

P1) - ABF - 006

1997

UMA LELE • NICOLAS VAN DE WALLE • MATHURIN GBETIBOUO

**MANAGING
AGRICULTURAL
DEVELOPMENT
IN
AFRICA**





THE MADIA STUDY

Although many generalizations have been made about the agricultural crisis in Africa, relatively few detailed country and cross-country studies of African agriculture based on systematic data analysis have been conducted. Similarly, although foreign aid has constituted a large part of total government expenditures in Africa for close to fifteen years, there has been little analysis of the role of external assistance in African countries that goes beyond political criticism of official assistance or the alleged self-serving objectives of donors. The impetus for the study "Managing Agricultural Development in Africa" (MADIA) was to begin the process of filling this gap and to explain the nature and sources of the agricultural crisis, particularly the extent to which it originated in resource endowments, historical and contemporary events, external and internal policies, and the economic and political environment.

The MADIA study involved detailed analysis of six African countries—Kenya, Malawi, Tanzania, Cameroon, Nigeria, and Senegal. In addition to the World Bank, seven donors, USAID, UKODA, DANIDA, SIDA, the French and German governments, and the EEC participated in the study. The analysis of country policies and performance during the last 20-25 years was carried out with the benefit of substantial input from the governments and nationals of each of the countries represented. The study had three main areas of focus: (1) the relationship between domestic macroeconomic and agricultural policy and agricultural performance, (2) donors' role in the development of agriculture, and (3) the politics of agricultural policy.

The MADIA study was the result of encouragement and support from many people. Anne Krueger, former Vice President for Economic Research Staff in the World Bank, encouraged the establishment of these studies on aid and development in 1984. Gregory Ingram, former Director of the Development Research Department, provided unstinting support for the study. During the reorganization of the World Bank in 1986, the strong support from Benjamin King, then acting Vice President for Economic Research Staff, proved invaluable. Barber Conable, President of the World Bank, and Mr. Edward V. K. Jaycox, Vice President for the Africa Region, have played a key role by ensuring support for the study's completion, as did Stanley Fischer, the Vice President for Development Economics. Yves Rovani, Director General of the Operations Evaluation Department, was particularly helpful as the MADIA study drew heavily on the works of OED.

A special debt of gratitude is owed to the World Bank's Research Committee, which provided the initial funding for the study, and to the MADIA Steering Committee. In particular the strong support of the chair of the Steering Committee, Stephen O'Brien, has been of critical importance.

Finally, without the active and continued encouragement of many African policymakers and donor officials, including numerous colleagues in the World Bank, this study would not have provided new perspectives. This support has taken the form of numerous reactions to written and oral presentations, and refinement of the analysis to identify the areas of consensus and continuing controversy.



**COTTON IN AFRICA:
AN ANALYSIS OF DIFFERENCES
IN PERFORMANCE**

UMA J. LELE • NICOLAS VAN DE WALLE • MATHURIN GBETIBOUO

Acronyms

ADMARC	Agricultural Development and Marketing Corporation
BCGA	British Cotton Growing Association
CAP	Cotton and Agricultural Processors Ltd.
CCCE	Caisse Centrale de Coopération Economique
CCM	Chama Cha Mapinduzi
CFDT	Compagnie Française pour le Développement des Fibres Textiles
CGIAR	Consultative Group on International Agricultural Research
CICAM	Cotonnière Industrielle du Cameroun
CLSMB	Cotton Lint and Seed Marketing Board
COTMAN	Cotton Marketers' Association of Nigeria
CRC	Cotton Research Corporation
IAR	Institute of Agricultural Research
ICAC	International Cotton Advisory Committee
IRCT	Institut de Recherches du Coton et des Textiles Exotiques
IRA	Institut de la Recherche Agronomique
KTDA	Kenya Tea Development Association
LBA	Licensed Buying Agents
LSMB	Lint and Seed Marketing Board
MOA	Ministry of Agriculture
NCB	National Cotton Board
NCCCCP	National Consultative Committee on Cotton Production
SODECOTON	Société de Développement du Coton du Cameroun
SODEFITEX	Société de Développement des Fibres Textiles
SONACOS	Société de Développement des Oléagineux du Sénégal
SOTEXKA	Société des Textiles de Kaolack
TANU	Tanganyika African National Union
TARO	Tanzania Agricultural Research Organization
TCA	Tanzania Cotton Authority
TCMB	Tanzania Cotton Marketing Board
TEXCO	Tanzania Textile Corporation
TFC	Tanzania Fertilizer Corporation

Acknowledgement

An earlier draft of the paper received valuable comments from the following reviewers: James W. Adams, Manmohan Agarwal, Mohsin Alikhan, Charles Aneur, Francois Bocchino, Bela Belassa, Daniel Benor, Peter Brumby, Stephen Carr, Ajay Chhibber, Kevin Cleaver, Michael Collinson, Vincent Cusumano, Ronald C. Duncan, Carl Eicher, Peter H. Freeman, Alan Gelb, Arntraud Hartmann, Peter Hazell, William Jaeger, David Jones, Kathryn McPhail, John W. Mellor, Minhchau Nguyen, F. Stephen O'Brien, José Oliveras, Michel J. Petit, Christian Polti, Thomas Reardon, Joanne Salop, Rick Scobey, Anand Seth, Alain Sez nec, John Staatz, David R. Steeds, Gert Stern, Roger Sullivan, Elton Thigpen, J.A. Nicholas Wallis, Harry Walters, and Michael T. Weber. Their contribution is greatly appreciated.

While we have attempted to reflect their concerns, given the diversity of views on many of the issues addressed in this paper, it has not been possible to reconcile the different perceptions. The views expressed and any errors and omissions remain solely the responsibility of the authors.

The authors are also grateful to Natasha Mukherjee for research assistance, and to Pat Blair and Suzanne Wood for editing.

Contents

Summary and Policy Implications	5
Introduction	7
Cotton Performance in MADIA Countries	9
Cameroon.....	11
Senegal.....	11
Tanzania.....	13
Kenya.....	14
Other MADIA Countries.....	14
Explaining Differences in Performance—Price Factors	15
The Impact of Price Factors.....	15
Farm-level analysis.....	18
Comparative advantage.....	20
Measuring Price and Nonprice Factors.....	20
Explaining Variations in Performance—Nonprice Factors	22
Agro-Ecological Factors.....	22
Cotton as an Instrument of Regional/Political Equity.....	23
Institutional Factors.....	23
Input and output price supports.....	23
Research and extension.....	27
Processing issues and backward coordination.....	28
Weighing the Evidence	29
Recommended Institutional Reforms	30
Francophone Countries.....	30
Anglophone Countries.....	31
Annex 1	32
Annex 2	33
Notes	34
Bibliography	35

This material was prepared for discussion at the MADIA Symposium. These papers reflect only the views of their authors and should be used and cited accordingly. The authors' findings, interpretations, and conclusions are their own. They should not be attributed to any of the agencies or governments participating in the MADIA study, the World Bank, its Board of Directors, its management, or any of its member countries. All rights reserved.

Illustrations

Tables

1. Africa cotton: growth in production, domestic availability and trade volumes	7
2. Seed cotton production in the MADIA countries, 1960/61—1987/88	9
3. Characteristics of cotton farming systems in the MADIA countries	11
4. CFDT presence in local cotton parastatals	12
5. Areas under cotton cultivation in the MADIA countries, 1960/61—1986/87	13
6. Seed cotton yields in the MADIA countries, 1960/61—1986/87	14
7. Ratio of producer prices for cotton lint at official and purchasing power parity exchange rates to world cotton lint prices, 1960/61—1986/87	15
8. Nigeria: Import parity price for cotton, 1986	16
9. Producer prices for seed cotton, deflated by CPI 1980=100	17
10. Ratio of seed cotton to maize producer prices in the MADIA countries, 1964/65—1987/88	18
11. Returns to labor from cotton and alternate agricultural and nonagricultural employment in the MADIA countries	19
12. Agro-ecological conditions in cotton cultivating regions of the MADIA countries	22
13. Organization of the cotton sectors in the MADIA countries	24
14. Numbers of African and expatriate cotton researchers in anglophone and francophone Africa, 1984	28
Annex Table I Seed Cotton Price Elasticities in the MADIA Countries	33

Figures

1. Share of Sub-Saharan Africa in world agricultural exports, 1961-1987	7
2. Seed cotton production in francophone and anglophone Sub-Saharan Africa, (excluding Zimbabwe), 1961-1987	8
3. Seed cotton yields in the MADIA countries, 1970/71—1983/84	10
4. CFDT presence and seed cotton yields in selected francophone Sub-Saharan African countries	10
5. Producer prices for seed cotton converted at purchasing power parity exchange rates in the MADIA countries, 1970/71—1986/87	16
6. Production and real price indices for seed cotton in the MADIA countries, 1970-87	21

Summary and Policy Implications

The development of African economies depends to a great extent on the performance of their agricultural sector, within which export crops play an important role. However, Africa's share of world trade in traditional export crops has declined steadily during the past two decades. Indeed, increased internal demand due to population growth is leading to higher imports of many commodities that were once exported. An investigation of the factors affecting various commodities across Sub-Saharan Africa can throw light on how best to improve internal production and foster both intra-African and international trade.

This paper focuses on cotton, a key export crop, which is grown in 30 out of the 44 African countries. The world demand for cotton grew at 1.2 percent per annum from 1961 to 1986, less rapidly than cocoa (2.1 percent) and tea (3.3 percent); but Africa's demand for cotton grew faster than for most other commodities that it exports—with the exception of palm oil. In the MADIA countries with which the paper is concerned (Cameroon, Senegal, Nigeria, Kenya, Tanzania, and Malawi), output performance has been distinctly mixed. By and large, cotton production in the francophone countries has been superior to that of anglophone countries (except for Zimbabwe) since the early 1970s, even though many of the latter had excelled earlier. This paper asks why.

A distinguishing feature of cotton production in the francophone countries is the structure of their domestic cotton industry. These countries exhibit a high degree of coordination between the upstream and downstream actors in the cotton production apparatus. The presence of the *Compagnie Française pour le Développement des Fibres Textiles* (CFDT) has provided them with more effective vertical integration than is found in anglophone Africa, although both groups have a wide range of arrangements as to the extent of integration/decentralization. Empirically, it is difficult to separate the effects of the CFDT presence *per se* from those of integration, since CFDT has brought (in addition to integration) professionalism, know-how and detailed knowledge of both the country-specific circumstances and the international market and finance.

A closely associated difference between the two sets of countries is the role played by institutional factors in alleviating physical constraints and ensuring effective price incentives. Anglophone countries are characterized by a low input/low yield technology whereas the francophone countries, induced by CFDT, feature a high input/high yield technology. Despite its success in increasing production and yields per hectare in francophone countries, the CFDT

induced approach has come under heavy criticism for its high costs, monopoly approach, and excessive focus on cotton. In anglophone countries, where population pressure on the land has reduced fallow periods—leading to a decline in soil fertility and yields while at the same time increasing the demand for food—a low input/low yield extensive approach to cotton production has made competing food crops increasingly attractive, and is threatening the future of cotton cultivation—except as a risk minimization strategy. What lessons can be drawn for the future of the cotton industry from these two sets of experiences?

The central conclusion of this paper is that, while differences in macroeconomic and sectoral pricing policies appear to have been critical, institutional factors have been fundamental in explaining the sustained growth of cotton production in francophone countries. The CFDT approach has led to the development and extension of technology and assured the availability of inputs, marketing and processing facilities. In particular, it has ensured adequate financing of the cotton sector, making possible, among other things, timely payments to farmers. Its high cost of assistance could be brought down if the current diminution in numbers of resident expatriate CFDT experts, as observed in Mali and Côte d'Ivoire (see Table 4) continues without a loss in cotton productivity.

Although the impact of price incentives on cotton production is important for determining short-run shifts between food and export crops or for allocating labor between cotton and other crops (including off-farm wage employment), this paper demonstrates, first, that a variety of other incentives have been important, including CFDT's own incentive to make profits, related directly to the volume of exports, and second, that prices must not be considered in isolation from a range of nonprice factors, including the nature of the colonial legacy. The two sets of factors jointly explain the much greater relative success of the cotton subsector in francophone Africa. Thus, the *Société de Développement des Fibres Textiles*, SODEFITEX, in Senegal, and, the *Société de Développement du Coton du Cameroun*, SODECOTON, in Cameroon, have been relatively effective agents of government policy. In the anglophone countries, faulty mechanisms and procedures for paying producer prices and ensuring input supplies have seriously undermined their potential impact, and the cotton subsectors lag behind in terms of a wide variety of indicators. The difference is particularly striking in Kenya, which has otherwise made much more impressive strides in several

other crops, relative to most of the francophone producers. This suggests the need to understand the commodity-specific challenges posed by each crop, the approaches uniquely suited to the requirements of that crop, and the particular constraints that may be difficult to alleviate.

Donors of MADIA countries need to be aware of the tremendous institutional weaknesses of many Sub-Saharan African countries, which makes it essential to consider carefully the choice of institutions and factors affecting the long-term development of export crops such as cotton. They need to: (i) devote greater attention to the role of agricultural research and its strong link to effective agricultural extension, input, credit, and marketing systems; (ii) pay greater attention to the financing of institutions; (iii) place greater emphasis on the quality, critical mass, and length of time for which technical assistance is provided, with particular emphasis on creating indigenous institutional and human capacity and an incentive structure conducive to good economic performance; and (iv) develop regional and international cotton research and marketing strategies for and within African countries (including, perhaps, establishing a CGIAR-type presence), in view of the atrophying expertise in cotton of the traditional colonial donors and the changing pattern of world market demand. CFDT has been able to provide a regional approach to cotton research which transcends national boundaries—and which covers many areas of the same ecological zones. The declining role of CFDT (as a regional research organization) and its parcelling out to national research systems of Ministries of Agriculture could impact adversely on cotton research; and unless a research organization of the CGIAR type, but with strong linkages to producing households, supports cotton research, production and productivity of cotton in the small African countries could suffer the same fate as that of other export crops for which Africa has lost her share of the world market. Recognition of CFDT's accomplishments in addressing the above issues, and thus in successfully alleviating the technological and institutional constraints to cotton development in francophone Africa,

highlights why its technical assistance has been more effective than most, including other French assistance in francophone Africa.

As for the recipient countries, politics has played a heavy role in the support or demise of the cotton sectors in the MADIA countries. Depending on the political strength of the cotton-producing populations, which has itself depended on (but by no means assured) the economic importance of the domestic cotton industry, governments have been willing or reluctant to let producer organizations effectively represent the interests of the cotton producers in the operation of the industry. Given the many complexities involved in developing the cotton sector, governments need to (i) show a greater awareness of the professionalism needed to develop crops, (ii) provide better incentives for cotton-industry managers to respond to the needs of their producers, and (iii) address the technological, financial, international market, and ecological complexities involved in developing the cotton sector. The emphasis in the past has been placed far too narrowly on producer price incentives. This paper argues that, in francophone Africa, the chances of developing a viable indigenous cotton industry are likely to be greater if donors promote a broader set of incentives and a long-term approach to agricultural research, training, and technical assistance, and especially to the link between research and the demands of the world market, rather than the short-term approaches (based on parcelling out different parts of the industry) currently being advocated. Some of the essential elements of the CFDT approach (which are also present in Zimbabwe's successful cotton sector) also need to be considered for adaptation to cotton industries elsewhere. These include (i) the need for credit to farmers (ii) the timely payment of producer prices, and (iii) an excellent research and input delivery system closely tied to the nature of the internal or external market and based on a thorough understanding of the location-specific circumstances affecting cotton producers.

Introduction

In general, the performance of the agricultural sector in sub-Saharan Africa since independence has been poor. Export crops, in particular, have suffered. As can be seen in Figure 1, the region's share of world agricultural exports fell precipitously throughout the 1970s and 1980s.

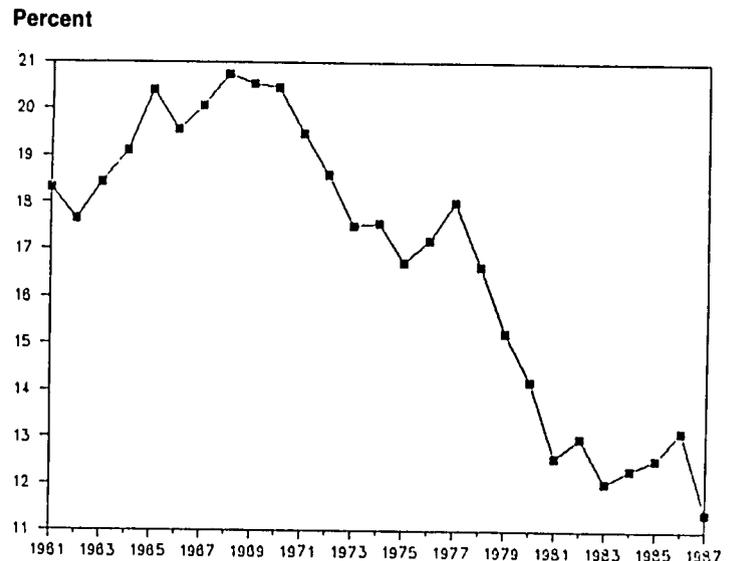
The reasons for this poor performance are poorly understood and the subject of much debate. Some have emphasized the inadequacy of producer price incentives because of high taxation of the agricultural sector. (World Bank 1981, 1984; Eicher 1982) Adverse macroeconomic policies are said to have an even more significant effect on effective taxation rates in the agricultural sector than do sector-specific policies. (Krueger, Schiff and Valdes 1988) This school of thought stresses the need to "get the prices right." Others, in contrast, have sought explanations in a host of non-price factors. (Delgado and Mellor 1984; Lipton 1987; Ray 1988) including political (Bates 1981), technological, institutional, infrastructural, and human-capital constraints. (Lele 1988a; Lele 1989). Some recent theoretical literature has argued that favorable price incentives themselves promote capital formation, technological progress, and institutional innovation. (Hayami and Ruttan 1985; Mundlak 1988). Relatively little empirical work exists, however, to test the relative importance of, or the nature of interaction between, price incentives and nonprice factors.

This paper attempts to throw light on the debate by reviewing the development of one commodity, cotton, across selected African countries and by attempting to pinpoint the causes of relative success and failure of different commodity development schemes. Cotton has been chosen in part because policy conclusions, *ceteris paribus*, could apply to a broad range of countries. At present, Sub-Saharan Africa accounts for 4.5 percent of world cotton production and about 10 percent of world exports. The annual market value of African lint exports has averaged over US\$1 billion in recent years. The crop is grown in more than 30 African countries, under diverse climatic conditions and in varying soil fertilities. Some 4 million African households derive cash incomes from planting, handling, or processing it.

With declining soil productivity and rising profitability of food crops, the future of cotton production in Africa has come into question. Its adverse environmental impact has often been criticized. Furthermore, international cotton prices fluctuate widely (the coefficient of variation for the international price of cotton being 42 percent) and have been badly depressed since 1986. Nevertheless, in many parts of Africa, where long-term options are few, cotton production may be an efficient means of increasing employment and incomes. Domestic demand is currently growing faster than production, and gross cotton imports are soaring. Imports rose by more than 5 percent per annum between 1961 and 1986, and are projected to increase by 2.4 percent a year (compared with only 0.7 percent for the world as a whole) until the year 2000 (see Table 1).

This paper explains variations in the performance of national cotton subsectors by focusing on the key interactions between price and nonprice factors. Price factors refer to output and input prices, and to exchange, interest, and wage rates. Nonprice factors include: (i) the agro-ecological

Figure 1
Share of Sub-Saharan Africa in world agricultural exports, 1961-87



Source: World Bank, BESD Databank.

Table 1
Africa cotton: Growth in production, domestic availability, and trade volumes (percent per annum)

	1961-86	1970-86	1987-2000*
Production	1.0	-0.1	0.9
Domestic Availability	2.0	-0.9	0.9
Gross Exports	-0.6	-1.5	-0.2
Gross Imports	5.4	4.7	2.4
Memo Items:			
Cotton, World	1.2	1.2	0.7
Palm Oil, Africa	18.1	22.3	7.9

*Forecast

Source: The World Bank, "Price Prospects for Major Primary Commodities, 1988-2000," volume 2, Washington, D.C., November 1988.

factors that surround the cultivation of cotton, and (ii) the institutional environment, including, in particular, the political support and technocratic content of institutions, their adequate funding and trained personnel, and the existence of technological packages and systems for extension. In demonstrating the fundamental importance of the institutional environment in determining performance, the paper shows that the adequate funding of institutions has critically influenced their ability to implement a pricing policy, and that poor funding is not necessarily explained by currency overvaluation. Further, the effectiveness of price policies in ensuring a supply response has itself been heavily conditioned by the quality of the institutions that carry out cotton research, extension, input supply, and commercialization—which in turn reflects the broad political environment that determines a national commitment to

succeed in cotton and to develop (and retain) human capital.

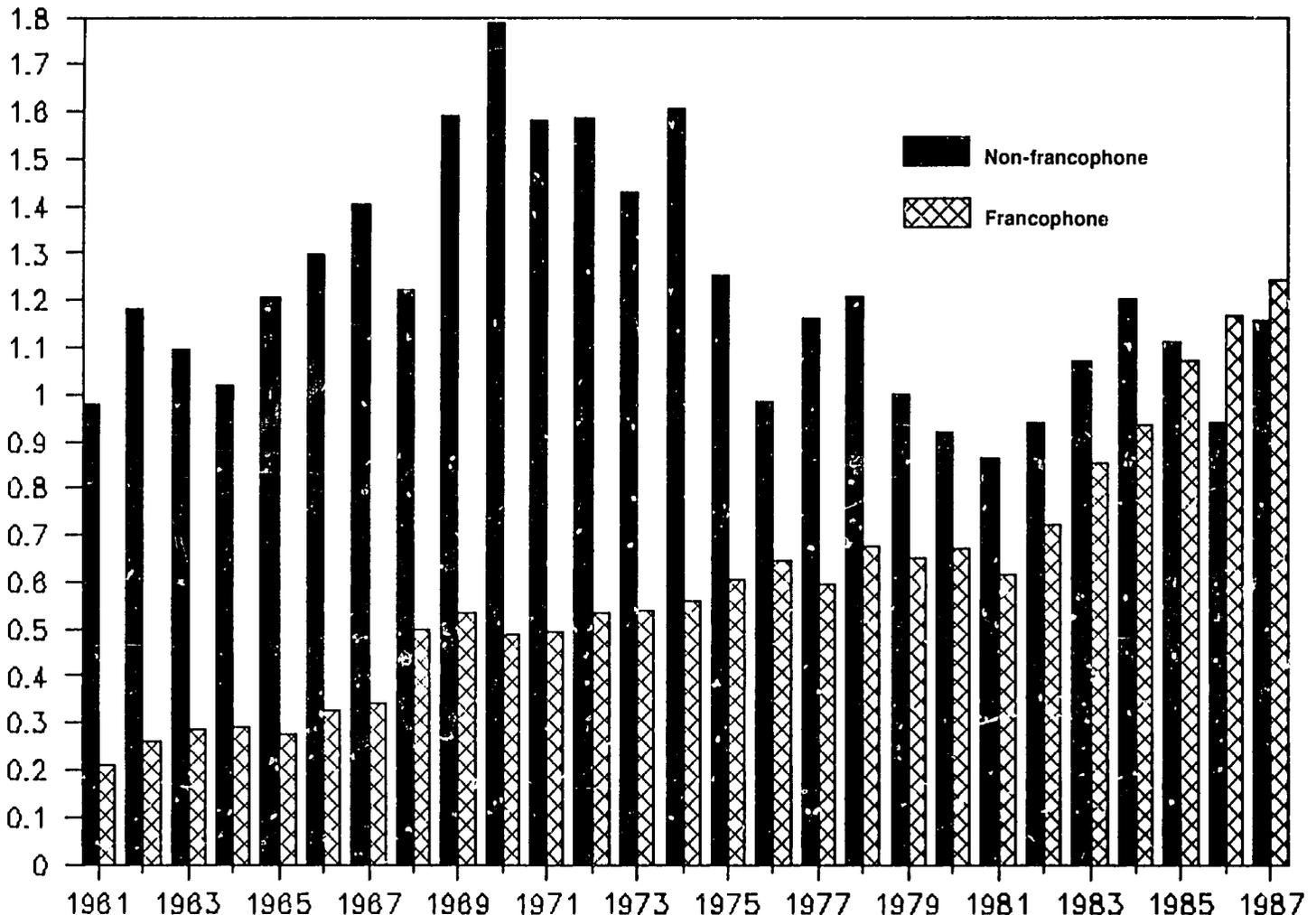
Two quite distinct camps can be seen among cotton producers over at least the past two decades. Broadly speaking, the two camps can be described as francophone and anglophone, although these terms are only convenient shortcuts to refer to a great many organizational differences. The cotton-producing francophone countries, for example, have emphasized technology-led intensification, while extensive cultivation has characterized the anglophone systems. Figure 2 illustrates the growth of cotton production in the fourteen francophone countries relative to that of their fifteen anglophone counterparts, several of which were very successful during the colonial period but have since declined. As can be seen, the francophone group, which started producing cotton on a commercial scale only in the early 1960s, has overtaken the anglophone group, which has shown slow growth at best. Output in the former French colonies grew by 740 percent between 1960 and 1985, while the other African producers collectively increased production by only about 60 percent in that time, primarily because seed cotton yields are substantially higher in francophone than in anglophone Africa as a result of the higher level of technology used. Francophone

production currently accounts for almost half of Sub-Saharan African output, compared to an 11 percent share in 1961/62.

The next section describes the production record of the six MADIA countries that are the focus of this paper. The following two sections seek to explain divergences in performance in terms of the relative impact on cotton profitability of price and nonprice aspects of the production environment. Then the paper weighs the evidence in favor of well-coordinated, if not fully integrated, organization of the cotton sector.

The economic viability of the cotton sector in francophone Africa has come under questioning, particularly since the collapse of world cotton prices in 1986. The last section discusses questions of economic, technological, and financial viability in the context of recent changes in international trade and aid arrangements, and in the domestic macroeconomic, political, and institutional arrangements that have affected the cotton subsectors. The implications of these changes for the reform measures being developed by donors and governments are also discussed. Although the examples are taken from the MADIA countries, the lessons could easily be generalized to other rainfed environments in Africa.

Figure 2
Seed cotton production in francophone and anglophone Sub-Saharan Africa, 1961-87 (excluding Zimbabwe)
Million metric tons



Cotton Performance in MADIA Countries

Cotton performance in the six MADIA countries—francophone Cameroon and Senegal, and anglophone Nigeria, Kenya, Tanzania, and Malawi—parallels the larger history of cotton performance in franco- and anglophone Africa. As Table 2 shows, production in both Cameroon and Senegal is dynamic. Production in Tanzania, Nigeria, Kenya, and to a lesser extent Malawi, is stagnating.

Much of the difference in performance by francophone countries is attributable to the important role played by the *Compagnie Française pour le Développement des Fibres Textiles* (CFDT), the parent company of the francophone African cotton parastatals. CFDT is a semi-private public enterprise in which the French state holds 64 percent of the equity. It

was created in 1949 to promote cotton production and provide support for downstream activities in the then French colonies. Until local cotton parastatals were created in the 1970s, CFDT was virtually the only actor linking all aspects of the francophone cotton sectors.

Even after the local parastatals were created, CFDT retained its historical ties with the francophone countries. It owns substantial shares of the parastatals' equities, averaging a 28 percent participation in 1987 in the eight countries where CFDT is most actively involved. (Equity participation ranges from 40 percent in Mali's CMDT to 17 percent in Chad's COTONCHAD.) In addition to equity participation, CFDT provides technical assistance in the

Table 2
Seed cotton production in the MADIA countries, 1960/61-1987/88 (In metric tons)

Year	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
1960/61	29,200					203,013
1961/62	25,100					183,813
1962/63	41,400					167,511
1963/64	45,600					214,115
1964/65	44,000	141,353	54			252,612
1965/66	57,500	137,866	302	13,555		290,215
1966/67	55,800	158,994	1,186	13,632		390,410
1967/68	49,085	83,586	4,157	11,441		433,514
1968/69	68,013	172,219	9,905	13,127	11,156	295,875
1969/70	91,334	277,651	11,500	15,819	18,209	390,970
1970/71	38,394	119,651	11,483	17,230	21,389	209,900
1971/72	43,197	116,348	21,547	16,540	22,494	228,300
1972/73	45,296	146,832	23,461	17,220	22,099	197,300
1973/74	27,837	93,865	33,077	16,183	16,212	230,200
1974/75	40,042	155,046	42,376	14,560	21,407	195,000
1975/76	49,462	177,069	30,842	17,985	17,777	221,100
1976/77	47,767	243,677	45,208	19,806	17,956	126,000
1977/78	46,358	112,491	37,491	26,714	22,635	194,694
1978/79	59,497	110,131	33,546	35,442	24,218	168,082
1979/80	80,335	86,475	26,868	29,213	22,411	177,755
1980/81	84,453	26,390	20,607	26,783	23,114	174,960
1981/82	79,819	79,971	41,007	24,258	21,739	133,038
1982/83	72,361	58,235	47,081	23,501	14,800	127,993
1983/84	94,580	37,115	30,461	16,271	13,368	140,393
1984/85	97,502	46,150	46,913	39,281	32,122	152,267
1985/86	115,544	30,845	27,942	27,469	32,710	126,378
1986/87	122,772	75,377	26,871	30,938	21,757	138,060
1987/88	113,700	110,000	38,931	36,563	42,300	147,000
Growth rate (%)						
entire period:	3.9	-6.3	17.2	4.5	2.0	-2.6
1970-85:	8.1	-9.7	3.8	4.2	1.0	-3.6
Coefficient of variation (%)						
entire period:	43	54	59	37	25	38
1970-85:	39	56	31	31	24	21

Sources: Cameroon: SODECOTON, Rapport Annuel de la Campagne 1985/86; Ministère de Coopération, République Française, "Le Coton en Afrique de l'Ouest et du Centre," August 1987.

Figures for 1986/87 and 1987/88 from personal correspondence with Francois Bocchino, General Manager, CFDT, Paris.

Nigeria: de Matharel, "Study of Cotton Marketing, Seed Production and Quality Control," Paris: CFDT, 1987, Table 1.

Senegal: Ministère de la Coopération, République Française, "Le Coton en Afrique de l'Ouest et du Centre," Paris, August 1987.

Figures for 1986/87 and 1987/88 from personal correspondence with Francois Bocchino, General Manager, CFDT, Paris.

Kenya: Ministry of Agriculture. Figures for 1986/87 and 1987/88 calculated from cotton lint production (in bales) assuming a 32% ginning outturn.

Malawi: Malawi Statistical Yearbook 1975 and 1983; Malawi Economic Report 1987.

Tanzania: 1960-1969: World Bank. 1970-1978: Marketing Development Board. 1979-1987: USDA, "Tanzania Cotton Annual Report," 1987.

Table 3
Characteristics of cotton farming systems in the MADIA countries

	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
Average area planted per farm (ha)	0.6	0.8	0.35	0.45	0.63	1.25
Average land availability (ha/person)	Far North: 1.98 North: 11.16	1.14	3.22	Coast: 6.18 Nyanza/Western: 0.46	1.28	2.1
Average labor use: (persondays/ha)						
Manual labor	115	115	115	115	115	115
Animal traction	75					
Mechanized traction	60					
% of Acreage:						
Intercropped with food crops	0%	70%	0%	70%	15%	10%
Sprayed	95%	0%	99%	10-20%	90%	10%
Fertilized (chemical)	95%	0%	96%	0-5%	13%	
Yields (kg/ha)	1,300	250	1,012	350	700	400
Ginning gattos	40%	33%	39%	32%	36.8%	33.5%
Competing crops	Groundnuts Maize Sorghum/Millet	Maize	Groundnuts Sorghum/Millet	Sugarcane Maize, Tobacco Groundnuts	Maize	Maize

Notes: These estimates concern only rainfed cotton cultivation. Cameroon figures concern 1986-87; Nigeria and Kenya figures 1985-86; Malawi figures 1980-81; Senegal figures 1984/85; and Tanzania figures 1983-84.

Sources: various unpublished documents.

Cameroon

Between 1960 and the 1970s, production growth in Cameroon largely reflected expansion of the area under extensive cotton cultivation (see Table 5). Yields were generally stagnant, at 500-600 kilos per hectare (see Table 6).

However, the protracted drought of the early 1970s, when producers retreated into subsistence agriculture and production declined from 91,000 tons to 38,000 tons within a year, resulted in major structural changes in the sources of Cameroonian production growth. First, CFDT shifted its production strategy from an extensive to an intensive one. To keep producers interested in cotton, CFDT emphasized the use of chemical fertilizers and pesticides, and plot consolidation was encouraged to facilitate mechanization. Second, the authorities encouraged a shift in production from the North, where continuous cultivation and declining rainfall had resulted in declining yields, to relatively higher-potential areas further South, where soils were less degraded and precipitation levels are higher and more predictable.

These policy changes yielded quick results. Production increased by 9 percent annually from 1975/76 to 1985/86, even though the area under cultivation declined by 0.3 percent a year. Almost two-thirds of the crop now comes from the North Province, as compared to only one-third in the 1960s, when the more northerly Far North Province dominated production.¹ Yields have been consistently higher both because of the change in technology and the shift to new production areas. They now surpass 1.2 tons per hectare. In some regions of the Benoué, yields have reached 2 tons per hectare, somewhat of a record for rainfed cotton in Africa.

Cotton is Cameroon's third largest agricultural export by value (behind cocoa and coffee). It is generally believed that production will remain profitable at the farm level even with reduced real producer prices and abolition of subsidies on inputs. At the national level, however, the economic viability of cotton production is an important issue, because of SODECOTON's high cost of operation, its monopolistic hold over cotton trade, and a belief that CFDT focuses excessively on cotton to the detriment of other crops.

Senegal

Cotton was introduced into Senegal only in 1963, as a cash crop to diversify the economy away from heavy dependence on groundnuts. After an initially difficult start with irrigated cotton in the Fleuve region, commercial-scale production began around 1965 in rainfed areas of upper Casamance and Eastern Senegal, the two regions which now contribute up to 90 percent of all of Senegal's relatively small cotton output. Unsuitable soils and problems of salinity and of acceptable levels of rainfall, especially in upper Casamance, limit potential production to an area of roughly 40,000 hectares.

Senegal's cotton sector has been dynamic despite its harsh climatic environment. The late-arriving industry benefited from CFDT's experience in other francophone countries. As early as 1966, seed cotton yields were above 1000 kilos per hectare—low by the standards of francophone West Africa but much higher than the best yields in anglophone Africa. When yields fell below 700 kilos per hectare during the mid- to late 1970s, mainly because of adverse weather conditions, new and better adapted, shorter-germination varieties with better fiber characteristics were introduced to the farmers, with the result that both seed-cotton and fiber yields rebounded from below 700 kilos per hectare and 270 kilos per hectare, respectively, to more than 1000 kilos per hectare and 400 kilos per hectare in the 1980s.

Cotton is second only to groundnuts among Senegal's agricultural exports. As in Cameroon, production prospects depend on the availability of land of suitable quality and on the ability of SODEFITEX to keep Senegalese cotton cost-competitive on the international market. Cost-reducing technology, further intensification, and the adoption of such high-performing varieties as IRMA 96-97, which was introduced in 1987, offer possibilities on the competitiveness front, although the high cost of CFDT's technical assistance for training of indigenous capacity tends to undercut cost-reducing possibilities.

Table 4
CFDT presence in local cotton parastatals

	Number of CFDT agents	Area under cotton cultivation (in hectares)	CFDT agents per 10,000 hectares	Production of seed cotton (in metric tons)	CFDT agents per 10,000 metric tons	Average seed cotton yields (in kg/ha)
Burkina Faso						
1985	12	82,300	1.46	88,134	1.36	1,071
1986	11	94,625	1.16	115,491	0.95	1,221
1987	10	126,850	0.79	169,227	0.59	1,334
Average	11	101,258	1.14	124,284	0.97	1,209
Central African Republic						
1985	23	79,563	2.89	45,516	5.05	572
1986	16	83,105	1.93	35,479	4.51	427
1987	14	65,677	2.13	24,904	5.62	379
Average	18	76,115	2.32	35,300	5.06	459
Togo						
1985	10	43,562	2.30	54,756	1.83	1,257
1986	6	68,824	0.87	63,558	0.94	923
1987	3	61,408	0.49	79,067	0.38	1,288
Average	6	57,931	1.22	65,794	1.05	1,156
Madagascar						
1985	9	23,595	3.81	33,813	2.66	1,433
1986	9	32,954	2.73	42,871	2.10	1,301
1987	7	42,850	1.63	40,886	1.71	954
Average	8	33,133	2.73	39,190	2.16	1,229
Niger						
1985	3	4,627	6.48	3,884	7.72	839
1986	3	5,509	5.45	4,389	6.84	797
1987	2	9,421	2.12	8,138	2.46	864
Average	3	6,519	4.68	5,470	5.67	833
Burundi						
1985	4	6,596	6.06	7,155	5.59	1,084
1986	3	6,664	4.50	7,895	3.80	1,185
1987	3	6,753	4.44	8,420	3.56	1,215
Average	3	6,671	5.00	7,823	4.32	1,161
Guinée						
1985	8	240	333.33	160	500.00	667
1986	10	1,161	86.13	568	176.06	473
1987	8	872	91.74	605	132.23	694
Average	9	758	170.40	444	269.43	611
Guinée Bissau						
1985	5	2,428	20.59	1,215	41.15	500
1986	5	2,312	21.63	1,023	48.88	443
1987	4	1,889	21.18	1,329	30.10	704
Average	5	2,210	21.13	1,189	40.04	549
Senegal						
1985	9	38,842	2.32	27,942	3.22	719
1986	7	25,482	2.75	26,652	2.63	1,046
1987	6	29,000	2.07	38,700	1.55	1,334
Average	7	31,108	2.35	31,098	2.25	1,000
Cameroon						
1985	48	89,232	5.38	115,544	4.15	1,295
1986	38	94,420	4.02	122,520	3.10	1,298
1987	27	94,555	2.86	113,900	2.37	1,205
Average	38	92,736	3.82	117,321	3.05	1,265
Côte d'Ivoire						
1985	18	153,054	1.18	189,314	0.95	1,237
1986	18	159,296	1.13	213,532	0.84	1,340
1987	15	180,310	0.83	260,000	0.58	1,442
Average	17	164,220	1.02	220,949	0.76	1,345
Mali^a						
1985	15	139,218	1.08	175,092	0.86	1,258
1986	16	145,747	1.10	201,653	0.79	1,384
1987	9	142,222	0.63	187,000	0.48	1,315
Average	13	142,396	0.88	187,915	0.67	1,320
Chad						
1985	19	148,103	1.28	99,469	1.91	672
1986	20	124,075	1.61	89,469	2.24	721
1987	34	148,652	2.29	121,300	2.80	816
Average	24	140,277	1.63	103,413	2.26	737

Note: ^a Only in CMDT areas.

Sources: CFDT personnel numbers: Compagnie Française pour le Développement des Fibres Textiles, Rapport d'Activité, issues from 1985, 1986, and 1987. Production and area numbers: Ministère de la Coopération, "Le Coton en Afrique de l'Ouest et du Centre," Paris, August 1987. Compagnie Française pour le Développement des Fibres Textiles, Rapport d'Activité, issues from 1985, 1986, and 1987.

Table 5
Areas under cotton cultivation in the MADIA countries, 1960/61-1986/87 (in hectares)

	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
1960/61	54,846	270,000*		38,000	22,000	192,000
1961/62	63,612	300,000*		39,000	33,000	240,000
1962/63	67,868	300,000*		51,000	37,000	280,000
1963/64	72,227	300,000*	30	47,000	37,000	309,000*
1964/65	78,922	300,000*	102	58,000	38,000	348,000*
1965/66	91,755	300,000U	386	57,000	41,000	440,000
1966/67	97,820	300,000U	962	57,000	53,000	452,000
1967/68	98,081	300,000U	3,047	57,000	56,000	402,000*
1968/69	101,314	300,000U	6,447	60,000	45,000	364,000
1969/70	108,194	364,000U	9,805	65,000	37,000	436,000
1970/71	102,055	445,000U	13,618	81,000	48,000	440,000*
1971/72	99,046	405,000U	18,316	77,000U	53,000	400,000*
1972/73	87,679	405,000U	20,359	53,000U	50,000	400,000*
1973/74	61,176	445,000U	28,630	53,000U	53,000	380,000*
1974/75	64,520	486,000U	38,598	53,000U	54,000	395,000*
1975/76	73,178	500,000U	37,483	60,000	38,000	231,000U
1976/77	59,930	526,000	43,845	79,000	40,000	364,000U
1977/78	48,436	704,000	47,109	80,000	40,000U	389,000U
1978/79	47,130	635,000	48,299	126,000U	36,000U	455,000U
1979/80	56,594	526,000	30,908	90,000	34,000U	455,000U
1980/81	65,227	476,000	29,913	134,000U	32,000U	440,000U
1981/82	63,343	445,000	31,977	106,000	35,000	395,000U
1982/83	54,629	429,000	42,018	112,000	36,000U	360,000U
1983/84	71,092	405,000U	33,353	146,000	36,000U	344,000U
1984/85	73,316	405,000U	46,336	180,000	51,000U	340,000U
1985/86	89,232	405,000*	38,842	180,000*	50,000*	335,000*
1986/87	94,420	410,000*	25,490	180,000	53,000	335,000
1987/88		450,000*		180,000*	53,000	338,000
Growth rate (%)						
entire period:	-0.6	2.2	14.8	5.2	0.4	1.0
1970-85:	-1.5	-0.4	4.8	7.2	-1.7	-0.5
Coefficient of variation (%)						
entire period:	24	26	68	48	20	19
1970-85:	23	18	30	39	18	14

Notes: U Unofficial FAO figure

* FAO Estimate

Sources: Cameroon: Ministère de la Coopération, République Française, "Le Coton en Afrique de l'Ouest et du Centre," Paris, August 1987. Senegal: Ministère de la Coopération, République Française, "Le Coton en Afrique de l'Ouest et du Centre," Paris, August 1987. Figure for 1986/87 from personal correspondence with F. Bocchino, General Manager, CFDT, Paris, 1988. All other countries: FAO, 1948-1985 World Crop and Livestock Statistics, Rome, 1987.

Tanzania

Tanzanian cotton production, based largely in Sukumaland in the western region, grew more than tenfold between the late 1940s and the late 1960s, peaking in 1966/67. This growth was largely the result of an expansion of acreage under cotton cultivation, though average yields also increased somewhat as improved seeds, fertilizers, and pesticides began to make their way to smallholders (Collinson 1974). Intensification of food crop (particularly maize) production and marketing released land and labor for increased cotton production, resulting in increases in both average plot size and in the number of households growing cotton. By the late 1960s, the average area devoted to cotton per household exceeded 1.25 hectares, compared with 0.9 hectares in the late 1950s.

After the early 1970s, yields decreased by 3.2 percent annually and production declined steadily as input use regressed. Since producer price reforms were introduced in 1984 as part of the structural adjustment process, production has picked up from an average 42,000 tons of fiber

during the period 1984-88 to 86,000 tons in 1988/89, despite an erosion of cotton producer prices vis-à-vis those of maize from a peak of more than 4 to 1 in 1955 to about 2 to 1 in 1987/88. (An even further deterioration, to a 1 to 1 ratio vis-à-vis food crops, was reported to the authors in a personal communication from Carr for the current 1989 period.) Nevertheless, cotton production is still expected to hover around 80,000 tons, according to the International Cotton Advisory Committee, ICAC.

Cotton remains Tanzania's second largest agricultural export by value (behind coffee). It is still popular because, being more drought resistant, it offers greater income security. Nevertheless, production is likely to remain depressed. Food crops, apart from being essential for survival, require less labor and can be marketed more flexibly through barter and other nonofficial channels. Furthermore, movement of households into more concentrated, contiguous village areas through Ujamaa has led to the creation of artificial land pressure.

Table 6
Seed cotton yields in the MADIA countries, 1960/61-1986 (in kilograms per hectare)

Year	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
1960/61	532					1,057
1961/62	395					766
1962/63	610					598
1963/64	631					693
1964/65	558	471	529			726
1965/66	627	460	782	238		660
1966/67	570	530	1,233	239		864
1967/68	500	279	1,364	201		1,078
1968/69	671	574	1,536	219	248	813
1969/70	844	763	1,173	243	492	897
1970/71	376	269	843	213	446	477
1971/72	436	287	1,176	215	424	571
1972/73	517	363	1,152	325	442	493
1973/74	455	211	1,155	305	306	606
1974/75	621	319	1,098	275	396	494
1975/76	676	354	823	225	468	957
1976/77	797	463	1,031	251	449	346
1977/78	957	160	796	334	566	500
1978/79	1,262	173	695	281	673	369
1979/80	1,419	164	869	325	659	391
1980/81	1,295	55	689	200	722	398
1981/82	1,260	180	1,282	229	621	337
1982/83	1,325	136	1,120	210	411	356
1983/84	1,330	92	913	111	371	408
1984/85	1,330	114	1,012	218	630	448
1985/86	1,295	76	719	153	654	351
1986/87	1,298	184	1,054	172	410	412
1987/88		409		203	798	439
Growth rate (%)						
entire period:	4.5	-8.1	-0.4	-1.3	3.1	-3.8
1970-1985:	9.3	-9.8	-1.1	-3.1	2.7	-3.2
Coefficient of variation (%)						
entire period:	43	62	24	23	27	38
1970-85:	40	53	19	25	24	32

Source: Derived from Tables 2 and 3.

Kenya

In Kenya, cotton has been grown in the West and on the coast since the turn of the century; it was introduced into the Rift Valley province in 1974/75. Nevertheless, cotton remains an unimportant crop relative to tea and coffee, with only 1 percent of value added in agriculture. Production of seed cotton more than doubled between 1965/66 and 1978/79, peaking at 35,400 tons. Again, however, area expansion (averaging 7.2 percent a year) has been the most significant source of growth, while average yields have declined (by 3.1 percent). As a result, Kenya's output is small in relation to the more than 90,000 tons of fiber that its textile industry processes each year, and substantial imports are required.

Several features of the recent evolution of Kenyan output deserve notice. First, production has shifted away from its traditional center in the Western province. What growth there is has come almost entirely from the Central and Eastern province, where production resumed in the 1960s after a long setback due to repeated pest attacks.² Second, irrigated production, from roughly 3,200 hectares on the Tana River's Hola and Bura irrigation schemes, accounted for about 25 percent of the total by 1986. Irrigated cotton yields average 2000-3000 kilos per hectare, compared with 200-300 in rainfed cultivation, although irrigation invest-

ments have generally been extremely uneconomical (Lele and Meyers 1986).

Other MADIA Countries

The performance of cotton in Nigeria has been dismal. Nigeria was once a major exporter, but production has declined by an apparent 8 percent a year since 1970 and Nigeria must now import to cover much of its internal need for cotton. (Estimates of the contribution of domestic production to the requirements of the domestic textile industry range from 20 percent to 65 percent.) Yields appear to have declined (by 9.8 percent a year between 1970 and 1985) faster than area (0.4 percent), and stood at around 100 kilos per hectare in 1985. Most of the crop is grown in the North, and, as in Cameroon, Nigerian experts attribute some of the decline to diminishing rainfall (Yayock and Kumar 1988).

Malawi is one of the better performing countries in terms of yields among the anglophone set. Production stagnated until 1983/84, picked up briefly during the course of structural adjustment (when relative prices shifted in favor of cotton), and then dropped back to 1970s levels in 1986/87. Due to population pressure, there is a growing tendency to intercrop cotton and food crops.

Explaining Differences in Performance—Price Factors

Differences in the relative performance of the cotton industry in the MADIA countries are largely related to the profitability of growing cotton instead of an alternative crop. This relative profitability can be affected by price and non-price factors. Indeed, in some countries such as Tanzania and Nigeria, macro policy reforms since 1987 have to some extent altered the relative profitability of growing cotton by improving its price vis-à-vis competing crops such as maize. However, price correction, while frequently essential, tends to be a once-and-for-all phenomenon, whereas increased productivity, which is affected by nonprice factors, can affect relative profitability on a more continuous basis.

The Impact of Price Factors

Absolute price differences across countries are essentially due to macroeconomic policies. In this respect, Nigeria and Tanzania are prime examples of the disincentives created

by highly adverse macroeconomic policies. Lele has described elsewhere the negative effects of public expenditures, exchange rates, and trade policies on the agricultural sectors of the two countries (Lele 1988b; Lele 1984). In the case of cotton, particularly relevant factors were: (i) the rising prices of food crops relative to cotton in both countries, (ii) the adverse incentive effects of extreme shortages of consumer goods (in Tanzania), and (iii) the increased cost of wage labor (in Nigeria). Table 7 shows the divergence in incentives for cotton production in Tanzania and Nigeria by comparing producer-price equivalents for cotton lint at official and purchasing-power-parity exchange rates. At official exchange rates, the producer-price equivalents have been substantially above the world price in Nigeria since 1977/78 and in Tanzania since 1985. In terms of purchasing power, however, the producer price was only 78 percent of international cotton lint prices in Nigeria in

Table 7
Ratio of producer prices for cotton lint (at both official and purchasing power parity exchange rates) to world cotton lint prices, 1960/61-1987/88 (in percent)

Year	World lint price (\$US/kg)	Cameroon		Nigeria		Senegal		Kenya		Malawi		Tanzania	
		Official	Purchasing power parity										
1960/61	0.60	52.35		78.17									
1961/62	0.64	50.60		64.14									
1962/63	0.63	49.80		56.47									
1963/64	0.60	52.17		61.81									
1964/65	0.60	52.23		65.60		57.61							
1965/66	0.59	52.44		67.48		58.00							
1966/67	0.56	54.21		63.18		60.78							
1967/68	0.57	53.73		64.12		60.24				72.15			
1968/69	0.62	49.29		66.84		55.11				57.36			
1969/70	0.56	55.25		83.04		57.97				63.48			
1970/71	0.60	48.47	49.29	71.64	75.87	42.80	42.84	71.71	67.12	69.81	68.90	77.49	73.23
1971/72	0.72	42.51	44.29	60.31	59.95	36.03	36.72	63.89	62.87	58.81	57.57	63.93	62.14
1972/73	0.76	43.78	43.91	74.74	74.74	40.19	40.27	66.95	5.95	62.27	62.27	60.65	60.65
1973/74	1.24	36.77	35.26	48.91	52.83	27.76	26.46	43.82	-6.75	39.81	43.99	38.65	39.46
1974/75	1.30	36.42	34.75	57.79	58.59	25.38	23.99	52.12	53.84	44.45	48.77	36.34	35.07
1975/76	1.16	45.12	41.02	131.29	112.78	35.22	27.61	72.81	73.83	51.47	56.80	52.62	45.89
1976/77	1.62	37.29	34.20	91.95	65.56	27.82	23.76	48.18	50.55	36.55	39.97	43.99	41.40
1977/78	1.45	48.27	43.01	106.99	77.35	33.83	29.03	74.99	76.72	45.42	52.73	49.67	47.09
1978/79	1.39	52.90	45.76	113.38	78.00	38.45	35.03	91.69	87.75	53.04	61.55	64.09	60.12
1979/80	1.50	57.30	49.01	110.98	72.47	39.51	36.19	91.72	90.62	50.90	60.39	58.32	58.55
1980/81	1.87	52.95	45.85	118.48	72.98	35.66	35.41	74.47	73.80	40.89	47.50	58.36	52.41
1981/82	1.75	49.30	46.05	131.56	73.67	32.45	34.98	67.50	69.39	49.30	54.47	66.08	45.33
1982/83	1.45	55.83	53.76	158.43	88.09	36.62	37.46	69.50	68.53	67.15	78.41	82.11	44.18
1983/84	1.59	48.58	45.42	147.26	69.36	32.95	33.51	54.38	56.83	60.66	68.52	79.04	41.18
1984/85	1.66	51.12	46.47	167.62	56.82	27.64	31.90	58.65	56.54	53.12	55.59	70.73	35.08
1985/86	1.41	61.59	57.83	204.24	78.22	31.55	32.78	64.70	63.27	55.71	58.61	101.71	43.63
1986/87	1.06	82.08	90.57	194.34	91.51	64.68	60.60	90.85	111.02	68.87	78.30	79.93	177.08
1987/88	1.65	79.39	62.20	54.88	268.95	54.14	58.47	63.13	82.14	48.22	72.57	47.58	241.11

Notes: Ginning conversions were used to convert producer prices for seed cotton to producer prices for cotton lint.

Sources: Producer prices: see previous table.

Ginning ratios: Cameroon: time series from SODECOTON, as cited in Freud, Baris, and Zaslavski, "La Politique Agricole du Cameroun de l'Indépendance à Nos Jours," MADIA Study, 1987. Senegal: 39% from Ministère de la Coopération "Le Coton en Afrique de l'Ouest et du Centre," Paris, August 1987. Nigeria: 33% from de Matharel, "Study of Cotton Marketing, Seed Production and Quality Control," annex ix, Paris: CFTD, 1987. Kenya: 32% from MOA/MCD/CLSMB, "Policies for the Development of the Cotton Sub-Sector," Nairobi: Ministry of Agriculture, March 1987. Malawi: 37% (an average of ginning ratios of 3 varieties) from MOA, "National Agricultural Research Plan," Lilongwe, 1987. Tanzania: 33.5% from FAO/World Bank Cooperative Programme, "Tanzania, Agricultural Sector Review Mission, Working Paper 3: Export Crops," Rome: FAO, July 1987, p. 48.

1985/86, and as low as 44 percent in Tanzania. After the naira was devalued in late 1986, Nigeria's farm gate price was only 48 percent of the *c.i.f.* price of imported cotton lint (Table 8).

Figure 5 charts the evolution of official producer prices for seed cotton in the six MADIA countries, converted to reflect purchasing power parity. Producer prices in Kenya, Malawi, and Nigeria were higher than those in Cameroon and Senegal for much of the period, sometimes by as much as 50 percent. (In terms of purchasing power parity, Tanzania's producer prices were similar to those in Cameroon.) In the last few years, the Cameroonian government has reversed course; it now tends to pursue the most generous cotton producer price policy in Sub-Saharan Africa (Table 9).

By and large, however, a comparison of producer prices across countries does not adequately explain the relative performance of cotton in the MADIA countries. Such measurements mask differences in price levels among countries resulting from differences in transportation costs and exporting and importing status. In order to measure the true comparative incentives to cotton producers, therefore, it might be more appropriate to measure the price of cotton relative to competing crops such as maize or groundnuts.

Table 8
Nigeria: Import parity price for cotton, 1986

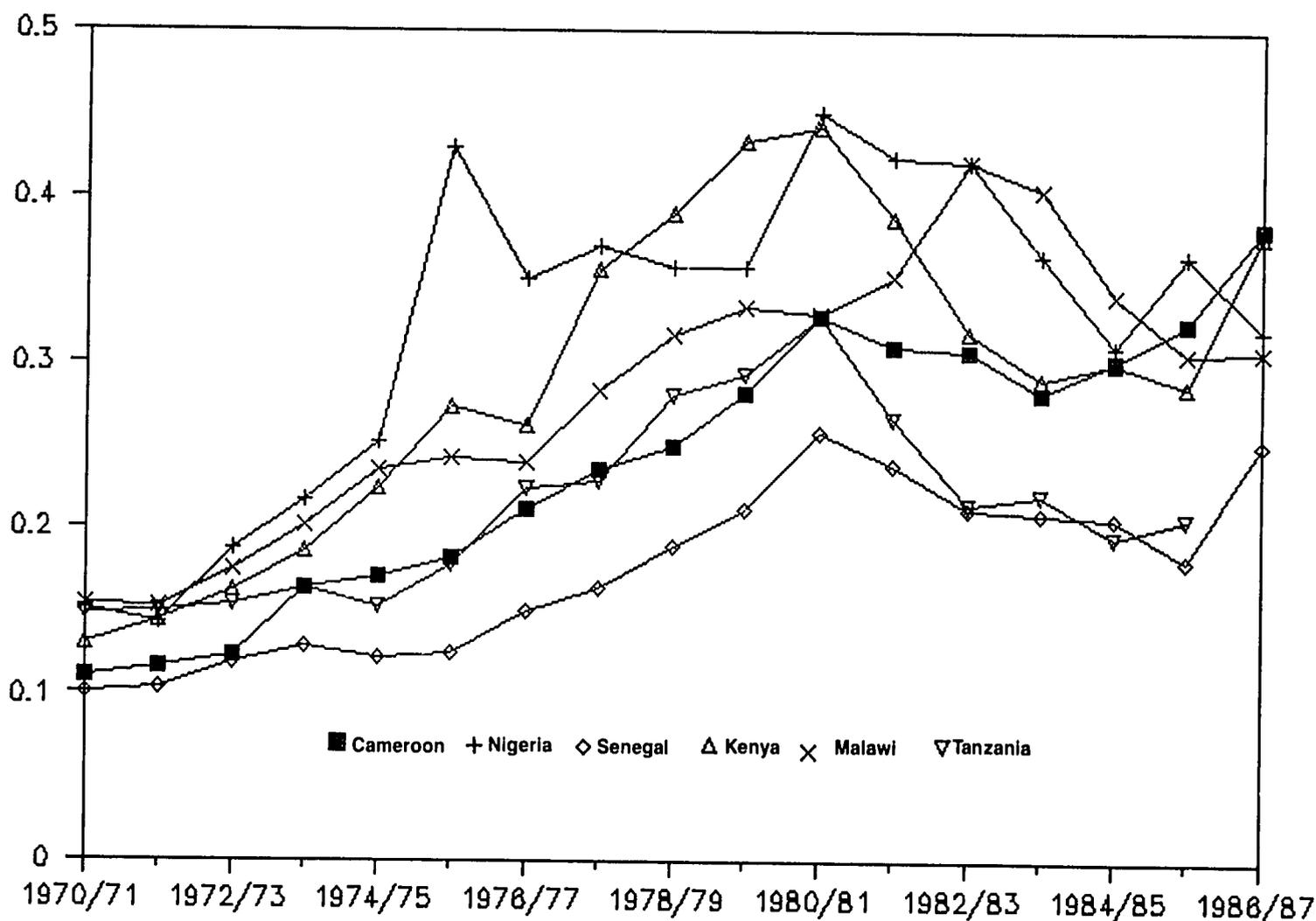
	Naira per ton	Percent of cost at source
Foreign price 1986 ^a (assuming \$1 = N 4)	1,882	75.3
Freight + insurance	400	6.3
C.I.F. Lagos	2,282	91.3
Port fees	49	1.9
Landed border price	2,331	93.2
Transport from Lagos to Kaduna (0.2 N/km for 850 km)	170	6.8
Cost at source	2,501	100.0
Producer price (post-1986 devaluation) ^b	1,200	
Producer price as % of import parity price	48	

Note: ^a Seed cotton equivalent.

^b Since most recent devaluation N 7=\$1.

Source: Uma Lele and Vishva Bindlish, "How Important are the Relative Effects of Economy Wide and Sector-Specific Policies in Explaining the Past Performance of Nigerian Agriculture?" MADIA Study, 1988.

Figure 5
Producer prices for seed cotton converted at purchasing power parity exchange rates in the MADIA countries, 1970/71–1986/87



Source: Table 6

Table 9
Producer prices for seed cotton, deflated by consumer price index (CPI 1980=100)

Year	Cameroon (CFA/kg)	Nigeria (N/kg)	Senegal (CFA/kg)	Kenya (KSh/kg)	Malawi (Kw/kg)	Tanzania (TSh/kg)
1960		0.70				
1961		0.57				
1962	98.41	0.47				
1963	89.12	0.51				
1964	84.25	0.53				
1965	82.45	0.52				
1966	80.44	0.42				
1967	77.61	0.45	92.33			
1968	80.13	0.52	92.24		0.30	
1969	86.87	0.53	88.70		0.30	
1970	82.08	0.43	73.22	3.13	0.32	4.14
1971	81.53	0.37	70.45	3.32	0.29	3.88
1972	75.43	0.43	71.14	3.60	0.31	3.61
1973	83.76	0.44	63.93	3.65	0.31	3.35
1974	80.84	0.46	56.65	4.37	0.32	2.81
1975	71.20	0.68	47.19	4.95	0.30	2.95
1976	82.84	0.56	57.66	4.58	0.30	3.68
1977	85.35	0.49	57.96	5.30	0.32	3.30
1978	75.89	0.41	56.06	5.20	0.30	3.41
1979	76.69	0.36	53.28	4.71	0.27	3.13
1980	80.00	0.40	55.00	4.07	0.23	3.00
1981	81.28	0.38	56.66	3.88	0.26	2.55
1982	83.73	0.39	54.71	3.52	0.31	2.28
1983	78.63	0.35	56.22	3.30	0.30	2.28
1984	89.01	0.31	50.30	3.33	0.27	2.15
1985	93.96	0.36	44.51	3.20	0.27	2.25
1986	91.06	0.48	53.63	3.02	0.24	2.63
1987	83.96	0.45	73.03	2.94	0.25	2.63
Coefficient of variation (%)						
entire period:	7	20	22	19	9	20
1970-85:	6	21	14	18	8	20

Sources: Cameroon: SODECOTON/MOA from Carole Gagne-Gervais, "Cameroon: The Cash Crop Sector: Its Performance and Future Development Possibilities," USAID/Yaoundé, November 1984. Data after 1983: World Bank, "Cameroon: Country Economic Memorandum," 1987. Nigeria: Uma Lele et al. "Nigeria's Economic Development, Agriculture's Role, and World Bank Assistance: Lessons for the Future," MADIA Study, 1989. Senegal: Ministère du Développement Rural, Direction Statistique. Kenya: Uma Lele and L. Richard Meyers, "Agricultural Development and Foreign Assistance: A Review of the World Bank's Experience in Kenya, 1963 to 1986," MADIA Study, December 17, 1986, Table VIII.2. Malawi: MOA, "Ministry of Agriculture Annual Statistical Report," 1986. Tanzania: Marketing Development Bureau. CPIs from World Bank BESD Database.

As Table 10 shows, until the mid-1980s, producer prices moved against cotton (and in favor of maize or, in Senegal, groundnuts) in all the MADIA countries except Malawi. As a result, returns to labor use were generally much higher for food crops than for cotton. Indeed, in Kenya, where nonfarm employment and wages are attractive, it has frequently been argued that returns to labor in cotton are not competitive with off-farm opportunities. In Tanzania, where unofficial maize prices have tended to be between three and four times the official price, relative returns to cotton had eroded substantially by the early 1980s (Table 10); the ratio of cotton to maize prices, which stood at 4:1 in the 1950s had moved to nearly 2:1 in 1987/88. The opposite results in Malawi are due both to relatively favorable prices of cotton vis-à-vis maize and to relatively high cotton yields, reflecting Malawi's superior record in cotton research among anglophone countries (Anthony 1986b). Also, official producer prices for maize have generally been low in Malawi, which until recently was a persistent exporter of maize in an environment of high transportation costs (Lele 1989a; Lele 1989b).

Productivity differences across countries may be more

important than producer price differences in explaining the relative profitability, and hence the relative performance, of cotton in the MADIA countries. Relative profitability at the farm level changes, for example, if the value and timeliness of different input subsidies are factored into the analysis and net returns to cultivation are calculated. Prior to structural adjustment reforms, all six MADIA governments provided free seeds and subsidized sprayers, insecticides, fertilizers, and credit. However, as shown in Table 3, modern inputs were widely used only in Cameroon and Senegal, where delivery systems operated effectively. In the other countries, family labor tends to be the only significant input in cotton production. The "effective" input subsidy element is thus greater in Cameroon and Senegal than in the other four countries.

Two important issues need to be investigated in this context—(i) the profitability of cotton at the farm level under alternative technologies and the relative returns to labor in cotton vis-à-vis other agricultural or nonagricultural pursuits, and (ii) the comparative advantage of cotton production in Africa under alternative technological scenarios.

Table 10

Ratio of seed cotton to competing crop (maize or groundnut) prices in the MADIA countries, 1964/65-1987/88

Year	Cameroon		Nigeria	Senegal	Kenya	Malawi	Tanzania	
	Producer price for maize	Consumer price for maize	Producer price for groundnut	Producer price for maize	Producer price for maize	Producer price for maize	Official price for maize	Open market price for maize
1964/65			1.50					
1965/66			1.50					
1966/67			1.50					
1967/68			1.50					
1968/69			1.90			2.73		
1969/70	1.88		1.61			3.23		
1970/71	1.76		1.61			3.38		
1971/72	1.77		1.62		3.54	3.28		
1972/73	1.72		1.30		3.18	3.37	4.23	
1973/74	1.90		1.34		2.97	2.87	4.58	
1974/75	1.79		1.15		3.13	3.43	4.35	
1975/76	1.23	0.78	1.01		3.37	4.34	3.42	
1976/77	1.72	0.72	1.13	2.04	2.74	3.77	2.73	
1977/78	1.44	0.61	1.13	1.41	2.71	2.25	2.50	
1978/79	1.30	0.86	1.18	1.13	3.24	3.52	2.50	
1979/80	1.17	1.06	1.33	1.49	3.54	3.94	2.71	
1980/81	1.33	0.82	1.32	1.57	4.26	4.19	2.82	
1981/82	1.38	0.69	1.36	1.43	3.48	3.25	3.00	
1982/83	1.50	0.83	1.11	1.87	3.41	3.24	3.20	
1983/84		0.72	1.11	1.87	3.26	2.45	2.47	
1984/85		1.03	1.11	0.96	2.40	3.39	2.69	0.58
1985/86		0.91	1.25	1.16	2.56	3.31	2.73	0.70
1986/87		0.93	1.11	2.05	2.67	4.10	2.10	0.74
1987/88			1.36		2.63	3.90	2.68	2.05
					2.63	3.90	2.37	

Sources: Cameroon: Cotton prices are from SODECOTON data. Maize prices are from FAO, "Statistics on Prices Received by Farmers," Rome: FAO, 1984. Maize consumer prices from Direction de la Statistique et de la Comptabilité Nationale. Sénégal: Sidi Jammeh and Chandra Ranade, "Agricultural Development and Foreign Assistance to Senegal: A Review of the World Bank's Experience in Senegal, 1969-1986," MADIA Study, March 1987. Nigeria: Uma Lele et al., "Nigeria's Economic Development, Agriculture's Role and World Bank Assistance: Lessons for the Future," MADIA Study, 1989. Kenya: Lele and Meyers, "Agricultural Development and Foreign Assistance: A Review of the World Bank's Experience in Kenya, 1963 to 1986." Data for 1986/87 from Ministry of Agriculture. Malawi: ADMARC Reports and Ministry of Agriculture. Tanzania: Marketing Development Bureau, and United Republic of Tanzania, Ministry of Agriculture and Livestock Development, "Annual Review of Agricultural Marketing, 1987," Dar es Salaam, 1988.

Farm-level analysis. For the farm-level analysis, the important issues are the extent to which cotton production is economically viable either for internal consumption or for exports, and whether under traditional low input/low yield extensive production technology or modern high input/high yield intensive technology—all in the context of rapidly changing exchange rates, leading to very substantial changes in the prices of tradeables (inputs and outputs) vis-à-vis nontradeables (e.g., labor). To make such an analysis, the following building blocks are required: (i) the factors influencing returns to labor in cotton vis-à-vis other alternatives under traditional and modern technology; (ii) the economic value of these factors, and (iii) the costs of developing and maintaining a cotton industry in the context of growing macroeconomic imbalances. Data limitations allow only very preliminary judgments on these important questions.

The example of Cameroon indicates that relative returns to cotton may be better if production involves the use of modern technology. In Cameroon, under high input/high yield technology, especially with the use of animal or motorized traction, returns to cotton production are substantially above both the minimum wage and returns to food crop production even though Cameroonian wage rates and food prices have been high. The need for complementarity in the introduction of mechanical and biological technology is important to stress in this context. On the one

hand, the use of traction is often economically unjustifiable without the increase in yields made possible by improved varieties. On the other hand, without labor-saving technology at the critical stages of planting, weeding, and harvesting, labor shortages can make the application of modern inputs economically infeasible. This is the case in the anglophone countries, where labor use in cotton competes with that in food crops. Of course, successful development of cotton can also increase food security by increasing the level and stability of incomes (Weber et al.).

However, there is some question whether, at current producer and input prices, the application of more intensive modern technology provides high returns to factors of production, especially labor (which is still the most critical input in African agriculture), in the absence of subsidies. For example, Carr has documented that, with the devaluation of the Tanzanian shilling, the kilograms of cotton required to purchase insecticides increased five-fold (from 79 kilos in 1970/71 to 414 in 1988/89). Even after inefficiencies in cotton and input marketing and prices are corrected, the majority of farmers will not obtain a marginal return of 2 to 1 (considered the minimum incentive needed) from using recommended pest-control practices. Carr concludes that most farmers will continue their present tactic of using insecticides only when a localized pest attack is particularly severe. Thus, cotton production in Tanzania will continue to depend largely on the area allocated to cotton, which in

turn is a function of the extent to which demand for food makes cotton production attractive (Carr 1989).

For the present analysis, we have estimated returns to person-days of labor on the basis of farm-management data on production costs for cotton for all MADIA countries. These estimates were then compared to returns to labor from alternative forms of employment, with the results shown in Table 11. The calculations are complicated by methodological issues as well as by the poverty of data on actual farm-level practices and yields. Nevertheless, they help to explain the shift of labor away from cotton in such countries as Kenya and Nigeria, where farmers use low input/low yield technology. In both countries, nonagricultural employment opportunities have grown, and returns to cotton production are low compared to any other form of labor earnings. In Kenya's case, this is not due to acute macroeconomic policy distortions of the sort found in Nigeria, although the agronomic, disease and pest problems encountered in Kenyan cotton production make the problem of increasing productivity particularly vexing.

In West Africa, Cameroon's high cotton yields make the crop profitable. Indeed, when animal or motorized traction is used, cotton has a 50 to 100 percent advantage over maize even though, as has been noted, maize prices have

risen substantially faster than cotton prices over time. This is in part because the use of animals or, particularly, motorized traction reduces labor requirements from 115-120 person-days per hectare to about 60 days. Mechanical cultivation does not have the same dramatic effect on returns in other MADIA countries because of their low yields, however. Thus, in Nigeria, despite relatively favorable prices, very low yields reduced cotton's profitability relative to maize until 1987, when seed cotton prices were raised. In Senegal, on the other hand, cotton's profitability has eroded despite relatively high yields (albeit lower than Cameroon's) and subsidies on inputs, owing to a producer price that is the lowest among the MADIA countries.

The analysis so far has assumed that official producer prices of cotton are in fact the relevant measure for calculating returns. In Nigeria, Kenya, and Tanzania, however, cotton producers are rarely paid on time (with delays of up to 9 months in Kenya and up to 2 years in Tanzania), nor do producers receive the full official price. An instructive comparator in this regard is Senegal, where the *Caisse Centrale de Coopération Economique* (CCCE) provides working capital to the Senegalese cotton parastatal, SODEFITEX, thus ensuring timely payments to cotton producers.

While it is tempting to attribute the payment problem in

Table 11
Returns to labor from cotton and alternate agricultural and nonagricultural employment in the MADIA countries (in US\$ per day, using official exchange rates)

	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
Cotton:		1.05	1.85	0.38	2.45	
Manual	2.85					0.91
Animal Traction	5.45					1.10
Motorized	7.39					1.44
Alternate Crops:						
Sorghum/Millet	3.78	1.87				
Maize	4.52	2.84	3.00	1.58	1.22	2.04 ^a
Groundnuts	3.43		2.08			6.05 ^b
Rice	4.33	6.50				
Sugarcane				6.70		
Coffee				3.83		
Tea				3.82		
Alternate Employment:						
Farm Labor		5.59				
Hired Labor	4.77				0.70	
Sugarcane Estate				0.54		3.20
Family Labor	0.90					
Government Farm Worker				0.81		
Municipal Govt. Employee				1.72		
Min. wage, private sector	2.00		4.25			
Min. wage, public sector	1.73					

^a Returns to labor for maize at official prices.

^b Returns to labor for maize at open market prices.

Sources: Cameroon: All data calculated from price (1986/87), labor use and yield information in Price Waterhouse Assoc. (Africa), "SODECOTON - Mission de Diagnostic," Annex Table 14, January 1987. Cotton calculations based on 115 days/ha (manual labor); 75 days/ha (animal traction); 60 days/ha (mechanized traction); maize: 65-70; sorghum/millet: 62; groundnuts: 78-90.

Nigeria: Uma Lele et al. "Nigeria's Economic Development, Agriculture's Role and World Bank Assistance: Lessons for the Future," Ch.5, MADIA Study, 1989.

Senegal: data from: République du Sénégal SODEFITEX, "Programme de Sauvegarde et d'Ajustement Colonial," Dakar, 1987, p. 55. Assumptions made: a/ cotton: use of 200 kg NPK and 3 pesticide treatments; b/ groundnuts: extensive cultivation; c/ maize: use of 16 kg of pre-chosen seed.

Kenya: numbers calculated from labor use data from Kenya Development Planning Division, Working paper (1987) provided by Michael Westlake, Ministry of Agriculture, Nairobi, Kenya. Calculations based on 115 days of labor per ha for cotton; sugarcane: 280 days/ha; maize: 148; coffee (smallholder): 342; tea (smallholder): 486; price and yield information from Michael Westlake and MOA.

Malawi: numbers calculated from price and yield information from ADMARC figures and MADIA database. Labor use assumptions: cotton: 115 days of labor per ha; maize: 78. Data from Cox and Spurling, "Unit Farms in Malawi," Bvumbwe Research Station.

Tanzania: numbers from Ministry of Agriculture and Livestock Development, "Annual Review of Cotton," Dar es Salaam, 1987 and "Price Policy Recommendations for 1985 Agricultural Price Review," Dar es Salaam, 1985. Assumptions made: a/ sugarcane number assumes all family labor; b/ maize numbers assume price, yields, and labor use for "high potential" variety.

Exchange rates from IMF, *International Financial Statistics*.

Kenya and Nigeria to the erosion of cotton profitability resulting from currency overvaluation, this argument does not necessarily apply. In Kenya, the exchange rate has not been greatly overvalued, and in both Kenya and Nigeria cotton producers cater mainly to an internal market. Rather, one must conclude that when cotton payments *per se* become uncertain, high official producer prices and input subsidies have little positive impact on producer growing decisions.

In this context, the annual nature of cotton cultivation is worth stressing. Unlike perennial crops such as coffee or cocoa, cotton does not require many sunk costs, so the producer needs to be persuaded anew to plant cotton, and his/her reaction to uncertainty is swifter. In general, the elasticities of cultivated land to price changes tend to be much larger in areas devoted to annual crops than in those of perennial crops, which occupy land quasi-permanently. The short-run elasticity for perennial crops is often estimated to be almost nil. Short-run elasticities for cotton acreage, in contrast, range from 0.13 to 1.84 for MADIA countries.³ As to price elasticities of *output*, the largest short-run (current to two-year lagged periods) elasticity of a perennial crop is reported in a comprehensive study by Askari and Cummings to be 0.87. However, as Askari and Cummings report, short-run output elasticity can be as high as 1.95 in the case of an annual crop such as cotton, and we have found elasticities as high as 2.02 for Nigeria and 2.06 for Kenya (see Annex Table 1).

In conditions of uncertainty, producers tend to attach more importance to food security (even though cotton, being less susceptible to drought than maize, is attractive both for spreading the risk of crop failure and as a source of cash income). Thus, the characteristic prudence of producers in the face of uncertain returns to cotton seems to explain the wide swings in seed cotton acreage and production in Tanzania, in addition to their overall stagnation. It also helps to explain the persistence of intercropping of food crops with cotton in the anglophone countries. The uncertainty of payment and lack of an effective price support also clearly decrease the incentive for cotton producers to invest in such technology as sprayers and pesticides, which would allow intensification and higher yields. The fact that the least-performing cotton-producing countries are those where the variability of prices is also the largest (see Table 9) attests to the importance of effective price support. The consequences of the lack of effective producer prices are visible in the large variability of acreage devoted to cotton in the countries where producers face high price variability for both cotton and competing crops.

Comparative advantage. The second, related issue for assessing variations in performance is the comparative advantage of cotton production in Africa under alternative technological scenarios, given rapidly declining soil fertility, growing population pressure, and the increasing attractiveness of food crop production (and nonagricultural employment), on the one hand, and stagnant or slowly increasing international cotton prices and the rapidly increasing cost of imported inputs, on the other.

Although the concept of domestic resource cost (DRC) does not reflect the costs of developing and maintaining smallholder production, DRC estimates provide a practical and simple way to rank crops in terms of their comparative costs or foreign exchange earnings or savings. These estimates need to be used with caution, however, espe-

cially when drawing inferences of comparative advantage in the production of a specific crop on a cross-country basis and over time. Variations in assumed shadow prices of domestic factors and exchange rates, for example, will influence the DRC estimates and, thus, the conclusions as to which country has the comparative advantage or the extent to which it has gained, maintained, or lost the comparative advantage over time. A review of various DRC estimates made by the Bank's operational staff suggests, for instance, that the DRCs for cotton production in Nigeria (included in the Agricultural Sector Review of September 1987) assumed a seed cotton yield of 1000 kilos per hectare. On this basis, cotton production in Nigeria seems "more advantageous" than in Cameroon or Kenya. But Nigeria's reported average cotton yields for the past three decades never rose above 350 kilos per hectare. A more realistic set of assumptions should show a higher DRC for Nigeria; and that cotton in francophone African countries is at least as efficient a producer of foreign exchange as in Nigeria even though the francophone countries have been heavy users of imported technology, with all DRC's being less than one. This happens partly because of the yield difference. If francophone DRC's are adjusted for the overhead cost of expatriate assistance, the figures should be slightly higher.⁴ Nevertheless with the declining number of expatriates in the francophone countries' cotton companies, and given the fact these latter companies now have a mandate far beyond cotton development, it is necessary to revise downwards the costs pertaining specifically to cotton production.

Measuring Price and Nonprice Factors

Two important issues for the future of cotton production in Africa are the extent to which nonprice factors can increase productivity of cotton and whether subsidies are needed to maintain and develop cotton production as an export crop or as a cheaper alternative to importing cotton to meet internal demand. The answers to these questions require, first of all, an understanding of the relative importance of nonprice factors in cotton supply response.

We have developed a set of models featuring price and proxies for nonprice variables to see if their relative importance can be measured. (See Annex 1 for a full discussion of methodology.) Whereas price variables are included in the models explicitly, the effects of nonprice factors are assumed to be the *residual effects* on cotton output after price effects have been taken into account. There are several reasons for this. First, data on nonprice factors such as investments in research and development (R&D), extension, infrastructure, and quality of management are hard to come by. In addition, the inclusion of nonprice factors into a single-crop supply model raises the conceptual problems described in Annex 1. Also, since output prices are not always paid nor inputs delivered in timely fashion, the extent to which a price effect or a nonprice effect is at work is difficult to discern. We have considered the ability or inability of institutions to deliver inputs or make timely payments as a nonprice factor, although it has price effects by influencing the profitability of cotton production. By using only the relative output prices of cotton vis-à-vis maize as the price variable, we would risk understating the importance of the price response by not capturing the effects of nonprice actions on prices themselves. Where inputs delivered on time are subsidized but captured in institutional nonprice variables, price elasticity coefficients clearly understate the role of prices. Furthermore, where

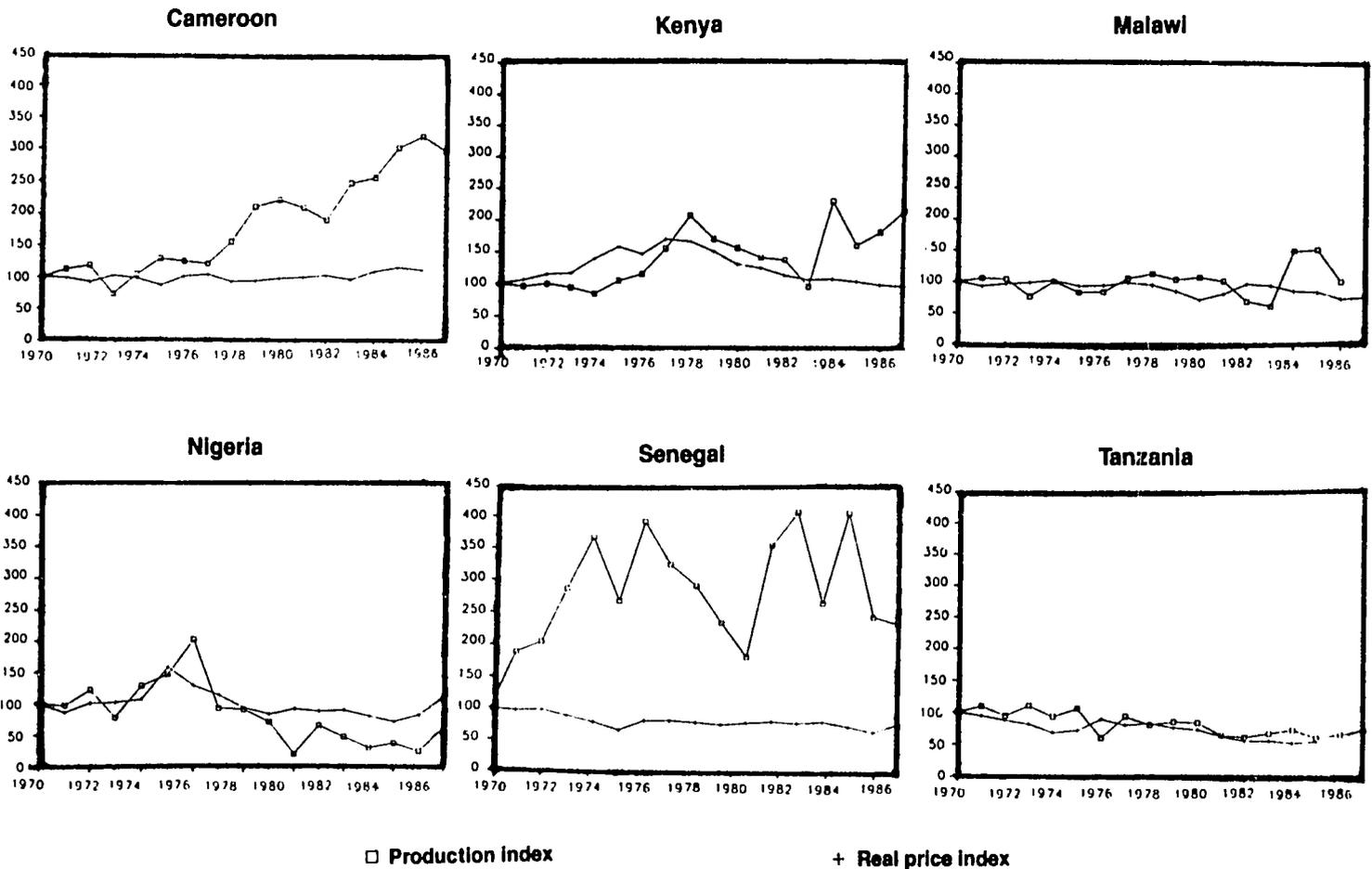
subsidies are not included, price effects are overstated. Few estimates of price elasticities, including those reported in the seminal study of Askari and Cummings, have attempted to capture these complex interactions, in part because of the difficulty of obtaining relevant data.

In an attempt to provide a quantitative measure of the importance of nonprice factors, we have run two sets of regression models to explain production and yield variations in the MADIA countries as a function of price, weather, and institutional variables. The models show that nonprice factors, as proxied by a time trend following the traditional way of accounting for supply shifts—almost invariably have a more significant impact on production and yield than prices alone. That is, the coefficient of the time trend was significantly different from zero more often than was the coefficient of the price variable.

The significance of nonprice factors in the MADIA countries is even better illustrated by simply plotting the production levels of seed cotton together with its real

producer price (see Figure 6). In countries where the institutional support to cotton production (including input subsidies) has been more effective, the supply of cotton has effectively shifted outward, and nonprice factors, as defined here, explain most of the variations in production levels. Nonprice factors, through various schemes (research, credit, and subsidized inputs), have allowed procurement prices to remain more or less constant in real terms (in Cameroon) or have compensated for the adverse effects of declining real prices (in Senegal). By contrast, in countries where there has been no significant technological change via mechanized or even ox-plough cultivation (or via fertilizer and pesticide use) and no significant institutional improvement—i.e., where labor is the only major factor of cotton production—the relative price of cotton vis-à-vis competing crops has been the most important factor of cotton supply response. This explains why price elasticities are higher in Nigeria and Kenya than in Cameroon and Senegal.

Figure 6
Production and real price indices for seed cotton in the MADIA countries, 1970-87 (1970 = 100)



Note: Producer prices deflated by Consumer Price Index (1980 = 100).
Source: Tables 2 and 6.

Explaining Variations in Performance—Nonprice Factors

Given declining soil productivity and the rising profitability of food crop production, the question arises whether cotton production can be made attractive relative to food crops for internal consumption, and perhaps even exports, without improvements in technology and input delivery and, if necessary, subsidies on inputs. These and other nonprice factors have a major impact on cotton performance in the MADIA countries, as the following discussion will show.

Agro-ecological Factors

Cotton can be produced under a wide range of temperatures and rainfall conditions (between the extremes of 12-40 degrees Celsius, and at a minimum rainfall of 300 mm per annum), provided that temperatures and rainfall are sufficient at appropriate phases of its growth cycle. It can also be grown on a wide spectrum of soil types and tolerates a wider range of soil acidities than most other crops. Table 12 summarizes the diversity of agro-ecological conditions in which cotton cultivation takes place in MADIA countries. In general, the lower the altitude, the better the growing conditions. Good drainage is an important factor, since shallow or clayey soils that are prone to excessive waterlogging are unsuitable for the plant. In addition, strong winds, as are found in pockets of northern Nigeria, can have a deleterious effect. Pests and diseases are a particularly serious problem, especially under the low input/low yield approach to cotton production that is prevalent in Kenya.

By far the most serious and controversial problem relates to the environmental impact of cotton production. Major crises may be brewing in a number of countries, especially in francophone West Africa (World Bank 1988), where the impressive growth of areas under cotton cultivation has been associated with deforestation, erosion, and soil exhaustion. Certainly, evidence of declining soil fertility in

Tanzania due to continuous cultivation, and cotton's lack of responsiveness to fertilizers during research trials near Ukiruguru, suggests that environmental problems—though they are not unique to cotton or to Sub-Saharan Africa—are more complex than previously recognized and have not received the attention they deserve.

Controversy arises because the long-term autonomous effects of population growth are difficult to separate from those resulting from cotton production price incentives. Traditional cultivation systems relied on an extremely long fallow period to allow soils to rejuvenate and regain organic matter. As long as population densities were low, this fallow system amply compensated for the fragility and low quality of soils in most cotton areas. But population has been increasing. The crop's success has halted the rural exodus in francophone cotton-growing areas and, in the case of Southeast Benoué in Cameroon, has attracted large numbers of immigrants, who tend to overexploit the soils. As a result, areas under cultivation have increased and fallow periods have shortened, if not disappeared entirely. The intensification package used for cotton, particularly in the francophone countries—fertilizers, pesticides, animal traction—quickly reveals the general process of declining fertility, which is less conspicuous in traditional cropping conditions. These problems are exacerbated by land tenure systems where titling and land rights are uncertain.

Technical as well as socioeconomic solutions to these problems urgently need to be formulated. These solutions need not imply the abandonment of cotton. But because cotton is often grown in ecologically poor regions highly susceptible to environmental degradation, cotton producers may need to be even more conservation-minded than their counterparts in forest areas. Cameroon's SODECOTON, in particular, needs to become more responsive to conserva-

Table 12
Agro-ecological conditions in cotton cultivating regions of the MADIA countries

	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
Soil Types	Lithosols ^a (Benoue Valley); Vertisols;	Regosols; Lithosols; Vertisols; Laterites;	Ferralitic; Ferruginous Lithosols;	Cambisols; (Coast) Vertisols; (Western)	Ferruginous w/ Lithosols; Ferralitic w/ Laterite; Calciumorphic; Alluvial;	Loamy soils; Granitic soils (Geita); Alluvial black cotton soils
Soil Chemistry	variable pH's	variable pH's	variable pH's	variable pH's	variable pH's	variable pH's
Mean annual temperatures (in Celsius)	18-39	19-40	15-40	16-35	20-35	15-28
Rainfall average (in millimeters)	500-1,300	300-750 ^b	600-1,200 ^c	800-1,450	800-1,000	600-1,000 pockets of 1,000-1,450
Altitude (in meters) (in Coastal province)	200-800	300-600	50-350	900-1,220	500-1,000	1,000-1,500

Notes: ^a Poor drainage at times.

^b to 8 months with less than 100 mm rainfall.

^c For Haute Casamance region where approximately 60% of total cotton in Senegal is produced.

Sources: All information found in various agricultural atlases. Information on soils, rainfall averages, and altitudes in Cameroon from personal correspondence with F. Bocchino, General Manager, CFDT, Paris, 1988. Information on soils in Tanzania: Michael Collinson, "Cotton Development in Tanzania: A Review of the Cotton Program in Sukumaland," Africa Rural Development Study Background paper, World Bank, September 1974.

tionist concerns. Being a paternalistic organization, it may be better able to address these concerns than parastatals in other, especially anglophone, countries.

Cotton as an Instrument of Regional or Political Equity

Since cotton is often grown in poor regions,⁵ the cotton industry has become an important instrument of governments' regional development and income distribution goals. In the Sahelian francophone countries, where production possibilities are very limited, for example, cotton development is often the cornerstone of a whole rural development strategy, a tendency that is reinforced by the fact that many of the cotton parastatals have now evolved into regional development agencies. In Kenya, the promotion of cotton has been perceived as a way of improving regional income distribution and countering the long-standing tendency, dating back to the colonial period, for males to migrate out of the western cotton-growing areas in search of off-farm employment (Kenya, Ministry of Agriculture 1962). Regional development programs have played a particularly positive role in the expansion of cotton in the francophone countries of West Africa, where CFDT's presence has allowed a more technocratic approach to cotton development to prevail.

Anglophone countries—for many country-specific ethnic, ideological, and political reasons that are beyond the scope of this paper—have shown a greater tendency to let economic, political and ethnic factors to dominate their relatively more decentralized cotton sectors. Thus, Kenya has promoted development of private and cooperative enterprises at least partly as a counterweight to Asian domination, dating from the colonial period, of the cotton marketing and processing industries. Nevertheless, relative to tea and coffee, cotton is an unimportant crop in Kenya both economically and politically. This lack of political clout may help to explain why the marketing and processing industries are not yet fully owned and operated by Africans. The extent to which this is a result of the complex problems of the cotton sector, which discourage African entrepreneurs from investing in marketing and processing (given other, more lucrative options)—as distinct from the unwillingness of the government to allow Kenyan private entrepreneurs to proceed—remains a highly debated issue, especially in the context of liberalization of the cotton industry, proposed by the World Bank as part of the structural adjustment process (see below).

In Tanzania, cooperative ginneries expanded rapidly in the 1960s in the traditional Western Growing Area of Sukumaland, Mwanza, and Shinyanga, in part reflecting the clout of the cotton producers, given the importance of the crop in the national economy. However, since the early 1970s, the role of the export crop producers and producer-dominated cooperatives has been undermined. The ruling political party (the Tanganyika African National Union, TANU, and later, the Chama Cha Mapinduzi, CCM) came to perceive them as a competitive political force, and the producers have become increasingly alienated from the political process (Hanak 1988). During the 1970s, Tanzania also took a political decision to decentralize governmental power to regional administrations, which eroded the role of the functional ministries generally. For cotton, the result has been a more loosely organized cotton industry with less effective technical services from the Ministry of Agriculture and a major setback for agricultural research and extension (World Bank 1983c).

Given that cotton is often grown in marginal areas where the farmer's concern for food security and risk abatement is high, a particularly consistent set of policies is needed for cotton cultivation—not simply toward the cotton subsector, but toward the production environment in general. Government policy toward improvement of the transport infrastructure, together with good price and supply stabilization, could have helped to avert the extreme production swings that were seen during the Sahel drought of the early 1970s, for example. Lele has pointed out elsewhere how unstable supplies of maize in government outlets during the 1970s prompted producers in rural Tanzania to minimize their dependence on problematical and expensive market supplies and to grow more maize for domestic consumption (Lele 1984). During the 1960s, in contrast, Collinson observed increased purchases of food by producers and a parallel shift in acreage to cotton cultivation (Collinson 1974).

Institutional Factors

Some key institutional factors have played a role in ensuring the effectiveness of incentives to cultivate cotton in the MADIA countries. These factors can be subdivided under three headings: (i) those that bear directly on the profitability of cotton through their effect on price factors, (ii) those that have enhanced technological know-how and support to the cotton industry, and (iii) those that help improve marketing options. Under the first heading, one can cite: prompt payment and stability of prices received by the producers; timely delivery of inputs and their sale at predictable price levels; and the ability to secure credit to purchase inputs. The second set of technology-related institutional factors includes: research and extension; infrastructural complexity, especially the density of roads and buying posts in cotton-growing areas; and, finally, the quality of upstream activities to ensure reliability of supply to ginneries and speedy processing of the raw seed cotton. Diverse combinations of private/public and vertically integrated/decentralized support systems as well as weak/strong market mechanisms are possible.

Input and output price supports. There are great differences between francophone and anglophone countries in the effectiveness of output and input price supports which have directly affected the profitability of growing cotton. In Cameroon and Senegal, cotton farmers are paid on time, have inputs delivered to them on time, and benefit from credit and active research and extension, as well as from input subsidies. In those countries, the use of modern inputs is growing steadily. By contrast, before recent structural reforms in Kenya, Tanzania, and Nigeria, not only were payments to farmers delayed by six to nine months or more; improved seeds were distributed haphazardly, with frequent complaints of late and unpredictable deliveries, insufficient quantities, and uneven or degraded quality. Inputs such as sprayers and insecticides were frequently unavailable to farmers in Kenya and Tanzania because cooperatives lacked enough working capital to buy and store appropriate stocks. These factors, along with the effect of continuous cultivation without a proper fallow period, and aggravated by suboptimal use of fertilizers, have led to soil exhaustion and to falling yields.

Even after the 1986 structural reforms, however, and apart from a number of logistical problems, questions remain as to the technological and financial viability of input use in East Africa. Years of research trials near Ukiuguru, for example, have shown an erratic response of continuously

cultivated cotton to fertilizer use. This high degree of risk, together with the increased cost of imported inputs, now make input use unattractive to producers without a subsidy.

To isolate the sources of problems and to undertake effective remedies, it is important to know to what extent the organizational environment produces differences in the effectiveness of service delivery. Organizational arrangements in both anglophone and francophone Africa have come under fire during the structural adjustment process, albeit for different reasons. Table 13 illustrates how the cotton subsector is organized in the different MADIA countries. The diversity of arrangements of the support systems is striking, in particular the different roles played by public institutions. Also of considerable interest is the extent of integration of the cotton sector and its effect on management. Cameroon and Senegal are at one extreme, with public sector institutions dominating the entire subsector from farm gate to processing and export.

In *Cameroon*, SODECOTON, which was established in 1974, is expected to act as an agent of government policies in the northern provinces, rather than as a profit-oriented enterprise limited to cotton production and marketing. Thus, it undertakes some applied cotton research on behalf of the Institute for Agronomic Research (IRA), the public research institution for the agricultural sector, and supports an extension force of about 650, reaching about 140,000 farmers. It is also the major source of rural credit in the

northern provinces of Cameroon and the provider of all agricultural inputs. In addition, it owns and operates the commercial ginneries and oil mills and has an important equity in *Cotonière Industrielle du Cameroun*, CICAM, the country's only textile factory. Perhaps most important, SODECOTON has taken an increasingly active role in promoting food crops. Its extension agents have advised farmers on maize, rice, and groundnut cultivation and have engaged in some marketing.

All these activities make SODECOTON the dominant rural development institution in North Cameroon. In 1986/87, its activities generated CFAF 15 billion (about US\$ 43.3 million) in income, including some CFAF 2 billion in the food crop sector, for the region's rural population. Reflecting its importance, SODECOTON has had a role in the implementation of all the major rural development projects financed by international donors. In *Senegal*, much the same can be said of the dominant role of SODEFITEX in the cotton region, although the presence of groundnuts as a competing cash crop has reduced its regional importance, especially given the relatively more attractive producer prices for groundnuts since the early 1980s.

CFDT's involvement in francophone Africa has raised the question of whether integration of services or CFDT's presence *per se* has been the source of SODECOTON's success. This is difficult to establish empirically; one can, however, stress that countries such as Zimbabwe, which

Table 13
Organization of the cotton sectors in the MADIA countries

	Cameroon	Nigeria	Senegal	Kenya	Malawi	Tanzania
Research:	IRA	Research institute linked to university.	ISRA	MOA	MOA	MOA/Parastatal TARO
Extension:	SODECOTON	Ministry of Agriculture	SODEFITEX	MOA	MOA	MOA
Cotton Seed:	SODECOTON	Ministry of Agriculture	SODEFITEX	CLSMB	MOA	TCMB
Fertilizer:	SODECOTON	Licensed private merchants	SODEFITEX	CLSMB (from MOA)	MOA	TFC/Parastatal
Pesticide:	SODECOTON	Licensed private merchants	SODEFITEX	CLSMB (from MOA)	MOA	TCMB
Credit:	SODECOTON	National banking system	SODEFITEX	CLSMB (from MOA)	MOA	Coop Rural Development Bank/ National Bank of Commerce/ Tanzania Investment Bank
Farm gate purchasing:	SODECOTON	Private/semi-public companies	SODEFITEX	CLSMB/Coop Unions/Private Firms	ADMARC	Cooperative Societies
Ginning:	SODECOTON	Private/State	SODEFITEX	CLSMB/Coop Unions/Private Firms	Private	Cooperatives/ Private
Oil Milling:	SODECOTON	Private/State	SONACOS	CLSMB/Coop Unions/Private Firms	Private	Cooperatives/ Private/Parastatal
Transport:	SODECOTON + private	Private	SODEFITEX/private	CLSMB/Private fleets	ADMARC/Private	Cooperatives/ TCMB
Export Marketing:	SODECOTON	Private	SODEFITEX	CLSMB	ADMARC	TCMB
Textile:	CICAM	Private	ICOTAF/STS/CCV & SOTEXKA	Private	Private	TEXCO

Sources: Cameroon: Ministère de la Coopération, "Le coton en Afrique de l'Ouest et du Centre," Paris, August 1987, p. 18.

Senegal: Ministère de la Coopération, "Le coton en Afrique de l'Ouest et du Centre," Paris, August 1987, p. 18 and from personal correspondence with Francois Bocchino, General Manager, CFDT, Paris, 1988.

All other countries from various internal World Bank documents.

have brought to bear a similarly professional approach, have also succeeded in cotton. CFDT's managerial role, while diminished over time, remains important in Cameroon, as elsewhere in francophone Africa. However, as pointed out earlier, the cotton sector of Mali and Côte d'Ivoire, where cotton production is even more successful, are close to fully indigenized. At the end of 1986, 38 expatriate CFDT agents were still subcontracted to SODECOTON in an advisory management role, as well as to support extension, ginning, and transport services. CFDT also procures some imported inputs and spares through its own purchasing division in Paris. And it has been influential as a link between the donors and SODECOTON, serving as a project consultant for the World Bank, for example. Indeed, CFDT helped prepare the US\$25 million Northern Province Rural Development Loan (in addition to the SDR 9.5 million IDA loan) that SODECOTON executed on behalf of the government. In addition, CFDT still holds 30 percent of SODECOTON's capital, as well as equity positions in CICAM and *La Compagnie Colonnière*, the agent in charge of most cotton exports, which acts as sales agent for SODECOTON. Despite its obvious importance, however, the presence of CFDT itself need not be crucial. Rather, our analysis indicates that CFDT's professional *approach* is the important factor.

The example of Kenya contrasts strongly with that of Cameroon. The Cotton Lint and Seed Marketing Board (CLSMB) was created in 1955 to serve as the Kenyan government's main instrument for intervention in the cotton sector, but it is much less vertically integrated than SODECOTON. The Ministry of Agriculture (MOA) undertakes most activities upstream of cotton production and supplies CLSMB with seeds, insecticides, sprayers, and land preparation services, which are then distributed to producers either free (seeds) or on credit plus a fee of 12 percent of purchase cost (all other inputs). CLSMB is not directly involved in food crop production or in any other aspect of rural development outside of cotton. Because CLSMB is formally responsible for the purchase, transport, and processing of seed cotton, it appears to many reviewers to be an integrated operation. In practice, however, CLSMB has delegated many of these functions to cooperative unions and private firms. Nine cooperatives or privately owned ginneries coexist with CLSMB's own five ginneries. In recent years, CLSMB has used private transporters to supplement its own fleet. It is not involved in cotton oil refining, which is entirely in the hands of the private sector.

CLSMB helps farmers to purchase inputs by providing them with interest-free credit through MOA and the cooperative societies (though the latter are notoriously corrupt and farmers complain of late and nonpayment for their cotton). It also extends interest-free credit to cooperative unions and societies to provide them with working capital for their ginning operations. Loan recovery has been a serious problem. As early as July 1980, CLSMB had the equivalent of US\$5 million in outstanding loans, evenly distributed between farmers and ginneries. Debts have increased because of the need to finance below-cost sales of cotton lint to the textile industry, where domestic lint competes against cheaper imports. While this is necessary to ensure a steady flow of lint for the gins, it is a function for which CLSMB is not equipped financially. The situation worsened in the early 1980s, before the world cotton market collapsed in early 1986. (The domino effect on cotton productivity of the marketing parastatals' poor financial

status has been evident not only in anglophone Africa, but even in Cameroon. While SODECOTON has been well funded, its weakened financial status since 1986 has reduced its ability to provide inputs to producers, which in turn has led to a decline of 100 kilos per hectare in seed cotton yields.)

Tanzania's cotton sector is even less integrated than that of Kenya, with different institutions in charge of extension, credit, marketing, ginning, and exporting. In addition, institutional instability has plagued the cotton sector since the early 1970s, in much the same way as it has the rest of Tanzanian agriculture. During the 1960s, the Lint and Seed Marketing Board (LSMB) which had been created in 1953, played a key role in coordinating cotton sector activities and marketing seed and lint, while cooperatives performed ginning and oil refining (Collinson 1974; Lele 1975). In 1973 LSMB was replaced by the Tanzania Cotton Authority (TCA), which centralized all cotton activities, taking on the cooperatives' functions when cooperative unions were dissolved in 1976 and replaced by Ujamaa village cooperatives. In 1984, TCA handed over some ginneries and oil mills in the Western Growing Area to the regional farmers' corporation, whose shareholders were the Ujamaa villagers. Finally, in 1985, TCA was dissolved and the Tanzania Cotton Marketing Board (TCMB) was created to take its place. At that time the cooperatives were reconstituted and put in charge of all ginneries and primary marketing functions. In each phase, the institutions in charge of marketing encountered financial difficulties, leading to delays in payments to producers, while the separation between credit, input distribution, and farm gate purchasing resulted in extremely low repayment rates, which only exacerbated financial difficulties.

More recently, in 1986/87, excellent weather and structural adjustment policy changes, including an improved producer price (especially relative to maize), led to a bumper crop, showing that producers are capable of delivering a strong supply response. However, institutional factors constrained the management of the resulting supplies. TCMB purchased less than two-thirds of the crop due to lack of funds, transportation problems, and weaknesses of the cooperatives. Even then, the purchases far outweighed the ginning capacity of the aging mills, causing delays of several months in the payments for cotton purchased. Tanzania's example shows not only that producer prices alone are inadequate to ensure sustained growth in production, but also that an exclusively price-based policy is counterproductive in the absence of complementary actions with regard to marketing, processing, and transport. Without the latter, producers lose faith in the system and become less willing to respond to relative price changes.

Nigeria is an interesting case because it has recently changed institutional arrangements. Until 1986, the National Cotton Board (NCB) had a strategic position in the sector, not unlike that of CLSMB in Kenya. Although the Ministry of Agriculture was put in charge of extension services to cotton producers, the NCB was to distribute seeds and other inputs, fix producer prices after consultation with the industry, and license agents for its purchases. These Licensed Buying Agents (LBAs) were supposed to buy the cotton at fixed prices, and then ensure proper bagging, storage, and transport to the gin. In December of 1986, however, NCB was disbanded along with all the other crop marketing boards, amidst widespread allegations of corruption, inefficiency and collusion with the LBAs on the prices

farmers actually received. One report described weaknesses in the seed distribution system, with late distribution of seeds of increasingly poor quality. It cited numerous allegations of farmers receiving less-than-official prices, late payments or no payments at all, of collusion between buying agents, false weighing, and illegal payments for quality grading (de Matharel 1987). Farmers responded by turning to alternative crops (maize) or to late plantings with low input intensity.

Nigeria's cotton subsector is now more difficult to summarize because of the complex web of institutions involved. Marketing has been taken over by a variety of agents, including the old LBAs, state government-owned companies, private merchants, and the textile mills themselves. A National Consultative Committee on Cotton Production (NCCCPI), created in 1986, is supposed to coordinate policy for the subsector. Prices are now set by the Cotton Marketers' Association of Nigeria (COTMAN), founded in 1987 and comprising about 100 members from the textile industry and from companies and institutions involved in cotton marketing. However, COTMAN's authority to fix producer prices has been a matter of dispute within the government. It is certainly not clear that COTMAN can in fact guarantee the prices that farmers actually receive; these now appear to be determined by supply and demand, with the farm gate price determined by the degree of monopsony power held by the buying agents. A report by Alikhan describes the emergence of a greater collaboration among the participants of the cotton industry since these reforms. These are apparently yielding early positive results (see Annex 2).

Nevertheless, the francophone countries appear to be much more strongly committed to their cotton subsector than the anglophone countries are. They have made greater efforts to ensure that coordination among institutions is satisfactory and that the sector is adequately funded.

The reasons for this apparent commitment, however, are more difficult to fathom. One clue may lie in the consistent presence of CFDT in one form or another in every francophone country since independence. As noted earlier, the relationship of CFDT's revenues to the growth of cotton exports from Africa has been a key to its own commitment to African cotton development. CFDT has supplied the cotton parastatals with technical assistance, a viable technical package, access to capital, and influence among donors and decisionmakers. There is now much disagreement as to whether CFDT's operations should be parcelled out to various other agencies—e.g., research and extension to the ministries and provincial departments of agriculture, input supply and credit to cooperatives, and cotton processing to private enterprises—and whether the cotton parastatals should be maintained as integrated companies. It may be, however, that CFDT's presence has brought about the stability and coherence needed for the development of a viable sector strategy, as well as the political influence to promote government commitment to the sector.

Another clue to the greater commitment of francophone Africa to cotton may lie in the absence of a minority business community, such as the Asians of Kenya and Tanzania, antagonism to whom led to premature indigenization of the sector. Whether the proposed schemes to break up the parastatals would mean Africanization of the cotton sector or its transfer from European to Asian hands remains one of the most intriguing—though least openly discussed—issues. To the extent that privatization means a larger role for Syrian and Lebanese businessmen in

francophone Africa, many governments will object strongly and will opt instead for joint European public sector partnerships. Donors, on the other hand, have argued that privatization, albeit involving minorities, is likely to break up the monopoly of CFDT, bring in more appropriate processing technology, and will perhaps result in greater indigenization over time through joint Asian-African ownership of business.

The basis of criticism of the cotton subsector in francophone countries, and what is sometimes called the "CFDT system," is thus important to understand. It includes (i) CFDT's high financial costs associated with monopoly operations and unnecessarily advanced technology in cotton processing; (ii) an alleged bias against foodcrops, and (iii) the high environmental costs that were discussed earlier. The following discussion will focus on the first two criticisms.

A recent French government study on African cotton concluded that average costs per kilo of cotton lint produced were no higher in francophone countries than in other African and non-African countries.⁶ While this is correct for production costs at the farm level, the cost estimate does not include the cost of expatriates in management positions. Their number and the emphasis on extension are bound to be expensive. The fact that CFDT has not yet produced a cotton management system that is completely and successfully Africanized may demonstrate the importance of professionalism in the cotton industry, combined with the political stake that producers develop in a successful operation (Lele and Meyers 1986). Nevertheless, it is clear that the cost of CFDT's assistance to the local cotton companies should be reduced, especially in countries such as Cameroon, where the CFDT experts are still numerous.

A true assessment of CFDT's costs would be extremely difficult to make. Not only are managerial costs often ambiguous, but the value of positive externalities created by efficient institutions is almost impossible to estimate. Benefits will vary among countries, but they may be substantial.

Cost comparisons are further complicated by the different environments in which cotton parastatals function. In Kenya, the relatively efficient ministerial structures allow the CLSMB to focus on cotton marketing alone, while in Cameroon and Senegal, the parastatals have had to compensate for the shortcomings of central government administration by taking on costly rural development activities assigned to them by government mandate.

These regional development activities make it difficult to assess the cost effectiveness of CFDT's assistance to the local parastatals in francophone Africa. Where a widening of the scope of operations has happened, as with CIDA in Côte d'Ivoire, SOCOTON in Togo, and SODEFITEX in Senegal, the new range of operations covers activity from rural infrastructure to health and education. In the case of SODEFITEX, for example, the broader regional mandate encompasses: development and technical assistance for cereals (millet sorghum, maize, and rice); construction of hydro-agricultural facilities and technical assistance to irrigated perimeters; marketing and processing of paddy rice; marketing of maize; development of snack groundnuts; development of livestock (including veterinary and breeding); promotion of animal traction and providing "support" to local blacksmiths; promotion of and assistance to village associations (in literacy and managerial training); construction and maintenance of feeder roads and village water

supply; primary health care; and applied research and monitoring-audit. A strict application of cost/benefit analysis to CFDT's assistance would need to take account of some or all of these functions as well as of the non-quantifiable and indirect externalities generated by the cotton parastatals.

The same issue of the cotton agency's relation to the ministry is posed when evaluating the criticism that CFDT's approach has undermined food crop production. Although SODECOTON is criticized for devoting most of its energy to cotton, it should be remembered that it was established precisely to address the complex problems of developing an industrial crop. Where other rural development institutions are efficient, as in Kenya, institutions such as the Tea Development Authority are rarely criticized for focusing narrowly on their own mandate, even though they might usefully serve a broader set of producer needs (Lele, Christiansen, and Kadiresan 1989c). In any event, SODECOTON did develop an interest in promoting food crops, in part because other institutions were ineffectual and in part because SODECOTON realized that producers' interest in growing cotton was weak as long as food security concerns were not met, the 1973-74 drought being the most dramatic lesson to this effect. Nevertheless, development of food crops has tended to pose problems for SODECOTON due to the lack of a market, and SODECOTON ended up losing revenues when it supported sorghum prices.

The cotton parastatals do seem to benefit from the best resources at the expense of other crops. They tend to attract the most market-oriented and productive producers with the best land, along with the lion's share of agricultural inputs like credit and fertilizers. Consequently, the best-trained manpower want to work for them. Indeed, one of the important roles of the cotton parastatals has been to develop an excellent cadre of trained professional Africans in much the same way that earlier tobacco schemes had done in Tanzania (Lele 1975). Over time, the absence of services and well-trained manpower in other agencies can lead to regional imbalances in research, extension, credit, and fertilizer access, with all the drawbacks that such imbalances entail. This is a cost of success, however, and the solution is to pay greater attention to other elements of rural development, not to undermine the cotton subsector by shifting responsibility for its development onto ineffectual ministries of agriculture.

Research and extension. A notable characteristic of African cotton is the fairly successful research systems established by both Great Britain and France after World War II. Some critics argue that francophone countries now need to put all research and extension under the Ministry of Agriculture, as in the anglophone model.⁷ After impressive performance in many countries in the 1950s and 1960s, however, the anglophone system of research and extension by and large failed to improve productivity during the 1970s or afterward. In France, the *Institut de Recherches du Coton et des Textiles Exotiques* (IRCT) was created in 1946 to coordinate French colonial research on cotton. Seed multiplication and dissemination of results were greatly helped by close collaboration between IRCT and CFDT, which has continued since independence, as well as by collaboration between the two French agencies and national cotton parastatals. Varietal research has continued, leading, for example, to the development of the higher ginning outturns referred to earlier. The IRCT, CFDT, and the related francophone national systems have successfully handled the requirements of the cotton crop, together with the enormous

location-specificity of the complex problems it faces.

In Great Britain, the Cotton Research Corporation (CRC), was in charge of promoting research.⁸ Despite limited funds, the CRC served effectively as the hub of a research network. It carried out excellent research, disseminating the results, financing and coordinating research projects, and assuring the long-term presence of research scientists in Africa who gained experience over time. Indeed, much of the growth of cotton in eastern and southern Africa in the 1950s and 1960s is directly attributable to CRC activity. In the early 1970s, CRC fielded some 31 scientists in anglophone Africa. CRC's resources were generated by a cess on consumers of textiles in the United Kingdom. As the British textile industry waned, however, so did resources for CRC, which was eventually disbanded in 1976. Although the British government supported cotton research in East Africa until 1982 on an *ad hoc* basis, so as to fill the void left by CRC, many of CRC's functions were not taken on by other institutions. Table 14 is eloquent on this point. By the early 1980s, ten francophone countries were benefiting from the services of 40 expatriate scientists for cotton research, while the nine anglophone countries had only nine.

In neither anglophone nor francophone countries has much priority been given to building indigenous research capacity or developing top-quality African scientists to work on cotton. This has created particular problems in anglophone countries, now that CRC has withdrawn. In Nigeria, for example, the Institute of Agricultural Research (IAR) has formulated an ambitious and expensive plan for cotton research, but the program has suffered from inadequate human and capital resources.⁹ Improved varieties have been developed, but they continue to exhibit ginning percentages of no more than 35, some 15 percent lower than that in neighboring francophone countries. In any event, multiplication and distribution of improved seeds has been haphazard, negating much of the research effort. For example, the dissemination of improved seed has been so disorganized that there are no records of the number and location of recipient farmers or of the varieties being disseminated, and few attempts have been made to maintain quality over several seasons. The story is no different in East Africa.

The contrast with francophone Africa is evident in the area of single cropping. While intercropping with food crops is a rational producer response to relative input scarcities and to an environment of risk and uncertainty, it also keeps cotton yields low because of the competition for moisture and (if the other crop is tall) for sunshine. In the francophone countries, research and extension services have provided farmers with the seeds, fertilizers, mechanization, and farming techniques to undertake single cropping. The more widespread use of farm mechanization, higher input use, and consolidated plots has helped diminish the labor scarcity problem, encouraging farmers to grow cotton alone or side by side with food crops, rather than intercropping it.

In Kenya, however, the interface between research and extension has been so weak that intercropping is probably increasing, particularly in western Kenya. The majority of farmers now intercrop with potatoes, maize, and/or beans. Fertilizer is not used on rainfed cotton, and insecticide is used only by a minority of farmers. Land preparation is predominantly by ox-plough, with a minority using rented tractors. This explains a tendency toward late plantings, as farmers wait for the first rains to soften up the soil. Improved seeds have been developed by the Ministry of Agriculture, but they are simply dropped off at market

Table 14
Numbers of African and expatriate cotton researchers in anglophone and francophone Africa, 1984

Anglophone Africa	Agronomy- Social Science		Genetics- Plant Breeding		Crop Protection		Fiber Technology		Socio- economics		Grand Total		
	African	Expatriate	African	Expatriate	African	Expatriate	African	Expatriate	African	Expatriate	African	Expatriate	
Kenya	6	0	5	1	7	0	0	0	0	0	0	18	1
Malawi	1	0	2	0	3	0	0	0	0	0	0	6	0
Nigeria	4	0	3	0	4	0	2	0	1	0	0	14	0
Sudan	3	0	3	0	5	2	2	0	1	0	0	14	2
Swaziland	1	0	0	0	0	1	0	0	0	0	0	1	1
Tanzania	2	0	1	1	2	0	0	0	0	1	0	5	2
Uganda	3	0	4	0	4	0	0	0	0	0	0	11	0
Zambia	0	0	1	1	0	1	0	0	0	0	0	1	2
Zimbabwe	1	0	2	1	3	0	1	0	0	0	0	7	1
Total	21	0	21	4	28	4	5	0	2	1	0	77	9

Francophone Africa	Agronomy- Social Science		Genetics- Plant Breeding		Crop Protection		Fiber Technology		Socio- economics		Grand Total		
	African	Expatriate	African	Expatriate	African	Expatriate	African	Expatriate	African	Expatriate	African	Expatriate	
Benin	0	1	2	0	2	0	0	0	0	0	0	4	1
Burkina-Faso	2	1	1	1	1	0	0	0	1	1	0	5	3
Cameroon	1	1	0	2	1	2	0	0	0	1	0	2	6
CAR	1	1	1	1	2	2	0	0	0	1	0	4	5
Cote d'Ivoire	1	2	1	2	1	3	1	1	0	1	0	4	9
Madagascar	2	1	0	0	1	0	0	0	0	0	0	3	1
Mali	3	2	2	1	3	1	0	0	0	0	0	8	4
Senegal	1	1	1	1	0	0	0	0	0	0	0	2	2
Chad	1	1	1	2	1	2	0	0	0	0	0	3	5
Togo	2	1	0	1	1	1	0	0	1	1	0	4	4
Total	14	12	9	11	13	11	1	1	2	5	0	39	40

Source: Ken Anthony, "Sub-Saharan Africa Agricultural Research Review, Cotton Research," unpublished paper, 1986.

centers and do not reach many farmers. Input distribution and credit have always suffered from uncertain and late delivery, even before the system more or less collapsed in 1986 (see below). Thus, cultivation techniques remain largely rudimentary, and yields extremely low. As noted earlier, cotton may simply not be profitable at such low levels of technology.

Another area where the results of research have affected francophone and anglophone countries differently is related to the focus of basic research. While the British-inspired cotton research systems focused mainly on spinning properties (to obtain longer and higher quality fibers, as prescribed by the Shirley Institute for industrial research, in Manchester), the French insisted on obtaining higher ginning yields, which would enable CFDT to earn higher profits without having to reduce procurement prices of seed cotton. There may be a limit to this line of research, however. The focus on increasing the ginning ratio has led breeders to introduce ever smaller seeds. At some point, these may spoil the quality of the fiber because the small seeds pass through with the lint during ginning.

In order to alleviate some of the upstream obstacles that are causing relatively low production yields and ginning ratios in anglophone Africa, it is possible that the Consultative Group on International Agricultural Research (CGIAR), which has been successfully supporting food crops, could now build on CFDT's experience and serve as an appropriate vehicle for dissemination of research results on cotton. Through CGIAR, instead of a smaller and more localized entity such as CFDT, benefits of research would reach a wider audience. Private research funding in anglophone Africa is hardly foreseeable, given the size of the necessary investment, the high risks, and the long maturation of

payoffs associated with such an investment.

Processing issues and the need for backward coordination. The importance of local processing is also fairly unique to cotton as a cash crop. Ginning, oil refining, and of course, textile milling, all provide cotton with several specific constraints. First, each step in the processing chain requires financing. With uncertain or low levels of funding, any link in that chain can be broken, leading to a vicious circle of late payments and debt. Second, variation in output levels can have serious repercussions for the costs of ginning, refining, and milling, and operating above or below capacity can lead to the same vicious circles. These difficulties are not unique to cotton among cash crops, but their potential impact is serious, because of (i) the wide output variation discussed earlier, and (ii) the smaller profit margin with the subsector, owing to cotton's relatively low value.

Each country in this sample has at one time or another witnessed important losses because of output variation at some stage in the processing chain. This has been a major problem in a country such as Kenya. As a member of the East African Economic Community, Kenya exported its better quality cotton lint and imported lower quality lint duty free from Uganda and Tanzania for its textile mills. With the closing of the border in 1977 and the introduction of a 30 percent import tax, domestic mills began to purchase the Kenyan cotton, driving lint exports down to insignificant amounts. The lint is appreciated for its high, if variable, quality and is generally preferred to foreign lints of the same type, although mill managers complain that Kenyan output is dirty, necessitating a costly cleaning process that results in a weight loss of 5 to 20 percent.

Weighing the Evidence

Although the impact of price incentives on cotton production is important for determining short-run shifts between food and export crops, or labor allocations between cotton and other crops (including wage employment), this paper has demonstrated that prices must not be considered in isolation from a range of nonprice factors that affect production. Instead, the two sets of factors must be addressed jointly in explaining the much greater relative success of the cotton subsector in francophone Africa. SODEFITEX and SODECOTON have been relatively effective agents of government policy in Senegal and Cameroon, respectively. Producers have not only consistently received the full official price for their output, but they have also benefited from extension and modern inputs that helped make cotton production attractive. In the other (anglophone) countries of the sample, price and input policies have been implemented in ways that seriously undermined their potential impact. As a consequence, the cotton subsectors in these countries lag behind in terms of a wide variety of indicators. This is particularly striking in Kenya, which has had a much more impressive record of agricultural modernization in areas other than cotton than most of the francophone producers, suggesting that cotton poses unique challenges among cash crops. The question is whether a low input/low output approach, as followed in anglophone Africa—while more efficient in the sense of lower DRCs than one which relies on expensive imported inputs—is likely to result in increased cotton production in circumstances of growing internal demand for food crops.

The key to the relative success of cotton development in francophone Africa has been the ability of the industry to maintain effective coordination among the different layers of participants. As the previous discussion has demonstrated, a vertically integrated research-production-marketing apparatus may be necessary in order to promote production of a commodity in a high risk/low return environment. The vertical (backward) integration which has characterized the CFDT-supported cotton companies has helped to circumvent the supply risk, especially in semi-arid low-income regions where the primary (legitimate) concern of the producer is for food security.

By and large, the French CFDT, through its various

interventions—ranging from upstream research to downstream marketing assistance—has helped alleviate most constraints and risks to the cotton sectors of its recipient countries. But a monopsony-monopoly of the CFDT type need not be the only structure of the cotton industry. The evolution of CFDT itself from a completely sealed research-extension-production-marketing organization into more open national organizations that allow entry to other actors is certainly a change in the right direction. In Nigeria, where the cotton industry was at first completely decentralized, a new mixture of backward, albeit limited, integration and of an outgrower program also seems to be a promising development.¹⁰

The francophone experience conveys another important lesson—that efficient credit is an important explanation for the relatively high level of adoption of modern technology in cotton husbandry. Because cotton is bound to have a sealed marketing chain—inasmuch as there are no leakages in the form of home-consumption or undue on-farm storage—the cotton companies were able to provide farmers with credit (in cash or kind) and recover it by deduction at source from the proceeds of the farmers' sales. The monopsony buyer's position of CFDT also helped, although that position is being lost where the cotton companies are carrying a broader regional development mandate, including the servicing of such crops as rice and millet, which can be consumed and whose marketing is undertaken by other agencies.

Will the CFDT-assisted cotton companies continue to be as successful without CFDT's (high-cost) support? As noted earlier, countries such as Côte d'Ivoire and Mali, with the fewest CFDT experts, are precisely those where cotton yields are the highest. It appears, therefore, that the transfer of technology to indigenous capacity, at least judging from these countries, can be done effectively and that CFDT can usefully step up the pace of indigenization. Long-term commitment to the process and the establishment of it as the explicit goal is, however, critical. Past donor assistance (e.g., the World Bank's) to cotton did not have such an explicit goal, even though it supported CFDT-related institutions in Africa.

Recommended Institutional Reforms

The African state's involvement in agricultural development has been called into question by a number of donors, including the World Bank. This has led to calls for reform of the public institutions involved in the agricultural sector. In the cotton subsector, these calls have become more insistent since the downturn in world prices for cotton in 1986, which created financial difficulties for a number of cotton parastatals.

Comprehensive reforms of cotton institutions are taking place, or being considered, in all MADIA countries except Malawi. In Nigeria, the NCB was abolished in 1986, while in Kenya a program has been formulated to divest the ginneries from the CLSMB.¹¹ In Cameroon and Senegal, it has been suggested that the role of SODECOTON and SODEFITEX be limited to seed cotton marketing, that upstream functions (research and extension) progressively revert to the Ministry of Agriculture, while downstream functions (input supply and credit) are given to the private sector. This section evaluates the problems of the cotton subsector and the desirability of institutional reforms in the context of the conclusions of the preceding sections. Given the importance of institutional effectiveness in explaining performance, what advice can be given to policymakers about the best solutions for cotton's present difficulties?

Francophone Countries

In Cameroon, SODECOTON's financial problems did not emerge until 1986 and the collapse of world cotton prices. Since then, SODECOTON has been buying farmers' cotton at a loss, not least because of the strength of the CFA franc. In the middle of 1986, for example, when world cotton markets bottomed out, the average equivalent producer price (CFAF 352 per kilo) was greater than the *c.i.f.* price (Le Havre), which fell to CFAF 266. As a result, SODECOTON ran an operational deficit of roughly CFAF 20 billion (approximately US\$40 million) in 1986, CFAF 13 billion in 1987, and CFAF 8 billion in 1988. For the ten previous years, the annual deficit had averaged only about CFAF 150 million, and there had even been small profits in 1983/84 and 1984/85. This record of relative success undoubtedly led SODECOTON to relax its management style, and encouraged the government to continue raising producer prices (by 1985, the highest in Africa). Both SODECOTON and the Cameroon government were unprepared for the downturn in 1986.

To put these numbers in some perspective, however, the cotton subsector's role in the northern economy should be borne in mind. In 1985/86, cotton provided the government with some CFAF 2.1 billion in public revenue. Various taxes on SODECOTON itself (excluding income taxes on its employees) have amounted to an additional CFAF 1 billion

in recent years. The parastatal's losses include outlays of CFAF 6 billion for rural development activities undertaken on behalf of the government, as well as an estimated CFAF 2.6 billion spent on input subsidies.¹² These numbers imply that a significant part of SODECOTON's recent deficit results from the particular status it has acquired as northern Cameroon's most (if not only) efficient public development institution. SODECOTON was clearly a viable enterprise when cotton markets were healthy, despite lax management, generous producer prices, and a variety of expensive developmental responsibilities, which cotton boards in anglophone countries do not bear.

SODECOTON's overall efforts have provided valuable—if difficult to quantify—externalities to rural development in the region as a whole. These developmental functions should not be undermined, at least not until the ministerial structures become strong enough to take them over. Meanwhile, their costs must clearly be taken into account in any cost/benefit evaluation of SODECOTON's performance. One solution being considered by donors—the transfer of functions to ministries of agriculture under a more generalized approach to research and extension (in contrast to a commodity-based approach)—presents serious problems in francophone Africa because agriculture ministries and their decentralized provincial services are especially weak and will take time to develop.

There is, however, a combination of reforms that could quickly bring SODECOTON's deficits down to a reasonable size, allowing time for the cotton markets to rebound. Such reforms include: (i) reducing transportation and market costs, (ii) freezing or cutting producer prices, and (iii) reducing the number of CFDT experts and delegating responsibility for services increasingly to producer groups. Much the same could probably be said of Senegal and SODEFITEX, where improved management and, especially, minor improvements in the distribution and use of inputs and prices would probably restore profitability. More grassroot-oriented cooperatives such as those beginning to be fostered in Mali may take over the commercial functions if they are allowed enough time to develop.

More fundamental long-term measures might include a higher degree of domestic industrial transformation, with the development of a national textile industry and greater training of Cameroonians to assume the functions of CFDT experts. Nevertheless, the current highly integrated approach has been effective in disseminating a viable technological package for cotton. While costs can and should be cut in the short run, it seems very unlikely that the most realistic international price scenarios will be able to cover the overhead costs involved in making African producers viable. Proposals to take away SODECOTON's

research and extension functions and transfer them to the Ministry of Agriculture—without benefit of CFDT's regional research network and without simultaneously establishing a broader regional or international system for cotton research—may well result in the collapse of the cotton industry in francophone Africa. Although every effort needs to be made to avoid duplication of functions with line ministries, it might be better to give CFDT ten years to indigenize its operations, including the development of African expertise and incentives related directly to the volume of exports. Similarly, privatization of input distribution in order to cut costs should be considered only with the greatest caution, due to the need to link distribution with credit and output marketing.

Anglophone Countries

In contrast to Cameroon and Senegal, cotton's problems in Nigeria, Tanzania, and Kenya preceded the downturn in world prices and are more clearly linked to the sector's institutional deficiencies. Thus, CLSMB's financial problems in Kenya have their origin in several factors. First, CLSMB was seriously underfunded and financed most of the subsector's expansion during the 1970s by borrowing. The cost of servicing the resulting debt amounted to around Kenyan Shs. 118 million (US\$7.4 million) between 1979 and 1985. Second, CLSMB has had a very poor loan recovery rate on its own lending to both farmers and cooperatives. The need to compensate for unrecoverable loans cost CLSMB some Shs. 94 million in the same period. By the end of 1985, CLSMB was no longer able to secure loans for its operations, and producers were left unpaid for the previous year's crop.

CLSMB thus appears to have been the victim of internal mismanagement. Furthermore, neither CLSMB nor the Kenyan cooperatives have been responsive to producer interests. Indeed, the way Tanzania has been able to undermine effective collective action by its cooperatives suggests that farmer-oriented grassroots cooperatives may not develop in other countries as early as donors have tended to assume. At the same time, CLSMB's ability to promote the cotton subsector has largely depended on a number of other institutional actors, such as the Ministry of Agriculture and cooperative societies, over which it has little control. And its developmental functions are less highly evolved because of the less integrated nature of the cotton subsector that characterizes anglophone Africa. It is difficult, therefore, to blame CLSMB's problems entirely on its own financial woes, let alone to blame it for the poor record of cotton production, even if it has operated in a country with a relatively good macro and institutional environment.

In Nigeria, the optimistic scenario is that the current

chaos is a necessary cost of liberalization, but that market forces will eventually organize the subsector and provide the necessary incentives for cotton farmers. In addition, a costly and ineffectual, if not counterproductive, public sector intervention will have been eliminated. Even so, farmers' incentives to grow cotton will continue to be constrained by the very low levels of productivity currently attainable without a more sophisticated technological package. The dissemination of this package, which is a pure public good, will continue to imply the need for effective public institutions for agricultural research and extension (Yayock and Kumar 1988).

More generally, one of the lessons from francophone Africa is that cotton booms followed the development of a viable technological package for intensive cultivation. As long as farmers could not expect more than 250-400 kilos of seed cotton per hectare, their loyalty to cotton was weak, and completely determined by food security concerns. Intensification alleviated these concerns not only by greatly increasing the farmer's cash income, but also (and perhaps more crucially) by freeing up labor for food crop cultivation. This lesson was confirmed in Tanzania: the rapid growth of production under extensive cultivation from 1950-70 is proving unsustainable, and the cotton industry has faltered as relative prices have become less favorable. Most of all, without intensification the growing population pressure will continue to make greater demands on resources for food crop production, reducing exports and increasing cotton imports.

Political problems may continue to undermine effective reform, as is evident in Tanzania and Kenya, but donors have devoted little attention to their implications. For instance, in Tanzania it is not clear that the CCM Party will be willing to relinquish control of the cotton industry to the cotton producers or to the producer cooperatives through genuine political decentralization. In Kenya, where the ginneries were traditionally owned by Asians before they were nationalized and given to cooperatives, privatization of the gins is now unlikely. Turning gins operated by the CLSMB over to the cooperatives (which had lost them to the Board because they mismanaged them) hardly seems a desirable option unless more professional cooperatives are developed that are also more directly accountable to the cotton producers. This will, however, take a consistent approach by donors and governments over a long period of time—and the experience of the last two decades does not provide much basis for optimism about the outcome, unless there is simultaneously a greater decentralization of the cotton industry to the producers, combined with more technical inputs for its long-term development.

Annex 1.

Theoretical Derivation of the Estimated Cotton Supply Models

The purpose of this annex is to provide the theoretical justification for the statistical models of cotton supply discussed in the text.

The models are derived from the conventional supply behavior based on profit maximization applied to cotton producers in the MADIA countries. The theoretical derivation need not be repeated, since any standard microeconomic textbook gives a thorough treatment. However, one must recognize that the theoretical derivation of the supply function may not be a straightforward textbook example because the francophone cotton companies are multiple output/multiple input firms. The outputs are heterogeneous, ranging from tangible commodities such as cotton and rice to intangible public goods such as health and literacy. The following discussion will, nevertheless, focus on the standard single output, which is assumed to be a composite good.

The model of cotton supply comprises two behavioral equations (area and yield) and one identity (production). The farmer's output reaction is decomposed structurally into:

(i) an area response, which depends upon relative prices and land availability; and

(ii) a yield response, which is determined by input use (which in turn is determined by input price), the quality of services provided to farmers, and weather conditions.

Output is then determined as an identity expressing quantity as the product of yield per unit of land and area cultivated.

The structural system above can also be collapsed into a single reduced form equation featuring output and input prices and some exogenous shifters as explanatory variables. While explicit measures of the price variables are not difficult to find, those of the nonprice shifters pose conceptual and statistical problems.

The relevance of using a time trend as a proxy for the effects of nonprice factors on the development of the cotton industries in the countries that were studied needs to be explained. The choice of the trend variable as a proxy rather than a (more conventional) direct measure of the nonprice effects—such as expenditures on R&D, extension, and infrastructure—in the specific case of the MADIA countries was dictated by the following considerations. First, it is clear from the graphs in Figure 6 that cotton production increases in Senegal and Cameroon were the results of shifts of, rather than price-induced moves along, the supply schedule. In these two countries, the relative prices have been constant or even declining over 1961-85, whereas production has increased at least sevenfold. Second, using such explanatory variables as expenditures on R&D and extension says nothing about the quality of

such investment outlays. One would need a hedonic weighting scheme to account for the quality and relevance of these investment outlays on production increases. Third, the long time lag before research results become effectively translated into innovative practices varies between 8 and 12 years, at least by those African farmers surveyed in Eicher (Eicher 1985). Thus, even assuming that the size of the expenditures on R&D and extension could correctly relate the degree of technological advance, the problem of timing the effects in the interpretation of the regression results remains. Using twenty-year observations—which would be a blessing given the status of the data on these countries—for a regression with an 8 or 12-year lag and at least two explanatory variables, substantially reduces the number of degrees of freedom. Furthermore, while the stated direct measures are less problematic in aggregate supply estimations, the fact that the expenditures are often not crop-specific poses an additional problem in single crop supply estimations.

Our knowledge of the cotton industries of these countries suggests that the shift of the supply schedules during the period under investigation was the result of nonprice factors. Since prices do not shift the supply schedule (at least directly), and very little (*price-*) *induced technological change* in cotton husbandry in the selected countries is known to us, it would be tempting to attribute the supply shift largely to the effects of nonprice factors. A time trend is a conventional and simple measure of technological change, which cuts through the intricacies of the problems mentioned above: The failure to include a time trend in the estimation of supply-response equations, when such technological changes have occurred, has led many researchers to find negative supply elasticities and to recourse to the target income hypothesis to justify their findings. While the target income hypothesis may be true, its application to supply-response analysis, which leads to a backward bending supply curve, should be attempted only as a last resort.

In summary, the choice of the time-trend variable is motivated by the fact that technological progress and the deterioration (or improvement) of institutional support did occur in the cotton industries of the selected African countries. Given that this technological and institutional support did not stay static, as the paper shows, it seemed most appropriate to capture the effect via the time trend. The time trend is *not* the nonprice factors. Rather, it is a proxy for their *effects* (technological and institutional) on cotton production in the selected countries.

The estimation results of regression models based on the above discussion follows:

Annex Table 1
Seed cotton price elasticities in the MADIA countries

	Price Elasticities: ^a		Nonprice Effect: Timetrend		Corrected R2	Durban Watson
	Cotton	Maize*	Coeff	T-statistic		
Area						
Cameroon	1.84	-0.84			0.27	1.41
Senegal	NS	NS	0.92	3.11	0.16	1.46
Nigeria	0.23	NS			0.81	1.91
Kenya	0.67	NS			0.91	2.05
Malawi	0.54	NS	NS	NS	0.43	1.58
Tanzania	0.13	0.13			0.72	2.29
Production:						
Cameroon	NS	NS	1.25	2.34	0.76	1.71
Senegal	NS	NS	0.68	2.23	0.12	1.94
Nigeria	2.02	NS	-2.11	-2.59	0.83	1.24
Kenya	2.06	-1.13	0.53	6.04	0.70	1.29
Malawi	NS	NS	NS	NS	0.18	1.96
Tanzania	0.60	-0.35			0.66	1.83
Yield:						
Cameroon	NS	NS	68.45	5.21	0.93	1.33
Senegal	1.21	-1.33			0.52	2.10
Nigeria	2.30	NS	-2.88	-3.24	0.71	1.67
Kenya	1.60	NS			0.60	2.10
Malawi	-2.07	NS	16.97	4.68	0.43	1.12
Tanzania	NS	-0.4	-15.26	-2.57	0.53	2.07

Note: ^a The t-ratios for the reported price elasticities are all larger than two.
NS Not Significant

*In the case of Senegal groundnut data was used.

Source: Lele, Gbetibouo, and Mukherjee Forthcoming.

Annex 2.¹ Nigerian Cotton Industry: Latest Developments

Some recent developments in Nigeria which may be worth highlighting in this paper are: the internal nature of the cotton subsector, the government policy initiative of backward integration and self-reliance under the Structural Adjustment Program, the private sector (textile industry) response and its early positive experiences emerging in terms of increased yields, a changing pattern of cotton production, accessibility of the farmers to rural credit (and hence inputs), and mechanization. These initiatives, together with the T&V Extension System, are making a dent in closing the large gap between demand and supply.

Policy Initiative and Response

The observations that the report makes on Nigeria's cotton subsector are correct. However, the cotton subsector scene is changing fast in Nigeria. The government's policy of backward integration by industries for local sourcing of raw materials is paying off. The government is also relying more on private sector initiatives. In the cotton subsector, the private sector (textile manufacturers) response has been encouraging, and it has initiated programs which could form an alternative or complement to measures taken under the World Bank-supported Agricultural Development Projects (ADPs) in making possible the revival of the subsector in Nigeria. While these experiences are still in the infancy stage, they are worth noticing.

The textile industry initially responded to the government's policy directives on backward integration by begin-

ing to get involved in large-scale farming. There seems to have been some reversal of this thrust, however, and industrial concerns now seem to be moving toward the creation of nucleus farms which provide the necessary base from which to support a large-scale outgrower program.

Increased Yields by Supplying Inputs

One of the largest textile manufacturers in the country has established a nucleus farm of about 2,000 hectares, and indicates that it has achieved yields of 2.0 tons per hectare. This, however, is a small part of the program, since the manufacturer relies heavily on a large number of small farmers for the bulk of its requirements. Under the outgrower scheme, provision is made for: land to selected farmers, land-preparation assistance in the form of tractor hire services (at cost to the farmer), good planting material/seed, fertilizer, chemicals, cash loans, extension services, and marketing linkages of buying back the crop at a minimum guaranteed price or the market price, whichever is higher. Land allocated to the farmer is 1 to 2 hectare, and the outgrower farmer cultivates it predominantly by using his/her family labor.

Positive Experiences

Some key interesting developments have been reported by the textile manufacturer since the inception of the scheme: (i) initially, loans (80 percent of it given to the outgrower farmer in kind, the remaining 20 percent in cash) were provided by the manufacturer; now, the nucleus farm project entity refers/certifies outgrower farmers to the

¹This annex was graciously provided by Mohsin Alikhan.

Nigerian Agricultural and Cooperative Bank, a public sector undertaking which extends loans. Its *repayment* record, according to the manufacturer is about 96 percent; (ii) the manufacturer indicates that outgrower farm yields have increased from about 250 kilos per hectare to 800 kilos per hectare in just over 3 years; and (iii) last, but more significantly, the farmer retains his own piece of land, on which he grows whatever he wishes (mostly mixed farming), thus not affecting his traditional security interest. On the land provided by the manufacturer, the outgrower only crops cotton. Given the high price of cotton (since it is highly protected through tariffs), the outgrower farmer enjoys a very favorable return for his efforts, currently earning a minimum price of N 2,000 per metric ton for Grade I cotton and N 1,800 per ton for Grade II. Independent reports indicate that farmers, contrary to previous reports of complaints, are now eager and willing to join the outgrower scheme. The manufacturer indicates that farmer demand to join outgrower schemes is higher than it can meet.

Demand-Supply Gap

The manufacturer plans to increase areas cultivated from 1,000 hectares in 1988/89 to 25,000 hectares by 1992/93, involving some 12,500 participating farmers. He has already opened a ginning mill and is in the process of installing an oil mill. Based on the success of this textile manufacturer, another large textile manufacturer has started work on a similar scheme in the same state.

These two schemes are under implementation in Gongola State, where cotton production has increased from a mere 750 tons of seed cotton in 1985/86 to 8,500 tons in 1987/88, making it the fifth-largest cotton producer in the country next to Katsina, Kaduna, Bauchi, and Sokoto states.

Since the gap between demand and supply of cotton is large (ranging roughly over 50 percent), the initiatives by the private sector described above show potential for success. Some caution is necessary to guard the captive farmer from the monopolistic/oligopolistic nature of these schemes. Until now, however, since the cotton demand-supply gap is large, the schemes are being implemented successfully, increasing farmers' incomes and making a positive dent in the rural areas, saving the country valuable foreign exchange through import substitution, and at the same time providing essential raw materials to textile mills, thus increasing their underutilized capacity. With the abolition of the Commodity Boards, a relatively close-to-free-market price system for cotton is currently working satisfactorily in Nigeria.

T & V Extension System and Research

It should be mentioned that efforts have been made in Nigeria to reorganize extension and training under a single unified extension system, using the T&V system and the positive gains of research-extension linkages achieved through monthly technology review meetings. It would not be advisable to disturb the T&V system, which is being implemented vigorously. The private sector initiatives described in the earlier paragraph could play a significant complementary role to the public sector initiatives carried out under the ADP system in an effort to revive cotton production in Nigeria.

Notes

1. See Marcel Rouspard, *Nord Cameroun: Ouverture et Développement*, (Paris, 1987) pp. 391-418 for an exhaustive discussion. Ambiguous evidence suggests a secular decline in precipitation levels all over northern Cameroon, which may have speeded up this evolution of production. For a discussion, see Alain Beauvilain, "Remarques sur la situation pluviométrique actuelle au Nord du Cameroun," *Revue de Géographie du Cameroun*, 5 (no. 1):47-62.
2. The resumption of production in these provinces was partly the result of an innovative practice of extending the cultivation of cotton over two seasons. The crop is sown in the short rainy season (October/November) and is let to mature during the longer rainy season (March/May).
3. Full discussion of the magnitude of these elasticities is provided in Lele, Gbetibouo, and Mukherjee, forthcoming MADIA study.
4. The exact cost of CFDT experts could not be found by the authors. Salary estimates from secondary sources and verbal accounts vary from \$US50,000 per expert to \$US150,000 including all benefits. The range is so wide that we prefer not to attempt a quantitative estimate of the DRCs.
5. In the West African Sahel, for example, cotton is typically the main source of agricultural income in the interior of the country, where per capita incomes are a third to a quarter of the levels in coastal areas.
6. See Ministère de la Coopération, République Française, "Le Coton en Afrique de l'Ouest et du Centre: situation et perspectives" (Paris, 1987), pp.74-86. The study estimates, for example, that the average cost per kilo of fibre varies from CFAF 819 in Cameroon to CFAF 506 in Mali, CFAF 528 in Burkina Faso and CFAF 629 in the Côte d'Ivoire. Cameroon's cost structure is among the highest.
7. See for example, Claude Freud, *Quelle Coopération?* (Paris: Editions Karthala, 1988), and Bonnie Campbell, "Inside the Miracle: Cotton in the Ivory Coast," in *The Politics of Agriculture in Tropical Africa*, ed. Jonathan Barker (London: Sage Publications, 1984).
8. This section draws heavily from Ken Anthony, "Sub-Saharan Africa Agricultural Research Review: Cotton Research," unpublished paper, September 1986; Fred E.M. Gillham, "A Review of Cotton Production Research in Nigeria, Eastern and Southern Africa," consultant report for the World Bank, August 1986; and Elton Thigpen, IECCM, the World Bank (personal communication with one coauthor).
9. The program is summarized in Gillham, pp.35-38.
10. Comments by M. Alikhan, World Bank Resident Mission, Nigeria, February 21, 1989.
11. A more detailed account of the recent development in the Nigerian cotton industry is related by Alikhan in Annex 2.
12. SODECOTON's rural development costs in 1987/88—after subsidy costs—were CFAF 3.6 billion. This figure is to be contrasted to 5.8 billion spent in 1985/86.

Bibliography

- Anthony, Ken. 1986. "Sub-Saharan Africa Agricultural Research Review: Cotton Research." Unpublished paper.
- Anthony, Ken. 1985. "U.K. Agricultural Research Aid to Kenya, Tanzania and Malawi." MADIA Study, World Bank. Washington, D.C.: World Bank.
- Askari, Hossein and John Thomas Cummings. 1976. *Agricultural Supply Response—A Survey of Econometric Evidence*. New York: Praeger Publishers.
- Balcet, Jean-Claude and Wilfred Candler. 1981. *Farm Technology Adoption in Northern Nigeria*. Mimeograph. Washington, D.C.: World Bank, West Africa Projects Department.
- Baris, P., Claude Freud and J. Zaslavski. 1987. "La politique agricole du Cameroun de l'indépendance à nos jours." MADIA Study, World Bank. Washington, D.C.: World Bank.
- Bates, Robert. 1981. *Markets and States in Tropical Africa*. Berkeley: University of California Press.
- Beauvilain, Alain. 1985. "Remarques sur la situation pluviométrique actuelle au Nord du Cameroun." *Revue de Géographie du Cameroun* 5 (no. 1):47-62.
- Beenhakker, H.L. and N. Bruzelius. 1984. "Transport and Marketing of Agricultural Products in Tanzania." Draft of report prepared for the Transportation Department, World Bank. Washington, D.C.: World Bank.
- Caisse Centrale de Coopération Economique. 1988. "Proposition pour un plan de redressement de le SODECOTON," Volume 1 and 2, Paris: CCCE
- Campbell, Bonnie. 1984. "Inside the Miracle: Cotton in the Ivory Coast." In *Politics of Agriculture in Tropical Africa*. Ed. Jonathan Barker. London: Sage Publications.
- Carr, Stephen. 1989. Back-to-Office Report. Internal World Bank Document. Washington, D.C.: World Bank.
- Cleave, John H. 1974. *African Farmers: Labor Use in the Development of Smallholder Agriculture*. New York: Praeger Publishers.
- Collinson, M.P. 1974. "Cotton Development in Tanzania: A Review of the Cotton Program in Sukumaland." African Rural Development Study Background paper, World Bank. Washington, D.C.: World Bank.
- . 1972. *Farm Management in Peasant Agriculture—A Handbook for Rural Development Planning in Africa*. New York: Praeger Publishers.
- Compagnie Française pour le Développement des Fibres Textiles (CFDT). 1987. "Rapport d'Activité pour l'Année 1986." Paris: CFDT.
- Cotton Lint and Seed Marketing Board (CLSMB). 1985. "Budgets for the Year 1st July 1985-30th June 1986." Appendix A: Income and Expenditure Budget. Nairobi: CLSMB.
- Cox, R.A.J. and A.T. Spurling. no date. "Unit Farms in Malawi, The Organisation, Recording and Results of Experimental Unit Farms." Research Circular no. 4/72. Bvumbwe Research Station.
- de Matharel, D. 1987. "Nigeria: Study of Cotton Marketing, Seed Production and Quality Control." CFDT Report. Paris: CFDT.
- Delgado, Christopher L. and John W. Mellor. 1984. "A Structural View of Policy Issues in African Agricultural Development." *American Journal of Agricultural Economics* 66 (December):665-670.
- Eicher, Carl. 1982. "Facing Up to Africa's Food Crisis." *Foreign Affairs* 61 (Fall): 151-174.
- . 1985. "Agricultural Research for African Development: Problems and Priorities for 1985-2000." Paper prepared for a World Bank conference on Research Priorities for Sub-Saharan Africa, Bellagio, Italy. February 25-March 31, 1985.
- FAO/World Bank Cooperative Programme Investment Centre. 1987. "Tanzania: Agricultural Sector Review Mission, Working Paper 3: Export Crops." Rome: FAO.
- Freud, Claude. 1988. *Quelle Coopération?* Paris: Editions Karthala.
- Gagne-Gervais, Carole. 1984. "Cameroon: The Cash Crop Sector: Its Performance and Future Development Possibilities." Yaoundé, Cameroon: USAID.
- Gautrand, Jacques. 1988. "Le coton africain ne veut pas mourir." *Jeune Afrique Economie*, no. 105.
- Gillham, Fred E.M. 1987. "A Review of Cotton Production Research in Nigeria, Eastern and Southern Africa." Consultant Report prepared for the World Bank. Washington, D.C.: World Bank.
- Government of Tanzania/Government of the Netherlands. 1986. "Plan of Operations. Assistance to the Cotton Sector in WCGA Including Support for Pamba Engineering Ltd." Dar-es-Salaam, Tanzania: Government of Tanzania.
- Hanak, Ellen. 1988. "The Politics of Agricultural Policy in Tanzania." MADIA Study, World Bank. Washington, D.C.: World Bank.
- Hayami, Y. and V.W. Ruttan. 1985. *Agricultural Development: An International Perspective*. Baltimore: Johns Hopkins University Press.
- Howell, John, Adrian Hewitt, and Ken Anthony. 1987. "U.K. Agricultural Aid to Kenya, Tanzania, and Malawi." MADIA Study, World Bank. Washington, D.C.: World Bank.
- International Cotton Advisory Committee (ICAC). no date. "Survey of Cost of Production of Raw Cotton." Washington, D.C.: ICAC.
- Jammeh, Sidi. 1987. "State Intervention in Agricultural Pricing and Marketing in Senegal." Ph.D. dissertation, Johns Hopkins University.
- and Chandra Ranade. 1987. "Agricultural Development and Foreign Assistance to Senegal: A Review of the World Bank's Experience in Senegal." MADIA Study, World Bank. Washington, D.C.: World Bank.
- Krueger, Anne O., Maurice Schiff and Alberto Valdes. 1988. "Agricultural Incentives in Developing Countries: Measuring the Effect of Sectoral and Economy-Wide Policies." *The World Bank Economic Review*, 2 (September): 255-272.
- Lele, Uma. 1988a. "Comparative Advantage and Structural Transformation: A Review of Africa's Economic Development Experience." In *The State of Development Economics: Progress and Perspectives*. Ed. Gustav Ranis and T. Paul Schultz. New York: Basil Blackwell Inc., pp. 187-221.
- . 1988b. "Agricultural Growth, Domestic Policies, the External Environment and Assistance to Africa: Lessons of a Quarter Century," in Colleen Roberts, (ed.). *Trade, Aid, and Policy Reform: Proceedings of the Eighth Agriculture Sector Symposium*. Washington, D.C.: World Bank.
- . 1975. *The Design of Rural Development: Lessons from Africa*. Baltimore: Johns Hopkins University Press.
- . 1989a. "Sources of Growth in East African Agriculture." *The World Bank Economic Review* 3 (January):119-144.
- . 1984. "Tanzania: Phoenix or Icarus?" in Arnold C. Harberger, (ed.), *World Economic Growth*. San Francisco: Institute for Contemporary Studies Press.
- . 1989b. "Structural Adjustment, Agricultural Development and the Poor: Some Lessons from the Malawian Experience." MADIA Study, World Bank. Washington, D.C.: World Bank.
- and L. Richard Meyers. 1986. "Agricultural Development and Foreign Assistance: A Review of the World Bank's Experience in Kenya, 1963-86." MADIA Study, World Bank. Washington, D.C.: World Bank.
- and L. Richard Meyers. 1987. "Growth and Structural Change in East Africa: Domestic Policies, Agricultural Performance and World Bank Assistance, 1963-1986, Parts I and II." DRD Discussion paper, nos. 273 and 274. Washington, D.C.: World Bank.

- _____ and Vishva Bindlish. 1988. "How Important are the Relative Effects of Economy Wide and Sector Specific Policies in Explaining the Past Performance of Nigerian Agriculture?" MADIA Study, World Bank. Washington, D.C.: World Bank.
- _____, Robert Christiansen, and Kundhavi Kadiresan. 1989c. "Issues in Fertilizer Policy in Africa: Lessons from Development Programs and Adjustment Lending, 1970-87." MADIA Study, World Bank. Washington, D.C.: World Bank.
- _____ and others. Forthcoming. "Nigeria's Economic Development, Agriculture's Role and World Bank Assistance, 1961-1986." MADIA Study, World Bank. Washington, D.C.: World Bank.
- Lipton, Michael. 1987. "Limits of Price Policy for Agriculture: Which Way for the World Bank?" *Development Policy Review* (London) 5 (June):197-215.
- Marketing Development Bureau (MDB). 1987. "Annual Review of the Cotton Industry." Draft of 1987 Report. Dar-es-Salaam, Tanzania: Ministry of Agriculture.
- Ministère de la Coopération. 1987. "Le coton en Afrique de l'Ouest et du Centre, situation et perspectives." Paris: Ministère de la Coopération.
- Ministry of Agriculture. 1987. "National Agricultural Research Plan." Lilongwe, Malawi: Ministry of Agriculture.
- Ministry of Agriculture. 1987. "Report of the Task Force on the Programme for the Rehabilitation of Ginneries." Summary Report. Dar-es-Salaam, Tanzania: Ministry of Agriculture.
- Ministry of Agriculture/Ministry of Cooperative Development/Cotton Lint and Seed Marketing Board. 1987. "Policies for the Development of the Cotton Subsector." Nairobi, Kenya: Ministry of Education.
- Ministry of Agriculture, Animal Husbandry and Water Resources. 1962. *African Land Development in Kenya, 1946-1962*. Nairobi, Kenya: Ministry of Agriculture, Animal Husbandry and Water Resources.
- Mundlak, Y. 1988. "Capital Accumulation, the Choice of Techniques, and Agricultural Output." In *Agricultural Price Policy for Developing Countries*. Eds. John W. Mellor and R. Ahmed. Baltimore: Johns Hopkins University Press.
- "Nouveaux records pour le coton en Afrique noire. 1987." *Afrique Agricolture*, no. 144, July.
- Price Waterhouse Associates (Africa). 1987. "SODECOTON: Mission de Diagnostic." General Report, Annexes.
- Ray, Anandarup. 1988. "Response to Lipton's (June 1987) Review of World Development Report 1986." *Development Policy Review* (London) 6 :211-222.
- République du Cameroun, Mission de Rehabilitation des Entreprises du Secteur Public et Para-Public. 1988. "SODECOTON, Diagnostic Rapport Provisoire." Yaoundé, Cameroun: Mission de Rehabilitation des Entreprises du Secteur Public et Para-Public.
- République du Sénégal, Ministère du Développement Rural. 1986. "Conseil interministeriel sur les resultats de la campagne de commercialisation 1985/86; l'état d'avancement de la campagne agricole 1986/87; note sur la filière coton au Sénégal." Dakar, Senegal: Ministère du Développement Rural.
- République du Sénégal, Ministère du Développement Rural/Société de Développement des Fibres Textiles. 1987. "Programme de Sauvegarde et d'Ajustement de la Filière Coton du Sénégal." Dakar, Senegal: Ministère du Développement Rural.
- Roupsard, Marcel. 1987. *Nord Cameroun: Ouverture et Développement*. Ph.D. Dissertation, Paris: University of Paris.
- Santley, J.C. 1987. "Tanzania: Agricultural Export Rehabilitation Project, Cotton Processing Industry." Draft of consultant report prepared for the World Bank. Washington, D.C.: World Bank.
- "Situation et perspectives du coton en Afrique de l'Ouest et du Centre." 1987. *Afrique Agriculture*, no. 148, December.
- Société de Développement des Fibres Textiles (SODEFITEX). 1987. "Note de Presentation." Dakar, Senegal: SODEFITEX.
- Société de Développement du Coton du Cameroun (SODECOTON). 1986. "Rapport Annuel, Campagne 1985/86." Garoua, Cameroun: SODECOTON.
- _____. 1988. "Note concernant le redressement de la filière coton." Garoua, Cameroun: SODECOTON.
- United States Department of Agriculture. 1987. "World Cotton Situation." Foreign Agricultural Service, Circular Series. Washington, D.C.: USDA.
- van der Sleen, Max. No date. "The Manawa Project: A New Saw Ginnery in Mwanza Region, Financial Feasibility Study." Report prepared for Netherlands Economic Institute. Mwanza, Tanzania: Tanzania Cotton Marketing Board.
- Weber, Michael T. et al. 1988. "Informing Food Security Decisions in Africa: Empirical Analysis and Policy Dialogue." *American Journal of Agricultural Economics*. 70 (December): 1044-1051.
- World Bank. 1981. "Accelerated Development in Sub-Saharan Africa: An Agenda for Action." Washington, D.C.: World Bank.
- _____. 1987. "Side Memoire: Kenya—Cotton Processing and Marketing Project." Joint Government/IDA Supervision Mission, 16-30 November 1987. Washington, D.C.: World Bank.
- _____. 1973. "Appraisal of Geita Cotton Project, Tanzania." Washington, D.C.: World Bank.
- _____. 1987. Cameroon: Country Economic Memorandum." Washington, D.C.: World Bank.
- _____. 1988. Operations Evaluation Department. "Cotton Development Programs in Burkina Faso, Côte d'Ivoire and Togo." Washington, D.C.: World Bank.
- _____. 1983a. "Eastern Senegal Rural Development Project." Appraisal Report. Washington, D.C.: World Bank.
- _____. 1984. Operations Evaluation Department. "Geita Cotton Project (Tanzania)." Project Performance Audit Report. Washington, D.C.: World Bank.
- _____. 1985. "Kenya: Cotton Processing and Marketing Project." Joint Government/IDA Mid-Term Review Mission, 4-22 November 1985. Washington, D.C.: World Bank.
- _____. 1982. "Kenya: Cotton Processing and Marketing Project." Staff Appraisal Report. Washington, D.C.: World Bank.
- _____. 1983b. "Malawi: Lower Shire Valley Agricultural Development Projects." Impact Evaluation Report. Washington, D.C.: World Bank.
- _____. 1986. "Malawi: Shire Valley Agricultural Consolidation Project." Project Performance Audit Report. Washington, D.C.: World Bank.
- _____. 1979. "Malawi Shire Valley Agricultural Development Project." Project Performance Audit Report. Washington, D.C.: World Bank.
- _____. 1987. "Nigeria: Agricultural Sector Review." Washington, D.C.: World Bank.
- _____. 1978. "Shire Valley Agricultural Consolidation Project." Staff Appraisal Report. Washington, D.C.: World Bank.
- _____. 1983b. "Tanzania: Agricultural Sector Report." Washington, D.C.: World Bank.
- _____. 1984. "Toward Sustained Development in Sub-Saharan Africa." Washington, D.C.: World Bank.
- Yayock, J.Y. and Vijay Kumar. 1988. "Cotton Production in Nigeria: Prospects, Problems and Recommended Action for Development." Report prepared for the World Bank. Lagos, Nigeria: World Bank.