of the second day to *rôtisseurs*, men who grill meat to sell on the street as fast food. Grilling hides the original color of the meat. Such meat accounts for an estimated 80 percent of all grilled meat served on the streets of Abidjan.

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<sup>49</sup> Ghanaian costs are estimated by applying a factor of 1.6 (to account for price inflation from late 1990 to early 1993) to costs given in World Bank, "Working paper IX", *Ghana Livestock Sector Review* (Washington, 1991), p. 112.

In Accra and Abidjan, importers of frozen meat from the world market keep it in large cold stores from which they sell wholesale to butchers, restaurants or directly to members of the public who can buy in sufficiently large amounts. Much of the imported meat consists of low-grade fatty offcut, oriented at a poorer clientele, though importers also sell better cuts. Sahelian interests do not dominate this short market chain.

It is at this retail point that the costs of the domestic and imported commodities, are compared to determine prime placed on quality and taste. However, domestic meat sold to the mass market in West Africa is typically sold in mixed piles of lean, fat, gristle, and bone, whereas imported meat is commonly limited to cuts of lean and fat. To avoid the complexities that this differential heterogeneity causes, the domestic and imported commodities are compared at the wholesale carcass stage.<sup>50</sup> The analysis incorporates a quality premium to account for the greater value placed on fresh local meat in comparison to frozen imported meat. A 20% markup is used as the premium on beef, sheep and goat meat, and is based upon several market comparisons of local fresh and frozen red meat of roughly equivalent quality.

The analysis also considers slaughter in the Sahel for meat export. Sahelian parastatals have historically sent chilled meat to the coast by trucks and to Central African capitals by plane. No one currently exports meat by truck. However, some exports by plane from Burkina Faso to Gabon do take place. Slaughter at Ouagadougou abattoir follows the same pattern outlined above but incurs a high "slaughter tax" of 7,500 FCFA per head of cattle which is presumably meant to cover costs until recently subsidized.<sup>51</sup> From the abattoir, red meat reaches Ouagadougou airport FOB for another 94 FCFA per kilogram.

## E. Meat processing

Meat processing includes formal sector factory operations such as chilling, freezing, canning and sausage manufacture; and smoking and drying in the informal sector. Sahelian butchers have traditionally dried and smoked meat for local consumption and for export. These products have high value densities and thus relatively low transport costs when taken to coastal countries. This transformation tends to use particular animal parts or flesh from thin and old animals. During drought such activities increase. In Burkina Faso urban centers Hausa butchers grill ruminant heads and feet and export them to Ghana. Pouytenga (the Burkina Faso fattening center) also produces dried meat, though it remains unclear whether the dried product enters into long-distance trade. In Abidjan, processors cook and smoke skins and cattle brains for sale in *maquis* restaurants.

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<sup>50</sup> This shift in the point of comparison may cause errors in the analysis to the extent that marketing costs from the wholesale to the retail level differ between the two types of meat, but this difference is judged to be minor.

<sup>51</sup> CF. Burkina Faso, Ministère de l'Agriculture et de l'Élevage, Secrétariat d'Etat à l'Élevage, *Etude prospective du sous-secteur élevage au Burkina Faso, tome II: annexes*, prepared by IEMVT-CIRAD/SFC SEDES-CEGOS (April 1991), p. 200.

There is a government-run "corned beef" factory in Bolgatanga, northern Ghana running at extremely low capacity usage, but which does not seem to be on the privatization list. At one point Ghana imported meat from South America to supply the factory. A sister company produces sausages at a factory in Tema. These and the Ferkessédougou feedlot/abattoir appear to constitute the sum total of formal sector meat industries in the coastal countries.

## **F. Skins and hides**

Skins and hides from slaughter provide opportunities for further value added through processing, from crude artisanal treatment to complete tanning for high-fashion soft leathers. Intermediate between these two extremes lies partial tanning to produce a "wet blue" product for finishing elsewhere. Sahelian countries have a tradition of tanning and leatherwork for which butchers have learned to remove the skin or hide with care.

In Burkina Faso a private company has taken over the former parastatal tannery. The *Société Burkinabè des Cuirs et Peaux* exports partially tanned skins and hides by train to Abidjan and then by boat to Italy and Spain. Its affiliate, the *Société de Manufactures de Cuirs et Peaux* produces finished leather goods.

TAMALI, the parastatal Malian tannery, is up for sale. Before liberalization, the state required that traders give TAMALI 50 percent of their skins and hides. TAMALI shipped most of the tanned products to China. Since then, traders have been sending their untanned skins and hides directly to Europe. No other formal sector tanneries exist in Mali.

In contrast to the Sahel, no tanning tradition exists in the coastal areas of Côte d'Ivoire and Ghana. These countries also have low availabilities in animal protein. So butchers there do not generally remove skins which consumers eat cooked with the rest of the small ruminant meat. When they do remove the skins they often do so without great skill, leaving tears. Moreover, the skins may not dry well in the coastal humidity. Thus little indigenous tanning occurs. A tannery which existed in Tamale, northern Ghana, has closed down and traders now take Ghanaian skins and hides to Ouagadougou for tanning.

In addition to eating small ruminant skins directly with the meat, coastal consumers also cook and eat hides removed from cattle carcasses after removing any hair and soaking them in water to soften them. Some of Abidjan's *maquis* restaurants serve smoked hide as a delicacy. In Côte d'Ivoire and Ghana, traders take part in a north-south trade in skins and hides, mostly for human consumption in the south.

## **IV. CONCLUDING REMARK**

Traditional ruminant livestock systems are complex systems and are also difficult to evaluate because of their isolation from established markets. Production occurs over a multiyear period and yields a variety of products, for which yields vary with the age and sex of each

animal and with the highly variable natural environment in which production takes place. Most production costs are for nontradeable factors and resources for which established markets do not exist. Marketing occurs through a myriad of informal channels.

However, despite these difficulties, models which simulate production and capture the important alternatives in marketing can yield representative examples of the economic costs and benefits of these production systems. The combination of production and marketing scenarios identified in this chapter provide a basis for evaluating the competitiveness of the livestock sector of the central corridor in competing with world suppliers of livestock products to the region's coastal urban markets. This is the objective of the next chapter.

## CHAPTER IV

### FINANCIAL AND ECONOMIC ANALYSIS OF THE RUMINANT LIVESTOCK SECTOR

The previous chapter has defined production-marketing-transformation scenarios as representing typical or interesting alternatives for livestock production in the central corridor. This chapter provides a financial and economic analysis of these scenarios in order to respond to the issues raised in Chapter II concerning the economic potential of the livestock sector. The first section briefly reviews the methodology and explains assumptions used in deriving reference prices for economic analysis. The second section examines the "base-case" results of the scenarios presented in the previous chapter, and investigates the sensitivity of these results to various important assumptions. A third section evaluates a number of the particular issues raised in chapter two, namely the profitability of alternative marketing routes and modes, the potential for fattening, and the prospects for exporting meat from the Sahel to the larger world market.

#### I. METHODOLOGY

##### A. Analytical approach<sup>52</sup>

Analysis of financial profitability is used to reveal current incentives to producers and market actors, while economic analysis measures the value of these same activities to the larger economy. In this study, the "larger economy" takes two alternative forms. First, in the base-case analysis, each country in the region is viewed as a separate economy which pursues its own best interests. However, a second perspective examines the value of livestock production and trade from the perspective of the **regional** economy. This perspective supposes that policies effected by countries within the region have a regional impact, and that resources of the region are relatively free to flow to respond to incentives to produce and trade within the region, while products of the region also flow in response to consumer demand. Examining the regional economy as a whole provides insight into policies to promote regional integration.

The economic analysis starts from the proposition that each country has a limited supply of non-tradeable factors of production — such as land, labor and capital — which it may use to produce goods and services for domestic consumption and/or export. It cannot directly trade these basic factors, but it can use them to generate value by applying them to economic processes, such as rearing and marketing livestock. The analysis therefore asks whether a given scenario of production and marketing of livestock products represents an efficient use of these

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<sup>52</sup> An explanation of the methodology used in the study is provided in the *Workshop Handbook* written for this study (AIRD, December 1992).

non-tradeable factors of production, or whether the country concerned would be better advised to purchase the products of these activities (meat, milk and byproducts) through trade, and use the scarce resources they require in some more profitable venture.

### 1. Financial analysis

To accomplish this analysis, a financial analysis is first conducted for each production/marketing scenario, using market prices to estimate the value of the product and the costs of production and marketing. The difference represents the profit or **net financial benefit** (NFB) perceived by economic operators in the scenario.

The financial analysis incorporates both explicit and implicit costs of production. Thus, for example, family labor is valued at the opportunity cost of labor discounted by a factor representing the transaction costs of seeking employment outside the family. Similarly, a capital cost is charged to all purchases, reflecting the implicit value of capital tied up in production. All prices used in the financial analysis apply to the 1992/93 year.

### 2. Economic analysis

Market prices include a number of distortions — such as taxes and subsidies — which deprive these operators of price signals which indicate the "true" economic value of the goods and services they buy and sell. The economic analysis corrects for these distortions in order to find the undistorted value of livestock products to the country concerned. Consumers in the central corridor meet their needs for livestock products by either buying goods produced by a variety of competing production systems or by purchasing these goods from the world market. The analysis therefore assumes that for most livestock products, world market prices represent the economic value or "opportunity cost" of domestic production.<sup>53</sup>

The economic analysis uses two measures of economic value. The calculation of these indicators is explained in detail in the methodological annex. The **net economic benefit** (NEB) represents the benefit of an activity to the national economy once all costs to the economy have been deducted. It relies on the evaluation of the financial profitability (NFB), but adjusts the prices of inputs and products of the activity to reflect their "opportunity costs" to the country as a whole.

A second indicator, the **domestic resource cost** (DRC) coefficient derives from the theory of economic comparative advantage that states that a country should produce and export goods in which it has a relative productivity advantage and that it should import goods in which it does not have this advantage. Productivity, in this sense, is defined as the efficiency with which a country's factors of production are converted into useful output. That output is measured in economic terms by value added, expressed in world prices. For any particular activity, the ratio of value added, measured in this way, to the net economic cost of the factors

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<sup>53</sup> Where a world market does not exist for a product, such as manure, it is a "non-tradeable" and so is valued using a local market price.

of production used in that activity is an indicator of productivity. The inverse, or ratio of the cost in domestic resources expended for production of a good or service, on the one hand, to the benefit (value added) gained in production on the other, is used as an indicator of comparative advantage. This latter ratio is the DRC coefficient. This coefficient is convenient because it varies in direct proportion to changes in exchange rate, and is unitless, thereby allowing direct comparisons across products, systems and national boundaries.<sup>54</sup>

## **B. Reference price assumptions**

Evaluating economic reference prices for tradeable commodities requires selection of an appropriate world market price, and adjusting the price for differences in quality between the world and domestic product, and for costs necessary to deliver the reference product to the same markets in which domestic production is being valued.

### **1. Product tradeability and the point of valuation**

The base-case analysis examines the competitiveness of carcass meat as an import substitute in Abidjan and Accra markets where there exists controversy about its comparative advantage.<sup>55</sup> Milk is also an import substitute in West Africa. However, in contrast to meat, most domestically-produced milk is consumed in or very close to the production zones, so the analysis examines milk reference prices for each production zone, as well as in urban centers near these zones. Reference prices used reflect 1992 averages to eliminate the effects of seasonality.

Skins and hides provide a variety of transformed products, each of which is evaluated separately, according to the scenario in question. Sahelian butchers are assumed to sell skins and hides to local tanneries which condition them for export to international markets for further transformation into leather. In these cases reference prices for skins and hides use the FOB price at the port of departure from the country. However, in both coastal countries, skins and hides may be eaten, in which case the skin becomes a part of the meat, and is evaluated as such *in situ*. The offal and other animal byproducts are valued at local market prices and are assumed to have the same tax and tradeable composition as local animal production costs.

### **2. Quality differentials**

In comparing world market and domestic livestock products, an adjustment must be made for differences in quality between the two products. For example, locally produced fresh meat

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<sup>54</sup>Interpretation of the DRC indicator is straight forward: DRC's less than one reflect a comparative advantage in production and correspond to a positive Net Economic Benefit; DRC's greater than one, or negative, reflect inefficient domestic resource use and therefore economic losses.

<sup>55</sup> In fact, cold chains take imported meat at least as far as Korhogo in Côte d'Ivoire, but no further than Kumasi in Ghana.

is generally considered superior to imported frozen meat because it has a lower fat content, its taste is preferred, and the circumstances of its slaughter are known (important for Muslims). The analysis considers these factors by adjusting the world reference price by the ratio of unit retail prices for the local and world market products. This ratio is assumed to reflect the net quality differential between the two products. Analysis of unit prices suggest that fresh meat enjoys a price differential of roughly 20 percent over its frozen imported equivalent in coastal cities.<sup>56</sup>

In fact, however, most meat imports to West Africa are low quality meats such as *capa*, a fatty cut of the flank. A comparison of preferences for fresh local carcass meat to *capa* in West African markets suggests that the premium for fresh carcass is lower than is found in European markets. In 1991, for example, *capa* sold for roughly 65% of the price of carcass meat at wholesale; however, in Europe it sells for less than 40-50% of carcass meat at wholesale.<sup>57</sup> This is in part because consumer prices in Abidjan are influenced by tariff policies. The current compensating levy attempts to maintain internal consumer prices at 510 and 750 respectively for *capa* and carcass meat, representing a differential of 68%.<sup>58</sup> The narrower differential between fresh and *capa* meat in Abidjan suggests that fresh West African carcass meat is undervalued in comparison to world market preferences when it is sold in coastal markets in competition with low quality world imports.

For dairy products, factors which consumers consider important in choosing between locally-produced and imported products include taste, the convenience of transport and storage of powdered milk, and the ease of finding potable water for reconstitution. In the livestock producing zones where local dairy products compete with those made from imported milk, no evidence was found that consumers distinguish between the two, although in larger cities and towns a clear preference for fresh milk was found. At least in certain situations, sellers offer only sour-milk concoctions which makes an evaluation of quality preference difficult. Moreover, some sellers make differentiation more difficult by using a seasonably variable mix of both types of milk. Finally, consumers' major concern is often not the origin of a product's milk but

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\* This preference is not reflected in price differentials in butcher shops serving the European clientele, however, because their clients place a higher value on other factors, including presentation, cut and the environment (hygiene, etc.) of the sale.

<sup>56</sup> This comparison is based on 1992 prices of 450-500 FCFA/kg and 700-800 FCFA/kg for *capa* and carcass meat respectively at wholesale in Abidjan, and of \$1000 and \$2450/T respectively at EC FOB prices. Comparisons from US markets are complicated by quality definitions. However, a comparison of USA wholesale prices also shows the extreme range in prices for meat products by quality: pure carcass fat sells for 10 cents/lb, 50% chemical lean ground beef sells at about 50 cents/lb, 80% chemical lean at between \$1.50 and \$1.80/lb and boneless steak at between \$3 and \$5 per pound. Boneless 65% trimmings sell for \$0.78/lb in comparison to a \$1.65/lb boneless carcass composite price or \$1.07 bone-in carcass price. This comparison gives a ratio of about 51% comparing bone in equivalents, which is slightly higher than in Europe, but still well below the Abidjan price comparisons.

<sup>57</sup> C.f. J. Coste, et al., *Etude: "Politiques commerce extérieur des produits d'origine animale en Afrique de l'Ouest et du Centre", rapport de synthèse*, prepared for République Française, Ministère de la Coopération et du Développement and Conseil de l'Entente, Communauté Economique du Bétail et de la Viande through SOLAGRAL/IRAM (March 15, 1993), pp. 469. and Annex table 2.a.

whether the seller has watered it down. Therefore, the analysis makes the conservative assumption that consumers make no distinction between milk of domestic and imported origin and assign a quality differential of zero to imported milk.

### 3. Reference prices chosen

Table 4.1 shows the reference prices for beef and sheep meat used in the economic analysis. The beef price is based on a 1992 average CIF price for Australian boneless frozen beef in the United States.<sup>59</sup> Reference prices for mutton are based on the 1992 average wholesale London price for New Zealand frozen sheep carcasses. Goat meat, for which a world market does not exist, has been evaluated using sheep meat prices because it is a direct substitute in coastal diets and its price is roughly equivalent to sheep meat in local markets.<sup>60</sup>

These prices have been converted into a corresponding carcass price to which has been added the cost of shipping to West Africa. Once unloaded at the ports of Abidjan or Tema (Accra) and taken to the port gate, import duties, including countervailing duties, increase financial prices to well above the economic price. This differential increases as the meat moves upcountry reflecting the implicit taxation in trucking services. (See Annex F for analysis of reference prices.) For the scenario exporting meat to world markets, the same world FOB prices for frozen meat have been adjusted to derive CIF prices in destination markets for Sahelian meat. As in the case of imports, a 20 percent quality differential for Sahelian meat is retained over world market imports because of preferences for fresh over frozen products.

Table 4.1  
REFERENCE PRICES FOR CATTLE AND SHEEP CARCASSES

Units		Cattle carcass price		Sheep carcass price	
		financial	economic	financial	economic
World price (CIF NY)	U.S.\$/T		1705		2592
	FCFA/kg		471		682
	cedis/kg		1037		1500
Abidjan	FCFA/kg	890	605	1176	859
Korhogo	FCFA/kg	1206	724	1583	1034
Accra	cedis/kg	1712	1534	2616	2359
Tamale	cedis/kg	1994	1769	3034	2709

<sup>59</sup> This price series was available until the end of 1992. The series appears to be the same series used by DCGTx in Abidjan for their calculation of the level of countervailing duties on beef. In 1991, they used an eleven month average as the basis of their calculation. The price series shows a drop during the winter months, so the current study also uses an average across seasons for the 12 months of 1992.

<sup>60</sup> Assessment of Kwaku Owusu Baah.

Reference prices for milk are derived for reconstituted milk from world prices for powdered skimmed milk and butter-oil of U.S.\$1,681 per ton of skimmed milk and U.S. \$1,797 per ton of butter-oil. These are simple means of the 1992 monthly high and low European FOB prices quoted for these products. A liter of reconstituted whole milk is assumed to require 96 grams of skimmed milk and 20 grams of butter-oil per liter of water. Table 4.2 presents resultant reference prices for a number of comparison points in the region: in the major cities in the producing zones, in secondary towns in the Sahelian countries (e.g. Dori or Mopti) and at the farm gate.

**Table 4.2**  
**REFERENCE PRICES FOR MILK**  
(local currency/liter reconstituted)

	Tamale		Korhogo		Ouagadougou		Bamako	
	financial	economic	financial	economic	financial	economic	financial	economic
City price	174	141	96	64	73	63	89	72
Secondary town price	--	--	--	--	92	74	120	92
Farm price	203	169	132	94	117	97	164	131

#### 4. Reference prices from a regional perspective

In evaluating scenarios based on Sahelian production, deriving reference prices at consumption points for livestock offtake poses a dilemma if the animals are sold in coastal countries. The dilemma arises because the animals' use value is derived outside the country of origin but within the region.

From a **national** perspective, the reference price for Sahelian livestock equals the FOB price which Sahelians can obtain at their borders using reference prices of meat in port cities from which marketing costs are subtracted using the economic costs of moving live animals from the Sahelian countries to these coastal markets. The analysis assumes that **all** costs, including taxes incurred in moving animals from the Sahelian border to the coastal market, or in importing meat from world markets, represent "economic" values because they are incurred outside the national economy and therefore outside the control of the Sahelian countries. Thus border prices, leaving Sahelian countries, although they are increased by protective policies in the neighboring coastal countries, are assumed to represent economic reference prices for Sahelian countries. The base-case analysis is carried out from the **national** perspective.

From a **regional** perspective, however, national political boundaries cease to be economic boundaries. A regional organization (of which the Sahelian country is a part) controls the incidence of taxes and subsidies within the entire region. The economic life of a Sahelian animal consumed in a coastal country takes place entirely within the region: taxes imposed on marketing in the coastal consuming countries are now deducted from the animal

marketing costs because they are intra-regional transfers rather than external taxes which a national government could not be expected to control. Similarly, taxes imposed in the coastal country on meat imported from the world market are removed for the purposes of the calculation of any reference prices for a scenario based on Sahelian production and coastal consumption. This adjustment generally has the effect of lowering the world reference price to the Sahelian countries because the protection afforded by the coastal markets is no longer viewed as an external phenomenon, but rather as a policy variable. An analysis from this regional perspective is presented for the Sahelian countries to highlight the potential advantages or disadvantages that obtain from regionally coordinated policies. (Note that national and regional perspectives are identical for coastal countries since they do not export significant volumes of livestock products to other countries in the corridor.)

### **5. Exchange rate assumptions for determining economic reference prices**

The official exchange rates used to convert the value of products denominated in foreign into domestic currency are 260 FCFA and 550 cedi per U.S. dollar. These rates are average rates which applied between July 1992 and June 1993 rounded to the nearest ten units. However, macroeconomic distortions, including balance of payments difficulties and high levels of import tariffs, suggest that the CFA franc has become significantly overvalued with respect to world currencies. Because the CFA franc zone countries have chosen to maintain a constant exchange with the French franc, devaluation has not been available as an adjustment tool to correct overvaluation. In mid 1993, however, the central banks for both the western and central CFA zones announced that transactions outside the CFA franc countries would no longer be convertible. These measures, taken to stop the development of a parallel market and speculation against a devaluation, is further evidence of the overvaluation of the CFA franc. Stryker and Salinger estimate that overvaluation in the cases of both Mali and Cote d'Ivoire are on the order of 50%.<sup>61</sup> This assumption is therefore used as the basis for evaluating the equilibrium exchange rate of the FCFA for the economic analysis.

For Ghana, on the other hand, since the initiation of the Economic Reform Program, its currency has been dramatically devalued from an extremely distorted situation in the early eighties to levels which appear close to equilibrium. An overvaluation of about 10% is retained in the analysis reflecting a continuing lag in adjusting the exchange rate to keep pace with inflationary pressures in the economy.

### **6. Decomposition of economic values for inputs**

In addition to derivation of economic efficiency prices reported above for products of ruminant livestock systems, the analysis also evaluates the opportunity cost of inputs used in production and marketing. For an important input, this requires that its costs be desegregated or "decomposed" into its tradeable and non-tradeable components, and that

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<sup>61</sup> B. Lynn Salinger and J. Dirck Stryker, *Exchange Rate Policy and Implications for Agricultural Market Integration in West Africa*, AIRD consultant report prepared for USAID (May 1991).

distortions caused by policy, market imperfections or other externalities be removed from the financial costs of these components. This decomposition analysis is undertaken for important inputs including transport, commercial feeds, and vaccines, and is presented in the tables in Annex G. Based upon these decompositions, a discussion of the policy distortions to input costs is provided in Chapter V.

## II. THE COMPETITIVENESS OF LIVESTOCK SCENARIOS IN THE CENTRAL CORRIDOR

Tables 4.3-4.5 present the results of the financial and economic analyses for production and marketing scenarios based on Sahelian cattle, coastal cattle and sheep respectively.<sup>62</sup> Each table groups scenarios by country of production and for different points of sale for the meat product of the scenario. Cumulative net financial and net economic returns are presented and each is expressed both per unit of animal production and per man-day of labor input. Units are CFA francs (FCFA), except for scenarios with Ghanaian production, for which returns are given in cedis. Finally, each table presents the DRC coefficient for each scenario, providing an indicator of economic comparative advantage which can be compared across scenarios and countries.

The unit of animal production used in the financial and economic analyses is the animal "reproductive unit" (RU) which represents a reproductive female and the share of other animals which accompany her in the herd. Typically, for cattle for example, there are 2.7 animals per reproductive unit, or 1.7 in addition to the cow, of which 0.3 are sold each year. However, for each model the RU varies slightly, based on reproductive, mortality and offtake rates. The economic analyses is therefore conducted on the combined or "joint product" of each RU. Three products — the meat, milk and hide or skin — make up this "joint-product". The weight of each component in the "joint product" of the RU is derived from the net present offtake of each product in 20-period simulation of herd growth.

The economic value of each joint-product component is evaluated in comparison to its value in world markets. In the scenarios considered, meat is consumed in either Abidjan or Accra, milk is consumed in the region of production, and hides and skins are either exported, in the case of animals slaughtered in Abidjan, or eaten, in the case of animals slaughtered in Ghana. The herd model also provides the net output per RU of other products (manure, offal, head, tail, hooves, horns etc.) which are considered as non-tradeable byproducts and valued at local market prices at their point offtake.

The financial and economic net benefits reported in the analyses which follow are cumulative, meaning that they examine total costs with respect to financial or economic product value at the final point of comparison, inclusive of production marketing and slaughter or processing costs. Thus any net benefit is actually shared by the producer as well

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<sup>62</sup> The computer model upon which these results are based is found in Annex C.

as the trader and other marketing intermediaries in the market chain. The base-case scenarios generally assume that animals are trekked to collection markets and then trucked to the final destination markets. Unless otherwise specified, transport is by truck along long-distance marketing links because trucking is generally assumed to be the dominant future transport mode. (See Section III below for the analysis of transport alternatives.)

## A. Base-case results

### 1. Cattle scenarios

Table 4.3 presents the summary financial and economic results of the analyses of the base-case scenarios: cattle production in Mali and Burkina Faso, followed by marketing of animals to the two large coastal markets in the central corridor, Accra and Abidjan. Milk is assumed to be marketed only at the local level, as is currently the typical case, except for the two peri-urban dairy scenarios, for which milk is marketed to the urban center. In all cases,

Table 4.3  
ECONOMIC ANALYSIS FOR SAHELIAN CATTLE SCENARIOS  
(FCFA)

	MALI				BURKINA FASO	
	Nara Transhumant	Mopti Transhumant	Sikasso Sedentary	Bamako Dairy	Dori Transhumant	Yako Sedentary
<b>LIVESTOCK FOR SALE IN ACCRA</b>						
Cumulative net financial returns						
per RU	-7442	4514	-5187	37422	-20460	-20884
per man day of labor	-382	913	-470	1215	-792	-1157
Cumulative net economic returns						
per RU	24646	31985	13396	-11170	11276	24380
per man day of labor	1266	6469	1214	-365	437	1350
Domestic Resource Cost (DRC)	0.54	0.40	0.66	1.18	0.73	0.57
<b>LIVESTOCK FOR SALE IN ABIDJAN</b>						
Cumulative net financial returns						
per RU	4914	13112	8540	54443	-792	4461
per man day of labor	252	2652	774	1767	-31	247
Cumulative net economic returns						
per RU	26153	30676	23617	3269	17651	25686
per man day of labor	1344	6204	2141	106	684	1423
Domestic Resource Cost (DRC)	0.52	0.41	0.53	0.96	0.63	0.59

hides are assumed to be exportable to the world market from the urban centers at which they are produced. Alternative scenarios of competition between regional livestock production and world markets are considered in section III.

a. Sahelian cattle

Cumulative financial returns are negative for most Sahelian scenarios selling in Accra but positive for sales in Abidjan. This result is confirmed by recent trade patterns in that very little livestock is currently traded from the Sahel to Ghana. Only the Bamako and Mopti production systems show low profits in sales to Accra. The Mopti system is competitive because it is the least-cost system modeled in the Sahel. Cattle sold in Accra from dairy production at Bamako are also financially profitable, but only because the strong profitability of milk sales in Bamako underwrite sales of meat to Ghana.

In all scenarios based on Sahelian production, profits are higher with cattle sales to Abidjan. Only Dori shows a slight loss, while financial profits are moderate for Nara, Sikasso and Yako, and strong for Mopti and Bamako.

In comparison to financial returns, economic returns are generally higher for both Sahelian and coastal livestock production. At equilibrium exchange rates, Sahelian cattle systems presented in Table 4.3 show a consistent pattern of positive economic value in competition with meat imported from world markets at both Accra and Abidjan markets. Moreover, in all cases, except peri-urban dairying at Bamako, the DRC is robust (DRC at equilibrium exchange rate<sup>63</sup> < 0.80), suggesting a strong economic comparative advantage with respect to world markets.

All differences between extensive livestock production scenarios are small relative to the potential range of cost variation within systems and errors in the estimation of costs. Therefore, clear conclusions regarding the relative economic or financial profitability of each system are suspect. For example, comparing Dori and Nara cattle systems, both of which are transhumant and associated with rainfed cropping, DRCs are substantially lower in Nara than Dori and net economic returns per RU and to labor use around Nara are nearly double levels for Dori. In the analysis, this is in large part because of higher labor requirements in the Dori model. However, to determine the reality of this difference will require further confirmation of labor costs in each zone. No corroboration of higher labor costs in Burkina is found in comparing the two sedentary systems, Yako and Sikasso. They show roughly equivalent competitiveness in coastal markets and also roughly the same levels of benefits per reproductive unit and to labor. No pattern distinguishes scenarios of transhumant production from sedentary scenarios. In Burkina Faso, the dryland sedentary system (Yako) shows better financial and economic profitability than the dryland transhumant system (Dori) but Malian sedentary and dryland transhumant systems (Sikasso and Nara, respectively) are almost identical in financial and economic value.

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<sup>63</sup> See section 4.II.B for a discussion of the effect of different exchange rates on comparative advantage.

Peri-urban dairying around Bamako shows the weakest economic returns overall with its value being marginally positive if animals removed from the herd are sold in Abidjan, but negative if animal sales are to Accra. This result is not surprising given its recent emergence. The weaker result is largely due to the increased use of relatively costly commercial feeds in production. Nonetheless, the fact that economic profitability is positive suggests future potential of these scenarios as demand for dairy products grows.

b. Coastal cattle

The financial and economic results for scenarios for cattle produced in coastal countries are presented in Table 4.4. Just as for the Sahelian models, milk is assumed to be marketed locally, while the animals are marketed live to their respective capitals.

Table 4.4  
ECONOMIC ANALYSIS FOR COASTAL CATTLE SCENARIOS

	CÔTE D'IVOIRE (FCFA)			GHANA (Cedi)	
	Korho T0 Transhumant	Korho S0 Sedentary	Korho S3 Sedentary	Tamale Sedentary	Accra Dairy
<b>LIVESTOCK FOR SALE IN CAPITAL CITY</b>					
Cumulative net financial returns					
per RU	6420	6295	5719	-2527	68698
per man day of labor	831	831	514	-341	3271
Cumulative net economic returns					
per RU	22089	19885	22469	11788	21544
per man day of labor	2859	2624	2020	1592	1035
Domestic Resource Cost (DRC)	0.43	0.42	0.45	0.55	0.71

Cattle scenarios entirely within coastal countries show a pattern consistent with those beginning in the Sahel. Those based on production in northern Côte d'Ivoire show positive financial returns of the same order of magnitude as for those based on Sahelian production. By contrast, production in northern Ghana is marginally unprofitable for sale in coastal markets, suggesting high costs in moving animals southward in Ghana. This is confirmed in the transport analysis (see section III). Lastly, as with Bamako peri-urban dairying, dairying outside Accra shows strong positive financial returns.

As in the Sahel, cattle scenarios based on dairy production are the least economically attractive although still robust, while both traditional sedentary and transhumant systems show robust economic returns. Differences between transhumant and sedentary systems in Côte d'Ivoire are again insignificant.

### c. Comparison of Sahelian and coastal scenarios

Comparing across Sahelian and coastal scenarios analyzed in tables 4.3 and 4.4 suggests that overall coastal scenarios' DRCs are at the same level as those beginning in the Sahel and competing in the same coastal markets. However, per reproductive unit (RU), net economic benefits do show a significant range, suggesting important differences in animal productivity. Mopti shows the highest returns, at 30,000 FCFA/RU, followed by Nara, Yako, and all the scenarios based on Korhogo production with returns between 20,000 and 25,000 FCFA. These are followed by Sikasso, Accra dairying and Dori with returns on the order of 10,000 FCFA. Tamale and, lastly, Bamako dairying show the lowest returns. These returns reflect the relative productivity per RU of milk and meat and also the size of the RU in each production system. (See Table 4.4). Thus, for example, despite Nara's relatively high DRCs in comparison to Sikasso (which suggest lower economic value added per unit of resources used), Nara shows significantly higher net economic benefits per RU than Sikasso, which indicates higher productivity per RU. Given that both scenarios are based on zebu production this suggests that there may be significant potential for raising productivity in the less intensive systems in Sikasso.

Cumulative economic returns per man-day are cited net of assumed payments to labor or opportunity cost assessments of family labor. Thus these returns represent earnings in addition to the assumed wage. Moreover, because the quantity of labor used is not always specified, (eg. labor costs represented by in-kind wage payments), labor quantities used by each system have been imputed by dividing total labor earnings by the assumed opportunity cost wage for each region. Finally, because net returns are cumulative in these calculations, the returns accumulate throughout the market chain, rather than just to production labor. Given these qualifications, the results nonetheless suggest several important differences across scenarios. Returns to labor are dramatically higher in Mopti than in other scenarios. This reflects the fact that the modeled Mopti herd was much larger than all other herds (with the exception of Sikasso), and therefore great economies of scale were achieved in labor use in this system. However, the presence of larger herds in the Mopti region is not statistically confirmed. For four other scenarios based on Sahelian systems — Nara, Sikasso, Bamako and Yako — and the Korhogo scenarios, net returns to labor are relatively consistently between 1,000 and 3,000 FCFA/day, which represents a substantial margin above typical rural labor opportunity costs in agriculture in the region (500-700 FCFA/day). These results support the assertion that labor in livestock production requires particular skills or knowledge, and therefore demands a premium in labor markets. The Dori model shows substantially lower, but still positive, returns. This may be because the Dori model is the only Sahelian model in which hired labor is permanent. Both Ghanaian scenarios also show significantly lower returns to labor (below 1,000 FCFA/day), which is consistent with lower labor opportunity costs in Ghana.

## 2. Small ruminants

For small ruminants, only meat and skins are considered as joint products, except for the scenario based on production in Mopti for which some milk is used for local human consumption. Table 4.5 presents the base-case results of the economic and financial analyses for small ruminants. They show results similar to those for cattle. As with cattle, financial analyses show more attractive returns in marketing livestock to Abidjan when compared to Accra. Financial return to sheep sales in Accra from Nara, Yako, and Dori systems are negative, again illustrating the unprofitability of livestock trade to Ghana. Moreover, financial returns for animals raised in Mopti and sold in Accra are again positive, confirming the low cost of production in the interior Niger delta. Only the Sikasso sheep system changes profitability in comparison to its cattle counterpart, in that its animals sell at a profit in Accra. All sales from the Sahel to Abidjan show positive margins of financial profitability, with Mali showing clearly higher profitability than Burkina Faso, due primarily to lower trading costs. Coastal country sheep systems are uniformly profitable in selling to coastal markets.

Comparisons of the absolute levels of financial profitability or economic benefit per reproductive unit are not directly comparable to those of cattle scenarios since the cattle units represent much higher absolute quantities of meat. Returns to labor are comparable, however, and suggest similar levels of net financial benefit are obtained per day of labor in similar sheep and cattle scenarios.

As with cattle, perusal of DRC coefficients suggests that all small ruminant scenarios based on Sahelian or coastal production have a clear comparative advantage in sale to both coastal markets in competition with world imports. Only in the case of Nara is the margin of economic profitability weak ( $DRC > 0.80$ ). Mopti in Mali, and Korhogo in Côte d'Ivoire and the forest goat system at Akyem Swedru in Ghana show the most robust results ( $DRC < 0.30$ ) and the greatest net benefits to labor and per reproductive unit. Again the scenario based on production around Mopti stands out with nearly double the net return to labor of all other scenarios, illustrating again its low labor requirements in production.

**Table 4.5**  
**ECONOMIC ANALYSIS FOR SHEEP SCENARIOS**

<b>SAHELIAN COUNTRIES</b>	<b>MALI (FCFA)</b>			<b>BURKINA FASO(FCFA)</b>	
	Nara Transh.	Mopti Transh.	Sikasso Sedent.	Dori Transh.	Yako Sedent.
<b>LIVESTOCK FOR SALE IN ACCRA</b>					
Cumulative net financial returns					
per RU	-5733	2632	2589	-6683	-6323
per man day of labor	-406	629	198	-649	-832
Cumulative net economic returns					
per RU	25555	23012	28947	11333	6012
per man day of labor	1808	5499	2218	1101	791
Domestic Resource Cost (DRC)	0.31	0.22	0.27	0.57	0.66
<b>LIVESTOCK FOR SALE IN ABIDJAN</b>					
Cumulative net financial returns					
per RU	10073	8491	14354	142	306
per man day of labor	713	2029	1100	14	40
Cumulative net economic returns					
per RU	22693	16641	24156	13462	8791
per man day of labor	1606	3976	1851	1308	1157
Domestic Resource Cost (DRC)	0.31	0.26	0.31	0.48	0.50
<b>COASTAL COUNTRIES</b>					
	<b>CÔTE D'IVOIRE (FCFA)</b>		<b>GHANA (Cedi)</b>		
	Korho S3 Sedent.		Tamale Sedent.	Akyem-Swedru Sedent. (goat)	
<b>LIVESTOCK FOR SALE IN CAPITAL CITY</b>					
Cumulative net financial returns					
per RU		35146		-2527	2764
per man day of labor		2851		-341	327
Cumulative net economic returns					
per RU		41631		11788	20127
per man day of labor		3377		1592	2383
Domestic Resource Cost coefficient (DRC)		0.17		0.55	0.26

Note: Returns are in FCFA for Mali, Burkina Faso and Côte d'Ivoire, and in cedis for Ghana.

## B. The impact of exchange rates on comparative advantage

The economic analyses reported above value tradeable costs in local currencies by using equilibrium exchange rates which are assumed to reflect the true opportunity costs of foreign exchange to these economies in the intermediate future. In all central-corridor countries, the equilibrium exchange rates are above current official rates (expressed in local currency/U.S.\$) indicating that current official parities of currencies are over-valued. This overvaluation means that tradeable commodities (such as meat and milk) in these economies are undervalued. For the cedi, this overvaluation is considered to be minor (about 10 percent). However, as of the first quarter of 1992 the CFA franc was considered to be overvalued by about 50 percent. As a result, if the analysis is evaluated at official exchange rates, the apparent economic attraction of livestock scenarios falls with respect to world markets.

Table 4.6 illustrates the effect which overvaluation currently has on the competitiveness of the livestock sector in the central corridor. It compares DRCs for each cattle and sheep scenario for official and equilibrium exchange rate assumptions. Sales of animals from the Ghanaian production systems take place in Accra. Sales of animals from all other systems take place in Abidjan. In all the CFA franc countries, overvaluation has significant implications. One scenario selling in Abidjan moves from positive to negative competitiveness. (The Bamako DRC becomes greater than unity at the official exchange rate.) This also occurs to two others not shown (Dori and Sikasso cattle) if animals are sold to Accra.<sup>64</sup> Three other scenarios move from robust competitiveness to questionable competitiveness (DRC > 0.8).

The impact of exchange rate overvaluation is more pronounced for scenarios based on Sahelian production systems than for coastal scenarios. Obviously in comparison to Ghanaian scenarios, this is primarily because the cedi is considered to be much less overvalued than the CFA franc (10 percent as opposed to 50 percent.) However, for Sahelian systems competing with Ivorian systems, the difference is due to the higher tradeable costs of Sahelian livestock products. This difference derives primarily from higher transport costs in delivering Sahelian products to coastal markets. Thus, while a devaluation of 50 percent results in a fall of between 0.25 and 0.60 in DRCs for the Sahel-coastal scenarios, DRCs only drop 0.20 to 0.25 for Ivorian scenarios, and only 0.05 to 0.10 in Ghana.

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<sup>64</sup> Note that, in general, the evidence from DRCs calculated at the equilibrium and official exchange rates for scenarios with production outside Ghana but sales in Accra (and which Table 4.6 does not display) reinforce the conclusions of reduced competitiveness drawn for scenarios comprising sales in Abidjan shown in Table 4.6.

**Table 4.6**  
**IMPACT OF EXCHANGE OVERVALUATION ON COMPARATIVE ADVANTAGE**  
(DRC coefficients)

SAHELIAN SYSTEMS	MALI				BURKINA FASO	
	Nara	Mopti	Sikasso	Bamako	Dori	Yako
<b>CATTLE</b>						
equilibrium exchange rate	0.52	0.41	0.53	0.96	0.63	0.59
official exchange rate	0.78	0.61	0.80	1.43	0.95	0.88
<b>SHEEP</b>						
equilibrium exchange rate	0.31	0.26	0.31		2.12	0.50
official exchange rate	0.46	0.39	0.47		3.17	0.75
COASTAL SYSTEMS	CÔTE D'IVOIRE			GHANA		
	Korho T0	Korho S0	Korho S3	Tamale	Accra	
<b>CATTLE</b>						
equilibrium exchange rate	0.43	0.42	0.45	0.55	0.71	
official exchange rate	0.65	0.62	0.67	0.60	0.80	
<b>SHEEP</b>						
equilibrium exchange rate		0.17		0.55	0.26	
official exchange rate		0.25		0.60	0.28	

### C. Analysis at the regional level

As explained in the derivation of reference prices (in section 4.I.B.4), there are two perspectives on the issue of competitiveness for Sahelian livestock. The base case, presented above, has assumed that imputed reference prices obtaining at the borders of Mali and Burkina Faso represent the economic value of these scenarios. From a regional perspective, however, these prices are distorted by policy measures taken by governments of the coastal countries in which Sahelian livestock is sold. Thus, for example, protective policies against imports of world meat to Côte d'Ivoire raise internal prices of meat in that country, and therefore also raise the price that Ivorian butchers are willing to offer for Sahelian livestock. Conversely, taxation of animals transported from northern borders to coastal markets reduces the price offered at northern borders in competition with imports in coastal markets. Chapter 5 will examine the policy implications of these two perspectives. Below, however, the economic implications of a regionally integrated market are examined. This perspective assumes that economic reference prices to Sahelian producers are net, not only of policy distortions in their own country, but also of policy distortions in coastal countries. In the analysis, therefore, the economic border price for Sahelian products is lowered by removal of the protection provided by coastal countries at their ports, but is increased by removal of all livestock movement taxes that these countries impose on Sahelian livestock competing in coastal urban markets

**Table 4.7**  
**EFFECTS OF A "REGIONAL" ECONOMIC PERSPECTIVE ON THE ECONOMIC ANALYSIS**  
(DRC Coefficients)

	Cattle		Sheep	
	National	Regional	National	Regional
<b>BURKINA FASO</b>				
Dori, transhumant	0.63	0.89	0.48	0.54
Yako, sedentary	0.59	0.87	0.50	0.58
<b>MALI</b>				
Nara, transhumant	0.52	0.73	0.31	0.31
Sikasso, sedentary	0.53	0.73	0.29	0.27
Mopti, transhumant	0.41	0.52	0.26	0.25
Bamako, peri-urban dairy	0.95	1.34		

Table 4.7 compares the resultant DRCs for this analysis with those in the base case for marketing animals from the Sahel to Abidjan. The results clearly indicate a reduction in competitiveness for Sahelian scenarios in the regional context. This occurs because, absent the protective policies in coastal markets, FOB prices that would obtain at Sahelian country frontiers fall, resulting in a less competitive position for Sahelian livestock. Overall, DRCs increase more for cattle scenarios than for sheep scenarios, suggesting that greater net protection is afforded to cattle by coastal policies. However, all scenarios using Sahelian production retain economic comparative advantage except for dairy cattle production around Bamako, although both scenarios with Burkina Faso cattle production are no longer robust (DRC > 0.8).

These results illustrate the importance of coastal policies to livestock competitiveness in Sahelian countries and provide concrete examples of benefits from de facto regional protection. (Their implications are explored further in chapter 5.) The "regional" perspective might be argued to be the more relevant perspective for planning investments in Sahelian livestock production, given the possibility of trade liberalization by coastal countries. However, any such liberalization would probably only occur in conjunction with worldwide liberalization, which would in turn raise world market prices. Thus the regional perspective probably represents a pessimistic interpretation of the true "opportunity cost" of future Sahelian exports, while the national perspective exaggerates competitiveness if coastal countries should ever abandon their commitment to border protection.

#### **D. Sensitivity analysis for base-case results**

The results reported in the previous sections are based upon a number of assumptions which are subject to change, and/or for which solid empirical data have not always been available. For this reason, the most important variables upon which the analyses are based are examined in this section to determine the sensitivity of the results to their variation. All

comparisons are made with respect to the base-case scenarios defined in section B, and for Malian and Burkinabè scenarios, animals are assumed to be marketed to Abidjan. Tables 4.8-4.11 show the base-case DRC, the base-case unit cost of the variable in question, the unit cost in local currency at which the DRC reaches unity, and the percentage change in the unit cost required to bring the DRC to unity.

### **1. Animal productivity**

To examine the sensitivity of the economic analysis results to animal productivity assumptions, meat yield (of all scenarios) and milk yield (only for the dairy scenarios) are independently lowered until the scenario becomes economically uncompetitive (i.e. DRC = 1.00). The results of the analysis confirm the robustness of the ruminant scenarios with respect to the assumptions about the values of animal production parameters made in the base-case analysis. In most cases meat yields can drop by more than 50 percent and scenarios remain competitive. For both cattle and sheep, the Burkinabè scenarios are the most sensitive to changes in meat yield yet, even for these scenarios, productivity can fall by 30 to 40 percent before systems become economically uncompetitive.

The dairy scenarios are less robust with respect to milk yields. The Bamako dairy scenario, in particular, is only able to reduce milk production by 9% and remain economical. The Accra dairy, on the other hand can reduce dairy production by a third and remain profitable. Milk yield was not examined for scenarios with extensive cattle production systems because in all these cases meat yield alone was sufficient to satisfy economic profitability, even with no milk offtake. Milk was not a product in sheep or goat scenarios, with the exception of Mopti, where again meat alone provided economic profitability.

**Table 4.8**  
**MODEL SENSITIVITY ANALYSES: PRODUCTIVITY FACTORS**

<b>CATTLE</b>							
	DRC	Original kg/RU	Meat Yield		Original l/ RU	Milk Yield	
			DRC=1	% change		DRC=1	% change
<b>BURKINA FASO</b>							
Dori	0.63	251	162	-35%	128	NA	
Yako	0.59	260	178	-32%	95	NA	
<b>MALI</b>							
Nara	0.52	276	145	-48%	99	NA	
Sikasso	0.53	221	120	-46%	90	NA	
Mopti	0.41	220	77	-65%	97	NA	
Bamako	0.96	251	238	-5%	601	545	-9%
<b>CÔTE D'IVOIRE</b>							
Korhogo T0	0.42	165	55	-67%	80	NA	
Korhogo S0	0.43	178	58	-68%	112	NA	
Korhogo S3	0.45	165	65	-61%	80	NA	
<b>GHANA</b>							
Kpong Tamale	0.55	167	76	-55%	58	NA	
Accra Plains	0.73	237	72	-70%	500	340	-32%
<b>SMALL RUMINANTS</b>							
	DRC	Original	Meat Yield				
			DRC=1	% change			
<b>BURKINA FASO</b>							
Dori	0.48	22	13	-39%			
Yako	0.50	22	13	-36%			
<b>MALI</b>							
Mopti	0.26	24	8	-66%			
Nara	0.31	23	10	-55%			
Sikasso	0.31	20	8	-60%			
<b>CÔTE D'IVOIRE</b>							
Korhogo T0	0.17	32	9	-72%			
<b>GHANA</b>							
Akyem Swedru (goat)	0.26	25	8	-66%			
Kpong Tamale	0.30	26	10	-63%			

## 2. Primary factor costs

Primary factors are generally understood to include land, labor and capital. In this context, labor and capital are easily understood, though their costs are not necessarily easily measured because of the lack of organized markets for these factors. Land is even more inscrutable since it is not a direct cost in livestock production or marketing in any of the systems considered. However, feed biomass obtained from range and crop land does constrain livestock production, thus this resource is assumed to be another resource or factor in livestock production. Given the difficulty in evaluating true opportunity costs for primary factors, the sensitivity of results to these costs is an important consideration in the analyses.

A breakdown of the share of each factor in total economic costs, is provided in Table 4.9. Several important characteristics of the models examined are evident. First, for scenarios based on transhumant and sedentary systems, with the exception of Mopti, labor is always the most important component of costs, followed by capital and tradeable costs which are typically of the same magnitude. Non-tradeable feed costs are generally insignificant. The average value of labor's share of costs across countries equals 54 percent, for both cattle and small ruminant scenarios, though this average masks a high 71 percent for Accra goats. The average share of labor in Malian systems (45 percent) fell markedly short of that in other countries (59-63 percent). This reflects unusually low labor shares in the Mopti area and high shares around Korhogo and Dori.

Capital costs for cattle systems range from 6 to 50 percent with a mean and a median of 23 and 18 percent, respectively. For sheep, the range was noticeably lower: from 8 to 27 percent with a mean and a median of 15 and 12 percent, respectively. Capital costs for cattle vary independently of whether the scenario involved transhumant or sedentary production, but dairy scenarios have lower-than-average capital costs shares. For sheep, transhumant scenarios had significantly lower shares of capital in total costs than sedentary scenarios. In contrast to labor trends, the capital component is generally highest in Ghana and lowest in Burkina Faso, although interest rates are assumed to be identical between countries.

Commercial feed costs are insignificant for all scenarios, with two exceptions. First, dairy scenarios at Bamako and Accra show feed costs representing close to one fifth of all costs. Second, the sheep scenarios based on production around Mopti, unlike the analogous cattle scenario, shows high feed costs due to the practice of renting *bourgou* (flood recession grazing on riverine land) for dry-season grazing.<sup>65</sup>

Lastly, foreign currency costs range from 10 to 37 percent, with the exception of the Accra goat scenario. The largest component of this cost is attributable to transport. The Accra goat scenario shows much lower tradeable costs because production occurs close to the point of final consumption of all joint products, resulting in a very low transport component in costs.

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<sup>65</sup> This is not the case for the Mopti cattle system for which this feed was free.

**Table 4.9**  
**DOMESTIC FACTOR COST COMPONENTS OF LIVESTOCK SCENARIOS**  
(Percentage breakdown)

SAHELIAN COUNTRIES	MALI				BURKINA FASO	
	Nara Transh.	Mopti Transh.	Sikasso Sedent.	Bamako Dairy	Dori Trans.	Yako Sedent.
<b>CATTLE</b>						
Labor	54	36	45	39	72	63
Capital	31	50	39	12	6	8
Feed	1	1	1	19	1	1
Foreign currency	14	14	15	30	20	28
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
<b>SMALL RUMINANTS</b>						
Labor	55	15	69		61	57
Capital	10	9	20		9	8
Feed	2	67	0		0	0
Foreign currency	32	10	11		29	31
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>		<b>100%</b>	<b>97%</b>
COASTAL COUNTRIES	CÔTE D'IVOIRE			GHANA		
	Korho T0 Transh.	Korho S0 Sedent.	Korho S3 Sedent.	Tamale Sedent.	Accra Dairy	Akyem Swedru Sedent. (goats)
<b>CATTLE</b>						
Labor	64	64	65	44	46	
Capital	18	19	17	42	11	
Feed	1	0	1	0	23	
Foreign currency	17	17	17	14	20	
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	
<b>SMALL RUMINANTS</b>						
Labor		50		49		71
Capital		14		23		27
Feed		0		3		0
Foreign currency		37		25		2
<b>TOTAL</b>		<b>100%</b>		<b>100%</b>		<b>100%</b>

Table 4.10 presents a break even analyses in which the costs of feed, capital and labor necessary to make each scenario become uncompetitive are evaluated.

**Table 4.10**  
**MODEL SENSITIVITY ANALYSES: NON-TRADEABLE FACTORS**

<b>CATTLE</b>							
	Base-case DRC	Value of Forage (FCFA/Tn, base = 0) DRC=1	Capital Costs (Base = 15%) DRC=1 % change		Labor Costs (FCFA/RU) Original DRC=1 % change		
<b>BURKINA FASO</b>							
Dori	0.63	2236	39%	162%	20109	38500	92%
Yako	0.59	2629	30%	100%	25466	53800	111%
<b>MALI</b>							
Nara	0.52	2992	38%	155%	11703	40500	246%
Sikasso	0.53	3070	35%	131%	8484	33750	298%
Mopti	0.41	4371	45%	199%	5346	36250	578%
Bamako	0.96	340	15%	1%	20558	24000	17%
<b>CÔTE D'IVOIRE</b>							
Korhogo T0	0.42	3086	37%	147%	6013	26200	336%
Korhogo S0	0.43	3571	44%	193%	6498	29000	346%
Korhogo S3	0.45	3102	41%	176%	9067	32000	253%
<b>GHANA</b>							
Kpong Tamale	0.55	1880	26%	73%	7621	19500	156%
Accra Plains	0.73	2550	26%	75%	38696	60500	56%
<b>SMALL RUMINANT</b>							
	Base-case DRC	Value of Forage (FCFA/Tn, base = 0) DRC=1	Capital Costs (Base = 15%) DRC=1 % change		Labor Costs (FCFA/RU) Original DRC=1 % change		
<b>BURKINA FASO</b>							
Dori	0.48	2964	67%	347%	7554	22500	198%
Yako	0.50	2214	45%	200%	6230	15750	153%
<b>MALI</b>							
Mopti	0.26	4208	103%	586%	2615	19250	636%
Nara	0.31	3946	104%	595%	7404	33750	356%
Sikasso	0.31	4150	101%	573%	7424	31500	324%
<b>CÔTE D'IVOIRE</b>							
Korhogo T0	0.17	5872	143%	853%	9183	51000	455%
<b>GHANA</b>							
Akyem-Swedru (goat@)26		2983	69%	360%	7379	27500	273%
Kpong Tamale	0.30	8850	92%	513%	11660	46750	301%

### a. Feed costs

Range, village pasture, fallow lands, and crop residues currently represent "non-commercial" sources of feed for livestock. They are assumed to have no opportunity cost because there exist few other uses to which they can be put. However, as grazing pressure increases, these feeds may become commercialized. Moreover, overgrazing by ruminants may incur hidden costs or "negative externalities" if it results in a reduction in the longrun productivity of the range. This may occur, for example, if grazing raises rates of soil erosion or contributes to the elimination valuable species of grass from the ecosystem.

Given these potential costs, the sensitivity analysis poses the question: at what level would the cost of currently free biomass render livestock rearing uncompetitive? To answer this question feed energy and protein needs are calculated in each herd model using standard technical coefficients of feed required for growth, lactation and fattening for cattle and small ruminants. These values are then converted to tons of low quality feed biomass using approximations of energy and protein content for low quality range biomass.<sup>66</sup> Feed biomass availability from commercial feeds consumed in each system is deducted from total feed requirements to provide net requirements from noncommercial sources. In the sensitivity analysis the unit value of this "free" biomass is then increased to evaluate the biomass cost which each scenario can sustain and remain economically competitive.

The results indicate that low quality feed cost cutoff values range between 1900 and 4400 FCFA/Tn in the cattle models and, similarly, from 2200 to 8900 FCFA/kg in the sheep models.<sup>67</sup> These numbers suggest maximum cost levels which low-quality biomass production costs should not exceed if fodder production is to be developed in the central corridor. (Obviously, fodder crops with higher nutrient values can proportionately exceed these values.) These costs should be considered to be inclusive of all social costs including negative externalities associated with grazing, since such costs have not been included elsewhere in the analysis. Lastly, insofar as each production systems may continue to have access to free biomass for a part of its needs, the unit costs of biomass which it could sustain for the remainder of its needs could increase proportionally.

### b. Capital costs

Capital costs have been parameterized for herd stock investments.<sup>68</sup> These costs account for as much as half of total production costs (for Mopti cattle). The analysis suggests that most cattle systems could support real interest rates of over 25 percent for all scenarios except the

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<sup>66</sup> Coefficients of conversion of nutrient value to biomass assume approximately 23 percent total ruminant-digestible nutrients and 2 percent ruminant digestible protein content per unit dry matter.

<sup>67</sup> The only exception to the range cited is the Bamako dairy production system, for which a price of only 300 FCFA/ton is enough to make the system non-competitive.

<sup>68</sup> Seasonal capital costs are evaluated separately in the model and are therefore not included in the sensitivity analysis. However these seasonal capital costs are never more than 2 percent of total costs.

Bamako dairy system. Small ruminant systems show less sensitivity to capital costs, with most systems able to support interest rates on stock investments of over 90 percent. In comparison to cattle, the lower sensitivity of small ruminants to capital costs reflects the more rapid return which they provide to stock investments because small ruminants become productive at a younger age and have higher reproductive rates.

c. Labor costs

Sensitivity to labor costs are evaluated by varying the total wage bill in production. This wage bill incorporates the value payments in both cash and kind to hired labor, as well as the assumed opportunity cost of family labor. With the exception of the dairy systems, the wage bill can increase by a factor of between 92 and 578 percent for cattle, depending on the production system, before production becomes economically unprofitable. The median value is 246 percent. For sheep the range is from 153 to 636 percent, with a median of 310 percent. These margins appear sufficient to cover errors inherent in estimation of these costs.

### 3. World prices and exchange rates

a. World prices

In light of the instability of world prices for livestock products, and the notorious use of export subsidies to promote sale of these products by the European community, an important question is: at what world price level do West African livestock scenarios become economically uncompetitive? To answer this question, Table 4.11 reports a final series of breakeven analyses for world meat and milk prices, each evaluated separately. The influence of world beef or sheep meat prices is evaluated for all ruminant models, but milk prices are examined only for the dairy scenarios, for which milk sale is necessary for economic profitability.

Cutoff values for world prices for all scenarios except the Bamako dairy case are well below historical lows for world meat prices since 1977.<sup>69</sup> In nearly all cases, scenarios involving extensive systems can accommodate more than a 50 percent reduction in world prices and still remain economically competitive. Moreover, all but three cattle systems (Bamako dairy, Dori transhumant, and Yako sedentary) remain economically competitive in comparison to the heaviest subsidies which Europe has imposed on carcass meat in recent years<sup>70</sup>

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<sup>69</sup> This assertion is based on comparisons to the following price (constant, 1985) series: for carcass beef, from Australia CIF, for which the lowest price was \$1637; for lamb, for New Zealand, for which the lowest price was \$1676 in 1989; and for skim milk for which the historic low was in 1984 at \$1360/ton. Argentina has reported lower unit export values of all cow meat of \$990 in 1990, however this price is for an aggregate product of lower average value than carcass meat.

<sup>70</sup> This comparison is to a subsidized price CIF Abidjan of only \$710/ton for carcass beef.

These results are even more robust when one considers likely future trends in world prices for livestock product. World Bank projections of beef indicate that prices should in fact rise in real terms by 13 percent through the year 2000. Its projections then show a decline through the year 2005, but to a level still 4 percent above current prices in real terms. Moreover, prospects for international liberalization of agricultural markets may result in even higher international livestock product prices. A USDA modeling analysis of the impact of liberalization suggests, for example, that multilateral liberalization could increase world prices for ruminant meats by 21 percent, non-ruminant meats by 12 percent and dairy products by 65 percent.<sup>71</sup> Such increases promise to substantially improve the competitiveness of West African livestock scenarios.

b. Exchange rates

Table 4.11 also examines the sensitivity of DRCs to exchange rate changes which are crucial in converting world prices to domestic costs. The results are similarly robust to changes in exchange rates. Despite the fact that permissible percentage overvaluation is based upon the assumed equilibrium rate, rather than current official rates, all but the Malian dairy system remain economically competitive at current official exchange rates (250 FCFA/\$ and 550 cedi/\$), and all remaining scenarios except those based on Burkinabè production systems can accommodate additional reductions of at least 20 percent.

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<sup>71</sup> Vernon O. Roningen and Praveen M. Dixit, *Economic Implications of Agricultural Policy Reforms in Industrial Market Economies*, USDA/ERS (1991).

**Table 4.11**  
**MODEL SENSITIVITY ANALYSES: INTERNATIONAL FACTORS**

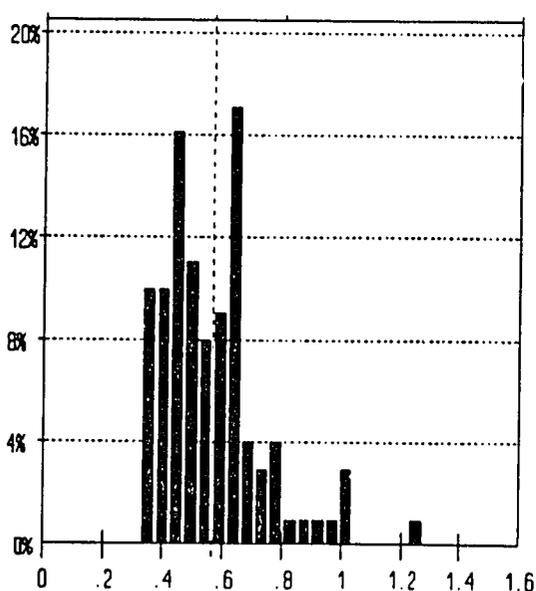
CATTLE	Base- case DRC	Ref. Beef Price (Base = \$1705/Tn)		Ref. Milk Price (Base=\$1701/Tn)		Equilibrium Exchange Rate (FCFA/\$, cedi/\$ for Ghana)	
		DRC=1	% change	DRC=1	% change	Original DRC=1	% change
<b>BURKINA FASO</b>							
Dori	0.63	918	-46%	NA		375	235 -37%
Yako	0.59	1002	-41%	NA		375	219 -42
<b>MALI</b>							
Nara	0.52	647	-62%	NA		375	195 -48%
Sikasso	0.53	687	-60%	NA		375	197 -48%
Mopti	0.41	256	-85%	NA		375	152 -60%
Bamako	0.96	1680	-1%	1700	-0.1%	375	360 -4%
<b>CÔTE D'IVOIRE</b>							
Korhogo T	0.42	217	-87%	NA		375	155 -59%
Korhogo SO	0.43	202	-88%	NA		375	161 -57%
Korhogo S3	0.45	354	-79%	NA		375	166 -56%
<b>GHANA</b>							
Kpong Tamale	0.55	599	-65%	NA		600	328 -45%
Accra Plains	0.73	307	-82%	1181	-31%	600	438 -27%
<b>SMALL RUMINANT</b>							
	DRC	Ref. Lamb Price (Base = \$2592/Tn)		Equilibrium Exchange Rate (FCFA/\$, cedi/\$ for Ghana)			
		DRC = 1	% change	Original DRC=1	% change		
<b>BURKINA FASO</b>							
Dori	0.48	1357	-48%			375	180 -52%
Yako	0.50	1451	-44%			375	187 -50%
<b>MALI</b>							
Mopti	0.26	520	-80%			375	97 -74%
Nara		855	-67%			375	116 -69%
Sikasso	0.31	710	-73%			375	117 -69%
<b>CÔTE D'IVOIRE</b>							
Zone K #3	0.17	513	-80%			375	64 -83%
<b>GHANA</b>							
Akyem S. (goat)	0.26	488	-81%			600	154 -74%
Kpong Tamale	0.30	759	-71%			600	183 -70%

#### 4. Combined sensitivity analysis

A final analysis examines the prospects that the base-case DRCs could exceed unity given simultaneous variations in world price, exchange rates, and productivity parameters for meat and milk yields. The analysis was conducted on two representative Sahelian production systems: the Nara cattle system and the Dori sheep system. In each simulation, risk analysis software was used to randomly select world price, exchange rate and meat and milk productivity assumptions based upon independently estimated normal distributions for each parameter.<sup>72</sup> Graphs 4.1A and 4.1B present the resultant distributions of DRCs for each scenario. The results illustrate the robustness of each scenario as an economic competitor in the coastal countries in the face of variability in these important determinants of economic performance.

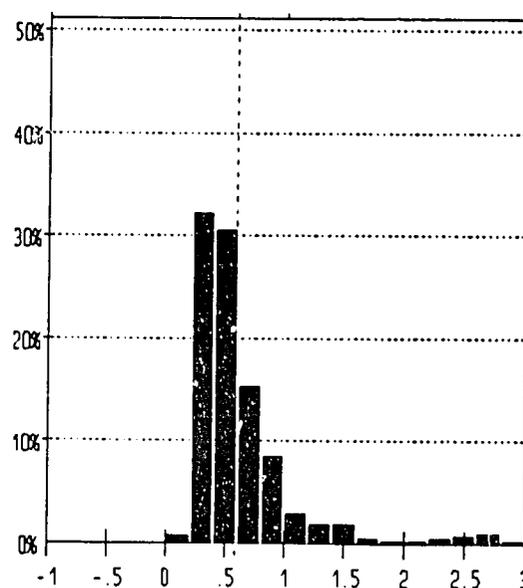
**GRAPH 4.1 DRC PROBABILITY HISTOGRAMS FOR VARIATION IN WORLD PRICE, EXCHANGE RATE AND PRODUCTION PARAMETERS**

##### A. Nara Cattle



(DRC expected value = .56)

##### B. Dori Sheep



(DRC expected value = .58)

<sup>72</sup> World price distributions were derived from 1977 to 1991 real price series for Australian beef, New Zealand lamb, and Netherlands powdered skimmed milk respectively. Exchange rate distributions were derived from IMF series on CFA franc exchange rates. Productivity parameters used the standard deviation estimates developed for the analysis of drought impact on productivity (see Chapter 3, section II).

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The cattle model shows less than a 5 percent probability of its DRC exceeding 1.0, while the sheep model shows less than a 15 percent probability. If, rather than using base-case "national" assumptions, the DRC were to be based on the "regional" perspective, the mean DRC for the Nara cattle model would rise to about 0.73 and that for Dori sheep to about, 0.64. Nonetheless, probabilities of the DRC surpassing 1.0 still remain below 10 and 20 percent respectively for these two scenarios.

### **III. SPECIFIC ISSUES EXAMINED BY THE ECONOMIC ANALYSIS**

#### **A. A comparative analysis of livestock marketing**

In the collective memory of the livestock trading fraternity, the late 1970s and early 1980s constitute a halcyon period for the livestock trade: traders realized sizable profits from relatively large livestock flows. In comparison, the years since have been dismal. Firstly, their flows declined precipitously due to rebuilding of Sahelian herds after the 1983-85 drought. Secondly, commodity booms had disappeared, reducing purchasing power for superior goods, such as meat. Thirdly, provoked by subsidies, coastal consumers switched to imported EC meat. Some traders have dropped out of the trade. On average, those who remain claim to make lower profits than before.

The analysis which follows seeks to determine how current market costs compare within the region. The analysis examines market chains along which livestock travels from the different production zones to Abidjan and Accra. Each chain comprises a number of links bringing livestock to successive markets and/or transshipment points. Each link involves transport costs of various sorts and often marketing costs. Fattening and, eventually, slaughter constitute other links. In addition, in order to distinguish costs in different currencies, links which otherwise would have spanned national boundaries are broken into two. Finally, some links thus defined form part of more than one market chain.

Animals move from regions of low market prices to regions of high market prices, so there exists a price difference along each link. The financial costs and profit associated with the link equal this price difference. Each item in the marketing budget is decomposed into the same cost categories used in the analysis of the production budget (taxes, tradeable inputs etc.). Adding together the contributions to each line item in the budget for a given market link, gives (i) the total financial cost of undertaking that link and (ii) totals for each of the different analytical cost categories. The private profitability of a link is obtained by subtracting from the price at the end point the sum of the financial price of the product at the starting point and the net marketing cost.<sup>73</sup> Having established not only the total financial cost for each link but also its economic components, these are added together to determine the cost structure of a variety of market chains of interest.

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<sup>73</sup>Annex E displays these analyses for each market link.) Tables for each link indicate (i) the economic cost structure for each item in that link's marketing budget and (ii) the total across items for each decomposed cost category for that link.

## 1. The financial profitability of livestock marketing

### a. Cattle trading

Analysis of animal prices and trading costs along a series of sixteen representative cattle trading routes provides a mean of 7.7 percent profit (with a standard deviation of 5.0 percent), as shown in Table 4.12. Variations in profitability do not display any trend by mode of transport, as would be expected in a competitive market.<sup>74</sup>

Table 4.12  
NET FINANCIAL PROFIT FOR CATTLE TRADE BY ROUTE

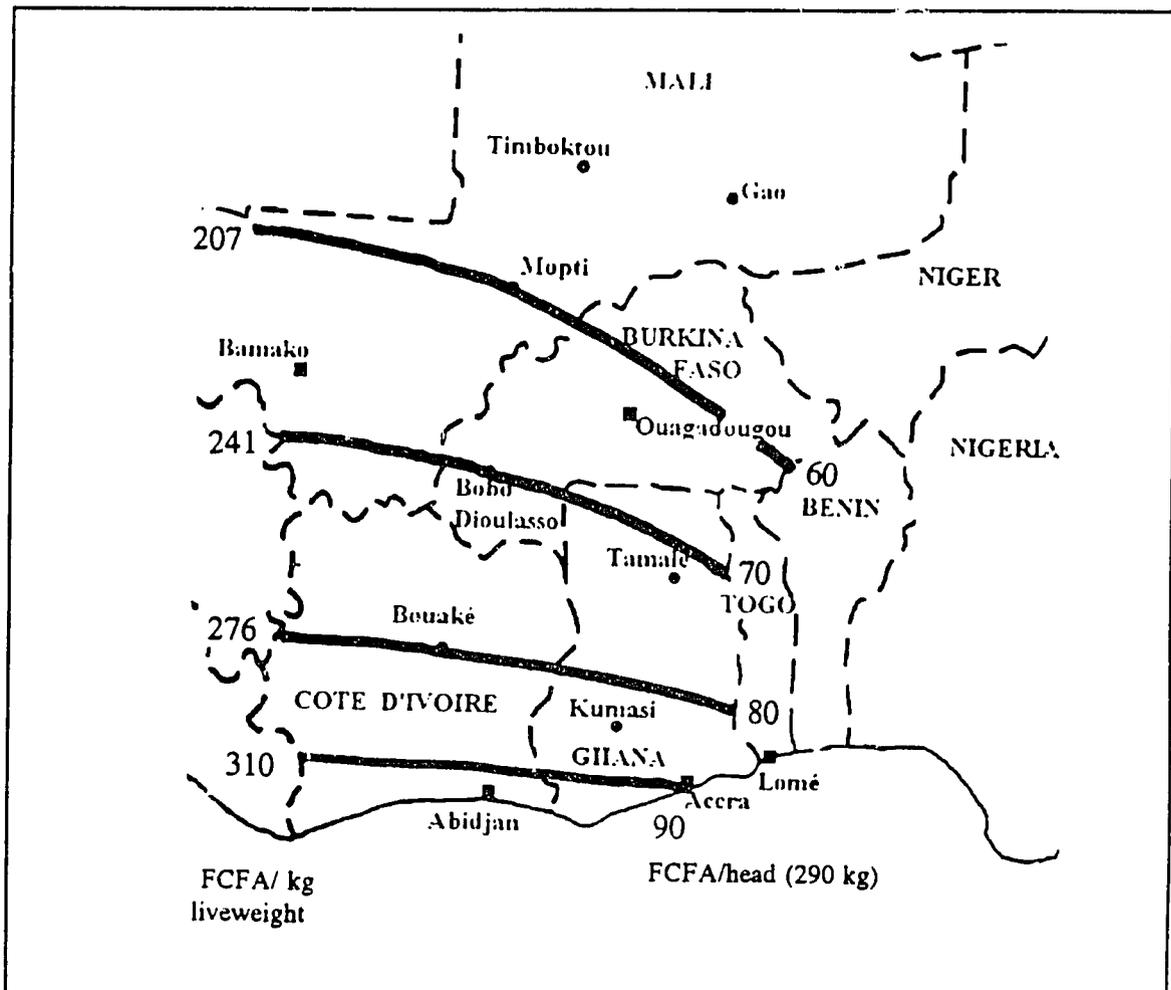
Market Link	Financial profit %
1. BURKINA FASO to CÔTE D'IVOIRE	
a. Dori to Bouaké (hoof); to Port Bouet (truck)	11
b. Dori to Ouagadougou (hoof); to Port Bouet (train)	11
c. Dori to Pouytenga (hoof); to Port Bouet (truck)	6
d. Dori to Pouytenga (hoof); fattening; to Port Bouet (truck)	3
2. MALI to CÔTE D'IVOIRE	
a. Nara to Bouaké (hoof); to Port Bouet (truck)	4
b. Nara to Kati (hoof); to Port Bouet by truck	11
c. Mopti to Port Bouet (truck)	11
d. Mopti to Bouaké (hoof); to Port Bouet (truck)	18
e. Sikasso to Bouaké (hoof); to Port Bouet (truck)	10
f. Mopti to Ferkessédougou (hoof); fattening/slaughter; to Port Bouet (truck)	-41
3. Within CÔTE D'IVOIRE	
a. Korhogo to Bouaké (hoof); to Port Bouet (truck)	3
b. Korhogo to Port Bouet (truck)	5
4. Within GHANA	
a. Tamale to Accra (truck)	6
b. Accra Plains to Accra (truck)	10
5. To GHANA from the SAHEL	
a. Mopti to the Ghanaian border (hoof); to Accra (truck)	0
b. Dori to Ghanaian border (hoof); to Accra (truck)	9
c. Dori to Pouytenga (hoof); fattening; to the Ghanaian border (hoof); to Accra (truck)	5

Note that marketing includes a preliminary link to bring it to the first market mentioned. This is done on the hoof, except in Ghana and Côte d'Ivoire.

<sup>74</sup> The mean profitability quoted excludes a chain from Fatoma (Mali) which includes fattening at the Ferkessédougou feedlot for which a loss of 41 percent was calculated. In contrast, other chains from Fatoma (without fattening) make above average profits; and a chain from Dori (Burkina Faso) with fattening at Pouytenga makes a profit, though less than the mean.

Trade to Accra from Burkina Faso shows an above-average profit, which falls to below-average when animals are fattened at Pouytenga. However, trade from Mopti to Accra, without fattening, only breaks even, consistent with the current lack of trade along this route.<sup>75</sup>

Map 4.1 explains why the route from Mopti to Accra should not yield any profit. Isoprice lines sloping west-northwest to east-southeast especially across the Sahelian countries, provide maximum profit to those who trade across them from the north-northeast to the south-southwest. Animals travelling from Mopti to the Ghanaian border cross these lines, but only at an oblique angle.



Map 4.1 Isoprice lines for cattle

<sup>75</sup> Despite statements from some traders that they formerly took herds from Mali to Burkina Faso on the hoof, evidence from both sides of the border suggests that few, if any, export herds currently follow this route. In order to examine the market linkages between the inland Niger Delta and Accra we had to reconstruct the cost structure from information for other, similar routes.

## b. Sheep trading

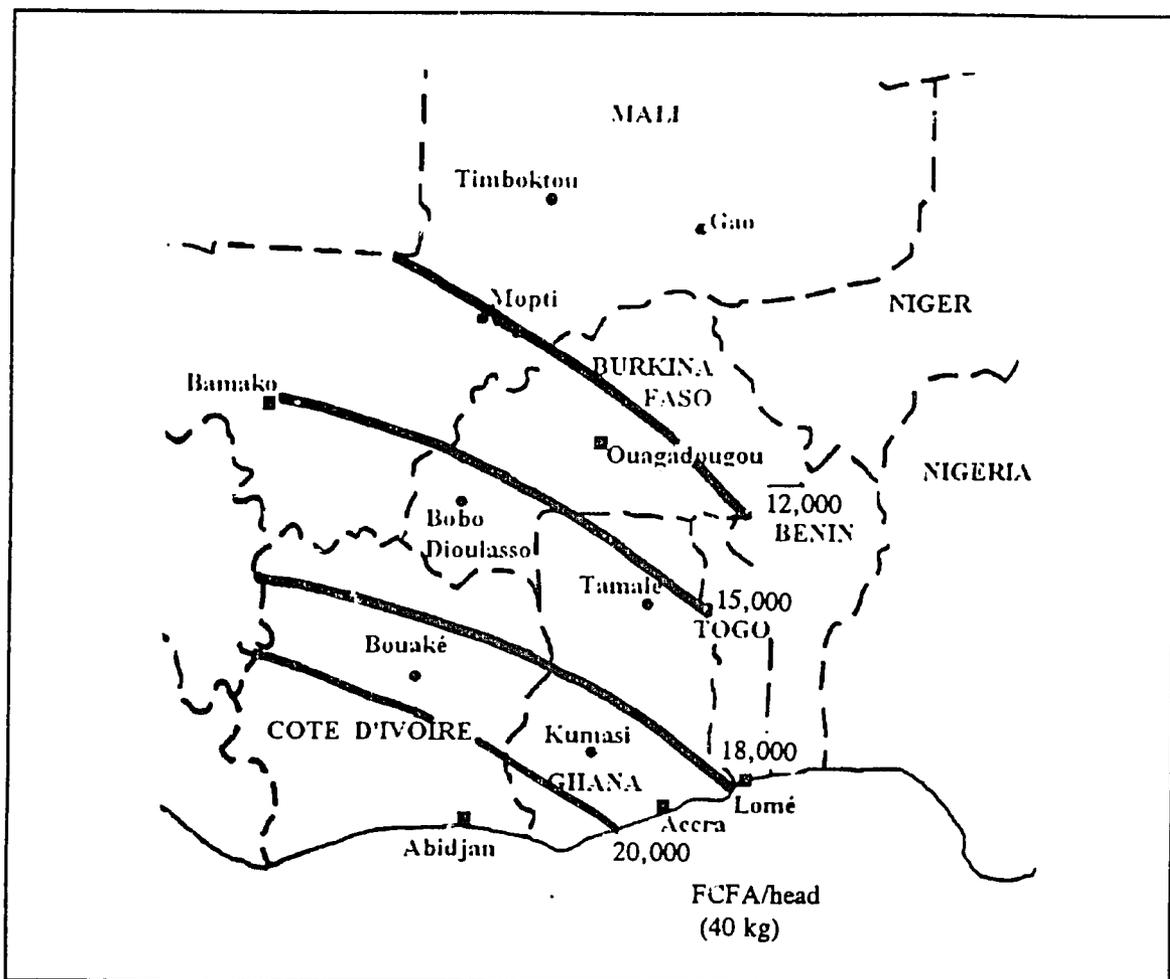
Table 4.13 summarizes a similar analysis of sheep trading routes from the Sahel to Abidjan and within Ghana, without fattening, and reveals much the same story. Mean profit equalled 7.0 percent with a standard deviation of 2.5 percent. However, three other trends are evident. First, when animals stop for fattening at Pouytenga en route from Dori to Abidjan, profit jumps to 29 percent. The analysis assumes a weight gain of 55 percent over 130 days, but even a weight gain of 25 percent would still provide a profit.

Table 4.13  
NET FINANCIAL PROFIT FOR SHEEP TRADE BY ROUTE

Market link	Financial profit %
1 BURKINA FASO to CÔTE D'IVOIRE	
a. Dori to Ouagadougou (hoof); to Port Bouet (train)	6
b. Dori to Pouytenga (hoof); to Port Bouet (truck)	8
c. Dori to Pouytenga (hoof); fattening; to Port Bouet (truck)	29
2 Within BURKINA FASO for export to GABON	
a. Dori to Ouagadougou (hoof); to airport (truck)	-16
b. Dori to Pouytenga (hoof); fattening; to Ouagadougou (hoof); to airport (truck)	16
c. Dori to Pouytenga (hoof); fattening; to Ouagadougou (hoof); slaughter; to airport (truck)	-7
3 MALI to CÔTE D'IVOIRE	
a. Nara to Kati (hoof); to Port Bouet by truck	12
b. Mopti to Port Bouet (truck)	8
4 Within CÔTE D'IVOIRE	
Korhogo to Port Bouet (truck)	11
5 Within GHANA	
Tamale to Accra by lorry	12
6 To GHANA from the SAHEL	
a. Mopti to the Ghanaian border (hoof); to Accra (truck)	-21
b. Dori to Ghanaian border (hoof); to Accra (truck)	-13
c. Dori to Pouytenga (hoof); fattening; to the Ghanaian border (hoof); to Accra (truck)	6

Note that marketing includes a preliminary link to bring animals to the first market mentioned. This is done on the hoof, except in Ghana and Côte d'Ivoire.

Second, the sheep trade from the Sahel to Accra appears unprofitable, particularly in the case of sheep from Mopti: this trade loses 22 percent. Trade from Dori without fattening loses 13 percent. The same trade but with fattening at Pouytenga makes 6 percent profit. The price structure across the corridor together with the profitability of sheep fattening at Pouytenga explain these results. Map 4.2 shows the price structure across the central corridor for sheep.



**Map 4.2 Isoprice lines for sheep**

Third, the analysis explores the financial profitability of exporting sheep and mutton of Dori origin via Ouagadougou airport to Gabon. With meat prices of 1,000 FCFA per kilogram-liveweight in Libreville, a trader loses 16 percent exporting an unfattened Dori animal at 1991 Air Afrique freight rates, but gains 16 percent exporting an animal fattened in Pouytenga. If the trader has the fattened animal slaughtered in Ouagadougou and instead exports the meat to Libreville by air at an FOB price of 350 FCFA per kilogram, liveweight, he loses 7 percent. These results are consistent with the abandonment of several efforts to export meat to Gabon in the past few years.<sup>76</sup>

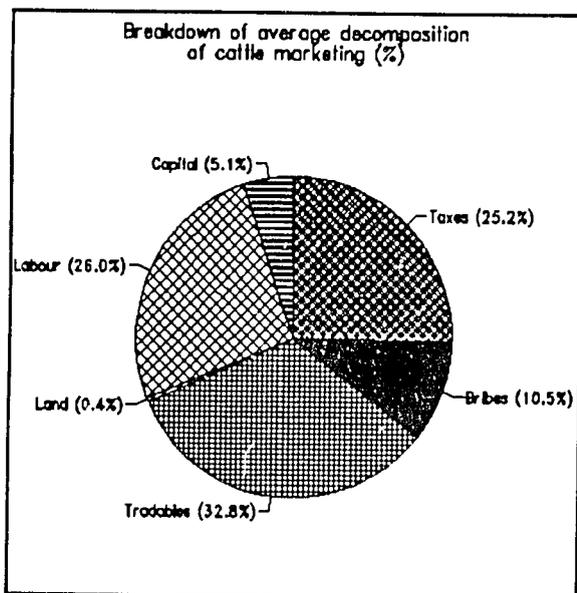
## 2. The cost structure of livestock trading

Graph 4.2 shows the breakdown of costs averaged over the seventeen cattle trading routes (including the route involving fattening at Ferkessédougou which does not greatly change the average). Factors of production account for 64 percent of traders' costs, but this varies from

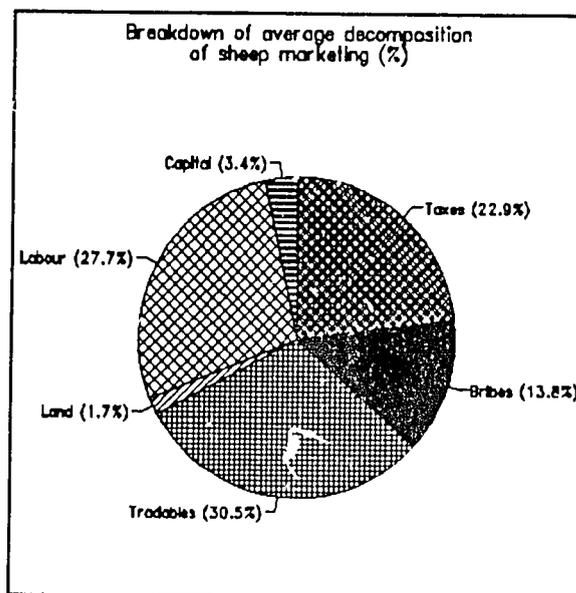
<sup>76</sup> Discussions with Department of External trade. Ministry of Commerce, Ouagadougou.

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43 to 83 percent, mostly because of taxation and bribes. The tax/bribe component of these costs is examined further in Chapter 5.



Graph 4.2



Graph 4.3

Tradeable factors and labor account for most of the factors of production used. Tradeable factors account for 33 percent on average, with a range from 24 to 43 percent. Routes with relatively long distances covered on foot also have lower-than-average tradeable components; those with fattening have higher-than-average tradeable components. Correspondingly, the labor component accounts for 26 percent on average but this increases with trekking and decreases with fattening. Capital and land generally account for very little, except when fattening is involved. Similar results obtain for sheep, as displayed in Graph 4.3.

a. A comparison of transport costs over time

Josserand analyses transport costs of central corridor livestock marketing in 1977 and 1990 to examine changes in the structure of marketing costs by truck and by train over that period.<sup>77</sup> Table 4.14 summarizes his findings. For both modes of transport, the importance of total marketing costs has roughly halved as a percentage of the purchase price of the animal between 1977 and 1990. However, whereas the total cost of trucking an animal has dropped

<sup>77</sup> H. Josserand, *Facteurs de contraintes sur l'offre de produits de l'élevage dans le "couloir central" (promotion des échanges à travers la réduction des coûts de commercialisation)*, paper presented at the Conférence sur l'intégration des marchés agricoles en Afrique de l'Ouest: enjeux pour les pays Sahéliens et leur partenaires commerciaux, IFPRI/ISRA, Saly Portudal, 2-4 décembre 1992, Paris: Club du Sahel, (1992), p. 6. He draws on data from: *La commercialisation du bétail et de la viande en Afrique de l'Ouest* (University of Michigan, 1980); N. Kulibaba and J. Holtzman (1990); and Conseil de l'Entente, CEBV and BDPA-SCETAGRI, *Approvisionnement et relance des échanges communautaires en bétail et en viande des pays membres de la CEBV* (1991).

from 56 to 26 percent of the animal's cost price, the corresponding drop for rail transport is from 45 to 24 percent. So transport by truck, though quicker and more flexible than rail transport, cost 24 percent more in 1977, but in 1990 that differential had dropped to only 8 percent. Expressed in the same relative terms, all components of cost have also dropped for both modes of transport, though particularly bribes.

Considered in terms of cost as a percentage of total marketing costs, the transport component has dropped for trips by truck and risen for trips by train. And whereas bribes have dropped in both cases, taxes have risen on trips by truck and dropped on trips by train.

**Table 4.14**  
**EVOLUTION OF THE LIVESTOCK MARKETING COST STRUCTURE**  
**FROM THE SAHEL TO ABIDJAN, BY TRANSPORT MODE (1977-90)**

	TRUCK		TRAIN	
	1977	1990	1977	1990
<u>Costs as a % of the animal purchase price</u>				
Transport	40	16	21	17
Taxes	11	8	17	7
Bribes	5	1	6	0.4
TOTAL	56	26	45	24
<u>Costs as a percentage of total costs</u>				
Transport	71	64	48	70
Taxes	20	32	39	28
Bribes	9	4	13	2
TOTAL	100	100	100	100

Adapted from H. Josserand (1992).

These figures indicate that, from 1977 to 1990, the cost of transporting animals from the producing to the consuming zones (expressed as a percentage of the cost of the animal transported) dropped by both modes of transport. However, without knowing more about the actual costs in those years, one cannot conclude that livestock marketing has become more efficient over this period: it may be, for instance, that the costs of doing business has dropped even faster as a percentage of the animal purchase price, generating excess profits.

Table 4.14 also indicates that, as trucking became more competitive with rail transport, governments turned to tax this mode relatively more heavily than rail transport. By both measures above and for both modes of transport, bribes fell over this period.

b. A comparison of cattle transport costs by mode and country

Based on cost data collected for this study, a regression analysis estimates the costs of cattle transport by mode and country. The analysis regresses total financial cost on distances

covered along each route modeled in the analysis for thirteen long-distance routes. Ghanaian trucking costs were converted to CFA francs at the parallel exchange rate. Rail transport was excluded because there was only one observation, leaving seven independent variables covering mode and country specific distances.<sup>78</sup> To model transport entirely as a variable cost, the constant term was constrained to equal zero. Table 4.15 displays the coefficients.

**Table 4.15**  
**ESTIMATED TOTAL COSTS OF CATTLE TRANSPORT**  
(FCFA per kilometer per head)

	Burkina Faso	Mali	Côte d'Ivoire	Ghana
Hoof	17	18	21	NA
Truck	25	18	23	30
RATIO	0.67	0.97	0.90	NA

Note: The R<sup>2</sup> for the regression equals 0.89.

The results are statistically convincing. They indicate a significance level of 0.01 or better for all coefficients with the exception of trekking in Côte d'Ivoire. However, note that traders paid for some transport in Côte d'Ivoire as part of a journey beginning in a Sahelian country. Such trekking or trucking, while geographically Ivorian, represents a cost paid in Mali or Burkina Faso, conceivably under quite different bargaining conditions than in Côte d'Ivoire itself. Thus the coefficients for transport in Côte d'Ivoire represent a mixture of Ivorian and Sahelian effects.<sup>79</sup>

The results suggest that costs per kilometer are slightly lower by hoof than by truck in all countries, and that costs are similar between CFA countries, although Ghanaian costs are significantly higher. The analysis above omits the single cattle marketing chain which uses the train from Ouagadougou to Abidjan, for which unit costs equaled 20 FCFA per

<sup>78</sup> Trekking in Burkina Faso, trucking in Burkina Faso; trekking in Mali, trucking in Mali; trekking in Côte d'Ivoire, trucking in Côte d'Ivoire; and trucking in Ghana.

<sup>79</sup> To isolate these effects for each transport mode, two additional variables were added to the analysis to allow for the location of the start of travel in Côte d'Ivoire by both modes. The results of this second analysis were much less statistically robust, with only one t-statistic significant at the 0.01 level and one other at the 0.05 level. Volume III, Annex E presents the results of this second analysis. Domestic Ivorian trekking proved much more expensive (51 FCFA/km), but was based on only a single case. Otherwise, the results were broadly similar to the first specification, with most costs lying between 18 and 22 FCFA/km.

kilometer. With a few exceptions, these results agree with recent available data from other sources, as shown in Table 4.16.<sup>80</sup>

**Table 4.16**  
**RECENT ESTIMATES OF TOTAL COSTS OF CATTLE TRANSPORT**  
**IN THE CENTRAL CORRIDOR**  
(FCFA per kilometer per head)

Route	To Abidjan from Burkina by train (1)	To Abidjan from Burkina by truck (1)	To Abidjan from Mali by truck (1)	Diverse routes various modes (2)
Average cost (FCFA/km)	21.9	19.3	19.8	21.9
No. of cases	3	3	5	3
Standard deviation	5.2	3.0	1.9	2.4

Sources (1) Ancy, (1991), "Image régional...", tableau 43  
(2) Kulibaba and Holtzman (1990), Livestock trading budgets.

In addition to the dubious case of all-domestic Ivorian trucking, the high-cost exceptions in Table 4.15 are Burkinabè and Ghanaian trucking. Vehicle taxes play a role in both, though more so in Ghana where trucking is particularly savagely taxed. In Burkina Faso, taxes on vehicles and diesel do not exceed those in Mali or Côte d'Ivoire by much as in Ghana but, whereas Mali has eliminated livestock export taxes, the Burkinabè trader pays 3,036 FCFA per head. In the terms of the current analysis, this equates to between 3 and 6 FCFA per kilometer, depending where within Burkina Faso the journey begins. In total, Burkinabè traders officially pay 9,000 FCFA per head in taxes (the *patente*, a tax on business turnover, local government taxes and customs duty). Traders trucking cattle out of Mali appear to pay taxes amounting to only about half the Burkinabè level, so the export tax would explain much of that discrepancy. In addition, exporters face bribes "of which the impact on trucking is particularly large".<sup>81</sup> On average, in 1991, exporters by truck from Pouytenga (140 km east of Ouagadougou) faced road barriers at which they were required to pay bribes every 43 kilometers within Burkina Faso, totalling 38,000 FCFA per truck.<sup>82</sup>

<sup>80</sup> This table summarizes results from the two sources cited, but with two omissions: a Kulibaba and Holtzman trekking link from Sikasso to Bouaké with net marketing costs of 31 FCFA per kilometer, and an Ancy link from Ségou to Abidjan by trekking and trucking with net marketing costs of 11.9 FCFA per kilometer.

<sup>81</sup> Burkina Faso, Ministère de l'Agriculture et de l'Élevage, Secrétariat d'Etat à l'Élevage, *Etude prospective du sous-secteur élevage au Burkina Faso, tome I: rapport de synthèse*, prepared by IEMVT-CIRAD/SFC SEDES-CEGOS (avril 1991), p. 206.

<sup>82</sup> Burkina Faso, Ministère de l'Industrie (1991), p. 85.

Trucking from Burkina Faso therefore appears expensive relative not only to trucking in Mali and Côte d'Ivoire but also to trekking and rail transport within Burkina Faso. The explanation appears partially to be that marketing in Burkina Faso is generally expensive because of heavy business taxes, but also that rail transport is particularly cheap and trekking is an effective way of evading taxes and bribes.

## **B. The value of ruminant fattening**

### **1. Description of fattening activities**

Herders who raise ruminants extensively rarely fatten their animals. Fattening generally occurs at some stage down the marketing chain when the animals arrive in a region with ample agricultural residues or maize, or in which agro-industrial byproducts are available at low enough prices.<sup>83</sup> This study considers two quite different fattening operations in such areas: Pouytenga (Burkina Faso) and Ferkessédougou (Côte d'Ivoire).

#### **a. Pouytenga**

The small town of Pouytenga lies about 140 kilometers east of Ouagadougou. It hosts an important market for many commodities, particularly livestock. Many Pouytengans fatten animals in their compounds: about 80 percent sheep and 20 percent cattle. A now-completed project encouraged them to grow fodder crops for fattening which they still do. However, most of their fattening inputs take the form of purchased agro-industrial byproducts. Traders truck the fattened animals directly to consumption markets.

Pouytengan fatteners feed their animals a mixture of cotton seed, bran, molasses, prepared feeds, agricultural byproducts and mineral salt; deparasitise them; and ensure that they receive a modest amount of additional veterinary care. They invest in few capital inputs other than a shelter for the animals and a few troughs or bowls. Fattening typically takes place over four to six months, during which time a sheep may gain fully 50 percent in weight for which the financial cost need not exceed 6,000 FCFA. Cattle are fattened over a similar interval, and several analyses suggest that weight gains range between 500 and 700 grams per day.

#### **b. SEBOVIA**

Several kilometers south of Ferkessédougou on the main road lies the industrial feedlot-abattoir complex now known as SEBOVIA. Formerly called the Complexe d'Exploitation Industrielle du Bétail (CEIB) and run by SODEPRA-nord, it incurred large

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<sup>83</sup> Feedstuffs used for ruminant fattening include: cotton seed, cotton seed cake, cereal brans and molasses. In addition fatteners of poultry around Abidjan use specially formulated feeds and soya cake. Pig fatteners around Abidjan use brewery wastes.

losses leading to its current three-year rental to a private company. The description and analysis which follow are based upon its activities prior to privatization.

SEBOVIA bought thin Sahelian zebu cattle and fattened them for up to three months before slaughter. Animals were slaughtered in SEBOVIA's own abattoir adjacent to the feedlot and the meat was trucked to consumption markets. It shipped 90 percent of the meat to Abidjan, selling much of it through the same outlets used for imported meat. One of the limiting factors in the SEBOVIA industrial feedlot's profitability was that it produced relatively fatty meat from older animals. The fattening operation was for 90 days, using cotton seed and cake, molasses and other feeds, and obtained an average weight gain of about 15%. However, fixed costs (52,000 FCFA) and labor costs (17,000 FCFA) per animal were high, yielding a total financial cost per head of 122,000 FCFA, greater than the initial cost of the animals themselves.<sup>84</sup> The large financial losses of this operation were sustained by subsidies from the government until its decision to privatize the scheme.

## 2. Economic analysis of fattening

In examining the effect of fattening on overall comparative advantage, Table 4.16 compares the base-case results of producing ruminants at Korhogo (cattle) and Dori (cattle and sheep) with the alternative of taking animals from these production systems and fattening them at SEBOVIA and Pouytenga respectively before marketing them in coastal markets. The economic value of animals from Pouytenga is evaluated for both the Accra and Abidjan markets, while the SEBOVIA product is only sold in Abidjan.

The cattle results illustrate that in comparison to the base case, all fattening operations represent a loss of comparative advantage in production. However, whereas the Ferkessédougou fattening scheme is clearly an uncompetitive activity and results in significant economic losses, the Pouytenga scheme results in a modest positive economic value both for sale in Accra and Abidjan. The Ferkessédougou scenarios also shows large financial losses, (the large public subsidies received in the past by the scheme are ignored), whereas the Pouytenga scheme shows low but positive net profits in sales to Abidjan and slight financial losses in sales to Accra.

Sheep fattening was examined only at Pouytenga for sale in Accra and Abidjan. Cumulative results are presented for animals raised in Dori, although the same marginal effects would be expected for animals from other production systems. The results of the analysis are similar to the cattle analysis in suggesting that small scale, private fattening has a positive financial and economic net value. Moreover, per RU or per unit of labor,

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<sup>84</sup> Note that the level of labor and plant costs is based on data from the 1989 CEIB annual report, i.e. from the feedlot's days as a parastatal. These costs hinge on an annual throughput of 6,556 head of cattle. Most likely, in 1993, under private management, the labor costs per animal are lower. But, unless its capacity usage has increased, it seems likely that the cost of capital per head remains high. Current management seems to have negotiated continued subsidies on feedstuffs which the former parastatal enjoyed.

cumulative financial and economic net gains are greater than in the base case, although again the DRC coefficients are somewhat less robust than for base-case scenarios. These results indicate that marginal economic gains to fattening are positive, although lower per unit of domestic resources used.

**Table 4.17**  
**ECONOMIC ANALYSIS OF FATTENING**

<b>CATTLE</b> Marketing destination Fattening option	Korhogo (T0) Sale to Abidjan		Dori Sale to Accra		Dori Sale to Abidjan	
	base case	fattening Ferre	base case	fattening Pouyt.	base case	fattening Pouyt.
Cumulative net financial returns						
per RU	6420	-6077	-20460	-17561	-792	372
per day	831	-787	-792	-680	-31	14
Cumulative net economic returns						
per RU	11810	-12846	11276	11761	17651	19705
per day	1529	-1663	437	455	684	763
Domestic Resource Cost (DRC)	0.59	1.77	0.73	0.75	0.63	0.65
<hr/>						
<b>SHEEP</b> Marketing destination Fattening option			Dori Sale to Accra		Dori Sale to Abidjan	
			base case	fattening Pouyt.	base case	fattening Pouyt.
Cumulative net financial returns						
per RU			-6683	-9333	142	2985
per day			-649	-907	14	290
Cumulative net economic returns						
per RU			11333	12329	13402	16365
per day			1101	1198	1308	1609
Domestic Resource Cost (DRC)			0.57	0.65	0.48	0.56

Units are in FCFA.

### C. The potential for meat exports to world markets

The potential for exporting meat from the Sahel to world markets is examined in a series of scenarios in which chilled carcass beef and lamb is air-freighted to Gabon and Saudi Arabia. These scenarios were chosen because in the past Burkina Faso has exported small amounts of

meat and live animals by air to both countries, as well as several countries in North Africa.<sup>85</sup> The analysis assumes that animals are slaughtered locally and the carcass meat is flown in isothermal containers from the respective capitals of Mali and Burkina Faso.

The results of the analyses, presented in Table 4.18, suggest that exports are not economically feasible to either destination for beef at the current official value of the CFA franc, although sheep meat appears weakly profitable from the Mopti and Nara systems for export to Saudi Arabia only. However, at assumed equilibrium exchange rates, all transhumant sheep systems in both countries, as well as the Mopti and Bamako cattle systems, show a capacity to compete for export to Saudi Arabia. Moreover, Nara and Mopti mutton and Mopti beef appear feasible options for export to Gabon.

Considering that Saudi Arabia is approximately the same distance as southern Europe, these results also indicate the potential for export to the larger world market. The analysis illustrates the crucial importance of transport costs in these scenarios. Saudi Arabia is a much more attractive destination than Gabon because of lower air freight rates; in 1992, these costs were approximately \$1,400 per ton to Gabon and \$1,000 per ton to Jedda. These rates illustrate a lack of competition in air freight services in West Africa, since shipping meat to Libreville is nearly three times the price per ton-kilometer of shipment to Saudi Arabia.<sup>86</sup> This issue has been taken up in conferences of West African Ministers of Agriculture in Dakar in 1991 and Paris in 1992, which generated a proposal to promote regional integration through liberalization of "the quasi-monopoly" which "certain airlines" enjoy in the region.<sup>87</sup>

Exporting meat might be made even more attractive if a higher-valued product were exported. This could be accomplished, first by deboning the meat prior to export, and secondly by shipping only higher-priced cuts of meat. In this way, the share of transport costs in total delivered cost would be further reduced and the final product would demand a higher price in segmented markets. This strategy would also allow West African traders to take advantage of the larger differential in price between higher and lower quality meat which exists in Europe to allow low-quality local production to compete with low quality imports, while exporting the highest quality production to compete in European markets.

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<sup>85</sup> According to Air Afrique statistics, Burkina Faso's 1989-91 air exports of livestock and meat from Burkina Faso showed an upward trend. During the first eight months of 1991, livestock exports equalled 176 tons and those of meat 5 tons. Ministère de l'Industrie, du Commerce et des Mines, 1991, p. 103-108.

<sup>86</sup> Delivery to Liberville, at a distance of 1,800 kilometers costs 0.19 FCFA per kilogram-kilometer, whereas the cost to Jedda (Saudi Arabia), 4,500 kilometers distant, equals 0.06 FCFA per kilogram-kilometer.

<sup>87</sup> "Produits carnés sur un train de mesures", *Afrique agriculture* N°187 (novembre 1991), pp. 11-12.

**Table 4.18**  
**ECONOMIC ANALYSIS OF RED MEAT EXPORTS TO WORLD MARKETS:**  
**DOMESTIC RESOURCE COST (DRC)**

CATTLE	MALI				BURKINA FASO	
	Nara Transh.	Mopti Transh.	Sikasso Sedent.	Bamako Dairy	Dori Transh.	Yako Sedent.
<b>SALE TO GABON</b>						
official exchange rate	2.21	1.45	3.58	5.82	3.70	5.04
equilibrium exchange rate	1.47	0.97	2.38	3.88	2.47	3.36
<b>SALE TO SAUDI ARABIA</b>						
official exchange rate	1.65	1.14	2.28	2.87	2.40	2.52
equilibrium exchange rate	1.10	0.76	1.52	1.91	1.60	1.68
SHEEP	MALI			BURKINA FASO		
	Nara Transh.	Mopti Transh.	Sikasso Sedent.	Dori Transh.	Yako Sedent.	
<b>SALE TO GABON</b>						
official exchange rate		1.09	1.08	2.62	-2.62	2.10
equilibrium exchange rate		0.72	0.72	1.75	-1.75	1.40
<b>SALE TO SAUDI ARABIA</b>						
official exchange rate		0.85	0.86	1.75	1.21	1.53
equilibrium exchange rate		0.57	0.58	1.17	0.81	1.02

However, any exports to a wider world market will require that Sahelian countries meet stringent health standards. European and American markets, for example, are closed to live-stock from areas such as West Africa where hoof and mouth disease and other highly contagious diseases are present. To obtain access to these markets, these diseases must be eliminated from the areas where cattle destined for export are raised. Several southern African countries have achieved sufficient control of these diseases to obtain the necessary health certifications for animals produced in controlled areas, although this effort has required substantial public subsidies. This suggests that while it may also be technically feasible in the Sahel, there would be considerable health costs to such a strategy which have not been assessed in this analysis. Given the very weak economic value of the world market export scenarios without these costs, it is likely that inclusion of these costs in the analysis would make all long distance exports to countries with restrictive health standards for meat economically unattractive.

#### IV. CONCLUDING REMARKS

The economic analysis has suggested that there exists a strong comparative advantage for Sahelian livestock production in competing with world markets for meat exports to coastal West Africa, and for delivery of milk product to local populations within the Sahel. Moreover, coastal West Africa has approximately the same degree of advantage in competing with world markets. Only relatively intensive peri-urban dairy production shows weak economic profitability in competition with world markets. Fattening in small private schemes appears to provide positive economic value added, though lower marginal benefits than for production without fattening. Fattening under such schemes therefore represents an attractive area for investment to increase meat production on the intensive margin as demand for meat products increases.

The analysis shows that intra-regional marketing costs appear to have fallen as a component of final product costs over time and to be relatively consistent across modes and countries. However, higher economic costs of marketing lower the economic and financial attraction of marketing to Accra relative to Abidjan. Trekking remains the least expensive form of transport in Sahelian countries, but has lost market share to trucking because of the convenience, flexibility and security in trucking, and a narrowing of cost differences between trucking and trekking. The possibility of exporting red meat beyond the traditional coastal markets may exist, but would be dependent on lowering the costs of air transport to more distant markets, improving the value of the product sold and meeting health and sanitation restrictions on world markets. These conditions are not likely to be met without additional costs which have not been evaluated by the analysis.

The comparative advantage of West African ruminant livestock production is robust even with substantial increases in labor or capital costs, or significant reductions in productivity, or world meat prices. However, these conclusions rest on the assumption of no economic costs to range, pasture, fallow and crop residue biomass, although other direct or implicit costs in obtaining access to these feed sources, such as grazing fees or exchanges for manure or milk, have been incorporated in the analysis. This assumption reflects the lack of alternative uses for low quality feed. However, it ignores potential environmental costs of utilizing these resource, and so may overstates the attraction of livestock systems.

In addition to feed, labor and capital costs have been shown to be significant components of total costs. Relative price changes in these factor markets could therefore significantly affect economic returns. Labor costs are not expected to rise significantly in the intermediate future, although restrictions on Sahelian pastoralist working in coastal countries as herders could raise wage costs, and therefore decrease the profitability of southern systems. More importantly, capital costs might fall if institutions to link livestock producers to formal capital markets can be improved.

The analysis uses historically low, but unsubsidized world prices to evaluate the economic reference price for livestock products. This assumption does not reflect the reality of heavily subsidized European meat currently entering West African markets. Even if current subsidy

levels are incorporated into the analysis, most production systems remain weakly competitive. However, these subsidies are not expected to persist in the intermediate future due to the fiscal burden of continuing the subsidies in Europe, and the likelihood that under GATT, these subsidies will be discontinued.

In determining the economic reference price of meat produced in the Sahel, the analysis has valued meat from a national rather than regional perspective. The former perspective increases the attraction of Sahelian production because under current conditions coastal country policies raise the reference value of livestock products at the borders of Sahelian countries. If such policies were to be eliminated, border prices to Sahelian countries, and with them economic profitability of livestock exports, would fall. However, this is likely to occur only if large world exporters eliminate their dumping policies, in which case the two effects would be offsetting.

A second policy issue crucial to the economic analysis pertains to exchange rate overvaluation. The analysis has assumed that the CFA franc is overvalued by 50%. Suspension of convertibility of the CFA in August 1993 confirms the severity of this problem. The analysis results illustrate that the competitiveness of CFA zone countries' livestock systems is currently heavily penalized by currency overvaluation. It also shows that Sahelian systems are penalized more strongly by current overvaluation of the CFA franc because of higher tradeable costs necessary to take their animals to coastal markets. An evaluation of these and other policy issues is the subject of the next chapter.

## **CHAPTER V**

### **THE IMPACT OF PUBLIC POLICIES ON LIVESTOCK PRODUCTION AND TRADE**

The analyses presented in this chapter examine policies which influence the current structure of incentives to producers and traders of livestock in West Africa. The profits to a producer from engaging in a particular activity are determined by the costs he must pay and the prices he receives for his product. These costs and prices are, in turn, subject to policies, both direct and indirect, which change these incentives. The financial analyses of the previous chapter summarized the cumulative incentive to produce and trade livestock products. This chapter focuses on the role of public policies in shaping these incentives.

The first section of this chapter reviews public objectives and explicit policies with regards to the livestock production and trade in their respective countries. The second section examines the consequences of these policies for the production systems which have been chosen for evaluation.

#### **I. A REVIEW OF PUBLIC POLICIES AFFECTING LIVESTOCK**

The governments of the countries examined by this study have pursued a wide range of policies affecting all stages of production, marketing and transformation in the livestock sector. Each country has a Livestock Service which typically coordinates vaccination programs, oversees livestock and meat marketing, provides veterinary treatment, and subsidizes some goods to the sector (vaccinations, veterinary medicines, inputs to livestock rearing, etc.). Since the 1970s, each country has also directly intervened in livestock production, marketing and transformation through parastatal organizations. Furthermore, each government has invested in rural development projects with components targeted at livestock development.

All countries also levy taxes on the livestock sector through a variety of direct and indirect measures. Direct taxes including market taxes; professional taxes on livestock brokers, traders and butchers; and border taxes are all levied on trade in livestock and livestock products. Significant indirect taxation of the sector also occurs through taxes on inputs to livestock production and marketing.

In addition, government policies in other areas have often had profound effects on livestock. These include land tenure legislation, programs to sedentarize pastoral groups, tax incentives to business investment, food aid distribution, and border closures. Furthermore, because livestock requires large capital investments and is a tradeable commodity, it is directly affected by capital and exchange rate policies.

Lastly, the conduct of government agencies in carrying out policy can have an important impact on the sector's performance. In particular, to the extent that governments tolerate

extortion of money from economic actors in the livestock sector by its own customs, security and Livestock Service agents they allow distortions to incentives to invest, trade and vaccinate animals, among other things.

Highlighted below are recent livestock sector policy developments in each country which are of particular relevance for the analysis which follows. (The country studies presented in Part II of this study provide more detailed descriptions of public policies affecting livestock sectors.) This is followed by a review of regional commitments of these countries. A third subsection compares specific policies of each country which affect livestock production and trade.

## A. Individual country developments

### 1. Côte d'Ivoire

Two organizations share important functions in the livestock sector: the Livestock Service (within the Agriculture Ministry) and *La Société pour le Développement des Productions Animales* (SODEPRA), a parastatal company which has undertaken most of the recent livestock projects and has had a much larger budget than the Livestock Service. The largest share of public investments in livestock has been targeted to the north of the country where, since the drought ending in 1974, SODEPRA has sought to create a tsetse-free environment and provide services to retain Sahelian herders and their animals attracted to an area of northern Côte d'Ivoire around Korhogo and Ferkessédougou.<sup>88</sup> Unfortunately, recent budget cuts have meant reductions in service which have constrained services and allowed reinfestation.<sup>89</sup>

As a net importer of red meat, Côte d'Ivoire has historically kept its markets fairly open to both world markets and to Sahelian markets, while developing its own red meat production and, in particular, its industrial feedlot operation at Ferkessédougou. With the dramatic increase in imports of subsidized EC meat in the mid-1980s, the government's initial response was to protect its investments in the Ferkessédougou operation by requiring importers to purchase certain quantities of Ferkessédougou meat for each ton of imports.

In 1987, however, the Ivorian government adopted a new strategy which stressed the creation of "an economic environment favorable to livestock development and private initiative." This strategy included the introduction of compensatory tariffs to counter dumped meat imports, subsidized credit to livestock rearers who did not meet bank criteria for loans, guaranteed land rights for livestock rearers, a stable supply of inputs (particularly agro-industrial byproducts) to livestock production, and professional marketing and distribution services. Finally, it stated an

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<sup>88</sup> P. Bernadet, *Association agriculture-élevage en Afrique: les Peuls semi-transhumants de Côte d'Ivoire* (Paris: Editions l'Harmattan, 1984).

<sup>89</sup> Mody Bakar Barry, *Impact des mesures d'ajustement structurel sur les systèmes de production et les échanges de produits animaux entre la Côte d'Ivoire et les pays Sahéliens limitrophes*, paper presented at the Séminaire CIRES-ACDI-LAVAL, Abidjan, 15-19 June 1992.

intention to privatize state-owned livestock companies and to redirect livestock agents from disbursement of subsidies to more directly productive work in the livestock sector.

Policy makers have attained some of these goals and have taken significant steps towards others. Most importantly, in early 1991, the government introduced a system of compensatory tariffs on imported meat. These vary according to the difference between the cost of bringing domestic meat to the Abidjan market and the cost of the dumped meat brought to the same point.<sup>90</sup> This policy protects not only the feedlot but all West African suppliers to the Abidjan market, none of whom are subject to this tariff.

Also, privatization has proceeded with the renting out of the former Complexe d'Exploitation Industrielle du Bétail (CEIB) feedlot and industrial abattoir (formerly run by SODEPRA) to businessmen on a concessionary three-year lease, with the intention of eventually selling it off. In the same vein, the government is currently planning the privatization of its distribution network for inputs to livestock rearing and of its "livestock stations", principally the Maraoué Ranch and the sub-regional seed multiplication farm for improved grasses. Similarly, when the new Abidjan abattoir is built, the government proposes to offer at least some equity to butchers. By the end of 1992, SODEPRA's feedlot, ranches and extension services ought to have been privatized and it should have ceased to exist.

The government continues to take measures to ensure a certain supply of inputs to livestock raising, although by means which differ according to the input in question. Each year its different agencies negotiate an agreement by which a portion of factory output of cotton seed cake and other feedstuffs is made available to SODEPRA at a subsidized price. To control the major infectious ruminant diseases, the government offers vaccines, vaccination equipment and vaccination services at no cost to livestock rearers. Producers must buy all other animal drugs and related equipment in the marketplace where they receive no subsidies. Indeed, although medicine is exempt from import duty, syringes and other equipment for veterinary care are subject to an 80 percent import tax. Private veterinary care for livestock has not yet been sanctioned (although it is available for domestic animals).

## 2. Ghana

Like Côte d'Ivoire, Ghana also has invested in its livestock sector since independence through the medium of parastatal companies, although no single company has had the means, or the broad range of activities, to rival SODEPRA. The Meat Marketing Board (MMB) was set up to develop a livestock industry based on ranching, but transferred its activities from promoting modern domestic production to monopolizing imports of meat from the world market. It changed tack to avoid losing money and to try to satisfy its urban customers. Liberalization

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<sup>90</sup> This policy was formulated in: J. Sarniguet, *Etude d'un système de protection du marché de la viande et d'un fond de développement de l'élevage (rapport provisoire)*, prepared by SEDES for Côte d'Ivoire, Ministère de la Production Animale, Présidence de la République, Direction et Contrôle des Grands Travaux and Commission des Communautés Européennes, juin 1988.

has removed this monopoly and opened up this business to the private sector and other parastatals. The government now intends to close MMB. Other parastatals dealt with poultry (Pomadze Poultry Ltd.), meat-packing and tanning. Most of these companies have already closed their doors or are listed for divestiture.

The Livestock Service runs vaccination campaigns against the major infectious ruminant diseases which the government subsidizes entirely. However, producers must pay for vaccinations for poultry. The private sector distributes veterinary medicines other than vaccines, after initial approval from the Pharmacy Board.

Ghana's medium term goals for the livestock sector are to improve productivity through better use of all available feed, development of water supplies and improved animal health. The private sector will provide veterinary care and feed supplies. The government intends to restrict its role to developing the private sector, animal husbandry extension, epidemiological studies and vaccination campaigns against major epidemic diseases. It will gradually phase out both direct and indirect subsidies to curative medicines and develop private veterinary practices, partly by providing incentives for veterinarians to transfer from the civil service to the private sector. Farmer groups are to be organized to provide economies of scale in the collection and distribution of crop residues and byproducts which the government will make available "at attractive prices" for ruminant nutrition. Private producers already dominate pig and poultry production.<sup>91</sup> In livestock marketing, the Ghanaian government intends to make producers aware of prices in urban markets through an improved market information system; it also intends to establish upstream markets to ensure that, once armed with this information, they have the opportunity to sell animals in a competitive setting.

To the extent that it is implemented, government policy will hand over more responsibility to the private sector and encourages a free market, with the exceptions of certain services which it does not expect the private sector to provide. The government has no policy to attract Sahelian herders to northern Ghana in the same way that Côte d'Ivoire used immigration as a principal tool to boost its livestock herds.

### **3. Burkina Faso**

In 1987, in an expression of its commitment to accelerated growth of the livestock sector, the government of Burkina Faso elevated the Livestock Service to the status of a special secretariat. Since then, to promote investment in the sector, it has reduced the tax burden on the sector by eliminating the head tax on livestock in 1987 and reducing export taxes on livestock in 1990. The sector continues to support only a light tax burden, primarily on butchers' and livestock exporters' value added, as well as minor taxes on market costs, health fees, business registration and slaughter.

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<sup>91</sup> Ghana, Ministry of Agriculture *Ghana Medium Term Agricultural Development Program: an Agenda for Sustained Agricultural Growth and Development (1991-2000)*, prepared in collaboration with the Agriculture Operations Division, West Africa Department, Africa Region, The World Bank (February 9, 1990), pp. 112-115.

Because of severe fiscal constraints the government has simultaneously tried to reduce the public burden of its activities and so has sought to divest itself of its production and marketing parastatals. Among these, ONERA, a parastatal which exported fattened animals has already been dissolved and the government plans to privatize the fattening operations which it served. It also wants to sell subsidized industrial poultry farms at Ouagadougou, Bobo-Dioulasso and Koudougou. Most importantly ONAVET has been targeted for privatization. This organization has 30 distribution centers around the country, through which it markets veterinary drugs and agro-industrial byproducts, which it sells at subsidized official prices.

Until 1991, ONAVET received the majority of these products at official prices as a negotiated quota of the outputs of national agro-industries. The government allows a parallel input marketing structure to function alongside ONAVET. However, traders may buy feeds from ONAVET for resale creating a parallel market in which the traders have about 80 percent of the market. Only in Ouagadougou may traders not purchase from ONAVET because the government judged that too much speculative buying had occurred.

In 1991, abattoirs in Ouagadougou and Bobo-Dioulasso -- not scheduled for privatization -- made substantial losses, provoking consequent recommendations for increased charges to butchers for services rendered. Subsidies to Ouagadougou's meat consumers in this way amounted to 25 FCFA per kilogram.<sup>92</sup>

Reflecting Burkina's current policies of liberalization and retrenchment of public initiatives in the sector, a 1991 planning document concludes: "The current system [of taxation] avoids distorting the sector and no longer constitutes a disincentive to production and export. However, it provides no incentives for positive action to orient the sector towards more intensive production or towards production more likely to preserve the environment."<sup>93</sup>

#### 4. Mali

The government of Mali splits responsibility for the livestock sector between the *Direction Nationale de l'Élevage* (DNE, overseeing animal production and health) and the *Office Malien du Bétail et de la Viande* (OMBEVI, overseeing marketing and transformation). However, as in the other countries, Mali's current priorities for the livestock sector are to reduce state intervention in all livestock industries and marketing services which the private sector can take over.<sup>94</sup> Instead, it has turned towards providing services to the private sector to make it more competitive. The move towards developing the private sector included the beginnings of the privatization of the veterinary profession in 1991 and the removal of subsidies

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<sup>92</sup> Burkina Faso, *Etude prospective ... 1991*, pp. 197-205.

<sup>93</sup> Burkina Faso, *Etude prospective ... 1991*, pp. 148, 184, 210.

<sup>94</sup> This strategy is defined in the *Programme d'Ajustement Structurel Agricole II* (PASA II), draft 1992.

on high-protein animal feeds. However, liquidation of several livestock parastatals has left Mali, by far the largest livestock producer in the central corridor, without a functioning tannery or an exporter of meat.

Two important livestock projects are at opposite ends of the project cycle. The World Bank-financed ODEM project finds itself in limbo at the end of its allotted span, while the USAID-financed APEX project has scarcely begun. APEX aims to improve animal production in the context of natural resource planning in western Mali, and to increase the efficiency of marketing livestock and livestock products throughout the country and in foreign markets. APEX's marketing initiatives are coordinated with the World Bank "Action Plan" to improve livestock market information available to traders and marketing infrastructure, to streamline government regulation of livestock exports and to reduce extortion along the way.

## **B. Regional policy context**

Each country examined in this study is a signatory to various international treaties and a member of several international organizations. These oblige each government to constrain its policy to conform to international norms. Some of these may pertain to particular topics, such as livestock, but many cover broad issues of international co-operation which indirectly affect the livestock sector.

At the broadest level, all four countries belong to the Economic Community of West African states (ECOWAS or, in French, CEDEAO) conceived as a trading bloc with a system of tariff preferences for goods of one member state exported to another. However, in practice this system does not function. Mali, Burkina Faso and Côte d'Ivoire belong to the *Conseil de l'Entente* and thus to its subsidiary, the *Communauté Economique du Bétail et de la Viande* (CEBV), which aims to promote the activities of the livestock sector in member countries. All three also belong to two wider groupings of francophone countries: the *Communauté Economique de l'Afrique de l'Ouest*; and the *Union Monétaire Ouest-Africaine* (UMOA) through which they share a common currency pegged to the French franc, and, in exchange for guaranteed convertibility to the French franc, subject themselves to constraints on their macroeconomic policies.<sup>95</sup> In addition, as Sahelian states, Mali and Burkina Faso belong to the *Comité Interétat pour la Lutte contre la Sécheresse du Sahel* (CILSS), set up to combat the effects of Sahelian drought on, *inter alia*, the livestock sector.

Overall, these linkages bind the francophone countries much more closely to each other than to Ghana. Moreover, ties between the francophone countries extend beyond specific obligations, such as those affecting the livestock sector, to include general familiarity with each other's institutions and common interests which these ties promote. Thus, as states with similar institutional structures and a common official language, they come well-equipped for further cooperation. Unfortunately, because Ghana does not share any of these linkages, it has little

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<sup>95</sup> As noted earlier, convertibility was suspended, however, in August 1993.

incentive to coordinate its policies, including those pertaining to livestock and meat, with those of the other three states.

## **C. Specific policies affecting livestock production and trade**

### **1. Market taxes**

In livestock markets throughout the francophone countries of the central corridor, the seller has to pay a market presentation tax, although in some markets the local authorities levy a sales tax instead. These typically vary from 100 to 200 FCFA for cattle and 25 to 50 FCFA for sheep.<sup>96</sup> Depending on the market, a range of other taxes may also be levied. In the stock markets in Abidjan for example, traders pay a 150 CFA franc market presentation tax per head and must also pay the Abidjan municipal and stockyard taxes: 1,000 and 1,100 FCFA per head respectively. In Ghana there exist comparable market taxes, council fees, sales taxes, and veterinary inspection taxes which typically range in price from 100 to 500 cedi per head.

### **2. Business taxes**

In addition to sales taxes, traders and butchers pay taxes which substitute for income tax. As businessmen in these countries do not generally keep books from which one may discern their net income, governments cannot directly levy income taxes. In lieu of income taxes, governments levy business taxes on them. In Côte d'Ivoire and Mali this tax takes the form of the payment for the *patente*, generally valid for three months or a year, in other cases valid for a certain number of animals. Only large traders or butchers can afford to pay for a *patente* which may cost several hundred thousand CFA francs annually. However, large operators can subcontract their *patentes* to others. In Burkina Faso, the equivalent is the business turnover tax (*taxe sur le chiffre d'affaires*) which comes to 2,000 FCFA per head of cattle in Pouytenga. By comparison, in Fatoma, Mali the cost of the subcontract per head of cattle came to 1,500 FCFA. In Ghana, the "income tax on capital" on long-distance livestock trade is a 3.6 percent tax on the value of the herd or about 3,800 cedis per head of cattle in Bawku (about 2,400 FCFA at the parallel exchange rate).

### **3. Livestock export and import taxes**

The Malian government has formally eliminated export taxes in recent years, but government officials do not necessarily observe this. One trader reported paying 1,000 FCFA for an export license for a herd leaving the Sikasso Region of Mali for Côte d'Ivoire.

In Burkina Faso, traders must pay fees to government offices for the right to export their herd, regardless of the destination or the mode of transport. Since June 1990, Burkinabè

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<sup>96</sup> In some locations these taxes are significantly higher. At Pouytenga in Burkina Faso, three separate taxes were levied: a presentation tax (100 FCFA), a prefectural tax (200 FCFA), and a local government (*Mairie*) tax (100 FCFA). At Korhogo market the sole market tax was 500 FCFA.

exporters pay a "export tax" on livestock, although they pay other taxes when they export livestock. These come to 5.6 percent of national values of 55,000 CFA francs for cattle and 15,000 CFA francs for sheep, yielding tax payments of 3,025 and 825 CFA francs respectively.<sup>97</sup> Officially, Burkina Faso also exacts taxes on imported livestock, but ruminants, usually imported from Mali on the hoof, escape these taxes.<sup>98</sup>

Côte d'Ivoire does not impose taxes on live animal imports from Sahelian countries.<sup>99</sup> Ghana, on the other hand does, although because of stringent quarantine requirements, very few animals are officially imported (see discussion below).

#### 4. Animal health requirements

Trade in live animals is also restricted by health considerations. Livestock Services oversee vaccination against infectious livestock diseases to prevent their spread by animals on the move. Governments have obligations under international treaties which oblige them to undertake this service, but it is clearly also in their collective best interests, and often their individual best interests, to do so.

For domestic trade, the Burkinabè government formally requires each trader to obtain a health pass (*laissez-passez sanitaire*), a document issued by the Livestock Service to attest to his herd's good health. For international trade, the trader formally requires an analogous "livestock passport" which also contains details of the herd composition, its itinerary and the veterinary posts via which it must pass. Neither certification costs anything.<sup>100</sup> However, before the Livestock Service can grant him such a passport, the trader formally needs to have already visited other government offices to (i) pay his business tax (the *patente*), (ii) obtain formal permission to export livestock (the *autorisation d'exportation du bétail*), (iii) pay a health tax (*taxe de visite sanitaire*) and (iv) obtain proof of the nationality of the animals (*certificat d'origine*).<sup>101</sup> The Livestock Service agent must also verify that the animals have received vaccinations against rinderpest, peri-pneumonia, pasteurelloses, anthrax, trypanosomiasis, and foot and mouth disease.

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<sup>97</sup> Burkina Faso, *Symposium national ... 1991*, p. 89.

<sup>98</sup> As of September 1991, Burkinabè taxes on imported animals were: cattle (3,723 Fcfa + 500 Fcfa/ton); small ruminants (993 FCFA + 500 FCFA/T; donkeys (4,152.5 FCFA + 500 FCFA/T horses (7,342.5 FCFA + 500 FCFA/T. Importers of meat and offal pay 145.75 percent of declared value + 500 FCFA/T. (Burkina Faso, Ministère de l'Industrie, *Symposium ... 1991*, p.121). This source gives no rates for camels or poultry.

<sup>99</sup> Burkina Faso, *Symposium national... 1991*, p. 122.

<sup>100</sup> Burkina Faso, *Symposium national ... 1991*, p.71.

<sup>101</sup> The *certificat d'origine* can often be "difficult to obtain". Burkina Faso, *Symposium .. document de base 1991*, p.121.

Animals exported from Mali also need health certification for international trade. Vaccinations against rinderpest and peri-pneumonia cost 34 FCFA per head of cattle; vaccination against trypanosomiasis costs 20 FCFA per head. However, trading budgets suggest that Malian traders do not obtain an equivalent to the Burkinabè *laissez-passer sanitaire* for domestic trade. Rent-seeking livestock agents sometimes sell traders livestock passports endorsed for vaccinations which their animals do not in fact receive.

Animals arriving in coastal countries without passports provoke government officials to hold up the herd and demand bribes. However, it is possible to receive the appropriate vaccinations in the importing country. The question for the trader is whether to undergo the bureaucratic costs in his country of origin or to risk bribes and delays in the country of destination. Those who export by truck or train almost always arm themselves with endorsed livestock passports with which to face the numerous government officials along the route. Those sending their animals across the border clandestinely on the hoof may risk waiting to vaccinate their animals on the other side.

Ghana has imposed a quarantine requirement on imported livestock following an outbreak of hoof and mouth disease in 1985 which the Livestock Service attributed to diseased Sahelian cattle. The Livestock Service therefore formally requires those wishing to import trade livestock to write to its Director of Administrative Services to schedule an appointment for the nine-day stay. Although the Livestock Service offers water and grazing around the quarantine station, a nine-day waiting period ties up working capital and requires extra labor time, adding significantly to marketing costs. However, very few animals use these official quarantine stations. Because the government does not control clandestine imports, at least at the point of entry, the quarantine policy may increase the possibility of importing disease. Moreover, Ghana's retention of this health requirement long after the disappearance of the proximate threat has left it open to charges from some quarters that it now uses this requirement as a non-tariff barrier to Sahelian livestock.

Côte d'Ivoire does not impose the same quarantine restrictions on livestock as Ghana, although veterinary inspections of animals are made and vaccinations are certified or given for a small fee.

## 5. Bribes and tips

Government officials informally tax traders or trek bosses along the market chain. These *taxes sauvages* are more frequent along the major routes where large concentrations of export herds are found. Demands for money also intensify at the many checkpoints on either side of international borders.

Traders often make payments to government agents to speed up paperwork necessary to legally export livestock.<sup>102</sup> However, illegal payments made en route are a much greater cost

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<sup>102</sup> For instance, in 1990, Kulibaba and Holtzman (1990) note payments totalling 200 FCFA per head of cattle to Malian officials for this purpose.

to traders. Army soldiers, gendarmes and police officers, customs officials, and forestry and livestock agents all exact payment along the way. This study found that Malian traders gave a total of 100,000 - 120,000 FCFA of bribes per truck load of cattle between Fatoma market in the interior Niger delta in Mali and Abidjan (about 3,700 FCFA per head). These costs were fairly equally split between Mali and Côte d'Ivoire. An official 1991 Burkinabè document gives a total figure of 83,000 FCFA over a similar distance between Pouytenga and Abidjan, again roughly equally divided between officials in the two countries concerned. Such sums compare favorably with previous findings: Kulibaba and Holtzman note a typical figure of 150,000 FCFA per road trip from central Mali to Abidjan.<sup>103</sup> Of this, most was appropriated by customs officials in both countries, followed by police officers in Mali, and livestock agents in Côte d'Ivoire. One Burkinabè report cites most rent-seeking activity as stemming from police and customs agents; another refers to the police and the gendarmes.<sup>104</sup>

In 1991, SBCF stated that Burkinabè exporters were moving towards forming a union which would provide a common front against those trying to extract bribes. It was thought that an organization would have more bargaining power against the officials, probably in much the same way that similar Ivorian unions offer a "package deal" for handling all bribes except those demanded by police, gendarmes and soldiers in trucking through Côte d'Ivoire for 30,000 to 40,000 CFA francs.<sup>105</sup>

One informant estimated that by trekking Sahelian animals beyond the Ivorian border, a trader can greatly reduce his bribery costs. He estimated that bribes per kilometer of trekking typically equal only half those by truck. Limited evidence from Kulibaba and Holtzman on shipments from Burkina Faso and Mali to Côte d'Ivoire support this contention. They suggest that trekking across the border before renting a truck in Côte d'Ivoire incurs a significantly lower level of bribes and extortion per kilometer than cross-border transport by either truck or rail.<sup>106</sup>

Officials may also take bribes as part of the process of importing livestock products. For instance, a government agent may accept under-invoicing or "forget" about part of a cargo in order to receive a bribe. The higher the bribe, the lower the tax. An informant suggested that Malian government revenue may drop by forty percent due to such practices.

## 6. Trade taxes on livestock products

As noted above, in 1991 Côte d'Ivoire introduced a variable levy to counter the effects of dumped EC meat products on domestic prices. To determine the level of this levy, the government calculates the domestic price of producing a certain cut of meat and bringing it to

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<sup>103</sup> Kulibaba, 1990. p. 87.

<sup>104</sup> Burkina Faso, *Symposium national ...* 1991, p.95; and Kulibaba and Holtzman, 1990.

<sup>105</sup> Burkina Faso, *Symposium national...*, 1991, pp. 95, 110.

<sup>106</sup> Kulibaba and Holtzman, 1990, pp. 94-98.

the wholesale level, and then the price which should obtain when an importer brings the same cut into the country, also to the wholesale level, after having paid all applicable taxes. If the imputed price of the imported meat falls short of the domestic price, the difference is applied as a supplementary levy on the imported meat, up to a maximum level set by law.

Thus, for instance, the 1992 domestic price of low-quality capa beef cut was based on an average domestic wholesale price for beef of 855 FCFA/kg and an EC standard quality factor of 0.6, indicating that consumers were prepared to pay for a kilogram of capa only 60 percent of what they were prepared to pay per kilogram for average beef. This resulted in a domestic benchmark price of 513 FCFA/kg. A calculation of the cost of importing capa from the world market, including all standard taxes, provided an import reference price of 432 FCFA/kg. The compensatory levy equalled the difference between the domestic and import reference prices, in this case 81 FCFA/kg, less than the legal maximum of 400 FCFA/kg. The government charges no levy where the domestic price equals or exceeds the import reference price.

Imports of most livestock products to Ghana are generally subject to a 20 percent import duty and a 7.5 percent sales tax. However, poultry and butter imports pay a higher sales tax of 17.5 and 35 percent respectively, while milk products are subject to a higher import duty of 25 percent. All meat is also subject to an inspection to assure that fat content is below 25 percent.

In Burkina Faso, taxes are applied on the import and export of livestock products. Skins and hides pay a 4 percent export tax, and meat exports pay an 11.25 percent tax. By comparison duties on imports of red meat are about 150 percent, although such imports are almost nonexistent. Imports of milk, the primary livestock product imported, are approximately 11 percent although, in 1991, the customs service raised the notional values to which it applied proportional import tax rates on concentrated milk.<sup>107</sup> However, a recent study found that due to removal of the "export tax" on live animals, effective export tax rates on meat exceeded export tax rates on livestock in 1991 because, although the formal tax rates were the same, the notional value of livestock used to calculate taxes underestimated its true value whereas the notional value of meat equaled its true value.<sup>108</sup> For this reason, the report suggested that the government consider eliminating this meat tax altogether.

Since 1991, Mali has imposed no export taxes.<sup>109</sup> However, it does levy import taxes of 6 percent on powdered milk and 16.6 percent on concentrated milk. Meat imports are subject to taxation at 65 percent, as are animals which enter the country officially.

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<sup>107</sup> Net import tariffs stand at 11.75 percent for loose powdered milk (5.75 percent in tins), 24.75 percent plus 500 FCFA for fresh milk, and 81.75 - 101.75 percent for cheese. Burkina Faso, *Etude prospective ... tome 1: rapport de synthèse* (avril 1991), pp.146-148, 184.

<sup>108</sup> Burkina Faso, *Etude prospective ... 1991*, p.184.

<sup>109</sup> Vaccines and other veterinary medicines entering Mali are taxed at 16.6 percent if they come from a country within the CEAO and at 22.1 percent otherwise.

## II. AN EVALUATION OF POLICY IMPACTS ON LIVESTOCK PRODUCTION AND TRADE

Direct comparisons of the results of the financial and economic analyses presented in the previous chapter permit an assessment of the impact of public policy on livestock production and trade. These comparisons are made in this chapter, first through the use of the **nominal protection coefficient** (NPC) which evaluates the ratio of financial to economic value for tradeable livestock products and inputs. A second important indicator is the **effective protection coefficient** (EPC) which measures the ratio of financial to economic "value added"<sup>110</sup> in a given production/ marketing scenario. In either case, when the financial value (numerator) exceeds the economic value (denominator) the ratio exceeds unity, demonstrating positive protection for use of domestic factors of production in the activity in question. An explanation of these protection coefficients is provided in the workshop handbook produced in conjunction with this study.

All world and local market prices used in the analysis are assumed to be for 1992/93. Where possible annual average price levels have been used, so that results reflect an average annual indicator undistorted by seasonality. Policy measures applied are assumed to be for the same period.

As explained in Chapter 4, the analyses of production, marketing and reference prices breaks down or "decomposes" all financial costs into their tax and economic cost components.<sup>111</sup> This process distinguishes between all taxes which apply to, and therefore distort, tradeable components of costs and those affecting non-tradeable components. A second important distinction is between true taxes (or subsidies if negative), representing transfers to the government, and illegal transfers paid to public officials.<sup>112</sup>

These latter "taxes" are distinguished to allow the analysis to measure their impact separately. Determining what should be classified as *taxes sauvages* is difficult, however. Kulibaba and Holtzman distinguish between several types of corruption along the marketing chain: payments for licit services, bribery, extortion and fraud.<sup>113</sup>

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<sup>110</sup> Value added is defined as the net value in production and marketing generated by non-tradeables after deducting tradeable input costs from tradable product value.

<sup>111</sup> These breakdowns are displayed explicitly in the tables in Annexes C, E, and F which present the various production, marketing and reference price scenarios.

<sup>112</sup> Although in theory, bribes might occur at any point in a scenario, they have been evaluated only for marketing and are assumed to be negligible at other stages.

<sup>113</sup> Kulibaba, and Holtzman (1990), pp. 86-88.

Payments for licit services start as tips to government agents for superior service, often in processing bureaucratic paperwork, but which may degenerate into accepted premiums without which the official will not grant even ordinary service. They constitute an extra cost to the trader which ultimately may not increase the value added in his business.

Bribery or "payment for illicit services" is a profit-sharing venture which occurs when a government agent allows a trader to break the law by, for instance, overloading a vehicle or not paying a tax. Bribery generally increases the trader's profit. In the examples just given, the other result is to reduce public safety or diminish taxes going to government coffers: in either case it compromises the common good.

"Extortion is money paid to officials to keep them from doing harm" to the trader's interests, such as delaying a truckload of animals from reaching market. A payment of this sort prevents the trader's profit dropping by an amount greater than the payment. One difference between bribery and extortion by this definition is the free will of the trader. The other difference is that the former generally reduces government tax revenue whereas extortion does not.

Fraud occurs when officials misdocument an event in order to profit from it. Kulibaba and Holtzman cite an example of livestock agents recycling export licenses which officially have only one life.

Treatment of all these costs in the current study focuses on the question of whether payments made by traders represent an economic cost or, instead, constitute non-economic transfers, either to the government (taxes) or to its agents acting as individuals. In the analysis, payments to individual government agents are allocated into one of two categories: "tips" or "bribes", used in senses which sometimes differ from their conventional meanings. "Tips" include payments for licit services, or extra payments made by traders on their own initiative to civil servants to gain commercial benefits (bribery, as defined by Kulibaba and Holtzman).<sup>114</sup> This analysis does not dwell on the fact that the former is "legal" and the latter "illegal": both constitute payment for some tangible service. However, as discussed above, payments for licit services need not provide benefits: when such payments for licit services do not increase value added, the official has turned the tables on the trader and, by requiring payment for standard service, has begun a gentle form of extortion. In this case, where a trader must make an illegal payment for no increase in the value added to his trading operation, it is considered a "bribe".

To identify the effect of policy impacts, the analysis examines separately the impact of policy on livestock inputs (NPC<sub>i</sub>) and livestock outputs (NPC<sub>o</sub>) and then examines the combined effects for representative production and marketing scenarios (EPC). Three versions of each of these protection indicators are evaluated, yielding a total of nine measures of protection.

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<sup>114</sup> Traders may also pay tips to non-government agents in the form of discretionary payments for services rendered. All tips are assumed to be returns to labor.

Firstly, the *official policy indicators* have numerators measuring financial values at levels pertaining if only official policy effects affect the scenario. In the case of importable livestock products, this is calculated as the border price plus all financial costs, taxes etc. necessary to deliver the product to the point of comparison. For tradeable inputs, this value is deduced from the financial cost by subtracting all costs assumed to be *taxes sauvages*. In the case of both products and inputs, these indicators assume there are no other distortions from the combination of a free market overlaid with specified government regulation. Any others would be removed if known. Official policy indicators have denominators evaluating economic (world) prices at official exchange rates.

Secondly, the *market* indicator evaluates the financial-price numerator using prices which pertain in internal markets at the points of comparison of the domestic and world-market products. Thus, whereas the official indicator captures the distortions which policy ought to create, the market indicator measures the net effect of factors that influence actual price levels. For livestock products these influences include not only official taxes, but also unmeasured distortions due to monopolies, quantitative restrictions on imports, sanitary restrictions, as well as strategies to evade these policies. For inputs, the market indicator includes estimates of *taxes sauvages* as well as official taxes. Like official policy indicators, market indicators have denominators evaluating economic (world) prices at official exchange rates.

A final version of each protection indicator, the *net* indicator relies on the market price comparison in the numerator, but evaluates the economic reference price in the denominator at equilibrium rather than official exchange rates. In comparison to the *market* indicator, the *net* indicator thus incorporates the impact of overvaluation on product protection.

A further distinction made for all versions of all indicators in the analysis which follows is between two different perspectives on the assumed sphere of protection: the **national** perspective, and the **regional** perspective. This difference reflects the distinction made in the economic analysis between the national and the regional economies. Specifically, "national" protection coefficients examine effects of policy in the country of production only, while "regional" protection coefficients incorporate policies in both the country of production and the country of final sale for products which are traded between countries within the larger region. In the analysis, therefore, the "regional" and "national" analyses differ only for Sahelian ruminant livestock systems which sell animals in the coastal countries.

In the base-case analyses all coefficients used to evaluate protection for products of each scenario are evaluated for the weighted joint-product of its production system, and are assessed at the point of assumed competition between each component product and its best substitute from the international market. Unless otherwise stated, these points of comparison are: the coastal capital city markets for meat, local village markets in the region of the production system for milk, and at the port FOB in the country of slaughter of animals for hides and skins, (except in the case of Ghana, where cattle hides are assumed to be consumed as non-tradeable byproducts of slaughter).

## A. Policies Impacts on Livestock Products

### 1. Cattle systems

#### a. Nominal protection due to official policy

The nominal protection coefficient (NPC) which represents the ratio of financial to economic prices for a specific commodity, is used as the indicator of policy effects on products of ruminant livestock systems. Calculations of NPCs are presented in Table 5.1 for representative Sahelian and coastal country cattle systems. Only one result is reported to represent extensive systems in each country (both transhumant and sedentary) because results are almost identical for all extensive models. This is because each system produces joint products in approximately the same ratio; only the peri-urban dairies, results for which are reported separately below, show significantly different results because of the much greater contribution of milk to their joint product. (Volume III, Annex C presents the indicators for all cattle systems.)

A number of important points are illustrated in Table 5.1. Examining first only *official policy* coefficients (oNPCs), from the **national** perspective NPC's are low but positive for extensive systems in both Sahelian countries, but much more positive for coastal countries.<sup>115</sup> The very slight protection in the Sahelian countries is due solely to tariff protection of the milk component of the joint product. If no milk were produced, these results would equal 1.00 for Mali which has no tax on its live animal exports, and 0.95 for Burkina Faso which lightly taxes exports, and therefore penalizes (or "negatively protects") cattle scenarios.

Both coastal countries, on the other hand, show significantly higher *official policy* NPCs for extensive livestock systems, reflecting the impact of countervailing import duties in Côte d'Ivoire, and ad valorem duties in Ghana on both meat and milk. Comparing extensive systems for Korhogo and Tamale suggests that Ivorian protection of meat (oNPC = 1.39) is only slightly higher than for Ghana (oNPC = 1.33).

As would be expected, peri-urban dairy systems in both the Sahel and coastal countries benefit from a stronger official protection than extensive livestock systems because their joint product benefits proportionately more from the higher protection on milk than meat. Nominal protection appears to be particularly high for the Accra dairy system which shows much higher protection than the extensive cattle system at Kpong Tamale.

The **regional** perspective illustrates the indirect effect of the protection provided by both coastal countries on meat and milk imports, for the Sahelian livestock systems which competes with these imports. As would be expected, the protection to Sahelian livestock rises substantially as a result of coastal country policies, and approaches protection levels of similar coastal country

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<sup>115</sup> By convention, when financial prices equal economic prices and the NPC = 1.00, analysts describe this as neutral protection. By extension, an NPC > 1.00 is described as "positive protection" and, perhaps more counter-intuitively, an NPC < 1.00 is described as "negative protection". The same applies to EPCs.

systems. As with coastal systems, *official* nominal protection is slightly higher for all Sahelian systems selling livestock to Abidjan in comparison to sales to Accra due to slightly higher levels of taxation of imported meat provided by Côte d'Ivoire.

**Table 5.1**  
**NOMINAL PROTECTION COEFFICIENTS**  
**FOR JOINT PRODUCTS OF CATTLE SYSTEMS**

	<b>MALI</b>				<b>BURKINA FASO</b>	
	(Extensive, Nara)		(Dairy, Bamako)		(Extensive, Dori)	
	National Protection	Regional Protection	National Protection	Regional Protection	National Protection	Regional Protection
<b>Official policy NPC:</b>						
sale to Accra	1.04	1.23	1.14	1.20	1.07	1.22
sale to Abidjan	1.04	1.39	1.13	1.31	1.06	1.37
<b>Market NPC</b>						
sale to Accra	0.74	0.86	2.03	2.19	0.79	0.91
sale to Abidjan	1.05	1.41	2.11	2.43	1.05	1.36
<b>Net NPC</b>						
sale to Accra	0.49	0.57	1.39	1.46	0.54	0.61
sale to Abidjan	0.70	0.94	1.41	1.62	0.70	0.91
	<b>CÔTE D'IVOIRE</b>		<b>GHANA</b>			
	(Extensive, Korhogo SO)		(Extensive)	(Dairy)		
	National protection		National protection	National Protection		
<b>Official policy NPC:</b>		1.39		1.33	1.93	
<b>Market NPC:</b>		1.31		0.52	1.90	
<b>Net NPC:</b>		0.97		0.48	1.75	

Note: sales destinations are for livestock only.

Not surprisingly, levels of *official* protection afforded to scenarios in which Sahelian livestock is marketed to the coast are roughly the same for Mali and Burkina Faso for either national or regional perspectives, since export policies are similar, and they face the same policy environment in coastal markets.

#### b. Market nominal protection levels

In Table 5.1, the *market* nominal protection coefficients (mNPC), reflecting comparisons of real prices to economic reference prices, show significant differences from official policy rates. First of all, considering only the effects of **national** policies, all extensive Sahelian systems exporting livestock to Ghana as well as Ghana's own extensive systems show

consistently negative protection levels ( $mNPC < 1.00$ ). This result suggests that domestic prices for red meat in Ghana are actually below world market levels. In contrast, all extensive systems exporting to Abidjan show low to moderate positive protection, suggesting that Ivorian prices for meat are somewhat above world market levels. Comparing *market* to *official* NPCs also illustrates the fact that while the two indicators conform closely for Côte d'Ivoire, they diverge significantly for Ghana. These results demonstrate that Ivorian prices are directly dependent on world market prices adjusted for import tariffs, but that Ghanaian meat markets are not strongly influenced by world markets. Rather, Ghanaian meat prices appear to be largely determined by internal markets. This conclusion is supported by the fact that Ghana depends much less on imported red meat than Côte d'Ivoire.

As predicted by *official* NPCs, *market* NPCs for dairy systems are well above those for extensive systems. Moreover, for Ghana, *official* policy correctly predicts *market* NPCs. However, the dairy system in Mali shows much stronger *market* positive protection than is predicted by official policy. Two types of explanation can be given for this result. The first explanation is that the distortion is due to the data used in the analysis. For example, real costs of importing and reconstituting world market milk in the Sahel may be higher than has been assumed by the analysis. Moreover, the premium placed on fresh milk over reconstituted milk may be much higher than has been assumed. A second explanation, however, is that the market for milk prices are being influenced by real factors other than official tax policy. These may include extortion of higher taxes than allowed by law on milk imports, the restriction of milk imports by non-price regulations, or simply monopsonistic pricing practices by milk importers.

Examining market protection levels from a *regional* perspective illustrates again the convergence of Sahelian protection levels with those of similar coastal systems due to the combined protection received by Sahelian producers in these markets.

### c. The impact of exchange rate overvaluation

At equilibrium exchange rates, as reflected by the *net* NPCs, all extensive systems show negative protection as a result of **national** policies, while both peri-urban dairy systems continue to receive substantial positive protection. For the FCFA countries the results demonstrate that overvaluation of the CFA franc more than offsets the protection afforded to livestock by duties and import restrictions. Moreover, combining domestic policy and exchange rate effects results in the convergence of protection levels for livestock sales in FCFA countries with levels for Ghana, where overvaluation is much less important.

From a **regional** perspective, protection to Sahelian cattle systems remains negative (but only marginally so) in the Abidjan market, but dramatically lower in the Ghanaian market, where tariff policies are ineffective due to the international competitiveness of the local market.

## 2. Small ruminant systems

Nominal protection rates for sheep systems show almost identical patterns to those for extensive cattle systems. These results are presented for representative systems in Table 5.2. From a **national** perspective, *official* policy protection from Burkina Faso is slightly negative due to the 5 percent export tax, while Mali shows no policy distortion, reflecting its abolition of export taxes. However, from a **regional** perspective, protection becomes significantly positive for sales to both Accra and Abidjan. Moreover, *official* protection is roughly equivalent for Malian and Burkina in both coastal markets, with the exception of Malian sheep in Accra, for which protection is about 0.10 lower. This is because Malian livestock which transit Burkina Faso must pay taxes en route which reduce their net financial value and therefore their protection in a regional context.

**National** nominal protection levels in coastal countries reflect the **regional** protection levels for the Sahel, as would be expected given trade patterns. Moreover, as with the cattle analysis, *market* NPCs are virtually identical to *official policy* NPCs for Côte d'Ivoire, but are significantly lower for Ghana, once again suggesting that Ghanaian market prices are not determined by world market prices, but rather by internal supply and demand conditions.

This dislocation of local from international markets in Ghana, suggests the ability of domestic production to meet demand in a market that is relatively undistorted by exchange rate overvaluation. Reflecting this fact, when account is taken of exchange rate overvaluation in all FCFA countries, *net* protection levels fall well below 1.00 in all cases, and approach levels found in Ghana. These results also confirm the competitiveness of sheep systems found in the DRC analysis of the previous chapter by suggesting that prices for meat, corrected for the implicit taxation of domestic products due to exchange rate overvaluation, are already well below world prices.

**Table 5.2**  
**NOMINAL PROTECTION COEFFICIENTS**  
**FOR JOINT PRODUCTS OF SMALL RUMINANT SYSTEMS**

	<b>MALI</b>		<b>BURKINA FASO</b>	
	National Protection	Regional Protection	National Protection	Regional Protection
Official policy NPC				
sale to Accra	1.00	1.08	0.95	1.17
sale to Abidjan	1.00	1.18	0.98	1.19
Market NPC				
sale to Accra	0.81	0.87	0.69	0.86
sale to Abidjan	1.08	1.29	1.08	1.30
Net NPC				
sale to Accra	0.54	0.58	0.46	0.53
sale to Abidjan	0.72	0.86	0.72	0.87
	<b>CÔTE D'IVOIRE</b>		<b>GHANA</b>	
	National Protection		National protection	
			(sheep)	(goat)
Official policy NPC	1.30		1.28	1.11
Market NPC	1.31		0.81	0.51
Net NPC	0.87		0.77	0.47

Note: Coefficients are for sheep unless otherwise indicated.

## **B. Policy impact on livestock inputs**

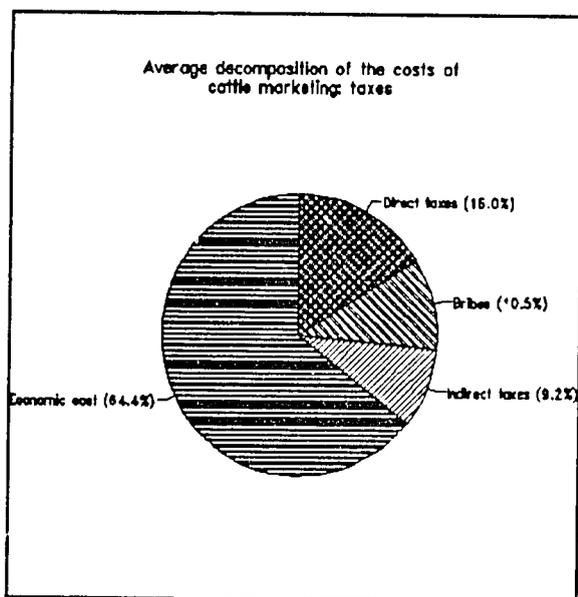
### **1. Taxation of production**

In most of the extensive livestock systems examined, very few commercial inputs are used in production, and therefore there is little scope for taxing inputs to production. The most important tradeable inputs are commercial feeds, vaccines, medicines, salt and occasionally a few implements for holding or watering animals. The decomposition tables in Annex G present the percentage share of taxes for tradeable and nontradeable components of important inputs to ruminant production. All four countries evaluated subsidized some veterinary products, particularly vaccines, and some commercial feeds, while import taxes are levied on most privately distributed medicines.

### **2. Taxation in marketing**

Marketing animals to the point of final consumption provides a much greater opportunity for governments to tax the livestock sector. However, it also provides opportunities for officials to extort illegal taxes from the sector. The cost structure of marketing sheep and cattle

examined in Chapter 4 revealed that the economic cost of marketing both species averaged only about 64 percent of the financial cost to the trader.



Graph 5.1

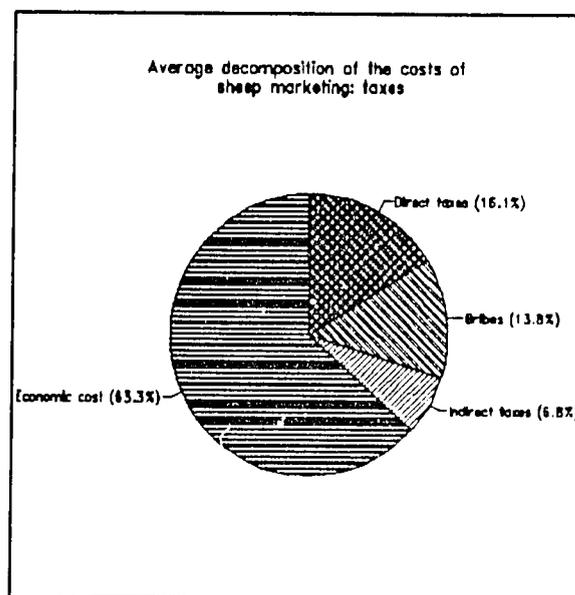


Figure 5.2

Graphs 5.1 and 5.2 show the average breakdown of the remaining 36 percent of marketing costs for a selection of cattle and sheep marketing scenarios. In both cases, taxes levied directly on marketing costs account for the largest share: 16 percent of the total financial cost for cattle marketing and 15 percent for sheep. Indirect taxes denote those embedded in the goods and services used in marketing, such as taxes already assessed on trucks and fuel before they are allocated to livestock transport. These account for 9 percent of marketing costs for cattle and 6 percent for sheep.<sup>116</sup> Of course, the absolute cost of transport taxes to livestock marketing increases with distance from the point of production to the point of consumption, and therefore the impact of these taxes is most significant for Sahelian countries for which transport is a high component of costs. Direct taxation is highest on routes to Accra, mostly because of the "income tax on capital" levied on Ghanaian traders. Direct taxation on marketing cattle in Burkina Faso is also high. (See Annex G for detailed analyses of transport costs.)

### 3. Bribes in marketing

Bribes paid along the route account for about 10 percent of costs for cattle marketing and 14 percent for sheep marketing. However, the difference in the level of bribes between species

<sup>116</sup> However, note that, to the extent that market chains include fattening at some point, these figures slightly underestimate the true level of taxation on marketing (by about two percent for cattle, seven percent for sheep) because fattening receives subsidies on inputs.

may not be significant due to the uncertainty associated with information about their net levels. They are of broadly similar magnitudes and account for about one third of the non-economic cost of trading. Sarassoro estimated bribes for cattle marketing along routes from Mali to Abidjan at 19 percent.<sup>117</sup> In this study, the mean for five Malian cattle export scenarios to Abidjan equals 14 percent, which may indicate that the level of bribes has fallen along these routes.<sup>118</sup>

Some, but not all, routes with a high trekking component appear to incur a low level of bribes. This contributes to the lower overall level of bribes for cattle marketing than for sheep marketing because, on average, sheep cover a higher proportion of the marketing chain in lorries than on the hoof. Local trucking within Côte d'Ivoire also appears to involve low bribe payments though this may be due to transport of sheep individually from Korhogo to Abidjan on the top of buses and possibly to an underestimate of bribes extracted on truckloads of cattle on the same route. Otherwise there is a fairly uniform level of bribery in the central corridor.

How much do traders pay globally in bribes? Assuming an annual flow of 50,000 cattle and 10,000 small ruminants from the Sahel to Côte d'Ivoire and Ghana, purchase prices of 60,000 and 12,500 FCFA respectively, and marketing costs which total 25 percent of the purchase price, the total annual supplement to the incomes of civil servants and the military from this source approximates 100 million FCFA annually.

#### 4. Aggregate impact on livestock scenarios

Reflecting the combined effects of the various policies on production and marketing inputs, *market* nominal protection coefficients for tradeable inputs (mNPC) presented in Table 5.3 below show moderate positive protection for all systems at official exchange rates.<sup>119</sup> Based on the preceding analyses, it is clear that this protection derives primarily from transport taxation, which accounts for over thirty percent of transport costs in all cases. This protection is only weakly offset by subsidies to veterinary products in all systems, and, in several cases, by feed input subsidies.

As with livestock products, however, exchange rate overvaluation more than offsets tariff protection on tradeable inputs in most cases, and results in negative *net* nominal protection. This result indicates that at equilibrium exchange rates, prices charged for tradeable inputs to livestock are slightly below their economic (world) prices, and therefore implicitly livestock producers are subsidized.

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<sup>117</sup> F. Sarassoro, *Les exportations du bétail Malien en Côte d'Ivoire*, (Abidjan: USAID/REDSO, juillet 1990), p. 12.

<sup>118</sup> This mean excludes a case which involves fattening at Ferkessédougou.

<sup>119</sup> All protection coefficients for inputs are based upon a national perspective of policy. A regional analysis is irrelevant since most tradeable inputs (vaccines, vehicles, fuel) imported to a Sahelian country do not pay duties in coastal countries through which they are transhipped, no important intraregional market exists for these inputs (with the exception of tradeable feeds).

**Table 5.3**  
**PROTECTION COEFFICIENTS FOR INPUTS**

	MALI			BURKINA FASO	
	Cattle Transh.	Cattle Dairy	Sheep Transh.	Cattle Transh.	Sheep Transh.
Official policy NPC	1.88	1.12	1.51	1.36	1.50
Market NPC	1.90	1.15	1.58	1.40	1.77
Net NPC	1.27	0.77	1.05	0.94	1.18

	CÔTE D'IVOIRE		GHANA		
	Cattle Sedent.	Sheep Sedent.	Cattle Sedent.	Cattle Dairy	Sheep Sedent.
Official policy NPC	1.62	2.09	1.66	3.27	1.13
Market NPC	1.63	2.12	1.68	3.27	1.25
Net NPC	1.09	1.41	1.54	3.00	1.15

For inputs, *market* NPC<sub>i</sub> indicators value costs at market prices, and therefore reflect both official and illegal taxation, while *official policy* coefficients are estimated by deducting illegal taxes from the market price paid for inputs.<sup>120</sup> Comparing the *official* to *market* NPC<sub>s</sub> provides an indication of the impact of *taxes sauvages* on input costs (see Table 5.3). For both cattle and sheep systems, the greatest change in price appears to be for Burkina Faso, where nominal protection rates on inputs drop by about 4 percentage points for cattle and between 7 and 20 points for sheep if the "bribes" are eliminated. In Mali, Côte d'Ivoire and Ghana, NPC<sub>i</sub> reductions of only one or two percent occur in cattle systems, with the exception of the peri-urban dairy models, which show 5 point reductions. Again, differences are greater for sheep, varying between 2 and 10 percentage points. Higher distortions for dairy systems are because milk marketing to urban points includes a small *taxe sauvage*. Overall, distortions are higher for Burkina Faso systems relative to other countries, and for sheep relative to cattle. The results also suggest that the comparison of *market* to *official* NPC<sub>s</sub> suggests that there is very little distortion to global input costs resulting from these illegal taxes.

### C. Combined effects of product and input policies.

Having examined the separate effects of policies on inputs to and products of ruminant livestock sectors separately, this section assesses their combined effect on the sector. This is performed in the analysis which follows using the Effective Protection Coefficient (EPC), which

<sup>120</sup> In all cases, these differences derive entirely from lower marketing costs for animals or fresh milk in the market chain. They do not reflect rent seeking in other inputs (vaccines, feeds etc), because information on these potential distortions was not available, and so not included in the analysis.

provides a ratio of the value added (tradeable product value - tradeable input value) in financial terms to the value added in economic terms. It thus provides a measure of the combined effects of tradeable product and input policies on production incentives.<sup>121</sup> EPCs have been calculated in the same way as NPCs, as *official*, *market* and *net* indicators. Moreover, for Sahelian systems, these indicators have been calculated for the two cases of marketing livestock either to Accra or Abidjan, and from both national and regional policy perspectives. (See explanations at beginning of section B.)

Tables 5.4 and 5.5 below present only effective protection analysis results for a selection of systems which represent the important differences across systems. (The effective protection coefficient presented in Annex C provides measures of this impact for all systems examined by the study.) Overall, the EPC results closely mirror, both in magnitude and in the relationship between the various indicators, the NPC results reported above on policies affecting only livestock products (See Tables 5.1 and 5.2). This fact suggests that policies affecting products have a much more important impact on incentives than policies affecting inputs. This is despite much higher coefficients of nominal protection on inputs, and is because the share of tradeable inputs in the total cost of livestock produced in the region is low.

An indicator of incentives related to the EPC is the effective subsidy coefficient (ESC), obtained by subtracting net taxes (adding net subsidies) on non-tradeable factors of production from (to) the numerator of the EPC. This indicator also measures incentives to producers. ESCs have been evaluated by the study and are reported in Annex C. However, they are not reported in the analysis above only because in all cases they are almost identical to the EPCs. This result is explained by the fact that almost no policies significantly affecting non-tradeable factor costs have been found for the livestock sector. The sole exceptions are taxes levied on income or profits of traders of livestock. The net effect of these taxes is to lower protection, although in no case does the effect exceed 2 percentage points of the EPC protection level.

Because of the close similarity between the NPC and EPC results, the discussion of EPC results does not repeat all comparisons made between indicators and hypotheses. However, a reiteration of the most important results serves as a fitting summary of the findings of the study with respect to the policy impact of public interventions on the livestock sector in West Africa's central corridor.

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<sup>121</sup> The *Net* EPC and DRC are closely related, both having the same denominator. The numerator of the *Net* EPC shows the scope provided by world prices and trade and price policy for some combination of domestic resource costs, rents, profits, taxes, and subsidies. The numerator of the DRC, on the other hand, consists only of domestic resource costs. The *Net* EPC thus indicates the potential for incurring domestic resource costs, whereas the DRC measures the degree to which these costs are actually incurred.

**Table 5.4**  
**EFFECTIVE PROTECTION COEFFICIENTS FOR CATTLE SYSTEMS**

Sale in	MALI				BURKINA FASO	
	Nara - Extensive		Bamako - Dairy		Dori - Extensive	
	National protection	Regional protection	National protection	Regional protection	National protection	Regional protection
Official Policy EPC						
sale to Accra	0.95	1.15	1.10	1.21	0.98	1.23
sale to Abidjan	0.92	1.29	1.07	1.41	0.95	1.34
Market EPC						
sale to Accra	0.62	0.72	2.39	3.04	0.41	0.75
sale to Abidjan	0.93	1.31	2.27	3.54	0.95	1.33
Net EPC						
sale to Accra	0.41	0.48	1.59	2.02	0.27	0.50
sale to Abidjan	0.62	0.87	1.52	2.37	0.64	0.88
	CÔTE D'IVOIRE				GHANA	
			Korhogo SO		Tamale	Accra
			National protection		National protection	National protection
Official policy EPC			1.30		1.29	1.79
Market EPC			1.20		0.78	1.72
Net EPC			0.80		0.72	1.50

## 1. National policy impacts

### a. Extensive systems

Measures of *official* effective protection reported in Tables 5.4 and 5.5 combine the estimates of theoretical financial costs for both products and inputs. From a **national** policy perspective, *official* protection in Mali and Burkina Faso is slightly below 1.00 for most extensive systems (EPCs range from 0.70 to 0.98) marketing either cattle or sheep to Accra and Abidjan. These results demonstrate that, in both Sahelian countries, the combined effects of national policies affecting inputs and products of extensive livestock systems selling animals to coastal destination are to penalize these systems. As the previous sections have demonstrated, in both cases, the important policies resulting in this negative protection derived from taxes in marketing. In addition, Burkina Faso taxes its livestock exports directly, further penalizing its livestock producers, as well as Malian animals which would transit Burkina Faso. As would be expected, as net importers of meat, both coastal countries show significantly positive *official* effective protection (EPCs range from 1.18 to 1.30) reflecting border tariffs for imported meat.

**Table 5.5**  
**EFFECTIVE PROTECTION COEFFICIENTS FOR SMALL RUMINANTS**

	MALI Nara		BURKINA FASO Dori	
	National Protection	Regional Protection	National Protection	Regional Protection
Official EPC				
sale to Accra	0.70	0.80	0.85	1.04
sale to Abidjan	0.84	1.04	0.68	0.82
Market EPC				
sale to Accra	0.45	0.52	0.52	0.61
sale to Abidjan	0.96	1.19	0.89	1.10
Net EPC				
sale to Accra	0.30	0.35	0.35	0.41
sale to Abidjan	0.64	0.80	0.58	0.73
	CÔTE D'IVOIRE Korhogo SO		GHANA Tamale    Akyem	
Effective Protection Coefficient				
Official EPC	1.18		1.28	1.08
Market EPC	1.18		0.77	0.45
Net EPC	0.79		0.71	0.42

By comparison to the theoretical impact of *official* policies, the real market effect as measured by *market* rates of protection is roughly identical for livestock sales to Abidjan, but significantly lower for sales to Accra. This finding is identical to the NPC results and again demonstrates the fact that prices in Abidjan are indeed determined by border prices, marketed up by official policy tariffs. In Accra, however, red meat prices are significantly below world market levels and therefore are largely divorced from policies affecting world trade.

A second conclusion that can be drawn from the near identity of *market* and *official* measures of protection in cattle and sheep sales to Abidjan is that the impact of distortions other than official policy are minimal. This implies that such problems alluded to above of *taxes sauvages* in marketing, quantitative restrictions or other controlling measures on imports, or of inefficient performance by livestock marketers are not very important in affecting prices of meat and, by extension, incentives to produce livestock.

#### b. Peri-urban milk systems

Peri-urban milk production systems are a notable exception to nearly all the conclusions reached above for extensive ruminant systems. First of all, unlike extensive systems (transhumant and sedentary) in Mali and Ghana, peri-urban dairies in these countries receive positive protection in both locations as a result of border taxes on milk products, which are

importable. Secondly, the divergence of *market* from *official* protection is not great in Ghana for these systems because high protection on milk is effective in raising the joint product protection since Ghana relies heavily on milk imports, unlike its red meat market. And finally, in contrast to extensive systems, *market* protection of the Malian dairy system appears to benefit from much higher protection than is warranted by the *official* policies which exist to protect these systems (mEPC = 2.3 while oEPC = 1.1). Two unrelated explanations have been offered: 1) marketing data are faulty or 2) markets for imported milk perform poorly. Further investigation is needed to clarify this issue. Evidently, however, this problem does not indicate an important impact of bribes in livestock marketing, since this would have the opposite effect on effective protection.

## 2. Regional policy effects

For Sahelian systems marketing animals to coastal markets, policies in the coastal countries provide an additional theoretical protection against world markets. In the case of the Abidjan market, where world market imports determine internal market prices, this protection is real, and results in roughly equivalent levels of *market* effective protection for Sahelian and Ivorian livestock. The rate of effective protection afforded to extensive livestock production in the region is about 30 percent above world prices (mEPC = 1.3) and close to 200 percent (mEPC = 3.0) for dairy systems.

In the case of the Accra market, however, border protection against world markets is an ineffective incentive to regional trade because low domestic prices for red meat relative to world prices result in consistently negative *market* effective protection rates for both Ghanaian and Sahelian livestock. The persistence of low market prices for red meat in Ghana confirm the findings of the comparative advantage analysis, which suggest that Ghanaian meat production is strongly competitive with world markets in the local economy.

However, for Sahelian exporters, negative **regional** protection also indicates that Accra is a much less attractive market than Abidjan and an unprofitable market in its own right. This result is supported by the negative private profitability demonstrated in the financial analysis and confirmed by Sahel-Ghanaian livestock trade statistics which show very low levels of trade, (see Chapter Three).

## 3. The impact of overvaluation

The stark difference between negative effective protection for ruminant livestock in Ghanaian markets and positive effective protection in Ivorian markets illustrates the current dilemma of a regional market for livestock in the central corridor of West Africa. This distinction arises despite very similar official nominal protection on products in both countries, and the relatively insignificant role of input distortions. It is due primarily to differences in currency regimes between Ghana and the FCFA subregion.

The analysis of *net* effective protection illustrates this problem. Using equilibrium exchange rates, all *net* EPC's for extensive livestock systems throughout the region fall below

unity ( $nEPC < 1.00$ ), and the differential between protection in Accra and Abidjan markets is greatly reduced. This result confirms, first, that overvaluation in the FCFA zone substantially penalizes producers in this zone in competition with world markets in Abidjan and Accra. Secondly, however, this effect illustrates that if the FCFA were devalued to its equilibrium level, conditions in Côte d'Ivoire would come to reflect those in Ghana. That is, red meat prices in regional markets would fall below world market prices, resulting in a dramatic reduction in world imports to the region and a rejuvenation of trade between the Sahel and the coast. Lastly, a reduction in differentials in profitability between routes leading to Abidjan and Accra would stimulate trade with Ghana.

## CHAPTER VI

### PROJECTIONS OF LIVESTOCK SUPPLY AND DEMAND IN WEST AFRICA'S CENTRAL CORRIDOR

This chapter projects broad trends in the development of the central corridor livestock sector to the year 2005 and identifies important constraints to its development that should be addressed by public policy. The approach and principal assumptions of the supply and demand analysis are presented in the first section below. The second section evaluates projections of net supply for each country, the prospects for growth in the livestock sector in the central corridor as a whole, and the implications of the analysis for regional and world trade.

#### I. APPROACH AND ASSUMPTIONS OF THE SUPPLY AND DEMAND PROJECTIONS

##### A. Policy assumptions

The base-case projection analysis presented in this chapter is premised on a continuation of policy orientations that exist today in the countries studied. Hence, it supposes, first of all, that the CFA franc will not be devalued, which will assure that the exchange rate remains a significant deterrent to exports and an implicit subsidy to imports of the CFA countries. It also assumes that tariff barriers to international trade will remain at current levels, and that the resultant low levels of protection to livestock will be maintained. Thirdly, policies of liberalization of domestic markets for input and product markets will continue with marketing and input costs remaining at current real levels. Real prices of products and inputs of the sector are assumed to remain constant, such that the projections ignore supply or demand changes due to price. Lastly, the base-case analysis assumes that all future direct investment in production will come from private sources, leaving public resources to sustain public infrastructure and health services. This assumption is thought to reflect current policy orientations towards public investments in livestock for all four countries examined.

An alternative hypothesis examines the possibility that devaluation of the CFA franc will occur and that, coincident with this devaluation, access to credit will improve for local as well as foreign investors in livestock. In this relatively free environment, financial incentives in production should converge with economic comparative advantage, resulting in an increased incentive to export to the coast, and a greater supply of livestock to meet demand. Recent trends suggest that these policies are beginning to stimulate economic growth, reinvestment in agriculture, and a reorientation of production towards exportable and import-substitutes. Each of these trends is expected to continue in this scenario.

## B. Demand assumptions

Demand projections are developed for urban and rural populations in each country, based on expected population growth and changes in consumption associated with changing per capita income. Population levels, expected population growth rates, and baseline consumption levels of each food category are specific to rural and urban populations in each country.<sup>122</sup> These assumptions are summarized in Table 6.1. Per capita consumption for each product group is generally assumed not to have changed significantly in the base year of the projections (1990) from the 1988 data levels upon which it is based, although adjustments have been made to reflect better information where available.<sup>123</sup> In addition, adjustments were made to allow excess demand (total consumption minus total production) to take into account best estimates of national surpluses or deficits.

Three hypotheses of real per capita income growth are advanced for the demand projections. A hypothesis of "modest" annual growth of 1 percent per capita income growth is assumed to be the base case reflecting incremental improvements in macroeconomic imbalances in all four countries. A second "optimistic" hypothesis, associated with the possibility that the CFA countries will devalue their currency, is that per capita incomes will grow at 3 percent in all four countries. Although this rate implies GDP growth of between 5 and 6 percent for the region, this rate of growth is below that projected by the Ghanaian government for the next eight years on the basis their recent rapid growth performance. Assuming the CFA countries were to devalue, this level of growth is also conceivable for their economies as domestic agriculture and industry regain competitiveness in international markets. Lastly, a "pessimistic" hypothesis assumes negative (-1 percent) real income growth per capita in all four countries. This hypothesis is plausible, for example, if political instability increases in the region, reducing productive investments in the regional economy. This would likely be associated with continued overvaluation and increasing budgetary and trade deficits in the CFA countries, and a return of macroeconomic imbalances in Ghana.

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<sup>122</sup> Population data and base consumption levels, except where noted, are from FAO, AGROSTAT (1990).

<sup>123</sup> Per capita consumption data are based upon FAO data on global availability as well as specific studies of consumption patterns for each country to distinguish between rural and urban consumption levels. (See sources to Table 6.1).

**Table 6.1**  
**SUPPLY AND DEMAND PROJECTIONS: BASE DATA**

	POPULATION AND INCOME			PER CAPITA CONSUMPTION (1988)							
	Population 1990 (millions)	Population growth 1981-90	Per Capita Income (local currency)	Beef	Sheep & goat	Offal & fat	Pork	Poultry	Milk	Eggs	Fish
<b>CÔTE D'IVOIRE</b>											
Rural	7.1	2.9%	135399	6.0	1.1	1.9	1.6	2.3	20.0	0.9	15.8
Urban	4.9	5.3%	227711	6.9	1.2	2.2	1.3	2.6	24.0	0.9	15.4
Total	12.0	3.9%	172718	6.3	1.1	2.0	1.5	2.4	21.6	0.9	15.6
<b>BURKINA FASO</b>											
Rural	8.2	2.4%	32279	2.8	2.0	1.3	1.3	2.6	16.0	1.3	2.5
Urban	0.8	5.1%	699753	5.0	3.5	2.1	1.0	4.0	10.0	1.3	2.6
Total	9.0	2.6%	92452	3.0	2.1	1.3	1.3	2.7	15.5	1.3	2.5
<b>MALI</b>											
Rural	7.4	2.8%	41120	5.4	3.8	2.1	0.2	2.4	16.7	0.8	9.2
Urban	1.5	4.0%	203853	8.0	4.7	2.9	0.2	3.5	7.6	0.8	8.0
Total	9.2	3.0%	72292	5.9	4.0	2.2	0.2	2.6	15.0	0.8	8.9
<b>GHANA</b>											
Rural	10.0	3.0%	96576	1.2	0.7	0.5	0.6	0.7	3.3	0.8	22.8
Urban	5.0	4.2%	216392	1.4	1.0	0.7	1.2	1.4	2.5	0.8	25.0
Total	15.0	3.4%	136121	1.3	0.8	0.6	0.8	0.9	3.0	0.8	23.5

Sources: All consumption data is based FAO total availability estimates divided by population estimates for 1990. Differentiation between rural and urban per capita consumption is weighted by differentials in estimates given in the Burkina Faso, Ministère de l'Agriculture, BDPA-SCETAGRI, *Etude Prospective du Sous-Secteur Élevage au Burkina Faso, Tome II*, p. 32 (1989 data); Henri Josserand, "A Study of Demand for Animal Protein in Selected Coastal Countries: the Case of Ghana," OECD/CILSS, July 1991, and Mali, Ministère du Plan, *Enquête Budget Consommation*, 1988-89.

Income elasticities of demand for each food product group used in the analysis are reported in Table 6.2 below. They are specific to rural and urban populations, and distinguish between coastal and Sahelian countries as well. These elasticities are borrowed from a number of studies of livestock demand in the region and of other countries with similar conditions. However, empirical data vary considerably with respect to income elasticities. Jahnke estimates income elasticities on the order of 1.0 for meat 0.8 for milk, and 1.1 for eggs, while the Ghana Living Standards Measurement Survey has estimated elasticities of 1.2, 1.8 and 1.2 respectively for the same products, and 1.0 for fish products in Ghana.<sup>124</sup> Baffoe-Bonnie (1977) and Forjoe (1991) each found beef, and Forjoe also found fish, to be superior products as well (income elasticity > 1.0).<sup>125</sup> Finally, Delgado and Lent have measured expenditure elasticities for Côte d'Ivoire of 1.0 for frozen European imported beef, .75 for fresh West African beef, 1.09 for fish and 1.15 for poultry.<sup>126</sup> Delgado and Lent's elasticities are similar to Jahnke's, but distinguish a more inelastic and statistically more robust response for fresh West African red meat as compared to frozen imports. They suggest that West African meat is therefore the preferred meat.

**Table 6.2**  
**INCOME ELASTICITIES OF DEMAND FOR LIVESTOCK PRODUCTS**

	Beef & veal	Sheep & goat	Offal & fat	Pork	Poultry	Milk	Eggs	Fish
<b>Burkina Faso and Mali</b>								
Rural	0.90	0.90	0.50	0.80	1.20	0.80	1.20	1.10
Urban	0.80	0.80	0.40	0.70	1.00	0.90	1.20	1.00
<b>Ghana and Côte d'Ivoire</b>								
Rural	1.00	1.00	0.50	0.80	1.20	1.20	1.20	1.00
Urban	0.90	0.90	0.40	0.70	1.00	1.00	1.20	0.90

Elasticities in the projection analysis have been adjusted from these data to conform to the following general assumptions. Elasticities are assumed to fall with rising income, and with increasing absolute per capita consumption levels. This means that, in general, they

<sup>124</sup> Jahnke's estimates are cited in Winrock, *Assessment of Animal Agriculture in Sub-Saharan Africa*, Winrock International Institute for Agricultural Development, 1992. Ghanaian elasticities are cited in H. Josserand, "A study of demand for animal protein in selected coastal countries- the case of Ghana," OECD/CILSS, July 1991.

<sup>125</sup> J. Baffoe-Bonnie, "Statistical Analysis of Demand for Beef in Ghana" (1977); Francis Jude Forjoe, "The effect of Price Changes on the Demand for Beef and Fish in Ghana" (1991), both dissertations at the Department of Agricultural Economy, University of Ghana, Legon.

<sup>126</sup> Christopher Delgado and Rebecca Lent, *Coastal Demand Constraints for Sahelian Livestock Products: Côte d'Ivoire*, Paper presented at the IFPRI/ISRA Seminar on Regional Integration of Agricultural Markets in West Africa, Saly Portudal, Senegal, December 2-4, 1992.

will be higher for coastal than Sahelian countries for red meat because per capita consumption is already higher in the Sahel. Secondly, they will generally be lower in urban than rural areas because per capita incomes and per capita consumption levels of most products are lower in rural areas. Milk is an exception to this because its perishability results in most domestic production being consumed on-farm in rural areas. Thirdly, the projection model does not allow for declining income elasticities of demand as incomes rise for each population group in each country. This adjustment would reduce overall expectations of excess demand for hypotheses in which incomes rise.

### C. Supply assumptions

Chapter 2 has outlined a number of trends in livestock production which are occurring in each ecological zone of central West Africa in recent years. Most importantly, driven by population growth and increasing pressure on pasture resources, there has been a tendency to sedentarize pastoral groups in the arid and semi-arid regions. Livestock and agriculture have become competitors for valuable floodplain land in riverine regions, but have become more integrated in dryland settings as use of animal traction, the value of crop residues, and its exchange for manure become more important. Crop extension in sub-humid zones has also been shown to permit more intensive and productive livestock raising in these zones as habitat for the tsetse fly is cleared for cropland. Based upon these areas of potential growth several supply projection scenarios are defined.

The base-case supply hypothesis assumes that all livestock production growth will follow the long-term trend since 1960. A second supply hypothesis releases constraints on investment and assumes that the CFA franc is allowed to find its equilibrium value. It uses projections of stock growth presented in Table 6.3 below. These projections are made separately for each climatic zone on the basis of assessments of available biomass, and current trends. These projections reflect projections made by a recent Winrock International study of the potential for animal agriculture in sub-Saharan Africa.<sup>127</sup> However, the projections for this analysis draw a distinction between semi-arid and sub-humid regions which were aggregated in the Winrock study. Arid zones are expected to experience very little stock growth (0.2 percent/year) because of biomass constraints. Stock in semi-arid and sub-humid zones, on the other hand, are projected to grow at 2 and 3 percent respectively, reflecting a current surplus of biomass in each zone. The herds in the sub-humid zone are projected to grow faster, although from lower initial levels, in Mali and Burkina Faso. The models for both coastal countries only evaluate growth for the sub-humid zone because only a very small proportion of ruminants is found in the humid zone, and the humid zone is not expected to experience either stock or productivity improvements for ruminants.

A third hypothesis retains all the assumptions of the second, except it allows growth not only in the numbers of projected stock but also in its productivity. This hypothesis

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<sup>127</sup> Winrock, *Assessment of Animal Agriculture in Sub-Saharan Africa*, Winrock International Institute for Agricultural Development, 1992.

envisions that ruminant meat productivity in all zones except the humid zone can be increased by 2 percent annually, and milk offtake can increase by 1 percent annually. These increases are almost identical to projections by the Winrock study for meat, but more conservative for milk because milk marketing is expected to represent an important constraint in marketing additional milk product. These increases are constrained in all zones by maximum productivity levels representing maximum animal liveweights at offtake of 340 kg for cattle and 40 kg for small ruminants and representing an annual lactation maximum per reproductive cow of 500 liters/year. However, it transpires that these regional maxima, which are approximately equivalent to maximum productivity levels reached in the Winrock study in the year 2025, are not constraining during the projection period to 2005.

Supply projections rely on independent projections of herd size, offtake rates, and animal weight for each animal system. These projections begin with the average stocks in each country for the period 1988-90. Assumptions concerning growth rates in herd size and animal weight are based on past rates of expansion, projected changes in technology, and limitations on the availability of land and labor. DRCs derived in this study have been used to determine if the products are exportable or can substitute for imports at the national and regional levels. In addition, the DRC is used as an indicator of the long-run growth potential of the product. All products except fresh milk are assumed to be regional import substitutes. Therefore production of all products except milk is constrained to levels sufficient to accommodate regional demand. Because of its perishability, and costs in transport, fresh milk is assumed to substitute for imports only on the national level.<sup>128</sup>

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<sup>128</sup> These regional constraints on supply ignore the possibilities that surplus production could be exported to other countries in the region. However, as will be shown, these constraints are never binding anyway. The inverse possibility, that other neighbors will supply the regional market is also ignored because livestock imports from other neighbors are small.

**Table 6.3**  
**RUMINANT PRODUCTION PARAMETERS BY AGROECOLOGICAL ZONE**

	Rainfall mm	Plant growth days/yr	Biomass production kg dm <sup>2</sup> /ha	Potential animal density Ha/TLU max	Present population as % of potential	Growth rates for cattle:		Growth rates for Sheep/Goat:	
						Stock % per year	Meat Yield % per year	Stock % per year	Meat Yield % per year
Arid	0-500	< 90	187	30	82	0.2	2.0	0.2	2.0
Semi-arid	500-1000	90-180	508	6	63	2.0	2.0	2.0	2.0
Sub-humid	1000-1500	180-270	720	4.5	28	3.0	2.0	3.0	2.0
Humid	> 1500	> 270	--	--	100	0.0	0.0	0.0	0.0

	MALI			BURKINA FASO			CÔTE D'IVOIRE			GHANA		
	% area	% cattle	% sm. rum.	% area	% cattle	% sm. rum.	% area	% cattle	% sm. rum.	% area	% cattle	% sm. rum.
Arid	33	7	27	5	10	15	0	0	0	0	0	0
Semi-arid	25	65	67	85	80	80	0	0	0	0	0	0
Sub-humid	9	28	6	15	10	5	20	90	90	40	95	90
Humid	0	0	0	0	0	0	80	10	90	60	5	10

## **II. PROJECTION OF EXCESS DEMAND FOR LIVESTOCK PRODUCTS IN THE CENTRAL CORRIDOR**

This section summarizes projections of supply and demand for various animal protein to the year 2005 by tabulating the levels of net imports of each required over time. The projections assume that the relative prices of different protein sources remain constant over time.

### **A. The base case: Supply trends continue**

To simplify the presentation of results, Table 6.4 presents only the excess demand of each livestock product for the entire region for the base-case projection. Excess demand equals total demand less total production from all four countries, and suggests the level of imports from the world market that would be needed to satisfy demand. Changes in excess demand for ruminants for each country in the region are also presented to illustrate the likely impact on regional trade.

The base-case analysis assumes moderate (1.0 percent) per capita income growth, and extrapolates long-run growth trends through the year 2005. At the regional level, unmet demand (and therefore net imports) will grow almost tenfold for beef and move from a marginal excess supply to importing more than 22,000 tons of goat and sheep meat. As would be expected, given rapid population growth and moderate income growth, both coastal countries become increasingly large net importers of both commodities over the projection.

Through the year 2000, both Mali and Burkina Faso remain net exporters of beef. Surprisingly, however, Mali becomes a net importer of sheep by the same year. Moreover by the year 2005 both Mali and Burkina Faso become net importers of beef. These results derive from assumptions that production growth in both countries will continue past trends which have been low (less than 2 percent). As would be expected, coastal countries' imports rise rapidly.

Among other products, milk (fresh milk equivalents) shows the most dramatic absolute growth in excess demand, representing roughly 30 thousand tons of powdered milk imports for the region by the year 2005. Eggs show a dramatic rate of increase in excess demand but from a low initial level of near self-sufficiency, while poultry and offal each show a tripling of imports to the region. Only pork and fish show net regional surpluses by the year 2005, although these surpluses suppose a continuation of rapid production growth. For fish, however, projected historical growth is highly unlikely due to constraints on maximum production.

**Table 6.4**  
**EXCESS DEMAND FOR LIVESTOCK PRODUCTS (tons)**  
 (Base-case hypothesis: 1% per capita income growth per annum)

	1990	2000	2005		1990	2000	2005
<b>Regional total excess demand by product</b>							
Beef & Veal	12381	79020	115866	Milk	291500	511514	636855
Sheep and Goat Meat	-1495	18217	22759	Eggs	175	48661	61177
Pork	1100	-2523	-6636	Fish	105000	-18887	-140686
Poultry	8100	12270	24997	Offal & Animal Fat	9900	26386	30237
<b>Total excess demand by country and principal products</b>							
<b>MALI</b>				<b>BURKINA FASO</b>			
Beef and Veal	-35100	-10330	2642	Beef and Veal	-3250	-2382	1288
Sheep and Goat Meat	-4968	17421	25545	Sheep/Goat	-72	-1685	-2133
<b>CÔTE D'IVOIRE</b>				<b>GHANA</b>			
Beef and Veal	44601	79964	102200	Beef and Veal	6130	9673	12443
Sheep and Goat Meat	3456	10342	14705	Sheep/Goat	89	1608	2465

## B. Alternative supply projections

Projection results presented in Table 6.5 examine the prospects for regional excess demand on the basis of alternative assumptions with respect to stock and productivity growth. It also illustrates the impact of hypotheses of alternative income growth on excess demand.

Expectations of probable stock increases in comparison to past historical trends show little difference in excess demand estimates for beef. Expectations are, in fact, almost identical to trend. For small ruminants, on the other hand, stock growth assumptions are lower than past trend, and result in a 24 percent increase in excess demand for the region by the year 2005.

The introduction of potential productivity increases has a dramatic effect in reducing excess demand. In combination with stock increases, these increases result in excess demand for beef falling by more than 30 percent from trend projections for all demand hypotheses. Net imports of sheep and goat meat are reduced even more (by 70 percent) from the base case by the year 2005. Moreover, the absolute volume of net imports declines over the period because the rate of growth of regional small ruminant production exceeds growth in regional demand. Assuming productivity gains, and given moderate growth of per capita income, Burkina Faso remains an exporter of both cattle and sheep, and Mali remains an exporter of cattle throughout the entire projection, although Mali still becomes a net importer of sheep by the year 2005.

**Table 6.5**  
**PROJECTIONS OF REGIONAL EXCESS DEMAND**  
**GIVEN ALTERNATIVE HYPOTHESIS OF ANNUAL PER CAPITA INCOME GROWTH**  
(tons)

Demand hypotheses	Pessimistic (-1 % growth)			Base Case (1 % growth)			Optimistic (3 % growth)		
	Yr 2005			Yr 2005			Yr 2005		
	Year	Year	as % of	Year	Year	as % of	Year	Year	as % of
	2000	2005	base-case hypoth.	2000	2005	hypoth.	2000	2005	hypoth.
<b>Supply projections</b>									
<b>Historical Trend</b>									
Beef and Veal	53202	77059	67 %	79020	115866	100 %	110554	168251	145 %
Sheep and Goat Meat	11941	13325	59 %	18217	22759	100 %	25883	35493	156 %
<b>Expected Stock Increases</b>									
Beef and Veal	51417	74238	64 %	77235	113045	98 %	108770	165430	143 %
Sheep and Goat Meat	15106	18848	83 %	21382	28281	124 %	29048	41016	180 %
<b>Expected Stock and Potential Productivity Increases</b>									
Beef and Veal	28329	36933	32 %	54147	75741	65 %	85681	128126	111 %
Sheep and Goat Meat	2364	-2812	-12 %	8641	6621	29 %	16306	19356	85 %

As would be expected, given positive and relatively high income elasticities for all livestock products, excess demand increases rapidly with increases in per capita income growth assumptions. Excess demand for both beef and sheep meat rise by more than 50 percent by 2005 in moving from the base-case to optimistic hypotheses about income growth. Conversely, excess demand falls by roughly 35 percent over the projection under the pessimistic hypothesis. The analysis suggests that sheep and goats could even become net exports from the region if productivity increases are achieved. However, it is unlikely that investments necessary to reach productivity targets would occur under such adverse economic conditions. The more probable match of high income growth with increasing productivity gains suggests that net imports of beef to the region would still rise by tenfold, over 1990 levels, and sheep meat would become a regional import as well, with net imports on the order of 20,000 tons.

### C. Conclusions

The livestock market projections presented in this chapter suggest that rapid rates of population growth will bring about a rapid rise in demand for ruminant livestock in the four countries of the Central Corridor in even the most pessimistic hypothesis. Moreover, in all except hypotheses of negative income growth, demand will outstrip regional growth in production for ruminant livestock products even supposing that substantial gains in

productivity can be achieved. These conclusions clearly demonstrate that there is no long term threat of the coastal market for Sahelian livestock drying up.

On the contrary, the projections suggest that unless Sahelian countries can raise productivity in livestock production significantly, within several decades they may be unable to meet their own internal demand for livestock products. In light of past stagnation of productivity indices for ruminant livestock, productivity growth will require substantial investments in a number of areas including animal health, husbandry, feed resources, and marketing.

While the analysis does not concentrate on non-ruminant livestock products, these have the potential to accommodate much of the unmet protein demand created by rising populations and income. In particular, poultry and pig production can be expanded with few constraints, assuming that feed imports are not restricted.

## CHAPTER VII

### IMPLICATIONS FOR PROMOTING LIVESTOCK DEVELOPMENT IN THE CENTRAL CORRIDOR

#### I. PROSPECTS FOR CENTRAL CORRIDOR MARKETS FOR LIVESTOCK PRODUCTS

Over the last decade, the livestock market of the central corridor of West Africa has stagnated. Livestock production growth in the Sahel has been punctuated by herd losses as a result of devastating droughts. Coastal country herds have grown more steadily and, in the case of Côte d'Ivoire, have benefitted from the influx of herds during each Sahelian drought. Improvements in animal productivity have been undetectable in the region over the last several decades.

The loss of coastal market share for Sahelian countries was coincident with herd offtake reductions after each drought, but has persisted for other reasons which have eroded the competitiveness of Sahelian livestock in coastal markets. These reasons include the appearance of heavily subsidized world meat imports in the early eighties, overvaluation of the currency in the CFA zone countries during the mid to late eighties, and increasing substitution of other protein sources for red meat in consumers' diets. Moreover, as a result of the declining per capita purchasing power of the population, per capita consumption of livestock products has fallen in all four countries of the central corridor in comparison to the peak levels of the 1970s.

On the other hand, population growth has sustained gradual growth of overall demand for livestock products. Projections of future demand suggest that regional excess demand (aggregate consumption less aggregate production for all four countries) for animal protein will grow under most plausible hypotheses. Even if per capita income growth does not return to the region, demand will outstrip production growth unless productivity is raised. Yet productivity improvements will require substantial additional investments in the sector, which are not likely without some per capita income growth.

Moreover, projections of production and consumption growth for Mali and Burkina Faso, based on past trends, suggest that export growth from these traditional surplus producers will be stagnant due to rapidly rising domestic consumption. As a result, their share in coastal markets may continue to decline. Thus despite the inevitability of rapidly increasing demand for livestock products in the region, the prospects for livestock trade within the corridor are poor if current trends continue. This prospect can only be reversed if cattle and small ruminant surpluses in the Sahel can be increased.

## **II. POTENTIAL FOR RUMINANT LIVESTOCK PRODUCTION**

While projections of past trend do not predict sufficient production growth to meet expected increases in demand for the central corridor region, analyses of comparative advantage suggest a natural advantage for regionally-produced ruminant livestock in coastal markets. The semi-arid and sub-humid zones have been shown to be strongly competitive in producing ruminant livestock products under current techniques. The conclusion is robust with respect to assumptions concerning the productivity of these systems, the costs of production, as well as world prices. This comparative advantage suggests that there is still significant potential to increase the livestock sector production economically. The analysis has illustrated that production growth can come at the extensive margin from increasing herd numbers, or at the intensive margin by raising herd productivity through the use of commercial inputs. Moreover, livestock marketing can be reoriented to increase value added to the sector.

### **A. The expansion of livestock production**

The evaluation of different types of livestock-producing systems found in the central corridor illustrates a continuum of potential for herd growth. As was argued in the previous chapter, biomass availability will allow for considerable growth in herd size in all but the arid zones of the corridor, while disease, poor feed quality and climate constraints effectively rule out herd growth in humid areas. However, in the semi-arid and sub-humid zones, there exists considerable potential for herd growth.

In the semi-arid and sub-humid zones, livestock herd growth occurs primarily in association with agriculture. These mixed farming systems offer a more diversified use of resources, and therefore a more secure livelihood. Livestock contributes to this association through animal traction, manure, and the generation of cash-flow to finance agricultural investments. In turn, animal production benefits from crop byproduct production, access to fallow lands, and reduced disease threats in areas kept cleared for agriculture. In the analysis of this study, comparisons of DRCs of sedentary and transhumant herds provide a rough indicator of the prospects for increasing crop-livestock interaction since sedentary herds are in all cases found in closer association with crop farming. Overall, these comparisons suggest that the economic comparative advantage in sedentary production does not differ significantly from transhumant herds. Although the respective livestock systems models are too crude to rank the economic attraction of these systems, the similarity of their results suggests that economic comparative advantage need not erode, and may even improve in some cases with a transition to integrated livestock and crop systems.

A second and related trend in herd growth, noted in Chapter 2, has been the southerly movement of herd concentrations. The principal force behind this movement is human population growth in the arid and semi-arid zones; the very limited agricultural resource base in these zones has forced additions to agricultural populations southward. With this movement,

livestock concentrations have also moved southward.<sup>129</sup> In addition, two severe droughts in the last two decades have forced herds into more southern zones for survival and many have remained there. An analysis of economic performance with latitude suggests that the more southerly systems typically show lower economic returns per reproductive unit (and per animal) but roughly equivalent comparative advantage with respect to world markets. Decreasing returns to factors used in animal production reflect their lower animal productivity, particularly because of the smaller size and higher mortality rates of breeds suited to the semi-arid and semi-humid zones. However, the overall competitiveness of a scenario based on livestock rearing in these zones receives a boost from the lower marketing costs for animals produced in these zones, compared to those from the Sahel.

These results suggest that sedentarization of pastoral peoples and settlement of the wetter semi-arid and sub-humid environments need not reduce the economic viability of livestock production. However, this conclusion is based on only a static analysis of current conditions in these zones and does not capture the impact of changes which may accompany this transition. For example, threats of endemic disease -- particularly trypanosomiasis -- must be reduced before livestock ruminants can be sustainably increased in the more humid areas. This can occur as land is cleared for agriculture, eliminating the habitat for important livestock disease vectors. However, evidence from Nigeria and Côte d'Ivoire suggests that campaigns to eradicate the tsetse fly, the vector for trypanosomiasis, *only* for livestock production (by either insecticide treatments or bush clearing) is usually not profitable without public subsidies.<sup>130</sup> Use of chemotherapies is more economical for individual animals and for herds receiving only occasional (typically seasonal) exposure, but not as a permanent method to manage continuous herd exposure. Thus, without public support, livestock herd growth can not be expected to exceed the numbers that can be accommodated in conjunction with agricultural expansion in the sub-humid zone.

Labor resources may also become more constraining with increasing integration of livestock and crop agriculture, at least at certain points in the agricultural calendar.<sup>131</sup> Under certain conditions this development may lead to further livestock integration into farming through animal traction, while in others it may result in greater specialization in livestock rearing.<sup>132</sup>

Environmental problems associated with increasing animal densities, such as soil erosion due to the denuding of land with overgrazing, and water contamination from animal use will also inevitably occur. With rapid herd growth in new areas, a number of other unexpected problems

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<sup>129</sup> Cf. Boucoum Kolado, Mali country report, Volume II.

<sup>130</sup> S. N. H. Putt, et al., *The Social and Economic Implications of Trypanosomiasis Control: A study of its Impact on Livestock Production and Rural Development in Northern Nigeria*, Veterinary Epidemiology and Economics Research Unit, University of Reading, Study No. 25, 1980, pp. 513--525.

<sup>131</sup> Delgado, 1979.

<sup>132</sup> MacIntire et al., 1992, pp. 23-46.

may also arise. However, given the robust economic value of systems which are already practiced in these zones, the prospects are good that herd growth in the semi-arid and sub-humid zones will continue to retain a net economic benefit even after account is taken of these negative externalities.

## **B. Intensification**

Production "intensification" as defined in this study concerns the use of commercial inputs, primarily feeds, in livestock production. This process represents another strategy for increasing the potential for the livestock sector in the central corridor. This study has provided a number of insights into this process although, reflecting current conditions, the scenarios chosen for analysis show only a limited range of feed intensification from which to draw conclusions. The most "intensive" production scenarios examined in this study were the peri-urban dairy systems. As compared to the "extensive" systems (both transhumant and sedentary) these systems were clearly less strongly competitive, (with DRCs between 0.7 and 1.2), although they showed absolute net economic benefits per animal which were comparable to extensive systems because of higher animal productivity.

A second indicator of the prospects for intensification was provided in the comparison of traditional and improved sedentary herds in the Korhogo region. Because this comparison is for a single region and relies on a consistent set of data for each herd gathered by the same study, the effects of commercial feed use and occasional veterinary assistance, which define the difference between the two herds, are isolated from other variables which might affect the comparison. The analysis suggests that, in the more intensive sedentary system, additional input costs for feed and animal health are roughly offset by increases in productivity, such that no significant loss of comparative advantage is detected, while net economic returns increase substantially per animal when compared to the less intensive systems.

A further measure of the potential for feed intensification was provided in the sensitivity analysis of non-commercial feed costs. The analysis suggests that costs of grazing cannot rise beyond 2 to 5 FCFA/kg of dry range biomass before production ceases to be efficient, assuming constant productivity with increasing availability of this roughage-grade fodder. If costs of such fodder reached this range: commercial feeds would rapidly become uncompetitive as a substitute for domestic rangeland, unless these supplements can raise animal productivity levels. This is feasible, for example, if commercial feeds are used to supplement rations during periods of stress, or to raise protein content in rations.

The analysis of fattening also sheds light on the process of intensification by demonstrating that small private fattening activities can yield positive value added, although at less attractive returns than extensive production. However, given increasing constraints on expansion of extensive production, increased investment in these types of schemes seems inevitable.

These results suggest that feed intensification reduces the margin of comparative advantage and that increasing reliance on commercial feeds will eventually eliminate any comparative advantage. This tradeoff has also been documented in North Africa where many systems have already exceeded economically optimal levels of commercial feed use in production.<sup>133</sup> On the other hand, this study's results also demonstrate that feed intensification can increase substantially and remain competitive under certain conditions, such as proximity to fresh milk markets, and direct access to a large meat market and a reliable supply of low cost agricultural residues and agro-industrial byproducts.

### C. Market reorientations

Costs of marketing animals from areas of surplus in the northern part of the central corridor to consumer markets in the south have been shown to be an important component of total livestock production costs (as high as 25 percent). The predominant mode of transport has undergone a complete transition in the last two decades from trekking to trucking, while rail remains a feasible alternative in Burkina Faso, although problems with access to and reliability of service have reduced its use. Unit transport costs appear to be fairly competitive across routes and modes, although within Burkina Faso and Ghana costs are higher than in Mali and Côte d'Ivoire. This suggests that there may be room to bring down costs in marketing to Accra, particularly since current volumes marketed to Accra from the region are very low. Reduction of the various official and illegal taxes imposed on the trade of live animals would further encourage regional trade.

Aside from the marginal cost savings to marketing, another option for raising the potential for meat sales would be to seek new markets for these products. This option may seem irrelevant given that the region is expected to remain a meat-deficit region. However, this meat deficit is primarily for low quality fatty products, while demand for the high quality component of local production faces weak demand given low consumer purchasing power. At the same time, important price markups exist for high quality meat in world markets. One strategy would therefore be to introduce greater differentiation of meat products to take advantage these price differentials. An analysis of the prospects for exporting carcass meat to Middle Eastern markets has been shown to be weakly competitive. However, the viability of such a scheme will depend on the ability of the region to satisfy foreign market demands on health standards without large additional expenses. If greater product differentiation were introduced, such that only the highest-valued cuts of boxed, boneless meat were sold in international markets, and if airfreight costs were held to competitive international rates, then exports to world markets might become an attractive option. This strategy would simultaneously earn greater value for high quality domestic product, and create a domestic source of low valued byproduct of these exports to compete directly with low-quality imports from world markets.

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<sup>133</sup> Cf. Jeffrey Metzel and Lynn Salinger, *An Economic Appraisal of the Impact of Government Policies on Rangeland Livestock Systems of North Africa and the Middle East*, AIRD, December 1989.

### III. IMPACT OF CURRENT NATIONAL POLICIES ON THE REGIONAL LIVESTOCK SECTOR

The past decade has witnessed a retrenchment of public initiatives in the livestock sector which has been manifested by the reduction, liquidation or sale of most of the large meat production, marketing and transformation parastatals which all four governments established during the previous decade. Simultaneously, large livestock development projects have nearly vanished as donors have become disenchanted with their typically poor performance. Lastly, all four governments have taken measures to liberalize the functioning of livestock input and product markets, and to spur private sector actors to play a greater role in these markets.

In this context, remaining policies affecting the sector have been shown to be comprised primarily of taxes on livestock products and a combination of taxation and subsidies of inputs to the sector. Considering inputs first, the analysis has demonstrated that transport and marketing taxes represent the most important policy impact on livestock sector costs. They are only partly offset by subsidies in all countries on animal vaccinations. Overall, these input taxes make up between ten and twenty percent of total production and marketing costs.

A component of these taxes which has drawn particular attention in previous work on the sector has been illegal taxation (*taxes sauvages*) which is typically applied to live animals traded in the corridor. This study has demonstrated that these taxes, while making up a significant share of marketing costs, represents only about two percent of the final price of livestock products in consumer markets. Therefore these costs are not very significant in changing the incentives to trade, although they may alter the routes and modes of transport used.

Border policies affecting livestock product prices are of two sorts. Borders between the countries in the region have relatively low or nonexistent levels of official taxation for animals leaving the Sahel and entering the coastal countries. On the other hand, Ghana and Côte d'Ivoire have relatively high border taxation protecting their markets from world prices of milk and meat. These policy differences result in Sahelian country production receiving much less protection than coastal country production from their respective country's policies. However, as the analysis has demonstrated, from a regional perspective coastal country policies also protect the products of Sahelian countries which are sold in coastal markets, and as a result, there is a relatively consistent level of official protection for livestock systems throughout the central corridor. This regional perspective illustrates the important benefit to Sahelian countries of coastal country border tariffs.

Coastal countries do not benefit in a similar way from Sahelian policies, and as a result they have much less at stake in maintaining unrestricted livestock trade in the region. To date, due to other links of trade, currency, language, history and political ties which Côte d'Ivoire has with the Sahelian countries, it has been willing to sustain unrestricted intra-regional trade while maintaining border protection against world markets to benefit its own livestock industry. Ghana, however, has shown much less interest in maintaining such trade. For example, the current health quarantine policy for live animals serves as an effective deterrent of official trade

because of the high transaction costs involved. These restrictions have not caused more tension because financial incentives to trade livestock to Ghana have been low.

Ghana is unique among the four countries of the Central Corridor in that its currency is much less overvalued. World prices are therefore much less attractive and imports represent a much smaller part of the total volume of meat consumed in the country. For this reason, world markets and official border protection against this market have little effect on internal market prices which are substantially below world price levels. Nominal and effective protection levels are therefore negative if measured using market prices, reflecting not the impact of border policy, but rather the efficiency of local production in underpricing world markets.

For the CFA franc zone countries, the overvalued currency has the most important negative effect on levels of protection for ruminant livestock. This disincentive is only partly offset by tariff measures to protect coastal markets, such that when it is taken into account net effective protection coefficients for selling ruminant livestock to both Accra and Abidjan are still negative from all production zones in these countries. Given these results, the analysis concludes that the cumulative effect of all public policies, inclusive of overvaluation, product protection policies, and taxation or subsidization of input costs, is to discourage production of livestock in Mali, Burkina Faso, and Côte d'Ivoire.

#### **IV. A STRATEGY FOR THE SECTOR**

The analysis has suggested a declining commitment on the part of the four governments to support livestock production at a time when demand for these products is expected to increasingly exceed the region's ability to supply demand. At the same time, traditional ruminant production has been shown to hold a strong competitive edge against world trade, although at low productivity levels and assuming that almost no commercial inputs are used in production. Ironically, whereas the livestock sector displays substantial comparative advantage, the overall effect of policies affecting ruminant livestock has been shown to penalize production and trade in livestock, both at a national and regional level.

Under these conditions, projections for production growth are low, and are expected to derive primarily from gradual expansion of herd numbers into higher rainfall areas, with increasing integration with crop agriculture. This situation calls for a regional strategy to promote more rapid livestock production through measures to redress negative effective protection from the sector, encourage more rapid stock increases and promote higher herd productivity, particularly in the sub-arid and sub-humid zones. Several components of this strategy which have been raised in this report are addressed below.

##### **A. Devaluation**

The most important policy response to improve incentives to efficiently promote the livestock sector of the region is to correct the distortions caused by the overvalued CFA franc.

Direct devaluation would produce the most direct correction of this problem, although to do so may be politically infeasible. Moreover, effective devaluation will require monetary discipline, which might erode with the inflationary pressures that devaluation would initially introduce.

Alternatively, correction for overvaluation could be made through compensating border policies. For the Sahelian countries this could be done through subsidization of livestock exports to coastal markets, while for coastal countries, this would imply higher taxation of world imports at coastal ports. However, subsidization of Sahelian animal exports to coastal markets is not likely to be easily administered. For example, given the evidence presented in this study of corrupt practices at border posts handling livestock, it is likely that there would be substantial leakage of export subsidy monies. Also, the temptation to recycle exported cattle might add to the leakage.

A second problem would be the fiscal drain that such a subsidy would put on public finances. This might be eased by a directly compensating taxation scheme (eg. for the import of milk products) to generate the necessary revenues to finance export subsidies. However, such a scheme would be cumbersome to coordinate and politically difficult to defend to local milk and meat consumers, who would see import taxation raise milk prices while export subsidies lowered meat prices abroad, thus penalizing domestic taxpayers and meat consumers.

These difficulties suggest that short of actual devaluation, the best hope for the Sahelian countries is to continue to rely on border protection by coastal countries. The analysis suggests that this protection should be somewhat higher to completely offset the impact of overvaluation. This scheme is feasible if further border protection is acceptable to the coastal countries. However, increasing border protection would raise costs to coastal consumers and with it their protests.

## **B. Common regional protection**

The solutions to the problem of devaluation have illustrated the most important regional issue for the livestock sector: how to harmonize policies to create a consistent level of protection from world markets for livestock products of the region. This protective barrier has been shown to be important because of the practice of the EC and other world exporters to "dump" livestock products on world markets.

Under current policies, although official protection levels are roughly equivalent for red meat for Ghana and Côte d'Ivoire, market prices are higher in Côte d'Ivoire. As long as the CFA franc remains convertible, no strong incentives exist to sell Sahelian surpluses in Ghana. In fact, some incentive has existed to sell Ghanaian livestock products to Côte d'Ivoire.<sup>134</sup>

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<sup>134</sup> This has been principally for poultry, which is not examined in this analysis. Paradoxically, because of stringent controls on fat content in meat in Ghana some trade of import fatty meat apparently moved in the opposite direction (from Côte d'Ivoire to Ghana) in 1992.

This situation may rapidly change with increasing restrictions on the convertibility of the CFA franc. If, with overvaluation, the CFA franc ceases being convertible, a stronger parallel market will develop which will encourage CFA franc zone traders to sell to Ghana as prices denominated in cedis become more attractive.<sup>135</sup> This development will serve to reverse current disincentives to trade with Ghana. Under these conditions, harmonization of protection policy will be increasingly difficult if parallel currency markets continue to operate. However, if these developments also push the CFA zone to devalue its own currency, harmonization of policies protecting the region from world market dumping will be easier.

### **C. Unrestricted intra-regional trade**

Direct and indirect taxation of livestock marketing from interior zones of production to coastal consumption points represent more than 10 percent of total costs and over 30 percent of marketing costs. Measures are needed in all countries to reduce market taxation, simplify procedures, and discourage collection of *taxes sauvages* by public authorities. Burkina Faso and Mali have already lowered export taxation levels. Already initiatives are being taken under the "Sikasso initiative" and a multi-donor sponsored action plan to implement these measures. In addition, consideration should be given to reducing the high indirect taxation of livestock marketing through taxation of transport fuel and vehicles.

Given high unit transport costs, the multiple stages and intermediaries in livestock marketing, and the long distances between production and consumption points for animals, both Sahelian countries should take further measures to improve market efficiency. With increasing use of trucks, changes in the structure and conduct of livestock marketing should be anticipated and promoted. These changes will ultimately reduce the number of links between producer and final consumer, and in so doing, reduce market margins. To facilitate these changes, good roads to producing zones and market infrastructure designed to accommodate the special needs of trucked animals may be needed. More importantly, policies which slow trucking transit times should be eliminated. In addition, Burkina Faso should examine how to better use the railway to Côte d'Ivoire to provide a more competitive transportation alternative to the coast.

### **D. Promote rational input use**

Commercial feed use has been shown to be minimal in most ruminant production systems, but to show promise as a supplement for improving herd performance, as well as for fattening. In this context, policies affecting feed pricing are going to become increasingly important as intensification proceeds. Experiences in countries which have advanced further in this process suggest that to subsidize commercial feeds to promote herd growth can cause severe overstocking of range lands rather than substitution of commercial feed for the biomass obtained from these lands. Moreover, ruminant production systems which rely heavily on commercial

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<sup>135</sup> Already in August 1993, the BCEAO announced restrictions on convertibility for regional traders outside the CFA franc zone due to this very problem. *Africa Analysis* (No 178, August 6, 1993), p. 1.

feeds quickly become uneconomical and so are unsustainable in the long run. Caution should be taken to promote commercial feed at their true opportunity cost to society.

All four countries subsidize vaccinations but make little additional contribution to promoting livestock production. This analysis suggests that these vaccine subsidies have little direct impact on overall competitiveness although the health benefits of such vaccinations are clearly important. Therefore the merits of these policies should be based on concerns for optimal protection against disease rather than issues of profitability raised in this study. Other inputs to ruminant livestock production are few, although with increasing integration of livestock and crop production, a number of additional inputs will become more important (eg. additional medications, insecticides, materials for enclosures/pens etc.). Public assistance in the introduction of these relatively new inputs may be needed.

More broadly, with the progression of livestock-crop integration, and of increasingly intensive livestock production, a need to develop new production techniques adapted to the particular conditions of production in each region will be required. Some specific production issues which have been confronted in this study include optimal use of crop byproducts in ruminant production; cost effective control of trypanosomiasis; and management options to address labor and land conflicts between livestock and agriculture. Public investments in research and extension will be required to address these and other issues (such as the optimal use of animal traction) which will occur on the extensive and intensive margins where this production growth will occur.

#### **E. Promote product differentiation**

The analysis has illustrated the disadvantage faced by regional livestock in competing with low-quality imports. It has been suggested that locally-produced livestock products be better differentiated in marketing so that higher prices can be obtained for the high-quality portion of these products in more lucrative markets. This would require identification of prospective markets, investment in the processes and training necessary to supply differentiated products, and promotion of these products. In the case of red meat in particular, establishment of production-slaughtering schemes which will meet the necessary health standards to penetrate prospective markets would also be necessary. This process of differentiation should create opportunities for other value-added activities in meat and milk sectors, including canning, drying or freezing meat, and manufacturing milk-derivative products. Obviously such schemes will require significant investments and may not be immediately feasible. However, small steps to improve and differentiate product quality will create conditions in which greater value can be obtained from the livestock sector's product.

#### **F. Final remarks**

Despite poor performance in the recent past, the prospects for the ruminant livestock sector of the central corridor of West Africa are very attractive. Assuming that the structural

reforms of the past decade do yield better economic performance in West Africa in the next decade, this improvement will be accompanied by rapidly-growing demand for livestock products, which will create an opportunity for expansion of the livestock sector. The economic analyses suggest this sector can competitively meet this challenge, although the resources to do so will come less from traditional pastoral systems and increasingly from agricultural zones in the semi-arid and sub-humid tropics.

However, growth of herd numbers in these zones must be accompanied by productivity increases if regional livestock is to retain its share of the regional meat market. Productivity growth will require investments to improve feed supplementation, animal health and herd management. These investments are only likely to be made if the disincentives of current policies are removed. Most importantly, the negative protection afforded by currency overvaluation in the CFA franc zone must be redressed. In turn, these requirements challenge the donor community to assist in reinvigorating livestock production in the region through investments to raise productivity, and through sponsorship of reforms to correct current negative protection to the livestock sector.

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