INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

2020 VISION

IFPRI Discussion Paper 00920

November 2009

Institutional Reform in the Burkinabè Cotton Sector and its Impacts on Incomes and Food Security

1996–2006

Jonathan Kaminski
Derek Headey
Tanguy Bernard

2020 Vision Initiative

This paper has been prepared for the project on
Millions Fed: Proven Successes in Agricultural Development
(www.ifpri.org/millionsfed)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR).

FINANCIAL CONTRIBUTORS AND PARTNERS

IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI receives its principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR). IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, and World Bank.

MILLIONS FED

"Millions Fed: Proven Successes in Agricultural Development" is a project led by IFPRI and its 2020 Vision Initiative to identify interventions in agricultural development that have substantially reduced hunger and poverty; to document evidence about where, when, and why these interventions succeeded; to learn about the key drivers and factors underlying success; and to share lessons to help inform better policy and investment decisions in the future.

A total of 20 case studies are included in this project, each one based on a synthesis of the peer-reviewed literature, along with other relevant knowledge, that documents an intervention's impact on hunger and malnutrition and the pathways to food security. All these studies were in turn peer reviewed by both the Millions Fed project and IFPRI's independent Publications Review Committee.

AUTHORS

Jonathan Kaminski, The Hebrew University of Jerusalem
Research Fellow, Department of Agricultural Economics
Email: kaminski.jonathan@gmail.com

Derek Headey, International Food Policy Research Institute
Research Fellow, Development Strategy and Governance Division
Email: d.headey@cgiar.org

Tanguy Bernard, Agence Française de Développement
Research Fellow
Email: bernardt@afd.fr

Notices

[1] Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI–wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at www.ifpri.org/pubs/otherpubs.htm#dp.

Copyright 2009 International Food Policy Research Institute. All rights reserved. Sections of this document may be reproduced for noncommercial and not-for-profit purposes without the express written permission of, but with acknowledgment to, the International Food Policy Research Institute. For permission to republish, contact ifpri-copyright@cgiar.org.

Contents

Acknowledgements	v
Abstract	vi
Abbreviations and Acronyms	vii
1. Introduction	1
2. The Reforms	4
3. The Intervention's Impact	11
4. Estimating the Effects of the Reform Based on a Counterfactual Scenario	22
5. The Intervention's Sustainability	30
6. Lessons Learned from the Burkinabe Cotton Reforms	35
Appendix A. Description of the Household Survey and Production Data Used	38
Appendix B. Additional data for the counterfactual computations	39
References	42

List of Tables

Table 1: The chronology of cotton reforms in Burkina Faso 7

Table 2. Types of cotton market structures in Sub-Saharan Africa, along with structural changes 9

(●——►) and attempted structural changes (● - - - ►) 9

Table 3. Cotton production performance in Burkina Faso, Benin, and Mali, 1995–2007 11

Table 4. Nominal Rate of Assistance, West and Central African countries, 1970 to 2005 (percent) 13

Table 5. Estimates of the number of beneficiaries of the intervention, 1996-2006 14

Table 6. Percentage change in household expenditure by occupation, 1995–2003 18

Table 7. Headcount poverty change by regions: 1994–2003 18

Table 8. Back-of-the-envelope estimates of the increased demand for non-cotton goods and services in cotton-growing areas 19

Table 9. Evolution of land use for a representative sample of cotton households in 2006 20

Table 10. Evolution of nutrition-relevant food consumption for representative producers in 2006 21

Table 11. Main hypotheses for the counterfactual and the reform scenarios 23

Table 12. Summary table of the main intervention's impact for cotton households in 2006, compared to 1996 35

Table B.1. Yields and input use in rural cotton Burkina Faso in 2006 (representative sample) 39

Table B.2. Production function estimates 41

List of Figures

Figure 1. Cotton cultivation in Africa and in West Africa 1

Figure 2. Five-year average of seed cotton production in six African countries: 1980-84 to 2000-2004 12

Figure 3. Adjusting Burkina Faso's adjustment figures for cotton smuggled from Côte d'Ivoire 14

Figure 4. A methodology for estimating counterfactual scenarios 22

Figure 5. Counterfactual estimations for changes in land-use (for the main crop) 25

Figure 6. Land allocated to cotton in four Francophone cotton producers: 1994-2007 25

Figure 7. Counterfactual estimates on annual average growth in crop yields (Kg/ha): 1996–2006 26

Figure 8. Counterfactual estimates on annual average growth in crop production: 1996–2006 27

Figure 9. Change in agricultural incomes per active worker for the average household (2006 US$) 28

Figure 10. Change in the number food-secure people under alternative scenarios 29

Figure 11. FAO/IIASA estimates of land suitable for cotton cultivation under different scenarios 32

Figure 12. FAO estimates of degraded land area 33

Figure B.1. Counterfactual estimations for changes in total cultivated land 40

ACKNOWLEDGEMENTS

We would like to acknowledge the support of David Spielman from IFPRI and the Bill & Melinda Gates Foundation, the comments of two anonymous referees and several students reviews of the first draft of this paper.

ABSTRACT

Like other West African cotton producers, Burkina Faso's cotton strategy has traditionally involved substantial government intervention in both input and output markets. Despite some notable successes, this state-led strategy became widely criticized by the late 1980s for inefficiencies, inequities, and for inducing macro-economic instability. However, Burkina Faso rejected both the status quo and wholesale liberalization paths, and instead embarked on a more gradual and sequenced reform path that included strengthening farmers' groups before partially liberalizing input and output markets. Although these reforms have coincided with Burkina Faso becoming the largest cotton exporter in Africa, this paper more rigorously assesses the success of these reforms through both descriptive evidence and a counterfactual analysis of what might have happened if the prereform status quo had continued. We conclude that the reforms were highly successful in terms of production growth, job creation, and in improving nutrition and poverty reduction among cotton producers. However, we also consider important caveats. Partly by design, the reforms were less successful at raising yields, stimulating development in the broader economy, and addressing environmental concerns. The more damaging criticism that the reforms have proved financially unsustainable is also considered. Without being apologist, we argue that the new institutions created under the cotton reforms at least provide a deliberative forum for successfully addressing the problem. A key challenge for the near future will be to ensure that the key institutions in this forum–particularly the farmers union and the former parastatal–are made more accountable to farmers and other key actors in the cotton sectors.

Keywords: Millions Fed, Food Security, Burkina Faso, Cotton, Burkinabe, Reform, SOFITEX, CFDT

ABBREVIATIONS AND ACRONYMS

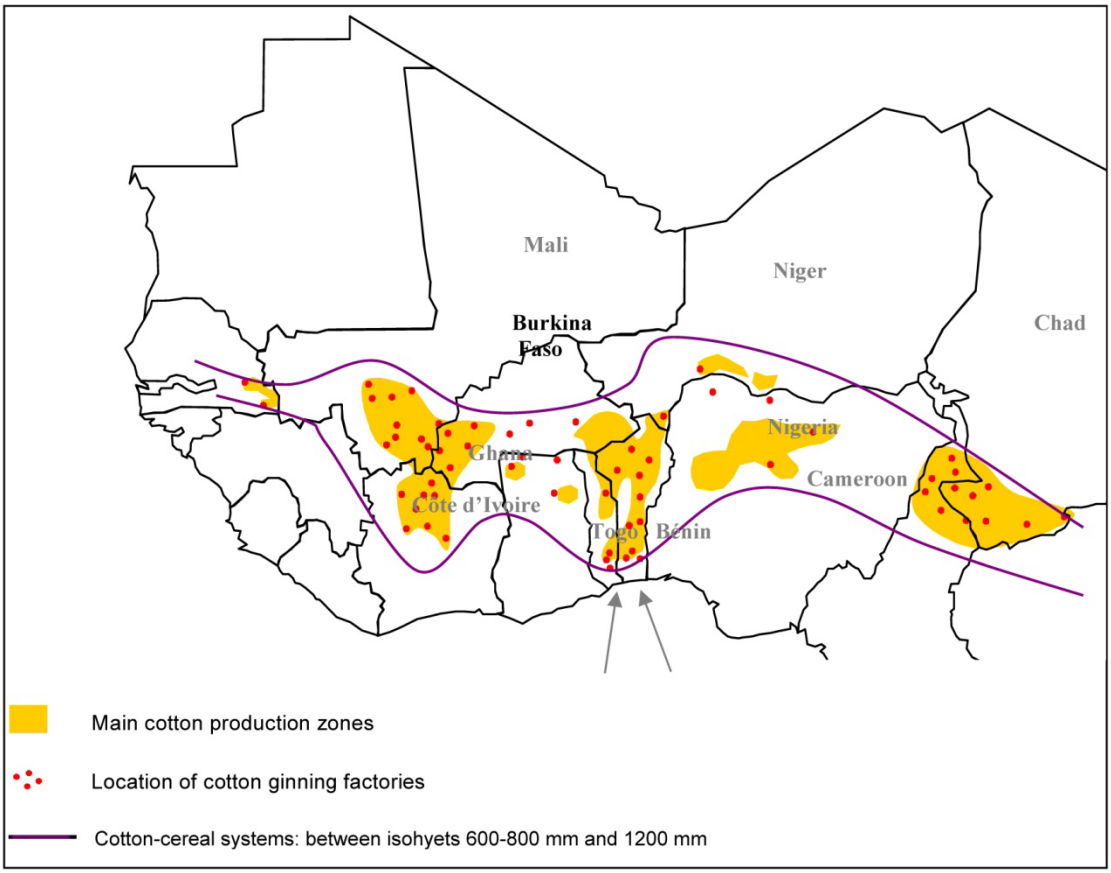
AFD	Agence Française de Développement
AICB	Association Interprofessionnelle du Coton du Burkina Faso
APROCOB	Association Professionnelle des Sociétés Cotonnières du Burkina Faso
BACB	Banque Agricole et Commerciale du Burkina Faso
BAO	Banque d'Afrique de l'Ouest
BIB	Banque Internationale du Burkina Faso
BICIA-B	Banque Internationale pour le Commerce, l'Industrie, et l'Agriculture au Burkina Faso
CFA	Communauté Financière d'Afrique
CFDT	Compagnie Française pour le Développement des Fibres Texties
CIRAD	Centre International de Recherche Agronomique pour le Développement
CMDT	Compagnie Malienne pour le Développement du Textile
CNCA	Caisse Nationale du Crédit Agricole
COPACO	Compagnie Parisienne de Coton
DAGRIS	Développement des Agro-Industries du Sud
DGPSA	Direction Générale des Prévisions Statistiques Agricoles
DHS	Demographic Health Survey
ICAC	International Cotton Advisory Committee
IMF	International Monetary Fund
INERA	Institut National de l'Environnement et de Recherches Agricoles
INSD	Institut National des Statistiques et de la Démographie
IPC	Interprofessional Committee
IPS	Inter Press Services (News Agency)
IRCT	Institut de Recherches du Coton et des Textiles Exotiques
IRD	Institut pour la Recherche et le Développement
FAO	Food and Agricultural Organization of the United Nations
FASOCOTON	Société Cotonnière du Faso (Centre)
FENOP	Fédération Nationale des Organisations de Producteurs du Burkina Faso
GPC	Groupement de Producteurs de Coton
GV	Groupement Villageois
OECD	Organization of Economic Cooperation and Development
ORSTOM	Office de la Recherche Scientifique et Technique d'Outre Mer (called today IRD)
PNGT	Programme National de Gestion des Terroirs
SOCOMA	Société Cotonnière du Gourma (East)
SOFITEX	Société des Fibres Textiles du Burkina Faso (West)
SWAC	Sahelian West African Club
UNPCB	Union Nationale des Producteurs de Coton du Burkina Faso
USD	United States Dollar

1. INTRODUCTION

Cotton and Economic Development in West Africa

The history of cotton in West Africa is both an economic and a political story. On the economic side, cotton has always been a principle cash crop used to barter or purchase other tradable goods (Schwartz 1996). Under the colonial era, it gained further importance as an internationally traded good[1], although usually with limited results (Bassett, 2001; World Bank, 2004). Starting in the 1950's however, cotton cultivation expanded sharply[2]: from 1960 to 2000 production in the African Financial Community (CFA) zone grew at a compound rate of 9 percent per year, so rapidly that by 2,000 francophone Africa accounted for 70 percent of all cotton lint produced in Sub-Saharan Africa, 4.4 percent of total world production, and 13 percent of international cotton fiber exports (a six fold increase from 1960). As of today, 16 to 20 million people in West Africa depend directly or indirectly upon cotton cultivation in a cotton belt stretching across at least 11 countries.

Figure 1. Cotton cultivation in Africa and in West Africa



Source: FAO (2009a); SWAC (2004); and OECD (2004).

[1] According to Moseley and Gray (2008), cotton markets were one of the first commodity markets to be organized at a global scale when the textile sector was industrialized in Great Britain in the late 18th century. Sub-Saharan Africa was "increasingly seen as a potential supplier for European mills" after the civil war in United States.

[2] The expansion of cotton in Sub-Saharan Africa is an outcome of state-led efforts and state-cotton traders' partnerships (more evident in Francophone Africa) and "export promotion policies pushed by the World Bank and IMF" (Moseley and Gray, 2008).

On the political side, cotton is a vitally important sector in a number of these economies, making it the subject of intense competition between different groups. For most of the post-independence era, central governments heavily taxed the cotton sector, which has been the most important source of foreign exchange earnings in countries such as Mali and Burkina Faso (Baffes 2007). However, cotton producers have gradually gained political voice and learned to organize their action to influence policymaking. As a result "The cotton revolution has been the outcome of multi-layered negotiations among farmers, government officials, and a heterogeneous group of cotton promoters over time" (Bassett 2001). The political consciousness of cotton farmers is quite unique in West Africa, and is deeply rooted through the role of cotton in the traditional societies of several ethnic groups, which attached to cotton issues a high "emotional content" (Schwartz, 1996). This shaped the collective action of cotton farmers during the colonial period, when farmers resisted forced cultivation (Bassett 2001; Roberts 1997),[3] as well as the postcolonial period, when farmer agencies were led by the traditional ethnic groups cultivating cotton. Another factor of politicization is the "catalytic mobilization effect" that arose from the early organization of cotton markets at the global and the local scale, which enabled farmers to interact with officials, bilateral donors, and big cotton traders at a scale that is rare in African agriculture (Bingen 1994 1996, and 1998).

The political importance of cotton had meant that West African governments have always taken a keen interest in managing the sector and benefiting from its success. For most of their history, West African cotton economies have utilized monopsonistic state companies for extension services, input, and credit provision, and the marketing of outputs, with prices for seed cotton set panterritorially and panseasonally. This state-led strategy therefore ensured a high degree of government control, but also addressed several of the most important market failures that smallholders face, such as poor access to credit, inputs and information, and highly variable output prices. But despite early successes, the state-led strategy became increasingly criticized by the late 1980s. Foremost among the cited problems were: (1) growing financial insolvency due to bad management and corruption in cotton parastatals[4]; (2) stagnating yields (related to bad management); (3) low profitability for farmers due to substandard margins resulting from both explicit and implicit taxation, and declines of the world price of cotton fiber; and (4) the overall expansion of the cotton sector, which rendered national economies vulnerable to external shocks, such as volatility in cotton prices.

As a result, many African countries (and their donors) considered reforming their cotton sectors in the 1990s with the aim of addressing these problems, although the direction and outcomes of reforms varied tremendously (Goreux and Macrae 2003; Poulton et al. 2004, Tschirley et al. 2009). In particular, a number of countries opted for a radical liberalization of the sector, which often met with disappointing results largely attributed to coordination failures. In spite of better managed ginning firms and better price incentives for farmers, the stability of tying input credit to output procurement was broken down due to the emergence of multiple buyers, which in turn provided the opportunity for farmers to break their input-for-output contracts and engage in side-selling, which further triggered a cascade of detrimental effects along the supply chain (see Poulton et al. 2004; Tschirley et al. 2009; Jayne et al. 1997; or Lele et al. 1989; for an early warning on the dangers of wholesale liberalization).

Burkina Faso notably went down a very different route by trying to address the government failures plaguing the system (corruption, mismanagement, and principal-agent problems) without unleashing the market failures lurking underneath the surface (coordination problems, public goods, economies of scale, and information asymmetries). After considerable debate about the direction of reform among multiple stakeholders, the Burkinabè[5] cotton sector underwent a series of sequenced

[3] Note that the interest of the French in African cotton came as soon as they settled and envisioned the local cotton as a source of ensured revenues, even if the production was entirely controlled by the capitalists. Roberts (1997) shows how this was disapproved of by several specialists who were in favor of the economic development of cotton by the Africans themselves, according to their traditional use.

[4] For some authors, it is the very combination of cotton's economic and political successes that may have contributed to the politicization of its management and the emergence of rent-seeking behavior (Tschirley et al. 2009).

[5] The word "Burkinabè" will be used hereafter in this paper. It is a word borrowed from the Mossi language with the sound

institutional reforms (Section 2). In the mid 1990s, local farmers groups were made more cohesive by restricting membership to cotton farmers only and by allowing groups to select their own members. Then a National Cotton Producers Union was formed and allocated a 30 percent share in the national cotton parastatal, SOFITEX. Next, the government partially liberalized cotton markets by allowing the progressive entry of new players in input and transport markets, as well as new private cotton monopsonies within regions, with an aim to prevent side-selling. Finally, an interprofessional agreement was established to elicit cooperation among key stakeholders, and a new price-setting mechanism with a smoothing fund was established to reduce price volatility.

This paper assesses the effectiveness of these reforms. In particular, we argue that these new arrangements have produced a number of important benefits, namely the enhanced professionalization and participation of producers, the privatization of the more inefficient parastatal activities, and a high level of market coordination and economic cooperation among the main stakeholders (Section 2). These led to noticeable improvements for households in the agricultural sector, despite an almost unprecedented flow of return migrants from war-torn Côte d'Ivoire (most of whom were absorbed into the agricultural sector) and declining cotton prices along with declining value of U.S. dollars with respect to Euros (Section 3). Overall, Burkina Faso's share of world cotton exports has tripled over the past decade, and in 2006, cotton provided about 580,000 full-time jobs (up from 345,000 in 1994) for about 18 percent of the economically active population. Food production has also increased in cotton producing areas over the reform period (DGPSA 2008), and there is also evidence that poverty has declined substantially since the reforms began. This has led to a significant improvement of households' food security for cotton households, in a country where 40 percent of the population is classified as moderately to severely food-insecure. Other things equal, we estimate that, at a minimum, the cotton reform accounts for a 5 percent decline in national food insecurity.

Of course the challenge of all non-experimental empirical research is proving causal linkages between reforms and these highly favorable outcomes. We attempt to do so in two ways. First, we use microeconomic survey data to innovatively establish counterfactual scenarios in which reforms did not take place (Section 4). Second, we use the admittedly imperfect natural experiment by comparing Burkina Faso and neighboring Mali, a country that did not engage in substantial reform but otherwise has similar agro-ecological conditions (Figure 1), common world prices and a common currency, a highly comparable economic structure, and an almost identical institutional history in the cotton sector. Pertinent comparisons with other West African cotton producing countries are also provided.

The basic conclusion from our research is that the reforms were well designed and fundamentally sustainable, and that they had large positive impacts on development outcomes in Burkina Faso. Moreover, given their relatively common circumstances, cotton producers elsewhere in Africa, especially West Africa, potentially stand to learn valuable lessons from the Burkinabè experience, both in terms of general principles and particular policies. Of course, we should not claim that the reform process is unfinished, or that the reforms solved all of the problems facing the Burkinabè cotton sector or West African cotton in general. Our analysis focuses on the 10 years of reform implementation, from 1996 to 2006, using most of the data from this period. However, recent difficulties experienced since 2006 justifiably raise concerns about the financial sustainability of the reforms. In our penultimate section (Section 5), we review these and other problems, including environmental and political sustainability, declining world cotton prices, unfair competition from Organization of Economic Cooperation and Development (OECD) cotton subsidies, and governance issues. These problems remind us that any individual reform cannot solve all of a sector's problem, and that successful reform is ultimately an ongoing rather than a once-off process. That said, the new institutional arrangements that have emerged in the sector offer a deliberative forum for debating key policy issues before implementing additional reforms.

"è". It is not conventional in the French language (according to orthographic rules) that sometimes used "Burkinabé" instead. However, the former was recently accepted by the French academy of letters.

2. THE REFORMS

Early Successes and the Pressure for Reform

According to oral traditions, the cultivation of cotton has always had a specific place in Burkina Faso for several ethnic and social groups (Schwartz 1996). Woven strips were used to pay for tradable goods (salt, kola) and cotton was processed by local craft men for domestic and ritual needs. In Burkina Faso, ethnic groups were specialized in its cultivation (for example, the Sénoufo and the Bwa) and processing (for example, the Marka). This early specialization shaped the later interaction of farmers with officials, with the specialized ethnic groups being the first to expand cultivation and to organize collective action. Cotton then became a coercive tool of the French Upper Volta colony when cultivation became compulsory in the 1920s, but farmers circumvented the "forced corvée" through out-migration and by selling their cotton on the local parallel market or by exporting it to Ghana (named Gold Coast). Similar failures can be found in Mali (Roberts 1997), Côte d'Ivoire (Bassett 2001) and elsewhere in the region (Isaacman and Roberts 1995). So in spite of several adjustments, the failure of the colonial policy in the Upper Volta led to it being dismantled in 1932.

In 1947, Upper Volta was reestablished as an autonomous colony and cotton was again the focus of the colony's development strategy. The French Company for the Development of Textile Fibers (CFDT) carried the marketing organization of the sector in the whole region through a new approach that ultimately led to the "cotton success story" in West Africa. The principle was to encourage farmers through free adhesion to a profitable activity, with strong support in research, extension, and assistance to farmers' organizations. The partnership between the CFDT and the Cotton and Exotic Textiles Research Institute (IRCT) allowed substantial improvements in cotton varieties, and marketing became profitable through the progressive recognition of CFDT quality standards (see below) on the world market.

Due to substantial increases in yields and to growing interests among farmers, cotton areas increased very rapidly after the independence of the Upper Volta in 1960. The CFDT[6] remained a key player, associated through a partnership with the young state, and with bilateral donors who funded several development projects for cotton in the 1970s. This association was then replaced by SOFITEX in 1979, the new parastatal firm also in charge of rural development projects. Meanwhile, the rural communities were progressively organized under a cooperative mode through village groups (GVs), which enabled farmers to self-manage their cotton marketing to SOFITEX, and to access input credit through village-level joint-liability schemes. The introduction of new production techniques (for example, the ox-plow, mineral fertilization, and pesticides) and high-yielding seeds ensured a two-fold increase in agricultural yields over the 1980s, increased cereal production, and improved food security among smallholders. With ample cotton profits, both SOFITEX and the state invested in rural infrastructures (roads, education, and health), and further improving of farmers' living standards.

Despite early successes, state-led contract farming and farmers groups gradually became less and less successful. Falling cotton prices in the late 1980s revealed serious structural problems that were overlooked under better circumstances. In collaboration with donors, West African governments initiated a series of financial and management audits of their cotton sectors. These revealed excessive costs arising from waste, overcharging, duplication of responsibilities, inadequate financial management, and a lack of incentives to control costs (Tefft 2008). Accusations of corruption in cotton parastatals were also common, as well as opportunistic behavior by farmers. In several countries these reviews of the sector coincided with political change, farmer protests and the adoption of broader structural adjustment plans at the behest of the World Bank, International Monetary Fund (IMF), and other donors. The World Bank and IMF also noted the large gap observed between the producer price and the international price in the aftermath of the CFA devaluation, which suggested that cotton farmers did not benefit from the devaluation (Bourdet 2004; ICAC 1998).

[6] The CFDT remained a key player until 2008 through SOFITEX as a co-investor (DAGRIS, GeoCoton) when it decided not to renew its capital shares in the parastatal.

Key Players in the Reform Process

During the revolutionary Sankara regime (1984-87), the state strengthened its support of farmers despite increasing financial difficulties. The regime came to an end in 1987, and was followed by the restoration of elections in 1991. The new regime promoted several political and economic reforms, such as a broad decentralization and a strengthening of the civil society. Nevertheless, these changes were implemented in a top-down fashion, and a more active civil society was restricted by the powerful oligarchy. Reform in the cotton sector was also delayed. The new regime of Blaise Campaoré was more interested in cotton profits and export earnings, and the administration soon colluded with SOFITEX around private nonbenevolent interests. Substantial resources from the state companies, such as SOFITEX, were used to finance the political party of Campaoré. As a result, the price paid to producers declined from 1988 to 1992, GVs accumulated large debts, and production started to collapse at the beginning of the nineties.

There was thus an urgent need to reform the sector. The "Dédougou riot" and the partial boycotting of production in 1991 exacerbated the problems experienced by the growers, who also established their first union, the National Federation of Producer Organizations of Burkina Faso (FENOP), to defend their interests against the growing corruption among officials and SOFITEX executives. The World Bank and the French Agency for Development also strongly supported a reform process, and both donors and the Burkinabè government recognized that the cotton sector was too important to ignore. With its increased weight in the overall economy, problems in the cotton sector had directly contributed to macro-economic instability, including high rates of public debt, inflation, and foreign exchange shortages (cotton exports contributed 50-70 percent of total export earnings in Burkina Faso, as well as in Mali). This led to the "Contrat-plan Etat-SOFITEX"7 in 1993, with the commitment of the state not to interfere with the management of SOFITEX, and with a plan to streamline the accumulated debts of producers and of the parastatal. The plan already mentioned the establishment of new institutions for local farmers, the Cotton Producers Groups (GPCs), together with local credit committees to better manage and monitor the input credit schemes. The privatization and liberalization of the sector were also previously discussed and the donors proposed that the future Burkina Faso National Union of Cotton Producers (UNPCB) be a shareholder of the SOFITEX.

Initially, however, both SOFITEX and cotton producers themselves were in favor of the status quo. According to the review by Bourdet (2004):

> ". . . the governments of the cotton-growing countries own little of the reforms introduced in the sector. There are two reasons behind this limited ownership of home government. The first is the strong opposition of a part of the urban elite and some farmer associations in cotton producing countries to the privatization of the state-owned ginning enterprises, which are at the centre of the network of institutions and actors composing the cotton sector. The second is the opposition of some bilateral donors, in particular France as the main bilateral donor, to the deregulation of the sector."

As a result of this opposition it took five years for the state to find an acceptable compromise and persuade SOFITEX and producer groups that reforms were in their best interests. To do so, SOFITEX and producers' representatives (those from the FENOP notably) were invited on mission trips to Benin, Côte d'Ivoire, and Mali (Côte d'Ivoire's experience with privatization was particularly instructive in that regional zoning had also been introduced there). The loose consensus on the direction of reform was reached when a cooperative framework for dialogue was established around the national stakeholders, and with the visits of Blaise Campaoré himself to the main cotton-growing areas (ICAC 1998).

For its part, the World Bank favored strengthening farmers groups, including a partial shareholding in reformed but not fully privatized parastatals, and recognized the longstanding historical presence of CFDT and the specific institutional framework of the region. However, the Bank did not

[7] This document belongs to the Structural Adjustment Plan for agricultural sectors in Burkina Faso. It was ratified by the state, the World Bank, the French Agency for Development, SOFITEX, and representative producers.

support the idea of local monopsonies that would have failed "to generate the competitive pressures that are the linchpin of this system" (ICAC 1998). The French disagreed with the Bank's position, citing the poor performance of newly-liberalized cotton sectors in other African countries (ICAC 1998). But because of the ownership of the French cotton firm (DAGRIS now called GeoCoton, formerly CFDT) in SOFITEX, cooperation between the French and the World Bank was essential for meaningful reform to take place.

Another potential sticking point was the role that farmers would take in policy decisions in the country. The government obviously recognized the emergence of politicized farmers (particularly FENOP), although they arguably viewed the incorporation of farmers as a necessary step for bringing the World Bank on board. Indeed, the close alignment of the interests of the Burkinabe government and the French suggests that they sought to minimize the political risk of reform through the establishment of a more government-friendly farmers union. Hence they promoted the formation of a new union, the UNPCB, in lieu of supporting the more unionist FENOP. That said, the leadership of UNPCB was partly drawn from FENOP—including the head of the UNPCB, François Traoré - and FENOP representatives were included in the initial fact-finding missions to neighboring countries.

With several hybrid reforms proposed, a consensus for the reform was reached among national stakeholders, the National Agricultural Bank (CNCA), farmers, the French Agency for Development, and the World Bank. Producer representatives were then sent to villages to convince local farmers about the advantages of the reform plan, while new extension agents were sent to explain the new legal rules for co-operative formation among cotton farmers. For its part, the state's primary interest was in streamlining the sector to make it financially viable, while also being in compliance with aid conditionality conditions. Hence the state had a strong interest in at least ensuring the success of the reforms, especially in terms of export earnings. Once the reform plan was agreed upon, the French Agency for Development invested substantial funds for capacity-building programs to assist the creation of the GPCs and the UNPCB.

Details of the Reforms, and their Economic Rationale

Table 1 shows the chronology and basic content of the reforms. The principal conclusion we will draw from Table 1 is that Burkina Faso's reform process was distinguished by a mix of gradualism, sequencing, and institution building. The gradualism is self evident from the fact that reforms were carried out over a 14-year period (1992 to 2006) in a stepwise fashion (Bourdet 2004). The interrelated importance of sequencing and strengthening institutions requires a more careful appraisal, including an appraisal of alternative reform paths. A particularly tempting avenue of reform for donors could have been wholesale liberalization, and with varying degrees of structure and speed, this was a path pursued by many other cotton-producing countries in Africa (Tschirley et al. 2009). As we noted in the introduction, however, the problem with this path is the tradeoff between competition and a series of market failures—such as information asymmetries and principal-agent problems in credit markets - that could quickly have led to side-selling, credit rationing, a self-defeating loss of competition, and the under-provision of various public goods (R&D, quality control, marketing, price stabilization). On the other hand keeping the status quo was also undesirable. But if some degree of public or private monopsony needed to be maintained, then strengthening smallholder participation would also be vital to avoid exploitation of farmers—a position supported by the French cooperation.

Table 1: The chronology of cotton reforms in Burkina Faso

Institution building –up	1992-1993: A formal commitment was made by SOFITEX, the cotton parastatals, to engage producers' representatives to participate in the reform debate through the "Contrat-Plan Etat SOFITEX".
	1994: Amendment in 1994 on the laws pertaining to the establishment of farmer groups.
	1996–1999: Introduction of free-adhesion based mechanisms for local groups of cotton farmers, replacing former village groups (the GVs) by market-oriented organizations, the GPCs, with the implementation of new local governance rules.
	1996–2001: Progressive establishment of the national cotton union (UNPCB), with the support of the French Agency for Development, the government, and SOFITEX (the national cotton parastatal company), based on the membership of local groups and their integration into regional unions.
	1998: Establishment of the Accord Interprofessionnel (Interprofessional Agreement) between SOFITEX, the state, UNPCB, donors, and the financial consortium (CNCA, BICIA-BIB), replacing the former "Contrat-plan" and defining the reallocation of responsibilities.
Progressive reallocation of responsibilities towards new institutions	1999: A partial withdrawal of the state, with the partial privatization of SOFITEX with the government allocating half of its SOFITEX's shares to the UNPCB.
	2000-2006: Progressive delegation of economic activities from SOFITEX and the government to UNPCB: provision of cereal input credit, management assistance of cotton groups and participation in quality grading, financial management and price bargaining. The state downsized its involvement in public good investment (research and extension services).
	2002–2006: Progressive introduction of new players: private input providers, new regional private cotton monopsonies (SOCOMA and FASOCOTON) in 2004, and private transport companies.
	2004–2006: Establishment of Burkina Faso Interprofessional Association of Cotton (AICB) with cooperation among well-represented[8] stakeholders: cotton farmers, banks, private stakeholders, government, and research institutes. Establishment of an association of cotton firms (APROCOB) interacting with UNPCB within the AICB.
	2006: Change in the price-setting mechanism with more correspondence relative to world price levels and the creation of a new smoothing fund, operational in 2008 and managed by an independent organization.[9]

Source: Constructed by the authors

Hence the first stage of reform was about building up farmer organizations rather than prematurely introducing competition into the sector. In 1996 the government legally replaced village groups (GVs) that were involuntary with market-oriented free adhesion groups for cotton farmers (GPCs). The significance of changing the rules for grassroots group formation should not be underestimated. Although collective decision-making and collective responsibility are widely thought to be highly ingrained features of rural African economies, farmers groups in Africa have a checkered history from an economic viewpoint (Bernard et al. 2008). In particular, the former joint-liability system of GVs grouped cotton and non-cotton growers from the same villages for their input needs, but the input cost was deducted from the value of cotton sales rather than sales of all products, meaning that farmers had weak incentives to produce cotton. Moreover, GVs were formed at village level, despite a high degree of heterogeneity within village and limited capacity for members to monitor each other. This eventually led to very high default rates across the GVs, as well as financial diversion from the GV activities to local rural development projects rather than cotton projects specifically. Worst still, the joint-liability system for credit repayment left the door wide open for all kinds of abuses, such as fertilizer and farm equipment

[8] Each stakeholder has representatives in the two committees of the interprofessional body: the management and the decisional committees. A growing number of decisions has been decided and enforced by these two committees since 2004. The model is a hybrid public-private regulatory agency.

[9] This smoothing mechanism is a new generation of smoothing funds and Burkina Faso was the first to adopt it as a strategy against the current cotton crisis in the region. The fund is linked to the price-setting mechanism and is used to compensate discrepancies between pre-harvest set prices and observed world prices at time of commercialization. The French cooperation originally put money into the fund in 2008 and the mechanism involves the smoothing of the set price of cotton purchase by cotton companies according to world price variations, compensation when world price declines substantially, and a contribution from farmers and companies when the trend is positive. The BAO is in charge of the management of the smoothing fund to ensure a balanced budget in the long run.

being misappropriated for either resale or other crops. As of September 30, 1995, their debt to the CNCA reached CFA francs (CFAF) 2.1 billion, not including internal outstanding debts (ICAC 1998).

Thus, the creation of GPCs was aimed at addressing these problems by allowing producers to create their own cotton-only groups, and for these groups to freely accept or reject new members. Groups are thus self-selected, and are likely to be more homogenous in terms of their household and farm characteristics. In fact, learning from past experience, these GPCs have adopted tight member policies (through high membership fees, refusal of certain individuals for weak reputation, and exclusion of defaulters), particularly when compared to noncotton groups in the same regions, which are 60 percent larger on average (25 and 42 members respectively).[10]

Once the reform of farmers' groups was underway, reform efforts focused on the parastatals. The approach was pragmatic and piecemeal, without brushing aside the problems that had been identified with the cotton parastatals. SOFITEX, for example, had a monopoly over the provision of input credit for cotton growers, but new private companies claimed they could provide inputs to farmers at a lower cost, thus improving farmers' profit margins (the same was true of transport services). The proposed solution was to grant regional monopolies/monopsonies to private firms. This "zoning" was essentially a compromise[11] reached by the Burkinabè government between the strong privatization leanings of the World Bank and the reluctance of farmers and SOFITEX to let go of the integrated commodity-chain model. Consensus-building was made relatively easy for the government because of its oligarchic structure and the consensus-building process based on field missions to Benin, Mali, and Côte d'Ivoire.[12] Burkinabè officials were particularly inspired by the Ivorian zoning approach initiated in 1998 when the Ivorian parastatal CIDT was split into three independently managed cotton firms. Although the Ivorian reforms eventually proved unsuccessful, Burkinabè reformers were able to learn from that experience (see below).

The economic challenge of zoning is the low induced level of competition, which can result in weak incentives both for producers and for local monopolies, as in the case of Mozambique (see Tschirley et al. 2009). In Côte d'Ivoire also, several local monopolies bankrupted due to their inability to gain profits in the short term, or to provide attractive arrangements to farmers. But despite the risks, zoning can reduce coordination failures since regulatory schemes need only coordinate and negotiate with the relatively small number of market players means. In the case of Burkina Faso, the government first established an interprofessional agreement comprised of SOFITEX, the UNPCB, which later led to the Burkina Faso Interprofessional Association of Cotton (AICB) by integrating other key market players, especially the regional monopsonies, the Cotton Society of Gourma (SOCOMA) in the East and the Central Cotton Society of Faso (FASOCOTON) in the Center. This partnership was small enough to allow effective negotiation over collective issues, such as common marketing strategies to help ginning companies derive higher value-added on world cotton markets, reallocating the cost bearing of agricultural research and extension, and price stabilization mechanisms.

New initiatives were also established to expand cotton production areas and improve yields, with farmers consistently involved in the deliberation process. The government undertook the development of 50,000 new hectares from 1996 to 2001 in the East and in new areas of the South. Other projects had trialed organic farming, and Burkina Faso was the first country in the region to experiment with Bacillus thuringiensis (Bt) cotton in 2003 (see Section 5 for further discussion). Extension programs also made new manure (organic fertilization) and animal-driven techniques more accessible for farmers, and their adoption rapidly increased over the reform period. That said, the reform did not lead to a full-scale

[10] Statistics are based on a 2002 survey of 84 GPC and 149 other formal groups within the cotton zone. See Bernard et al. (2008).

[11] The idea of "zoning" was first conducted by the World Bank in Côte d'Ivoire to foster more competition. But the Burkinabè zoning model was based on 'concession' areas with exclusive purchase areas, on which the World Bank strongly disagreed (ICAC 1998).

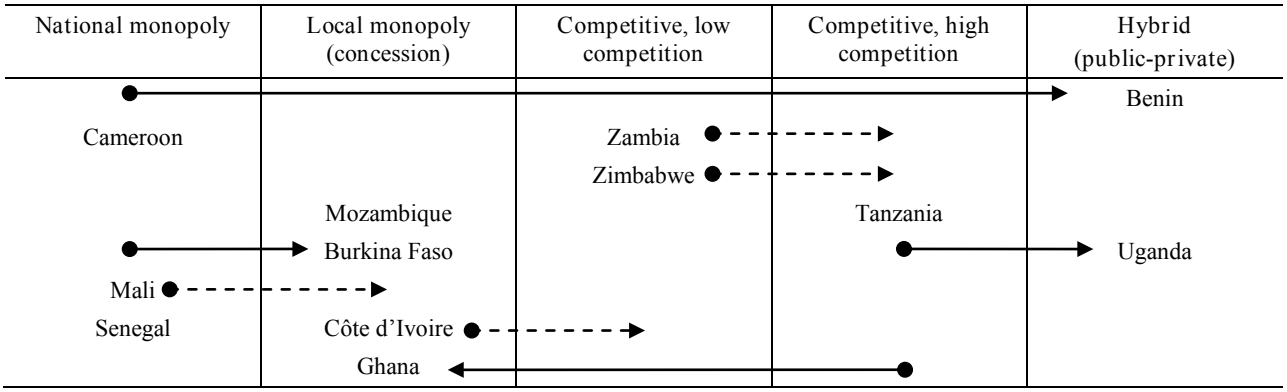
[12] It is worth noting that producers were consulted in the choice of the two private actors. In fact, they even rejected one of the initially chosen firms for its poor reputation in neighboring countries.

technical revolution, but instead provided a new institutional framework to deliberate on improved strategies for the sector.

Burkina's Intervention in Comparative Perspective

Burkina Faso is only one of a dozen or so significant cotton producers in Sub-Saharan Africa. Moreover, like Burkina Faso, most other African cotton-producing countries have made some attempt at reforming the cotton sector, and several have engaged in quite drastic reforms. A recent study by Tschirley et al. (2009) compares five types of market structure in nine African cotton-producing countries, and tries to track how these different types influence the performance of the sector. The five types of cotton market structures are depicted in Table 2, which shows a marked difference between more liberalized Eastern and Southern African countries (generally Anglophone),[13] and Francophone West African countries. Since Burkina's reform path is more relevant to other Francophone countries (and vice versa), we largely focus on these.

Table 2. Types of cotton market structures in Sub-Saharan Africa, along with structural changes (●——▶) and attempted structural changes (● - - - ▶)



Source: Tschirley et al. (2009). Francophone West African countries are highlighted.

According to Fok (2008) and Bingen (1998), the Francophone model addressed the interests of farmers, states, and the CFDT through its institutional specificity. This model is characterized by four key features. First, the joint CFDT-state parastatals were meant to attract foreign public capital (from the World Bank notably). Second, it benefited from 50 years of French investment in cotton research (ORSTOM, CIRAD) with central laboratories in France. Third, national parastatals were linked to COPACO[14], the marketing unit of CFDT, which ensured a market identity on the world market and recognition of quality. Fourth, monopsonistic power on national production allowed parastatals to purchase agricultural supplies at concessional terms, or through public subsidies.

Clearly this viewpoint identifies a strong economic rationale for the Francophone model, especially insofar as it addressed farmers' liquidity constraints, risk aversion, high transaction costs, and shortage of public goods. These features explain why Francophone West-African countries questioned the World Bank's critique of the sector, and instead adopted a more cautious approach to reform. Farmers groups and regional and national unions were also set up in Benin in 1993 (three years before Burkina

[13] Mozambique is an exception in bearing a closer affinity to West African cotton countries, in that it has regional monopolies (like Burkina Faso) and greater intervention in pricing (like all of West Africa). However, unlike Burkina Faso, farmers groups in Mozambique are very weak, regional concessions have been granted without any provision for periodic evaluation and re-tendering, and re-zoning has been ad hoc. See Tschirley et al (2009).

[14] Note that the zoning approach of Burkina Faso relied on already-established large traders on the export market of cotton fiber COPACO and Reinhart. As noted by Bassett (2008), these traders act as an oligopoly, and can benefit from more stable prices on the world market, securing some of their commercial margins.

Faso) and in Cameroon in 2000, while the process is still under way in Mali. In Mali, conservative leanings and strong ties to existing farmers' groups hampered the emergence of more flexible farmers' groups that could help increase repayment rates on credit (as per the GPCs in Burkina Faso),[15] and a more contestable democracy has slowed down the reform process. Mali and Cameroon are also trying to follow the Burkinabè model by allocating a significant share of the capital of privatized cotton companies to the farmers union, and all other West African countries are also trying to transfer more responsibilities for input supply and/or extension services onto farmers groups or the farmers unions.

However, apart from Burkina Faso, only Benin (in 1995) and Côte d'Ivoire (in 1998) have so far permitted private control of cotton companies, although both countries have precluded competition for the supply of seed cotton, whereas the rights to purchase seed cotton in Burkina Faso are allocated to three regional monopolies. The approach in Benin was to give responsibility for activities at different stages of the supply chain to separate private firms, then to establish coordinating institutions to ensure that the different stages of the supply chain function together. Thus, input supply was privatized first, starting in 1992, followed by ginning in 1995, then transportation. Multiple actors, mostly local firms, have now been allowed to enter these different stages, but the prices of different goods and services are still centrally determined, as is the distribution of seed cotton across ginneries (see Baffes 2007). Observers also point to the continued favoring of the poorly managed parastatal (Bourdet 2004), estimated to amount to an extra cost of CFAF 65 per kg sold (Salé et al. 2001). Bourdet (2004) also mentions the possibility of excess entry into the sector, which reduced profits. Another factor in Benin may be the more limited capacity to expand cotton areas, although we note that in other regards Benin has advantages over Mali and Burkina Faso (for example, lower transport costs). In spite of more competitive markets in Benin, SOFITEX remained more cost-efficient than its Beninese counterparts, thanks to a better institutional framework and better market coordination among the stakeholders.

In Côte d'Ivoire the zoning system collapsed because of a lack of an established regulatory scheme, as well as the disastrous effects of the political crisis. In addition, the selection of the new operators in Côte d'Ivoire was not based on long-term development objectives, and there was a growing conflict of leadership among producers and ginneries, and the inevitable disputes were difficult to resolve in the absence of any interprofessional committee (IPC). Add to that the political crisis in Côte d'Ivoire, and it is little surprise that cotton firms experienced financial difficulties and producers received lower prices. One consequence of this was that a significant amount of Ivorian cotton was smuggled into Burkina Faso and Mali.

Given their institutional, geographic, and economic similarities, differences in economic outcomes among Francophone cotton producers can largely be attributed to policy choices and the political dynamics underlying those choices. Hence, in subsequent sections we will use this admittedly imperfect natural experiment to assess the impacts of Burkina Faso's reforms. In our concluding section we will also make note of the important political preconditions for successful reform of West African cotton sectors.

[15] As shown in Bernard et al. (2009), the establishment of new market-oriented organizations at the local level may be constrained by former community-oriented organizations. The traditional village groups of cotton farmers in Mali are a case in point.

3. THE INTERVENTION'S IMPACT

In this section, we assess the impact of the cotton reform on several important indicators of growth and development. According to stakeholders, the purpose of the reform was to reorganize the sector, recover management and financial performance, and make viable outgrower schemes. This point of view is shared among bilateral donors, national financial institutions, and the state. François Traoré (president of UNPCB) though, envisioned the reform as a necessary step towards farmers' professionalizing and partnership.[16] Thus the expected consequences applied to production, export earnings, improving the financial status of farmers groups, and broader economic growth and poverty reduction. Although food security concerns were not an explicit objective, any increase in income should obviously impact on food consumption, so we also closely examine available food security statistics.

Growth in Agricultural Production and Exports

Table 3. Cotton production performance in Burkina Faso, Benin, and Mali, 1995–2007

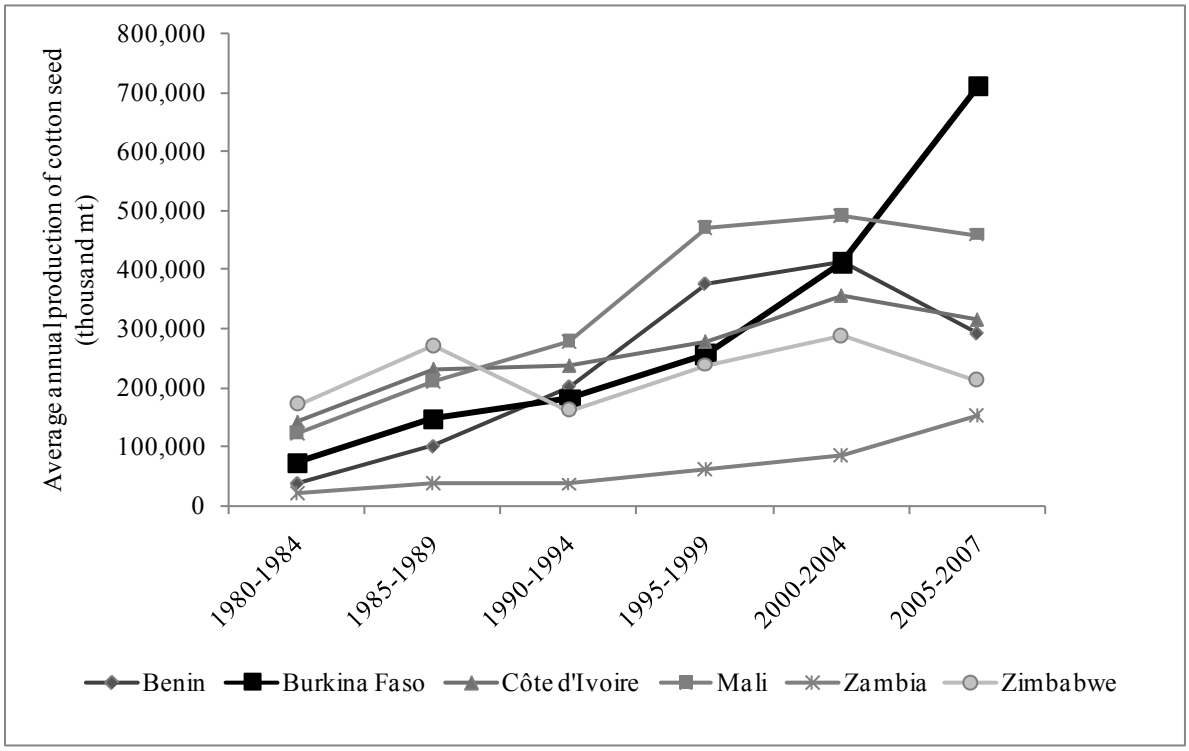
Performance	Benin	Burkina Faso	Mali
Production of seed cotton in 1995 (tons)	328,227	150,451	405,907
Production of seed cotton in 2007 (tons)	313,500	690,000	414,965
Average annual growth rate	-0.38%	13.53%	0.18%
Cotton areas in 1995 in ha	246789	145362	335463
Cotton areas in 2007 in ha	285000	699797	479734
Average annual growth rate	1.21%	13.99%	3.03%
Yields in 1995 in kg/ha	13,297	10,346	12,072
Yields in 2007	11,000	9,857	8,645
Average annual growth rate	-1.57%	-0.40%	-2.74%
Production/agricultural worker 1995	90.0 kg	16.6 kg	47.9 kg
Production/agricultural worker 2007	73.9 kg	53.9 kg	37.7 kg
Average annual growth rate	-1.63%	10.31%	-1.98%
Export earnings in 1995	169 US$ million	68 US$ million	201 US$ million
Export earnings in 2006	110 US$ million	235 US$ million	256 US$ million
Average annual growth rate	-3.83%	11.93%	2.22%

Source: FAO (2009a)

An indirect indicator of the success of the reforms is that Burkina Faso overtakes Mali and Egypt to become the African leader in 2006 and 2007 in cotton production and exports of lint cotton, based on a threefold increase in production since the early 1990s. Only Zambia can claim an equivalently impressive growth rate in cotton production, although even now Zambia only produces about one-fifth of Burkina's total production. So rapid has been Burkina Faso's cotton growth that production in 2007 exceeded Mali's production by 66 percent. As for its contribution to growth, cotton production accounted for 3.3 percent of national agricultural production before the reform, and reached over 8 percent in 2006 (FAO 2009a). For the other agricultural products, annual average growth rates in constant value have been around 2 percent, so cotton production has played an increasingly important role in agricultural growth, and accounts now for more than 10 percent of total GDP growth.

[16] He was notably inspired by the Malian experience from the late 1980s until the early 1990s (see Tefft 2008). However, he thought that cotton farmers should first set up their professional organizations before undertaking political action, so as to favor and facilitate the implementation of the reform.

Figure 2. Five-year average of seed cotton production in six African countries: 1980-84 to 2000-2004



Source: FAO (2009a)

In neighboring countries, production has followed very different patterns. Mali and Benin experienced some production growth, but at much slower rates than in Burkina Faso. After a short-term positive effect following early reforms, production collapsed in Benin after 2003 due to coordination failures in the newly liberalized sector, including difficulties in recovering input loans and lower investment in critical functions such as research and extension services. In Mali, production stagnated over the last decade after strong growth in the early 1990s. As discussed above, the sector has been characterized by uncertainty and gridlock over reform, particularly in the form of political tensions between the parastatal and farmers.

As to the sources of growth, an unusual feature of Burkina's success story is that production growth has largely been based on increased land use for cotton and the entry of many new producers (see below) in a very short period of time. This extensive growth pattern (a phenomenon also observed by Bassett (2001) for Mali, Côte d'Ivoire, and Guinea was largely driven by the intervention itself, since it significantly improved incentives for cotton production through better contractual relationships within farmer groups, and between farmer groups and cotton firms. Kaminski and Thomas (2008) show that the direct effects from the reform involved earlier payments of cotton seed to farmers, easier access to inputs, and a guarantee of selling. Thus, the lower risk profile of the cotton crop, together with better use of inputs, has been instrumental to Burkina's success.

Another potential source of growth can lie in the pricing issue. As Baffes (2007) showed, West and Central African Francophone countries typically went from taxing producers to a more or less neutral stance (except in the late 1980s), as displayed in Table 4. The shift from taxation to supportive governmental policies is often explained by the world prices levels, and the willingness of states to give sufficient incentives to farmers to keep growing cotton. Hence, taxation often occurred in "good times" and support in "bad times." This is observed through the indicator of "nominal rate of assistance," or the

percentage difference between the value of gross farm receipts including support or taxation, and gross farm receipts valued at world market prices without support. Nevertheless, the change in the price-determination mechanism over the last decade eliminated a major part of governments' intervention in pricing. From the World Bank perspective, this was one of the goals of reform, so the reform was successful in this respect. However, since several countries engaged in these reforms, it is notable that Burkina Faso achieved much higher production growth than its peers (Figure 2 and Table 3). This implies that simply fixing the prices was not sufficient to achieve production growth and that institutional reforms were key to Burkina's success (Kaminski and Thomas 2008). Further indicative evidence that it was the reform itself that contributed to this growth is that in the 10 years before the reform (1986–1995) production growth averaged around 9 percent per annum, whereas in the 10 years since the reform process, growth averaged over 20 percent per annum.

Table 4. Nominal Rate of Assistance, West and Central African countries, 1970 to 2005 (percent)

Country	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-05
Benin	-44	-49	-49	-5	-24	-22	-6
Burkina Faso	-44	-48	-58	-8	-26	-28	1
Cameroon	-41	-40	-37	33	-18	-22	3
Chad	-47	-48	-52	6	-21	-21	-3
Côte d'Ivoire	-32	-28	-50	-5	-30	-27	-5
Mali	-56	-55	-59	-17	-25	-33	3
Senegal	-46	-50	-59	-10	-19	-29	-11
Togo	-41	-46	-60	-14	-25	-24	-13
Average	-45	-44	-52	-3	-25	-26	-4

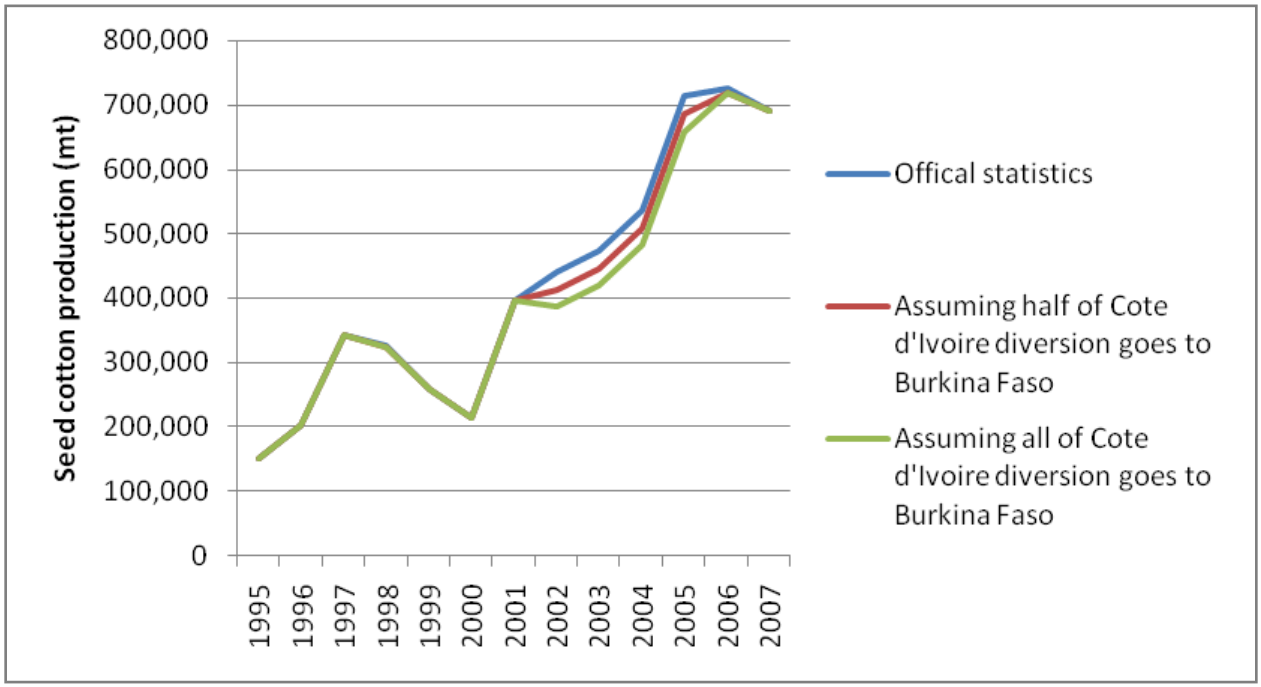
Source: Table 8 from Baffes (2007).

We also note that the indirect contributions of cotton sector growth to GDP growth might also be significant, especially in terms of foreign exchange. Pre-reform cotton exports represented less than 30 percent of national export earnings, but reached as high as 70 percent during the reform period and are now regularly around 50 percent. These additional earnings contributed to the purchase of both consumption and investment goods from abroad, although there is no data to make any stronger inferences as to the size of these intersectoral linkages, which in large part depended upon how effectively foreign reserves are used.

Finally, one significant concern in interpreting Burkina Faso's export performance is the side-selling problem associated with Côte d'Ivoire political crisis over 2002–2006. This crisis resulted in the Ivorian private company LCCI not paying many cotton growers for four years and made Côte d'Ivoire's borders more porous. Hence, a substantial quantity of cotton was smuggled across the Burkinabè and Malian borders. Could the Ivorian effect substantially diminish Burkina Faso's success story? On the one hand, the surplus of production inflow it generated is quite small compared to the national production trend in Burkina Faso during this period, and Burkina Faso production figures should not directly include smuggled cotton. However, it is likely that a large share of smuggled cotton that went through Mali and Burkina Faso was directly sold to local farmers or marketed through GPC structures by local traders or conveyors and then through more formal channels. Since 2002, cotton trafficking from Côte d'Ivoire to Mali and Burkina Faso has been up to 70,000 tons per year (in 2004) at peak, according to Aly Ouattara (IPS). Nadjin Ouattara and Diabaté (IPS) estimate that 220,000 tons of Ivorian cotton was sold to Burkinabe and Malian cotton firms from 2002 to 2006. According to the Supply Chain Monitoring Committee (*Comité de suivi de la filière)*, only 6,000 tons were diverted in 2006. On average, so one can consider that 25,000 tons of Ivorian cotton was marketed to SOFITEX each year from 2002 until 2006 (assuming the smuggled cotton was equally divided between Mali and Burkina Faso). Although this is substantial, it actually makes very little difference to the growth rate of cotton production in Burkina

Faso. Indeed, since there appears to have been no diversion in 2007, the average annual growth rate of production over 1995–2007 was unchanged (see Figure 3).

Figure 3. Adjusting Burkina Faso's adjustment figures for cotton smuggled from Côte d'Ivoire



Source: Official statistics are from the FAO (2009a). Assumptions regarding sourcing from Côte d'Ivoire are described in the text.

Contributions to Employment Creation

As noted above, growth in Burkina has involved an extensive growth process, including greater use of labor. Indeed, the share of cotton farmers (and related household members) almost doubled between 1994 and 2003, from 11.3 percent to 19.9 percent of agricultural employment.

Table 5. Estimates of the number of beneficiaries of the intervention, 1996-2006

	1996	2006
Number of households who cultivate cotton	98,520	176,570
Population living with cotton earnings	837,250	1,845,300
Full-time "cotton jobs" in the agricultural sector	345,000	580,000
Average cultivated land by a household who produces cotton	6.06 ha	6.92 ha
Average land share dedicated to cotton by cotton farmers	0.34	0.56
Number of GPCs (1999, rather than 1996)	6600	9100
Number of ginneries	5	18

Notes: Land shares are gross estimates but overestimate land use since other crops are often associated to cotton within the same plots (inter-cropping and mixed farming). On average, the net land share dedicated to cotton roughly shifted from 0.3 to 0.5 (figures given by local World Bank officer in 2006) but it is difficult to estimate precisely the net land share.

Sources: The below table displays estimates of cotton farmers' characteristics obtained by a survey of representative households in cotton areas of Burkina Faso (Kaminski 2006) and from official data (DGPSA 2008).

In terms of raw numbers, the acceleration in cotton production absorbed more than 200,000 new farmers[17] (the number of households of cotton farmers almost doubled in these 10 years) among which some were already cropping land and others were migrants. This absorption of new labor was remarkable not only because previous influxes of return migrants have been associated with unemployment and economic turmoil (for example, Ghana in the early 1980s), but also because the cotton reforms allowed returning migrants from Côte d'Ivoire to quickly access inputs and form their own farmer groups (Kaminski 2006), which were integrated into the UNPCB and regional unions. According to Savadogo and Sakurai (2007), the impact of the political crisis in Côte d'Ivoire on Burkinabè agriculture was the influx of 0.7 to 0.8 additional active workers per rural household. Overall, it is estimated that cotton growth in Burkina Faso created around 235,000 full time jobs, such that cotton farmers represent almost one-sixth of all rural households in Burkina Faso, the largest employment group in the country (see Table 5).

Financial Outcomes

An important goal of the reform was to ensure that farmers repaid loans. In this regard, results for external repayments of farmers' groups have been very impressive. From repayment rates of around 40 percent before the reform, repayment rates have risen to around 95 percent (under standard climatic conditions) thanks to a better management of outgrower schemes and more cohesive farmer groups[18]. Input use was already quite high among cotton growers before the reform, so input use per hectare has not risen markedly (see Table B.1 in appendix).[19] However, many new farmers and new areas of cultivation have benefited from greater access to inputs, which in turn supported the expansion of cotton cultivation.

The expansion of modern inputs has also contributed to increased availability of inputs for cereal production (on credit, and linked to cotton production), which are now cautiously managed by the UNPCB.[20] GPCs are central at a time of rapid commercialization of cotton production, since they reduce costs of collection by centralizing members' products (eventually gathering products from other local GPCs as well), check weights, and grades with purchasers, and even engage in legal action in case of disagreements. The establishment of many GPCs was easily accepted at the village scale because of the former failures of the GVs, and because extension agents and farmers' representatives made accessible the new cooperative rules, supported by the French cooperation. An estimated 12,000 such groups have emerged over the past decade and the number of GPCs has increased at a much faster rate than the number of producers, suggesting an effective process of matching member through self-selection. This has been supported by capacity-building programs and the training of representatives for management and secretarial tasks through literacy and technical programs.

Overall, more than 80 percent of GPCs are engaged in input provision, and nearly 100 percent in output commercialization services for their members' cotton. In many cases, such services are also provided for crops other than cotton. In all, GPCs appear relatively dynamic with less than 1 percent of them considered as inactive (10 percent for the other groups in the region). So the formation of cotton

[17] This figure is measured in terms of full-time employment in the agricultural sector where active men have a coefficient of 1, women, and children from 6 to 18 years and old people within households have a coefficient of 0.5.

[18] It is now possible to track input and land use for each individual cotton farmer through the data of GPCs, and to know the detailed financial information about individual profits and debts. Managers of GPCs are offered specific training programs and the local credit committees have substantially improved the performance of outgrower schemes for cotton farmers, according to their input needs for both cotton and cereals. Last, farmers themselves express more confidence in their local leaders and trust in the new governance systems.

[19] According to technical assistants and extension officers met in rural Burkina Faso in 2006, the quantity of fertilizers and pesticides that can be borrowed by hectare of cultivated cotton is limited to a certain debt threshold that depends on the group repayment history, the production history of the farmer, and its experience in cotton growing. Generally, the total input loan cannot exceed a debt threshold comprised between 40 to 60 percent of expected cotton production. For input loans for cereal production, the demand is separated from cotton needs, but also discussed with the same managers (and the ones of UNPCB) and the credit repayment is also based on cotton sales.

[20] This program may still be scaled up once financial institutions have been convinced by the encouraging results induced by the cotton reform.

groups at least achieved some immediate goals such as the increase in repayment rates mentioned above. GPCs comprised the grassroots link the in the broader five-part chain of farmer participation in the cotton sector (through the presence of GPC representatives for weighing and quality grading by SOFITEX agents, and participation in assemblies at departmental and regional levels), which extended up to regional farmers group, and up again to the cotton farmers union, the UNPCB (Goreaux and Macrae 2003).

This positive outcome should be attributed to the establishment of GPCs, although there are caveats. Some groups have incurred higher internal debts (cleared by the most productive members of the groups), as shown by Gray (2008), which has been associated with some disenchantment with cotton production since 2005. Internal debts grew substantially from 2006–2009 (see Section 5),[21] which has raised concern about the cohesiveness of GPCs (Kaminski 2009b). The effectiveness of GPC mechanisms (joint-liability and marketing in group) therefore seems to be jeopardized and vulnerable to external market and climatic conditions. This is particularly because contractual arrangements with SOFITEX have deteriorated over the past few years, which has farmers to divert input under later cash payments.[22] More research is required to verify why internal debt levels have risen in Burkina Faso, because there is little doubt that until 2006 external repayment rates were higher than in peer countries (Tschirley et al. 2009).

In addition to repayment issues, the financial sustainability of the sector also requires competitive ginning costs, efficient transportation and marketing, research and extension investment, improved management of cotton firms, and realistic but fair price determination mechanisms. According to Bourdet (2004), production costs at SOFITEX only increased slightly in nominal terms and most likely decreased in real terms, which explains the greater profitability in Burkina Faso as compared to Mali and Benin. During the late 1990s, investments in new ginning plants and factories also contributed to the increase in ginning yields. After the withdrawal of the state though, subsequent audits confirmed that the ginning equipment had become too old and decayed. There is also a recurrent problem of inadequate upkeep for the machinery.

Other factors contributing to Burkina's success include the greater competition among trading companies in charge of the sale of cotton from Burkina Faso and a more successful policy of forward sales in the early 2000s (Goreux and Macrae 2003). Increasing production costs of the Malian Textile Company (CMDT) in Mali are also well documented by several audits (for example, Gergely 2004), and often attributed to the lack of competition and to the perennial mentality that the state or donors will always bail the sector out if it gets into trouble (Bourdet 2004). According to Béroud (1999), French public aid notably contributed to "softening the budget constraints faced by state-owned ginning companies and to weakening incentives for ginning cost-efficiency,"while the interplay between Dagris and French cooperation meant that the latter was not sufficiently impartial. However, this argument is debatable for two reasons. First, cotton support has been a partnership between West African governments and French Agency for Development, meaning that the latter also had an interest in bailing out the sector in case of financial difficulties (i.e., irrespective on the French Agency for Development's relationship with Dagris). The softening of budget constraints should therefore be envisioned as a long-term convergence of interests between governments and foreign agencies. Secondly, the level of overall French support to the cotton sector has substantially decreased in the course of privatization over the past few years (in Burkina Faso). Governments are now expecting less support from foreign partners since the latter now have less strategic interests in the sector (Dagris has exited the shareholding of Sofitex in 2008), so donors now have a much stronger interest in promoting the financial stability of the sector.

[21] This was driven by later payments of seed cotton, pushing the most cash-constrained farmers to sell some of their agricultural inputs on the black market at the beginning of the next crop season, and also by lower purchase prices and higher costs of inputs.

[22] Of course there is bound to be substantial variation in repayment rates. A survey in 2006 (Kaminski, 2006) showed that internal debts varied substantially across GPCs and that credit repayment rates were significantly associated with group size and group heterogeneity.

Income and Poverty

The ultimate test of the broader success of this intervention is its implied reduction of poverty. However, poverty outcomes remain difficult to assess with descriptive data alone. In fact, while the overall trend of rural incomes in Burkina Faso has been positive, the poverty impacts of the intervention have clearly been distorted by the negative effects of the political crisis in Côte d'Ivoire,[23] decreasing cotton world prices, increasing prices of inputs (especially fertilizers), as well as by the positive effect of the unusually large price margins received by farmers. Hence, assessing counterfactual scenarios, as we do in Section 4, is also important.

In recent times cotton has developed a poor reputation with respect to poverty reduction because of the so-called Sikasso Paradox,[24] which states that even though cotton producers reside in fertile areas (for example, Sikasso, Mali) and produce a lucrative export crop that receives a large share of public agricultural support in West Africa, most cotton producers still live under the poverty line. In fact, this paradox seems to be explained by highly inappropriate poverty measurement in Mali, especially the use of rice prices in the place of general food prices line.[25] Several poverty studies at the national level have also found measurement problems in Burkina Faso, which partly explain why several poverty indicators indicated rising poverty, especially in the 1990s (Lachaud 2005 for instance, and Grimm and Gunther 2004).[26] However, Grimm and Gunther (2004) revise national poverty estimates[27] to correct for various problems, and find that although poverty increased from 1994 to 1998, headcount poverty over 1998–2003 fell from 62 percent to 48 percent (or 68.7 percent to 53.3 percent in rural areas).

Clearly these broad national poverty trends only bear a very indirect relation to the cotton intervention. However, Grimm and Gunther (2004) find that headcount poverty among cotton farmers reduced by a quarter over 1995–2003, from 62.1 percent of cotton producers in 1994 to 46.8 percent in 2003. In contrast, incomes of other occupations increased minimally or even declined, depending on the deflator used (see the expenditure data in Table 6). Data from Kaminski (2006) offer evidence consistent with Grimm and Gunther's (2004) findings since they find a headcount poverty rate[28] among cotton households of around 47 percent in 2006. Kaminski also argues that the conventional poverty statistics

---

[23] Grimm and Gunther (2004) provide a good overview of the impact of Ivorian crisis, and the many controversies over the impact. The less controversial numbers are that around 1.2 million persons with Burkinabè origin were thought to have lived and worked in Côte d'Ivoire before the crisis, and that the share of households receiving remittances from Côte d'Ivoire decreased from 20.7 percent in 1998 to 12.7 percent in 2003 (rural: 24.6 percent to 14.6 percent urban: 7.0 percent to 5.3 percent). The figures on loss of remittances are more contested, because some government sources suggest that returning migrants brought significant amounts of savings with them upon their return. Another source shows that transfers decreased by approximately 68 percent in real terms between 1998 and 2003 from approximately 4 percent to 1.3 percent of GDP. Grimm and Gunther (2004) estimate that without any reduction of remittances from Côte d'Ivoire the poverty headcount in 2003 would have decreased by an extra 2 percentage points.

[24] The Sikasso region of Mali is the country's most fertile (although declining soil fertility is now a significant concern) and the most rain-rich, and has, with other cotton-producing zones, received the support of both the country's public authorities and its international donors. However, national and international statistics have reported several times over a period of a dozen or so years that this region of Sikasso is the country's poorest rural region and that cotton producers are on average poorer than all other farmers in the country.

[25] See also AFD (2008) for a discussion of the discrepancy between statistical results and field observations. To assess whether this paradox was even true in Mali, we checked a poverty measure from the DHS at the regional level in Mali (the absence of any household durable goods). This measure indicated that in 2006 Sikasso was in fact the *least* poor region in Mali.

[26] Grimm and Gunther (2004) write "Previous poverty assessments were seriously affected by three types of bias: changes in the methodology used to compute household expenditure aggregates, changes in the household survey design, and high relative price variations over time, which were only imperfectly taken into account for the computation of the official national poverty line, which was therefore also subject to debate. . . The last issue concerns the official poverty line, which between 1994 and 2003 increased much more than the general Consumer Price Index (CPI), implying that the prices of the goods of first necessity and consumed by the poor increased faster than those of the goods consumed by the 'representative urban household' used for the computation of the CPI."

[27] Their extensive work is in line with the one of Lachaud (2005) who contributed to improve tremendously the quality of available data on poverty and incomes, and which can be used as consistent data for our study.

[28] We evaluated the rural poverty line at 100,000 CFAF per-capita in cotton regions in 2006, after a comparison with the standards of INSD (2003) and an evaluation of a basket of basic goods at their local market price (Kaminski, 2006).

arguably underestimate poverty reduction because cotton producers in 2006 include new entrants with higher poverty rates than more experienced cotton farmers. His data also show that the distribution of income among cotton producers was reasonably equal (a Gini coefficient of 0.41), with a relatively small subset of large landholders occupying the highest quintiles of the distribution. This would seem to imply that the cotton boom has not had regressive effects on income distribution among cotton households.

Subjective measures of wellbeing confirm the positive impacts on cotton farmers. Kaminski (2009a) observed that Burkinabè cotton farmers expressed significantly higher levels of satisfaction about their wealth situation after the reform. Moreover, he found that this improvement was not only econometrically explained by the standard determinants of the literature (relative and absolute welfare effects) but also by the effect of technology adoption (animal farming and ox plows in this case), and by exogenous positive opinions about the effects of the cotton reform on income and poverty reduction.

Table 6. Percentage change in household expenditure by occupation, 1995–2003

Occupation	Deflated with CPI	Deflated with household price index
Public	13%	5%
Private	4%	-3%
Informal	3%	-7%
Subsistence	33%	10%
Cotton	43%	19%

Source: Grimm and Gunther (2004).

Table 7. Headcount poverty change by regions: 1994–2003

	1994	2003	Change (points)		1994	2003	Change (points)
Minor cotton regions*				Non-cotton regions			
Center-South	67.2	65.9	-1.3	Sahel	62.9	36.9	-26
Center-West	61.1	42.1	-19	East	68.4	42.1	-26.3
Major cotton regions**				Center-North	63.7	36.0	-27.7
South-West	56.3	57.9	1.6	Plateau	60.8	60.5	-0.3
Cascades	58.3	38.4	-19.9	North	78.1	69.0	-9.1
Hauts-Bassins	33.8	34.7	0.9	Center-East	56.5	56.3	-0.2
Mouhoun	59.5	61.5	2	Center	8.8	23.2	14.4

Notes: ** (*) Regions where more than 40 percent (between 20 percent and 40 percent) of the population are directly involved in cotton production.

Source: Grimm and Gunther (2004).

Despite these different sources of evidence, it is still somewhat puzzling that some cotton regions, such as 'Hauts Bassins', 'South-West or 'Mouhoun', did not experience rapid poverty reduction despite growth in cotton (Table 7). In other words, cotton growth did not obviously spill over into broader poverty reduction, even at the regional level. Two factors might explain this. First, there may still be problems with the estimation of poverty trends in Burkina Faso. Second, cotton growth may indeed have had relatively weak multiplier effects on the local economy. Unlike food production, cotton growth does not impact poverty by lowering the price of food, which is one of the most direct determinants of poverty reduction. We also estimate that the spillovers of cotton growth onto the local economy are relatively modest. On the production side, inputs into cotton production (for example, fertilizers, transport) are rarely from the local regional economy, and farm level cotton outputs are only a significant input into the ginning process and cottonseed oil production. Currently around 4,500 people are employed in the

ginning industry by SOFITEX, 600 by SOCOMA and 400 by FASOCOTON. The local textiles industry is largely informal, but may employ around 50,000 people.

However, for local economies, demand side effects are usually more important, and generally account for 70 percent of the local spillover effects of agricultural growth (see Bezemer and Headey (2008) for a review). From data collected by Kaminski (2006) and informed guesses of which expenditure items are produced in the region and which are not, we estimate roughly a 7 percent increase in the demand for food in the region, and a 4 percent increase in the demand for non-food, or a 6 percent increase in demand overall (Table 8). These spillover effects are reasonable, but probably not large enough to have a major poverty reduction impact on the local non-cotton population. Moreover, for most of the country the spillover effects of the cotton boom are constrained by the relatively small size of the cotton sector: for example, the value of staples crop production (rice, maize, millet, sorghum) in Burkina Faso was four times higher than the value of cotton in 2006 (before the intervention it was around 10 times higher). So cotton's main contribution to broader poverty reduction is only partly the result of linkages. The more important effect was the direct increase in cotton income and the near doubling of the share of the rural population engaging in cotton production from 10.3 percent in 1994 to 18.2 percent in 2003.

Table 8. Back-of-the-envelope estimates of the increased demand for non-cotton goods and services in cotton-growing areas

Cotton households' characteristics	Food	Nonfood	Total
(1) Share of purchases that are locally produced	70%	40%	57.1%
(2) Share in expenditure items in total expenditure	57%	43%	100%
(3) Increase in cotton expenditures	30%	30%	30%
(4) Share of productive population in cotton production	50%	50%	50%
Total increase in demand within region=(1)*(3)*(4)	**10.5%**	**6.0%**	**8.6%**

Notes: (1), (2) are numbers are based household survey data from Kaminski (2006) and best guesses based on local knowledge. (3) and (4) are based on averaging the two estimates from Grimm and Gunther (2004), also presented in Table 7, and on information from other sources on the size of income growth among cotton producers.

Food Production and Food Security

The rapid growth in cotton production could impact food security and nutrition through two principal channels. First, the cotton intervention could have induced or spilled over into more rapid growth in food production. Second, the higher incomes of cotton producers would increase their own household food security.

Regarding the first of these channels, food production has obviously not increased as rapidly as cotton production. However, several products, which are mostly grown in cotton-cereal systems, have experienced a strong increase. For the case of maize, average annual growth rate in the value of production has been around 10 percent over the cotton reform period. Significant production growth has also been achieved for sorghum. The pertinent question here is whether the cotton intervention resulted in the production growth of these products.

We have some tentative evidence[29] that this is indeed the case. In Table 9, we see that growth in overall demand in cotton regions in Burkina Faso could be 7 percent or more, and a significant portion of this would be locally produced food (often perishable). But a second channel of impact would be via increased grain production from cotton farmers themselves, through the rotation of cotton production with

[29] We use the estimates of Kaminski and Thomas (2008) for land use, according to a survey of 300 representative Burkinabè cotton households (Kaminski, 2006) that contains precise data on both the production and consumption sides; and the estimates for yields (see in the appendix), based on the sample of cotton households belonging to the pseudo-panel of DGPSA from 1996 to 2004.

grain production, or through cultivated land extension (via mechanization and additional labor). Before the reform, cereal and cotton input credit were managed jointly by SOFITEX, but with significant credit rationing. However, the formation of cotton-specific farmer groups did not lead to a neglect of cereal production or the farmer's demand for diversifying production between cash crops and food staples, precisely because the groups themselves make autonomous decisions and also have influence on the management of the sector via the cotton unions. Cereal input credit is therefore guaranteed by regional unions, levied upon cotton sales, and monitored by technical assistants. Input credit allowances are assessed (for both cereals and cotton) within groups and externally with technical assistants, according to expected cotton production, cultivated land, and farmers' experience (which define an overall permissible debt ratio). As a result of these institutions, fertilizer application to maize increased by 20 kg/ha among cotton producers (see DGPSA). However, these positive effects on food production may be counterbalanced by the reallocation of larger shares of land from food production to cotton production. Indeed, at the national level it is true that the land allocated to cotton after the reform (2007) was three and half times larger than the land allocated to cotton before the reform (1994). Thus the overall impact on food production is ambiguous.

To resolve this question, Kaminski and Thomas (2008) estimated the evolution of land use (cotton vs. food crops) by cotton households. This enables them to estimate the total evolution of food crop areas for the average household cultivating cotton in 2006 (Table 8).[30] Using Kaminski and Thomas' land use function, our counterfactual projections in the next section imply that around 250,000 hectares were not cultivated with food crops as a result of the intervention. However, this is less than half of the increase in total cotton land, largely because total cultivated land has increased, thus partially offsetting the reallocation of food cultivation to cotton cultivation. Moreover, a significant share (10 percent of total cultivated cotton areas in 2006, according to Kaminski (2006), and 20 percent among new producers) of new cotton fields have been intercropped with food crops, meaning that the increase in land shares dedicated to cotton should be treated with caution as it is only a gross measure. This fact, together with the increase in food production yields, explains why the expansion of cotton production (mostly extensive) appears to have had a fairly neutral impact on food production among cotton growers. Indeed, land allocated to cereals was still larger in 2007 than it was in 1994, albeit by only 15 percent or so,[31] while the share of grain production of cotton-producing regions actually increased over the reform period, from one-third of national production to one-half.

Table 9. Evolution of land use for a representative sample of cotton households in 2006

	1996	2006
Total cultivated area	5.51 ha	6.92 ha
Land share dedicated to cotton	20%	56%
Average cultivated area under food crops	4.39 ha	3.07 ha
Average cultivated area under cotton	1.12 ha	3.85 ha

Note: These means account for new cotton producers whose land share was 0 percent and land under cotton of 0 ha before the reform and are weighted according to cultivated land by households to estimate the average increase in food crop cultivated areas.

Source: Estimates computed from Kaminski and Thomas (2008).

The impact on food security also depends on how increased cotton incomes contribute to food consumption. Even for net-producers of cereals, household food security can be threatened when surplus

[30] We use the linear prediction of the bivariate ordered probit model estimated by Kaminski and Thomas (2008) and the marginal effects of the ordered probit model.

[31] Again, however, these statistics suffer a significant measurement bias in that cotton lands were also cropped with grains. Moreover, we estimate that even if the growth rates in cotton cultivation areas had continued at previous rates (i.e., the rates over 1980-94) such that a larger proportion of new lands were diverted to food, food production in 2007 would only be by 5.8 percent larger than in 2007. This is because cotton still comprises a relatively small share of total land use.

cereal production is used to acquire cash at harvest times and food prices and marginal revenue are relatively low, before income is spent during lean seasons with higher food prices. Hence, both cotton (cash income) and food production (minus the input costs) determine food security. Cotton incomes may be particularly useful in enabling households to face familial and social expenses without having to sell their food crops or their livestock. Using data from a retrospective survey from Kaminski (2006) that tracks consumption patterns in 1996 and 2006, we define a threshold[32] of household food security and then estimate the evolution of food security across households over the reform period (Table 10).

Table 10. Evolution of nutrition-relevant food consumption for representative producers in 2006

	Changes in consumption by households				
	Large increase	Slight increase	Constant	Slight decrease	Large decrease
Fat nutrients	5%	48%	31%	10%	6%
Dairy products	5%	21%	43%	16%	15%
Animal proteins	17%	47%	14%	14%	7%
Fruits	6%	34%	36%	18%	6%
Vegetables	10%	44%	28%	15%	3%
Tubers	5%	33%	37%	18%	7%
Cereals	19%	53%	17%	7%	4%

Note: Large increase refers to an increase of more than 20 percent in per-capita consumption for the mentioned item. Big decrease refers to a decrease in more than 20 percent. Slight increase and decrease represent changes in less than 20 percent in magnitude.

Source: Authors' estimates.

We find that a large share of cotton households appear to have improved their food security situation. In 2006 around 69 percent of households who cultivated cotton could be classified as food secure. Of these 69 percent around 49 percent have increased their consumption in cereals, while 3 percent of the remaining 31 percent who are food insecure have decreased cereal consumption. Overall, an improvement in food security is likely to characterize up to 46 percent of households in the case of cereals. Focusing on the households located close to the food security curve, we also found that 12 percent of the population crossed the line upward during the reform, while 2 percent fell below (based on cereal consumption)[33]. These can be interpreted as lower bound estimates. On average, it is likely that food security has improved for 30 percent of the cotton population, and deteriorated for 4 to 5 percent. In 1996, around 40 to 45 percent of the population who cultivated cotton in 2006 was food secure while 70 percent can be declared as such in 2006. Hence, the rural population dependent on cotton cultivation has become much less vulnerable in terms of food needs.

However, there is no evidence that malnutrition has improved for the broader population. In fact, DHS data for Burkina Faso indicate that malnutrition rates for children under 5 years old rose in the 1990s and then declined somewhat in only a few regions, including the cotton belt in the West. Clearly nutrition is a broader national goal and a more complex issue that involves more diversified diets (see Kaminski 2009a; and Table 10 above). So in summary, the cotton success story has principally only influenced food consumption among cotton households themselves.

[32] This threshold corresponds to a food security curve accounting for basic cash needs, and the value of food needs per-capita, according to local market prices (Kaminski, 2006). We then compare the per-capita income measure of the household's agricultural production to this value, calibrated at 60,000 CFAF per capita. This value is estimated from a set of basic goods' value and expenses, as reported in Kaminski (2006).

[33] If we base the estimates on consumption of animal proteins, we obtain an upward move of 10 percent of the population, and a downward move of 3 percent.

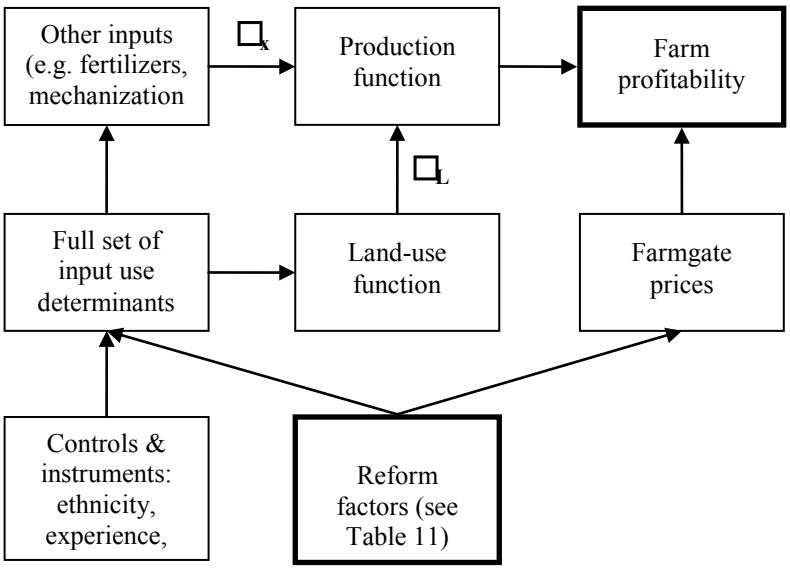
4. ESTIMATING THE EFFECTS OF THE REFORM BASED ON A COUNTERFACTUAL SCENARIO

As we noted in previous sections, the cotton sector in Burkina Faso has been subject to a number of adverse exogenous shocks that have distorted the overall impact of the cotton intervention itself. The principal shocks over the period in question were the falling level of world cotton prices, the fall of US dollar with respect to Euro, and producers' prices, and the effects of a large influx of return migrants from Côte d'Ivoire. In this section we will try to plausibly simulate what would have happened to cotton production without the intervention, without the Ivorian crisis, and if higher cotton prices had prevailed. We will also look at different combinations of these three basic events.

Methodology

Our strategy for simulating these different counterfactual scenarios is described in Figure 4 and as follows. Our first step was to consider the most important and most tangible benefits of the intervention, as well as what the impact the Ivorian crisis would have had on the various determinants of farm production and profitability. The characteristics of the reform and counterfactual scenarios are listed in Table 11. The channels of impact include access and use of inputs, prices received by farmers, and land use patterns, including access to land (which is important for return migration scenarios and ethnicity factors). Additional comments on each of these scenarios are listed in the last column of Table 11. Clearly the differences between the counterfactual and reform scenarios are a matter of judgment, but we believe the previous two sections, and existing research (Kaminski and Thomas 2008; Brambilla and Porto 2005; Savadogo and Sakurai 2007), have provided a sound basis for the assumptions listed in Table 11.

Figure 4. A methodology for estimating counterfactual scenarios



Notes: ε_x is the elasticity of output with respect to other inputs, and ε_L is the elasticity of output with respect to land. In the simulations these elasticities transmit the effect of the various assumptions that we make in Table 8 about the benefits of reform.

Table 11. Main hypotheses for the counterfactual and the reform scenarios

Channels of impact	Counterfactual scenario (C)	Reform scenario (R)	Comments
Purchase price of cotton	Decrease in 5 percent in real value	Increase in 5 percent in real value	The difference is due to the lack of farmers' influence in C
Maize local price	Increase in 20 percent real value	Increase in 10 percent real value	The difference is due to less production and more demand in C
Input access and use	Input credit decreasing by farm of experienced cotton growers; marginal input access for cereals and new cotton growers	Opportunity to borrow inputs for new land under cotton, and also for cereals (mostly maize)	Input access severely rationed in C due to low credit repayment rates under GVs, compared to GPCs
Contractual relationships in the cotton sector	Uncertainties about the date of payment, recurrent late delivery of inputs, disputes about quality-grading and weighing	Earlier payment of cotton seed, earlier delivery of inputs, better quality-grading process and transparent weighing	The conditions in C were the ones prevailing before the reform
Technical assistance	Encourages farmers to increase their cotton areas, but no effect on labor and land productivity:	Encourages moderate land allocation to cotton and improves farming systems.	These statements are drawn on Kaminski and Thomas (2008) estimations and interviews by Kaminski (2006)
Mechanization	Only experienced farmers who pursued cotton farming adopting animal farming at a 50 percent lower rate	Mechanization is correlated to experience in cotton growing, livestock assets, and technical assistance.	The slower rate of mechanization is due to less capital accumulation and lower farmers' incomes
Number of cotton households	With Ivorian crisis: 110,000 in 2006 Without Ivorian crisis: 99,000 in 2006 (10,000 experienced households exit and 10,000 new cotton households)	98,500 in 1996; 176,600 in 2006 Without Ivorian crisis: 164,800 in 2006	These figures are estimated according to the estimates of Brambilla and Porto (2005) for entry and exit in cotton production, and on Savadogo and Sakurai (2007) for the impact of Ivorian crisis
Number of active workers/household	With Ivorian crisis: 6.3 in 2006 Without Ivorian crisis: 6.05 in 2006	5.8 in 1996; 6.6 in 2006. Without Ivorian crisis: 6.35 in 2006	This is due to less incentives to out-migration in R and to the influx of returnees
Ethnicity effects	Significant for input access but less for land access (less demographic pressure because of less migration)	Play on access to land, more difficult for non-resident ethnic groups and migrants	Non-resident ethnic groups have a limited access to land in R, and to input access in C

Counterfactuals on Land-Use

Using the bivariate ordered probit model of Kaminski and Thomas (2008) we estimate changes in land-use patterns and in total cultivated land by recalibrating values of the model's explanatory variables according to the various scenarios assumed in Table 11. This, together with the hypotheses on the entry and exit of cotton households (and their within-composition) allows us to estimate the total increase in cotton areas over the reform period and under the several scenarios in Table 11.

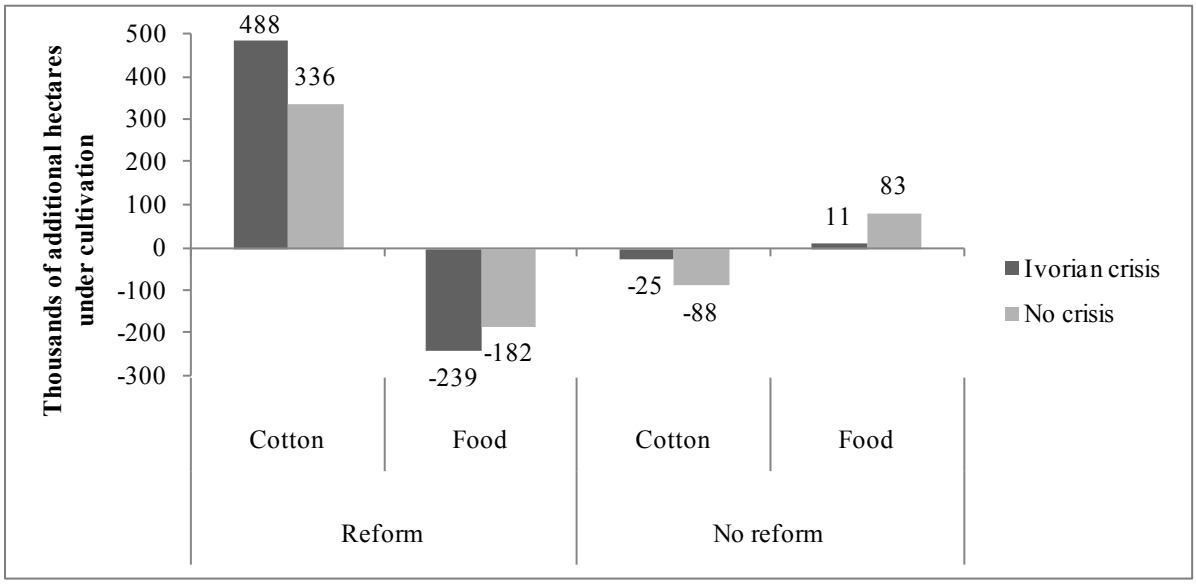
The first calculations apply to the change in total cultivated land by cotton households (Figure 5). Our first finding is that much more new land was cultivated because of the intervention and the Ivorian crisis. With the growth of the active labor force, migration, and mechanization, we estimate that new land cultivated was 250,000 hectares higher than it would have been without the reform (this is calculated by summing the reform values in Figure 5 and subtracting the "no reform" values). Of these 250,000 hectares, the Ivorian crisis drove around 94,000 additional hectares, or slightly over one-third.

In the case of cotton, around 500,000 hectares were cultivated because of the combined effects of the Ivorian crisis and the intervention. However, of these 500,000 hectares, the Ivorian crisis only accounted for about one-third of the increase in cotton areas, so the increase was largely driven by the intervention. Without the intervention, the land allocated to cotton would have stagnated. This is actually consistent with what happened in other West African countries where reforms were unsuccessful or postponed. After the 1994 CFA devaluation, the cultivation of cotton land increased in all Francophone countries (Figure 6). However, in the other three countries (Mali, Benin, and Côte d'Ivoire) the land allocated to cotton stagnated after around 1998, while in Burkina Faso it increased steadily up to 2007, by which time it was 3.5 times larger than it was in 1994.

Perhaps the only caveat to the success of the intervention's impact on land use is that without the intervention the area allocated to food crops in the cotton-growing areas of Burkina Faso would have been around 250,000 hectares more. However, as we noted in the previous section, the total land area cultivated with food crops in all of Burkina Faso still increased over the reform period. Moreover, our counterfactual estimates suggest that without the intervention there would have been no increase in total land use in cotton areas. This is because with no reform, the slower rate of mechanization and lower quality level of technical assistance counterbalance the impact of return migrants and other migrants on land extension. And since Burkina Faso is a land abundant country (actual land use is slightly over 50 percent of all potential arable land), making greater use of land[34] (in a sustainable fashion) constitutes an efficient development strategy. However, new land suitable for cotton and cereal production appears to be restricted, as shown by the expansion of cultivation to more marginal land with lower soil fertility. Hence, it is questionable to wonder about the sustainability of land expansion, which we address in next section.

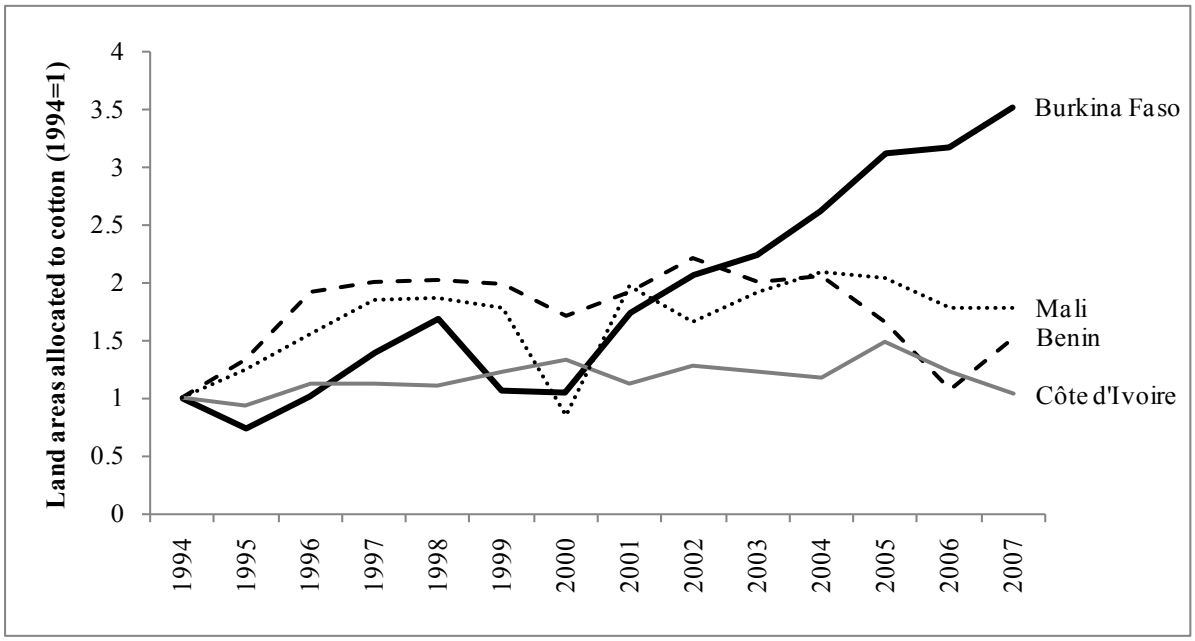
[34] Note that Gray and Kevane (2000) already reported that cotton regions are subject to demographic pressure on land, due to the extensive form of agricultural growth and to migration. Several conflicts among ethnic groups are likely to emerge.

Figure 5. Counterfactual estimations for changes in land-use (for the main crop)



Source: Authors' estimates.

Figure 6. Land allocated to cotton in four Francophone cotton producers: 1994-2007



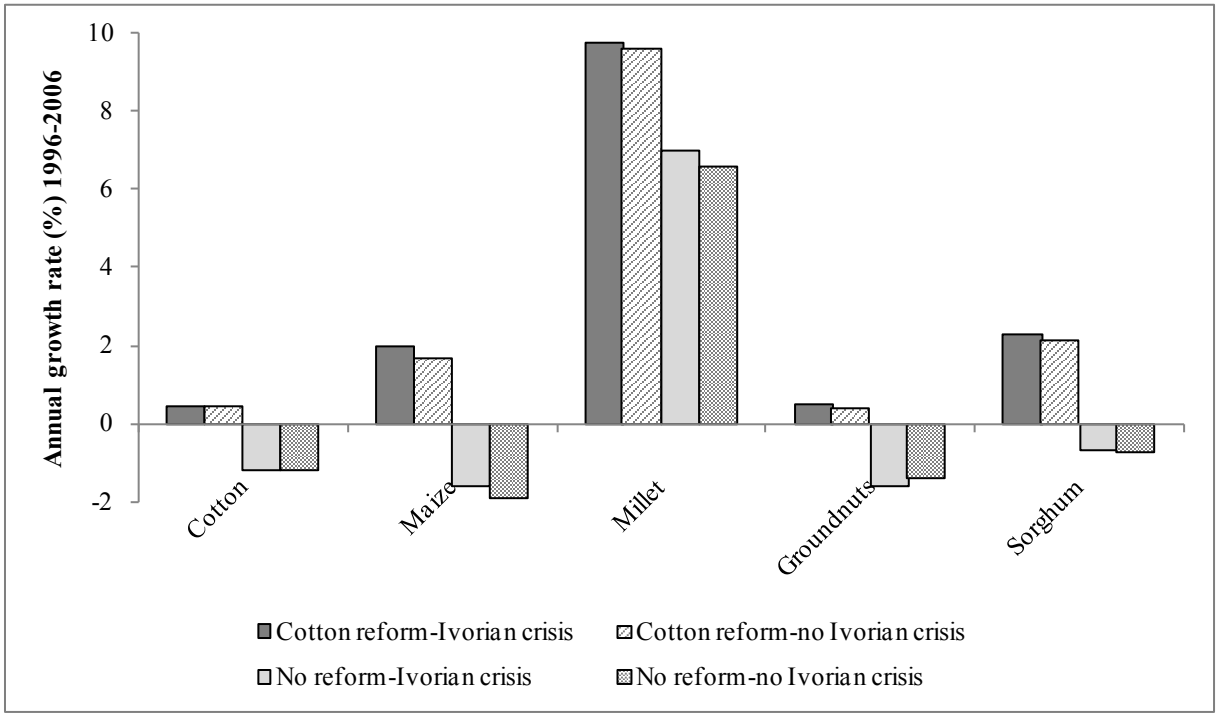
Source: FAO (2009a).

Counterfactuals on Cotton and Cereal Yields

To estimate counterfactuals on crop yields, we use data from 1996 to 2004 on production (DGPSA 2008), plot characteristics, and input use to estimate a Cobb-Douglas production function, in the spirit of Fan (1991). The production function is estimated for the main crops cultivated by cotton households of 2004, which are cotton, maize, groundnuts, white sorghum, and millet. We allow factor production elasticities to be time-varying to work with variable total factor productivity. As we do not have information on labor

and agricultural capital, we aggregate these terms into the constant and add a time-dummy to allow for technical progress. Then, we are able to estimate input elasticities through household-level random effects Maximum likelihood estimation (RE ML) and use the hypotheses on the counterfactual scenarios to compute counterfactual elasticities. The full production function results are presented in Table B.2 in Appendix B[35].

Figure 7. Counterfactual estimates on annual average growth in crop yields (Kg/ha): 1996–2006

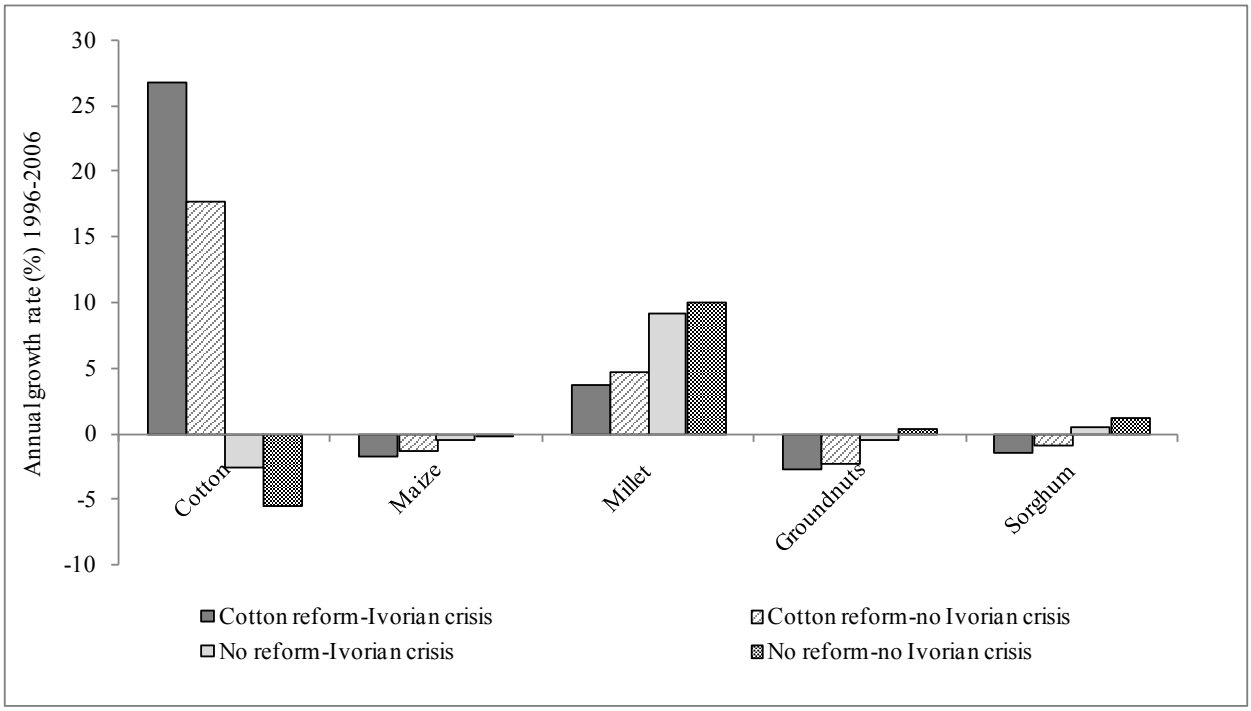


Notes: Computations are done accounting for all cotton households of 2006, including those who did not cultivate cotton in 1996 to derive the total net gain in crop yields over the reform period. Obviously, this does not apply to cotton.

Source: Authors' estimates.

[35] The main results of Table B.2 are that: 1. Land is the most productive factor and returns to land are increasing (significantly constant); 2. The use of NPK fertilizer was productive for cotton, and to a lesser extent, for maize, with increasing returns over time, while the use of manure was also productive for maize, groundnuts, and white sorghum with increasing associated returns for the latter crop; 3. Pesticides was an important factor of production for cotton, and even more so for maize; 4. Technical progress was significant only for maize and millet technologies. It is likely that technical progress was not significant for cotton because of the entry of more marginal land and less performing producers.

Figure 8. Counterfactual estimates on annual average growth in crop production: 1996–2006



Notes: Computations are done accounting for all cotton households of 2006, including those who did not cultivate cotton in 1996 to derive the total net gain in crop productions over the reform period.

Source: Authors' estimates.

Figure 7 shows the estimated annual growth in crop yield under different scenarios, while Figure 8 shows the estimated annual growth in crop production. Here again, results show that the reform is the decisive factor in the significant increase in farm yields, whatever crop is considered. As noted above, stagnant yields of cotton should be understood as an increase in yields for the most experienced farmers was counterbalanced by the entry of marginal land and less experienced farmers. The counterfactuals are especially useful in this regard because they show that without the reform cotton yields would actually have decreased. Another interesting finding is that cereal yields increased much more rapidly because of the cotton reform, notably for maize and sorghum, which are the crops that benefit more from rotation with cotton. Note that in this context the effect of the Ivorian crisis is rather marginal. We attribute this to the fact that many return migrants joined already-established households, such that the more labor-intensive use of the land would have increased yields, thus counterbalancing any negative effect on yields from new farms being operated by return migrants.

Turning to the production results (Figure 8), the reform scenarios are characterized by a slight decrease in food production, which was more than compensated for by a substantial increase in cotton production (the extent of this net benefit is assessed below when we look at farm incomes). Also of interest is the effect of the Ivorian crisis, which accounts for about one third of the growth rate in cotton production, with the intervention accounting for two-thirds.

Counterfactuals on Farm Incomes and Food Security

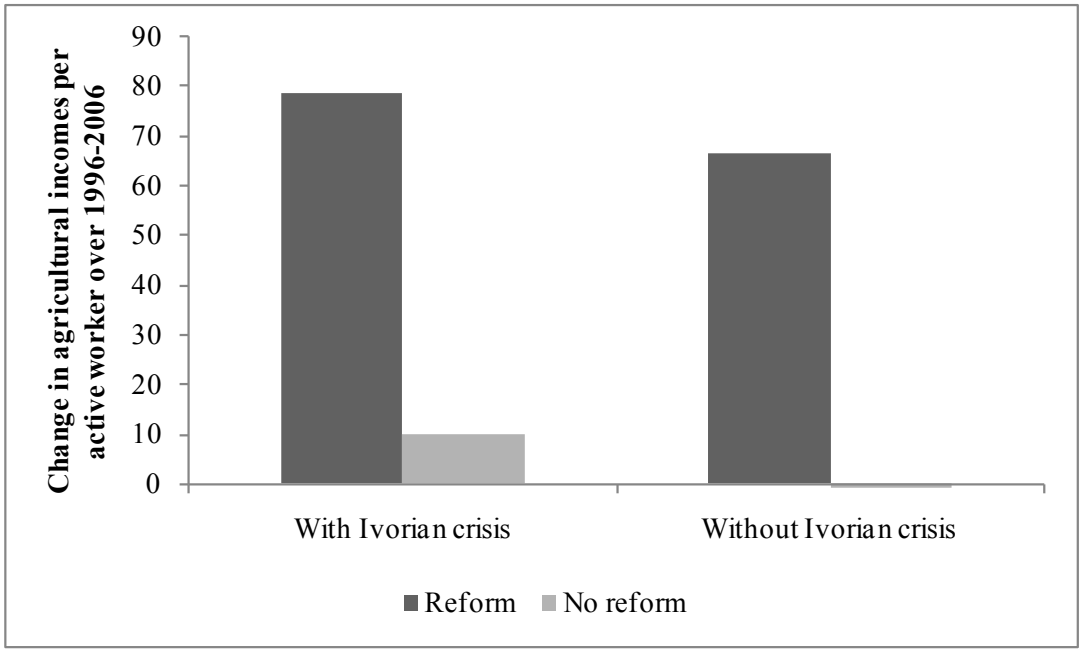
Based on the previous estimates, we are able to measure changes in overall agricultural incomes for each scenario for the average household, according to price data collected at the village level in 2006 by Kaminski (2006), and the cost of input credit. We do not specify any differences between food production

for self-consumption or for trade, because we are simply measuring the overall economic value of agricultural production change for the average household.[36]

Figure 9 below highlights the main findings. The results indicate that the effect of the intervention alone accounts for a significant change in the agricultural incomes generated by cotton households. The average worker increased his/her agricultural income by around CFAF 36,000, or US$ 69. To put this change in terms of a poverty reduction perspective, the rural poverty line was set at CFAF 100,000 per consumption unit in 2006, so 35 to 40 percent of all basic needs were derived from the net increase in agricultural incomes that resulted from the reform, in addition to the base income and other agricultural (for example, livestock) and off-farm activities.

As for food security outcomes, in the previous section we estimated that 70 percent of the cotton households were food-secure in 2006, but that only 40 to 45 percent were food-secure before the reform. Using the counterfactual estimations on agricultural incomes, we compute the counterfactual rates of food-security among cotton households (Figure 10). The results indicate that the cotton reform played an extremely positive role in the reduction of food insecurity among cotton producing households. This has benefited to 430,000 additional people if we account for the effects of the Ivorian crisis, and to 360,000 additional ones if the Ivorian crisis did not occur. Overall, that means at least 5 percent of the food-insecure population in Burkina Faso became food-secure because of the reforms. It is a minimal estimate for the impact of the reform, accounting for more than 7 millions highly to moderately food-insecure people in Burkina Faso. An upper bound of the estimated impact of the reform on food-security is around 8 percent of the food-insecure national population.

Figure 9. Change in agricultural incomes per active worker for the average household (2006 US$)

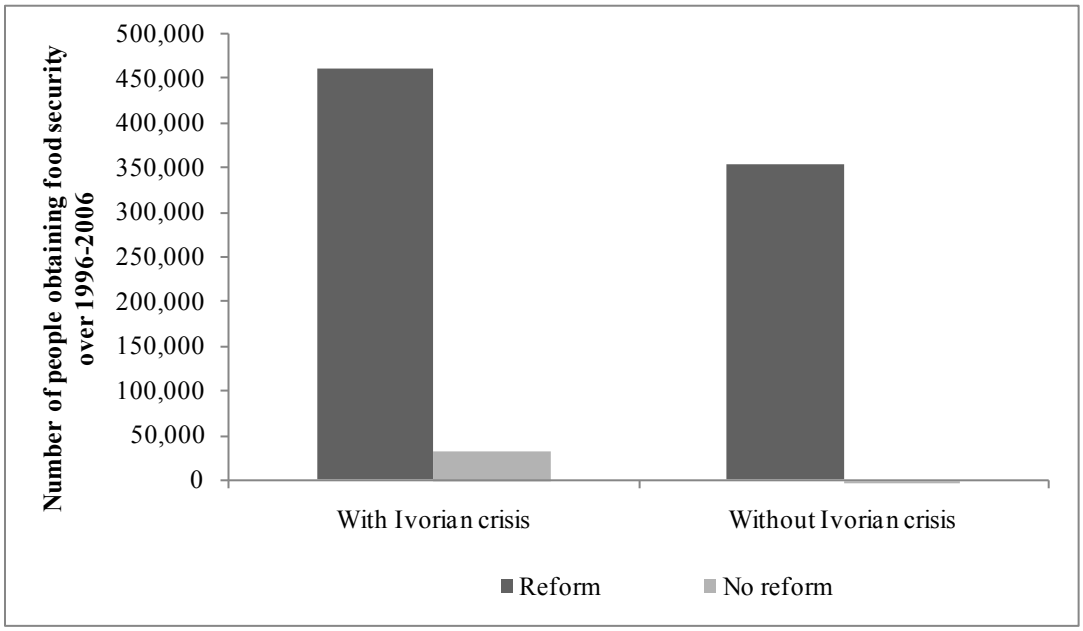


Notes: Computations are done accounting for all cotton households of 2006, including those who did not cultivate cotton in 1996 to derive the total net change in food security over the reform period.

Source: Authors' estimates.

[36] Note that we do not account for any change in livestock assets.

Figure 10. Change in the number food-secure people under alternative scenarios



Notes: Computations are done accounting for all cotton households of 2006, including those who did not cultivate cotton in 1996 to derive the total net change in food security over the reform period.

Source: Authors' estimates.

5. THE INTERVENTION'S SUSTAINABILITY

Sustainability relates to the economic or financial viability of an intervention, its political sustainability, and also its environmental sustainability. In this section we try to briefly consider each of these facets, although there is limited hard evidence on some of these dimensions.

Political Sustainability

The political sustainability of reform is all too often overlooked in economic appraisals of "good" policies. Nevertheless, political sustainability is a necessary condition for economic success, if only because the survival of a reform depends upon it (Rodrik 1996). Indeed, many periods of growth have not been sustained precisely because institutional arrangements capable of resolving conflicts did not emerge (Rodrik 1999). The West African cotton sector itself provides a long list of examples of political unrest, especially tensions between cotton farmers and governments (for example, Mali 1973, the early 1990s, and in 2000, but also Burkina Faso in 1992). Resolving these conflicts is therefore a major challenge in the cotton sector, especially in the context of an imperfectly competitive market in which monopsonies have considerable potential to exploit farmers in a laissez-faire setting.

Perhaps the first dimension of sustainability simply relates to completing the reform process. This is especially important in a gradualist process in which reforms proceed very incrementally. Although the UNPCB has emerged as an important player at a national level, the local farmers groups (GPCs) still face a number of constraints in their economic development. Most importantly, they are limited in the scope of services they can offer, for lack of resources. This is apparent from their low-level of capital stock: in 2002, 7 percent had warehouse facilities,[37] and less than 2 percent provided their members with an occasional access to a tractor. This lack of resources is itself enhanced by the GPCs' environment and their partners. First, they can be constrained by their own village environment: as shown in Bernard et al. (forthcoming), egalitarian norms sometimes impede the development and the effective functioning of market-oriented groups. Second, NGOs and other external partners sometimes perceive GPCs as community organizations more than professional ones. As a result, support is conditioned on the GPC engaging in 'social' actions that sometimes impair their capacity to pursue their economic strategies. Lastly, at times of limited government resources in rural areas, local administrations often rely on GPCs to help finance investments and services (schools, police office, health posts, etc) via a tax on their earned ristournes (refunds), when non-cotton farmers, traders, and civil servants are less expected to do so.

There are also doubts about the role of the UNPCB and how effectively it still represents the interests of cotton farmers. Certainly, farmers have tangibly benefited from the GPC-UNPCB relationship through participating in quality grading with SOFITEX executives, discussing financial issues with extension agents through local and regional credit committees, representing farmers in the claim instigated against U.S. cotton subsidies in Cancun in 2004, and getting a larger say in determining price outcomes (Gray 2008). But lack of accountability is an increasingly common charge leveled against the UNPCB. Kaminski (2006) found that the farmer agency was negatively appraised and that farmers had difficulties obtaining information on their leaders' actions. Lately, local cotton farmers have lost confidence in their leaders and do not feel well represented. Kaminski (2009b) reports that GPCs do not receive the same amount of management and technical support from their regional unions and that several GPCs and villages are not linked anymore to their departmental unions. Sometimes, the ristournes are not redistributed to GPCs (the financial funds aimed to cover the administrative costs of GPCs). There is also a growing suspicion from local farmers about the union's corruption and the collusion of interests between the union and government leaders (Gray 2008).

Governance problems of SOFITEX (while production and management costs were better in 2004) are also linked to a lack of transparency and turned to recently affect farmers harshly, while late payments have deteriorated the trust relationships between GPCs and other cotton firms. This year (2009), for

[37] Rainfall can negatively damage cotton quality once harvested, and therefore the price paid by collectors.

example, farmers have ordered inputs without having information about the price they will be charged (Kaminski 2009b).

So while the progressive establishment of UNPCB and GPCs delivered many positive services for farmers, it seems probable that further reforms will be needed in order to raise accountability and transparency, and improve the functioning of the UNPCB, as well as SOFITEX. Furthermore, since Burkina Faso's political system is highly oligarchic (collusion of autocratic politicians with urban elites), farmers have few means to influence policy outcomes if the UNPCB fails to voice their concerns (or indeed, if the UNPCB is the principal problem). In such circumstances the lines of communication between farmers and the government elite are effectively cut. Such a situation is certainly a cause for concern, because the inclusion of farmers' representatives in the original policy discussion was a key step in building a broader consensus.

Environmental Sustainability

Two of the major impacts of the intervention were increased cultivation of new land and increased application of inputs, such as fertilizers and mechanization. Both of these clearly have an impact on the environment. Fertilizers, and to some degree mechanization, can potentially have a very positive effect on the health of soils. Like many parts of Sub-Saharan Africa, Burkinabè soils typically have fairly low nutrient content because warm temperatures result in greater microbial activity in the soil leading to smaller amounts of soil organic matter than in the temperate zones. This means that appropriate fertilizer use is extremely important for Burkina Faso. This is especially true of cotton, which responds well to fertilizer application. Indeed, with appropriate application of fertilizer, FAO/ International Institute for Applied Systems Analysis (IIASA) estimates suggest that almost half of Burkina Faso's land area could be cultivated with cotton, far more than the existing 2 percent (Figure 11). But the efficiency of fertilizer use heavily depends on the organic matter in the soil (decreasing rapidly under 6 percent content). Hence, these features are calling for improved practices and knowledge among cotton farmers.

However, the main caveat in this context is the emphasis on appropriate application of fertilizers and other inputs. Tefft's (2008) review of the Malian cotton sector, for example, reveals that Mali's cotton farmers apply chemical fertilizers at roughly 75 percent of recommended input levels and manure and other organic soil amendments at 50 percent of recommended levels. These strategies largely relate to minimize risk and cash expenditures, but also to lack of knowledge of appropriate techniques and the consequences of soil mining. Hence, improving extension services and farmer knowledge are essential for making cotton production a sustainable enterprise in West Africa, although Tefft (2008) also found little agreement as to how serious under-application of fertilizers is for the long term sustainability of cotton farming in the region. In Burkina Faso, the less experienced farmers also under-use inputs, especially chemical inputs. However, it is debatable whether the lack of knowledge is determinant here. Indeed, farmers are mostly aware of the recommended levels of inputs but apply less because of other reasons: high costs, food security strategy for input diversion, side-selling for cash pressing needs, and so on (for example, experimentation with crop 'extensification').

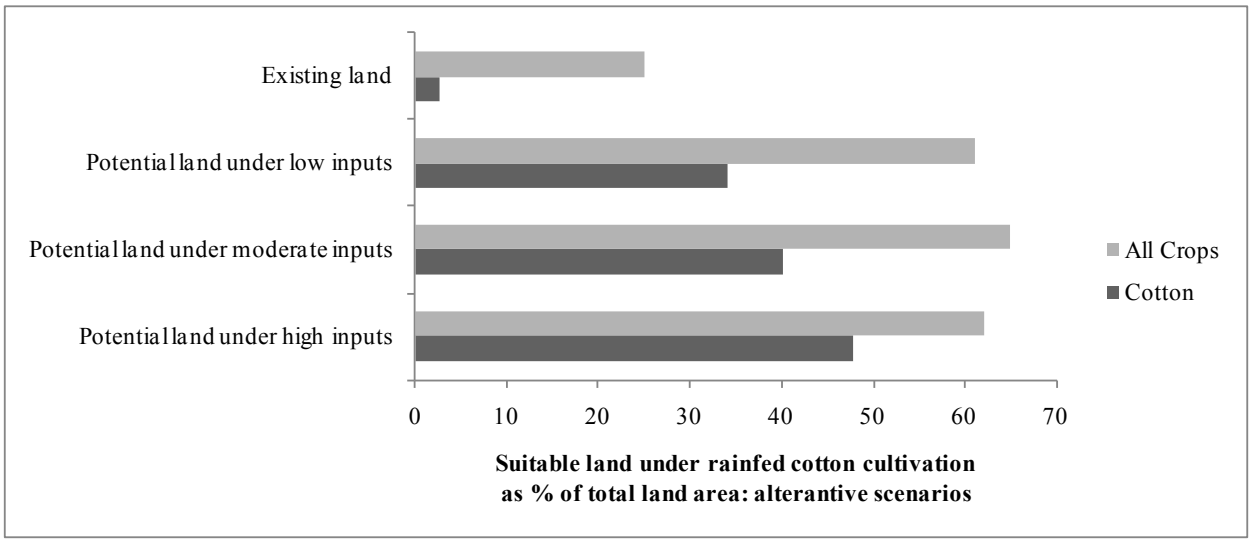
Most farmers did not apply manure in cotton plots, and to a lesser extent, in cereal plots (see Table B.1. in appendix). The main problem is the soil impoverishment caused by more intensive farming systems (less fallowing) when organic matter is not restituted to the soil. A sustainable way for soil conservation lies in appropriate farming practices, especially correct levels of manure application. More experimented extension officers, diffusion of new techniques, as well as promotion of mixed farming system (integration of livestock for manure availability), are of crucial importance in addressing these problems. Therefore, a larger emphasis should be devoted to organic fertilization and organic farming, in the context of increasingly costly mineral fertilizers and pesticides. In spite of increasing uses of organic matter in cotton farming systems, access to organic matter has remained difficult for farmers (manure or compost), although several markets have emerged recently in the region of Bobo-Dioulasso. As reviewed by Bassett (2009), organic cotton has recently gained importance in Burkina Faso under the supervision of Helvétas and UNPCB, who work with farmers to produce organic inputs. However, several major

constraints remain for producing adequate quantities of compost (50 cartloads of composts are required to fertilize one hectare), such as a limited access to raw organic matter (manure or grasses).

Another issue is land degradation. According to an FAO study from the early 1990s based on expert assessments, West African Sahelian producing countries are particularly vulnerable to land degradation. Moreover, Burkina Faso was rated as the country with the largest shares of its land subject to degradation: three-quarters of degraded land was classified as severely degraded, of which three-quarters was caused by agricultural activities (Figure 12). Of particular concern is that, large tracts of new land have come under cultivation, although a relatively small share is deemed to be marginal land. According to local experts, demographic pressure on land has increased with migration and demographic growth but free land is still available. Thus the issue is not yet one of encroachment on marginal lands, but maintaining soil fertility and integrity on lands already under cultivation.

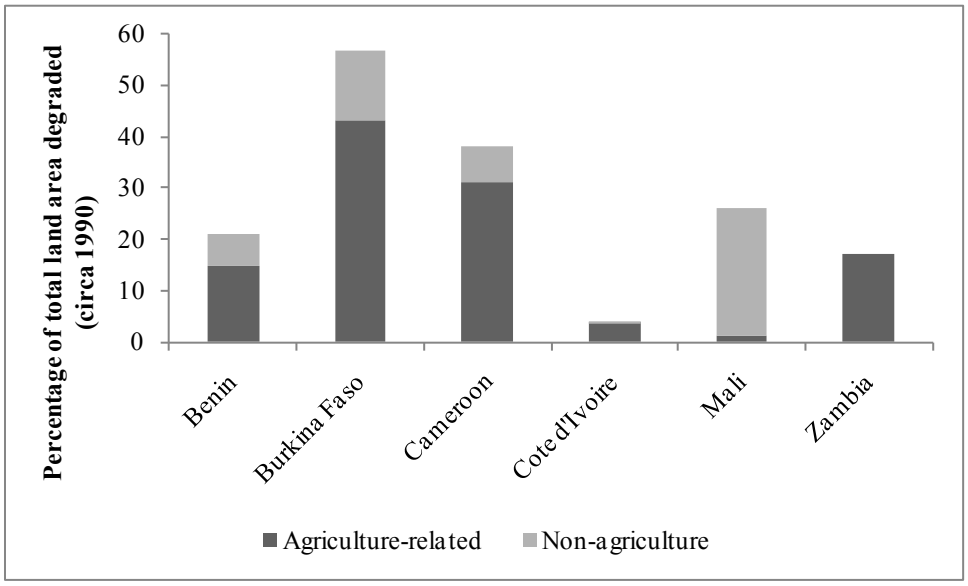
In cotton areas, there is no significant evidence of soil mining in either the traditional basin of cotton production in the Southwest (Gray and Kevane 2001) or in the expansive basin in the East (Mazzucatto and Niemejer 2004). Nevertheless the conservation of land is not yet adequately addressed by farmers. Kaminski (2006) found that 30 percent of cotton farmers use improved techniques, of land management, but this ratio falls to just 15 percent for non-cotton farmers in cotton areas. Farmers need to be assisted in scaling up soil conservation techniques. This has begun with national programs such as the National Land Management Program (PNGT), which is supported by technical assistance from the cotton sector and from French Development Cooperation. However, there are severe financial constraints and the adoption of these techniques is rather slow. In cotton areas the diffusion is somewhat more rapid than in other rural areas thanks to more capital accumulation (livestock) and better technical assistance. Cotton areas have also benefited from the emergence of a new market for manure, although this is often affordable for only the biggest producers (chiefly because of high transport costs).

Figure 11. FAO/IIASA estimates of land suitable for cotton cultivation under different scenarios



Source: Authors calculations from FAO/IIASA (2009) and FAO (2009a) data for existing land.

Figure 12. FAO estimates of degraded land area



Source: Authors' calculations from FAO (2009b).

Financial Sustainability

If Burkina Faso's cotton boom is built on an unsustainable financial model, then its success would certainly be illusory. Of particular concern is that growth of participation in the cotton sector was driven by unsustainably high prices being paid to farmers (Tschirley et al. 2009). In that sense the empowerment of farmers and the increased role of the UNPCB in price setting might have resulted in an over-correction to the previously low prices paid to farmers in the 1970s and 1980s. In all West African countries, the price mechanism was also linked to a stabilization fund designed to support producer prices when the world market was low, and to be replenished when the world market was high (by paying farmers lower prices than could otherwise be paid). The rationale for these funds was to avoid dramatic drops in producer prices and to limit market risks for cotton companies. According to Tschirley et al. (2009), these support funds functioned well in Burkina Faso and Cameroon until 2004, when the world price of cotton fell precipitously. Since then, however, they have fallen victim to the unsustainably high prices agreed to among cotton companies and the producer union. In Burkina Faso, the fund was depleted and could not cover the deficits during the 2005 and 2006 seasons, and recently revealed a three-year cumulative deficit of more than 100 million Euros.

The reasons for the depletion of funds partly related to overly generous prices for farmers[38,] but there were also allegations of corruption because the replenishment of funds from high-price years was less than expected. This was also because the price-determination mechanism was not flexible enough and was based on world prices of the past crop season. As a result the government and donors were required to bail out the fund. With this and the large regular expenditures on the cotton sector, it is no surprise that the Burkinabè cotton sector net budgetary contribution is actually negative. However, unlike Mali, value-added per capita in Burkina Faso is the highest in Africa (US$ 10.52). This means that for every dollar of value added generated, the Burkinabè government had to pay roughly 8 cents, whereas the Malian government had to pay six times as much (41 cents).

[38] Note that profit-sharing has continuously increased in favor of producers over the reform period along the cotton value chain (see Baffes, 2007; and Table 4), and that this might have threatened the profits of cotton firms under a more rigid price-determination mechanism. See Bassett (2008) for more information on the pricing issue.

Nevertheless, the negative budgetary impact is indeed some threat to macroeconomic stability and potentially constitutes a diversion of funds from higher return uses. To remedy this situation, the Burkina Faso Interprofessional Committee, with support from the French Cooperation, adopted in 2006 a new price-setting mechanism based on a formula linked to world market trends. Moreover, the government and the interprofessional Committee moved to have the stabilization funds managed by an independent entity, such as a bank (The West African Bank), according to predefined rules. This new mechanism has the double objective of moving away from political price-setting via a transparent formula linking pre-harvest producer prices to post-harvest world prices.

Unfortunately the pricing system was not correctly applied for the 2006-2007 season, resulting in additional losses for the cotton companies.[39] Still, the system is widely viewed as a significant improvement, and there are now talks of scaling up into a national "smoothing fund" backed by a regional refinancing facility (at the level of the Economic Community of West African States). Meanwhile, the government intervened again to recapitalize cotton firms as a means of shoring up the sector whilst before new private investors come on board (in line with to its willingness to withdraw from the sector). This shows that the new institutional structures in the sector have not been error-free in their decision making, but have addressed problems relatively quickly and in an appropriate manner—this responsiveness based on collaboration between all partners may well be one of the most significant outcomes of the entire reform process. Neighboring countries such as Mali are trying to emulate Burkina Faso's solutions to the financial difficulties of the sector.

[39] Econometric evidence in Baffes (2007) shows practically no co-movement between international prices and producer prices in West African countries, even though many countries used the world price of cotton as their starting point in determining producer prices.

6. LESSONS LEARNED FROM THE BURKINABE COTTON REFORMS

A healthy degree of caution should always temper our enthusiasm to learn from a success story. Of particular concern is that successful outcomes were not driven by the intervention itself (the so called functionalist fallacy), that the reform was unsustainable (environmentally, financially, politically), and that the reform cannot be generalized to other contexts because its design was highly context specific (the external validity issue). In this paper we have tried to show - through survey evidence, quasi-experimental comparisons with neighboring countries, and counterfactual simulations that the remarkably successful outcomes observed in Burkina Faso's cotton sector over the last 10 years were indeed primarily driven by the reform process (see Table 12 for a summary of impacts and results). While the first descriptive evidence presented in Section 4 exhibited ambiguous impacts on poverty and food-security (in the context of the Ivorian crisis notably), the counterfactual work clearly showed that the intervention enabled cotton households to increase their agricultural incomes (even receiving lower transfers from Côte d'Ivoire) and to better meet their food needs. Representing more than 15 percent of the population, cotton households experienced a decrease of 5 percent of total national food-insecure population, as a minimum estimate. While this figure may not appear as very significant, it gains more importance when we understand the dynamics of entry in cotton production. Most of the experienced cotton farmers and households were already food-secure before the reform. That means that on the 8 percent of national population who started to live with cotton earnings during the reform period, most of the food-insecure households turned to become food-secure.

Table 12. Summary table of the main intervention's impact for cotton households in 2006, compared to 1996

Indicator	Outcome
Number of beneficiary households	**176,570 households** representing **1,845,300 individual beneficiaries** in 2006
Change in cotton yields	+0.5 percent a year on average; -1.1 percent estimated if no intervention
Change in cereal yields	Maize: +1.8 percent a year; -1.7 percent estimated if no intervention Millet: +7 percent a year; +5.4 percent estimated if no intervention **Groundnuts: +0.5 percent a year**; -1.7 percent estimated if no intervention **Sorghum: +2.1 percent a year**; -0.7 percent estimated if no intervention
Change in total cultivated land	+248,900 ha; +2.3 percent a year on average for the average household; +36,300 ha estimated if no intervention
Change in cotton production	+13.9 percent a year; -2.9 percent estimated if no intervention
Change in food production	Maize: -1.9 percent a year; -0.5 percent estimated if no intervention Millet: +3.2 percent a year; +6.7 percent estimated if no intervention **Groundnuts**: **-3.2 percent** a year; -0.5 percent estimated if no intervention Sorghum: -1.6 percent a year; +0.5 percent estimated if no intervention
Change in agricultural incomes	+41,300 CFAF per active worker for the agricultural season; +5,100 CFAF estimated if no intervention
Change on households' food-security	+461,300 additional food-secure people; +32,900 estimated if no intervention
Change in malnutrition indicators	No significant change
Number of jobs created in the agricultural sector	+235,000 full-time jobs; +5.3 percent as an annual average growth rate

Notes: Computations are done accounting for all cotton households of 2006, including those who did not cultivate cotton in 1996 to derive the total net effects, assuming no significant effects on the non-cotton population.

In the previous section, we have also tried to address sustainability issues. In terms of financial sustainability, the reforms can certainly be criticized, although Burkina Faso also acted to resolve the problem with another set of new institutional arrangements (a new price-setting rule linked to world prices and independent management of the stabilization fund). In terms of environmental sustainability the reforms were neither particularly bad nor good, but future efforts to improve environmental sustainability are vital, especially in the face of climate change. Finally, in terms of political sustainability we argue that the reforms were initially successful in creating institutions that are more capable of dealing with conflicts, although recent reports indicate a loss of faith in the UNPCB in particular.
This leaves us with the important question of generalizability: To what extent can policymakers in other contexts learn from the Burkinabè experience? In this regard we distinguish between general principles, and specific practices that could potentially be adopted by other cotton producers.

With regard to principles, Burkina Faso's success story confirms much of the existing evidence on the process of reform. Specifically, gradualism facilitates institution building (prices can be changed overnight, institutions cannot), and allows policymakers to observe and improve upon the outcomes of reform. In contrast, wholesale liberalization can be dangerous in the presence of uncertainty, because liberalization is often difficult or costly to reverse. Gradualist or partial liberalization outcomes therefore offer policymakers some opportunity to gauge the impact of liberalization whilst keeping deeper liberalization on the cards for future reform.[40]

Sequencing also appears to have been important. In most of African agriculture, farming is beset by several fundamental market failures relating to information asymmetries, coordination failures, and insufficient provision of public goods. Reforming prices before reforming farmers' incentives could therefore have had little impact on production if government induced price distortions were not the binding constraint (ICAC 1998). In other contexts, liberalization in rural Africa has hurt farmers because of information asymmetries between farmers and agricultural traders/marketers (Kherallah et al. 2003). These empirical accounts are clear reminders of the Theory of Second Best (Lipsey 1956), which warns us that removing one distortion (for example, a monopoly) can lead to adverse outcomes if other distortions are also present (for example, coordination problems, information asymmetries, public goods).

Thirdly, like a number of Asian countries that used "deliberation councils" to bring together policymakers and private sector (industrial) representatives (World Bank 1993), Burkina Faso's Interprofessional Committee provided a useful platform for exchanging exchange information, resolving conflicts, and applying "soft" policies of persuasion rather than coercion. Even prior to the formation of the interprofessional committee in the sector, reformers encouraged SOFITEX personnel and farmers' representatives to tour neighboring countries and learn from their reform experiences. Thus, consensus building was a major feature of the reform process right from the start.

Finally, relative to most of its neighbors, policymaking in Burkina Faso has shown a greater degree of flexibility and pragmatism in its policymaking. This is perhaps best reflected in Burkina Faso becoming the first Sub-Saharan African state (excluding South Africa) to experiment with Bt cotton, in 2003. In 2008, the state allowed the marketing of Bt seeds through a partnership between INERA (the national agronomic research institute) and Monsanto, starting with 8,500 ha, although the success of Bt cotton still remains controversial in Burkina Faso. While trials showed that increases in yields and reduction in pesticide uses (with positive effects on farmers' health) are expected, some experts are concerned about the increasing cost of seeds (Bingen 2008), the unsuitability Bt cotton to local institutions (especially the weak regulatory and legal environment) and climatic conditions Traoré and Sanfo 2003; Gouse et al 3008). Even so, these caveats do not preclude the importance of experimenting with Bt cotton so as to better assess its potential and promote opportunities to "learn by doing".

Although these principles seem general enough, we still need to be careful not to fall into several logical traps, such as the "rationalizing after the fact" (ex post propter hoc) fallacy. For example, gradualism and sequencing are ex-post assessments of the reform process and not necessarily explicit

[40] Gradualism is in turn facilitated by political stability, which has characterized Burkina Faso since the early 1990s, but much less so than its neighbors.

reform principles, although we would argue that they largely emerged because of the precautionary and participative approach of the political process as well as an explicit awareness of the dangers of wholesale liberalization. A second fallacy relates to the whether these lessons can really be generalized to other contexts. Undoubtedly, Burkina's experience is mostly relevant to cash crop sectors in other African countries and cotton sectors especially. Even there, however, a high degree of caution is certainly warranted because of the very different historical contexts of cotton sectors across the continent (Tschirley et al. 2009). In West Africa the common historical and institutional background of Francophone cotton producers, and their joint membership in the CFA union and other regional bodies, hint towards considerable scope to adopt the Burkinabè cotton model, albeit with appropriate modifications. Indeed, because of their similarity to Burkina Faso, it is no surprise that neighboring producers such as Mali are interested in following in Burkina's footsteps. Reforming farmers groups, adopting interprofessional committees, granting regional monopolies, and outsourcing the management of cotton stabilization funds, are all plans that are either already in existence in Mali, or on the way to being adopted.

Perhaps the main stumbling block to successfully adopting the Burkinabè model is political. The introduction of new cotton farmers groups in Mali has met reluctance in villages, where former village associations are still contracting with cotton firms. The more politically active cotton unions have also resisted reform plans, and there appears to be a higher degree of social conservatism at the local level. Hence, the new cotton groups are reported not to be functioning very effectively. Malian cotton farmers also have a longer history of collective action (production strikes) and have a large political impact on Mali's more contested elections. In contrast, Burkinabè cotton farmers had little choice but to accept institutional and organizational changes. In Benin, a key difficulty has been making ex-post adjustments once liberalization was under way. In Chad and Côte d'Ivoire, the lessons from the Burkinabè model could also be worth learning, but it will require political stability and commitment as a necessary condition.

Despite these obstacles, the tremendous success in Burkina Faso over 1996–2006 has undoubtedly exerted considerable pressure for the reform of the cotton sectors of Mali and other Francophone countries. Given the common institutional histories of these countries, and the strength of the evidence presented in this paper, we believe these efforts to emulate and adapt the Burkinabè cotton model should certainly be encouraged. Neighboring countries, and Burkina Faso itself, also have the opportunity to learn from Burkina Faso's recent difficulties as well, particularly with regard to developing financially sound pricing mechanisms, ensuring accountability and transparency in the function of cotton groups and parastatals, and using more consultative approaches to formulating policy.

APPENDIX A. DESCRIPTION OF THE HOUSEHOLD SURVEY AND PRODUCTION DATA USED

Data Set	Observations	Information
Kaminski (2006)	300 representative cotton households interviewed in 2006, 15 GPCs, 20 villages, national stakeholders (interviews)	A retrospective survey about conditions of cotton growing, agricultural choices, land use, households incomes, consumption and living standards, as well as subjective indicators of well-being and about the cotton reform, over the 1996–2006 period, interviews with 15 GPC leaders and national stakeholders about the role of the reform on economic and social impacts
Kaminski (2009b)	60 cotton farms, 5 villages, local leaders and national stakeholders (interviews) interviewed in 2009	Survey about the relationship of farmers to cotton growing and social interactions at the village level, local realities about the new cotton system in Burkina Faso and statements made by the local actors, comparison to official statements made by national stakeholders
Bernard et al. (2008)	Survey of community and market-oriented village groups in Burkina Faso and Senegal carried out in 2002	A significant number of GPCs in the data base that reports information on participation in benefits, leadership structure, overall group management and performances, type of activities, organization, and rules
DGPSA (2008)	Pseudo-panel data on agricultural plots from 1994 to 2002 (between 20,000 to over than 30,000 plots a year)	Data used by the Ministry of Agriculture to compute agricultural forecasts and assessment of national food security. Precise measurement of plots achieved by the permanent agricultural surveys on the fields, as well as measures of input uses
INSD (2006)	National Demographic Census and Living Standard Measurement Survey	Data used by World Bank and Government to assess poverty rates at the national and regional levels, as well as human development indicators
FAO (2009a)	AGROSTAT	Main FAO dataset on agricultural production. FAO generally uses national sources to collate their data.
FAO (2009b)	TERRASTAT	FAO dataset on environmental variables. Assessments relate to the late 1980s and early 1990s and are based on expert assessments. Data quality is therefore an issue.
FAO and IIASA (2009)	Agro-Ecologic Data Base	Uses satellite and survey-based data to generate highly disaggregated spatial data on soil quality and climatic suitability for agriculture.
DHS (2009)	Demographic and Health Survey	Information on malnutrition, extreme poverty indicators at the aggregate regional level. DHS is funded by USAID and carries out homogenous nationally representative surveys in a wide range of developing countries.

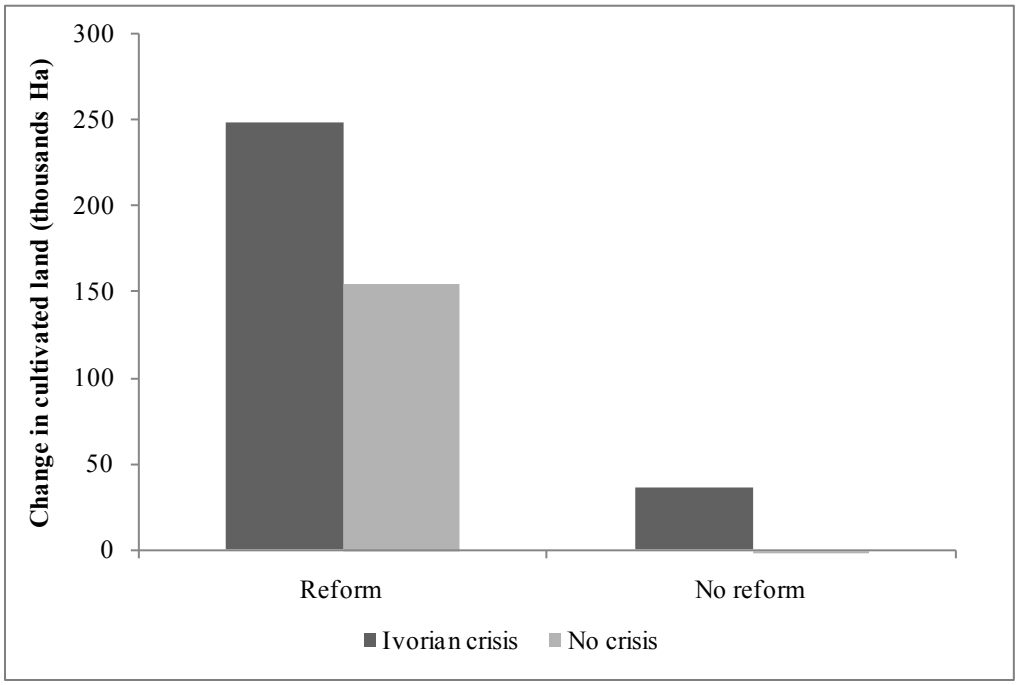
APPENDIX B. ADDITIONAL DATA FOR THE COUNTERFACTUAL COMPUTATIONS

Table B.1. Yields and input use in rural cotton Burkina Faso in 2006 (representative sample)

	Total	Mean	Median	Std. deviation	Min	Max	National level
Cotton							
Planted area (ha)	1092	3.67	2.5	3.52	0.5	25	675000
Cotton seed output (kg)	1206266	4034	2373	5084	201	49640	710 million
Yield (kg/ ha)		1037	1002	360	201	2073	1120
Urea (kg/ ha)		68.85	50	52.13	0	533	62.4
Chemical fertilizer (kg/ ha)		111	100	60.53	0	600	103.7
Organic fertilizer (kg/ ha)		13.4	0	65.43	0	1000	-
Pesticide (liter/ ha)		5.39	6	2.36	0	24	4.92
Other crops							
Planted area (ha)	985.6	3.29	3	1.33	1	15	-
Urea (kg/ ha)		18.32	0	34.58	0	250	7.2
Chemical fertilizer (kg / ha)		27.17	0	52.07	0	400	12 .8
Organic fertilizer (kg/ ha)		21.67	0	105.78	0	1600	-
Pesticide (liter/ ha)		0.15	0	0.77	0	8.67	0

Source: Survey of Kaminski (2006) in representative cotton production areas

Figure B.1. Counterfactual estimations for changes in total cultivated land



Notes: Computations are done accounting for all cotton households of 2006, including those who did not cultivate cotton in 1996 to derive the total net gain of cultivated land in cotton areas over the reform period.

Source: Authors' estimates.

Table B.2. Production function estimates

LN (production)	Millet	Maize	Cotton	Groundnuts	White sorghum
LN (Land)	1.089***	1.125***	1.067***	1.026***	1.140***
t*LN(Land)	-0.003	-.012**	-0.007	0.005	-0.006
LN(NPK)	-0.01	0	.046**	0.146	0.045
t*LN(NPK)	0.01	.014***	.009**	-0.024	-0.004
LN(UREA)	0.002	.128***	.069***	0.078	0.019
t*LN(UREA)	-0.003	-.017***	-.008***	0.007	0.007
LN(Phosphates)	-0.289	-0.074	0.09	-0.194	.162*
t*LN(Phosphates)	0.044	0.021	-0.009	0.025	-0.01
LN(Powd)	.073***	-.054*	0.022	-0.055	0.024
t*LN(Powd)	-.017***	0.006	-0.004	.014*	-0.005
LN(Pesticides)	0.015	.131*	.055*	-0.287	-0.202
t*LN(Pesticides)	0.016	-0.015	0.004	0.016	0.023
Manure	0.168	.140**	-0.014	.452***	-0.019
t*Manure	-0.014	0.012	..009	-.053*	.033**
t	.147***	.105**	0.042	0.023	0.056
t^2	-.010***	-0.003	0.001	-0.007	0.000
Pure	0.027	-.061*	-0.013	-.080***	-0.023
Relief dummies	yes				
Plough dummies	yes				
Constant	-3.92 (1.10)***	-3.53 (1.26)***	-3.55 (.62)***	-2.83 (.54)***	-6.73 (.68)***
Log-Likelihood	-6700.233	-10119.969	-9501.061	-7272.065	-10742.385
ρ	.302 (.022)***	.156 (.015)***	.208 (.017)***	.319 (.018)***	.202 (.015)***
#Households	1355	1980	2335	1548	1553
Observations	4388	6171	6776	5495	6911

Notes: NPK is the quantity of NPK fertilizers in Kg, Urea is the quantity of applied urea in Kg, Powd is the quantity of powder products in Kg, and Pesticides is the quantity of applied pesticides in liters. Manure is a dummy variable if manure application was done, pure is a dummy if no associated crops are cultivated in the plot, ρ is the proportion of error variance due to random effects within households. *** indicates significance at 1 percent, ** at 5 percent, and * at 10 percent.

Source: Authors' estimates.

REFERENCES

AFD (Agence Française de Développement). 2008. *Coton et Pauvreté au Burkina Faso. Analyse des conditions de vie des ménages au Mali et au Burkina Faso*. Document de travail, série Analyses d'impact n°1. Paris, France : AFD.

Baffes, J. 2007. Distortions to cotton sector incentives. In *Distortions to cotton incentives in Benin, Burkina Faso, Chad, Mali, and Togo*. Washington, D.C.: World Bank.

Bassett, T. 2001. *The peasant cotton revolution in West Africa, Côte d'Ivoire, 1880–1995*. Cambridge, U.K.: Cambridge University Press.

Bassett, T. 2008. Producing poverty. power relations and price formation in the cotton commodity chains of West Africa. In *Hanging by a thread*, ed. W. G. Moseley and L. Gray. Athens, Ohio, U.S.A.: Ohio University Press.

Bassett, T. 2009. Slim pickings: Fairtrade cotton in West Africa. *Geoforum,* forthcoming. Available online <doi:10.1016/j.geoforum.2009.03.002>.

Bernard, T., M-H. Collion, A. de Janvry, P. Rondot, and E. Sadoulet. 2008. Do village organizations make a difference in African rural development? A Study for Senegal and Burkina Faso. *World Development* 36 (11): 2188–2204.

Bernard, T., A. de Janvry, and E. Sadoulet. 2009. When does community conservatism constrain village organizations? *Economic Development and Cultural Change*, forthcoming.

Béroud, F. 1999. Les filières partenaires. *Coton et Développement* Hors Série (Septembre): 94–97.

Bezemer, D., and D. Headey. 2008. Agriculture, development and urban bias. *World Development* 36 (8): 1342–1364.

Bingen, R. J. 1994. Agricultural development policy and grassroot democracy in Mali: The emergence of Mali's farmer movement. *African Rural and Urban Studies* 1: 57–72.

_____. 1996. Leaders, leadership, and democratisation in West Africa: Observation from cotton farmers movement in Mali. *Agricultural and Human Value* 13 (2): 24–32.

_____. 1998. Cotton, democracy, and development in Mali. *The Journal of Modern African Studies* 36 (2): 265–285.

_____. 2008. Genetically engineered cotton: Politics, science, and power in West Africa. In *Hanging by a Thread*, ed. W. G. Moseley and L. Gray. Athens, Ohio, U.S.A.: Ohio University Press.

Bourdet, Y. 2004. *A tale of three countries—structure, reform, and performance of the cotton sector in Mali, Burkina Faso, and Benin.* Country Economic Report 2. Stockholm, Sweden: Swedish International Development Cooperative Agency.

Brambilla, I., and G. G. Porto. 2005. *Farm productivity and market structure: Evidence from cotton reforms in Zambia*. Working Papers 5. New Haven, Connecticut, U.S.A.: Economic Growth Center, Yale University.

DGPSA (*Direction Générale des Prévisions Statistiques Agricoles*). 2008. *Permanent agricultural survey, 1994–2004*. Ouagadougou, Burkina Faso: Ministry of Agriculture.

DHS (Demographic and Health Survey). 2009. DHS stat-compiler database. <http://www.statcompiler.com/>. Accessed on August 10, 2009.

Fan, S. 1991. Effects of technological change and institutional reform on production growth in Chinese agriculture. *American Journal of Agricultural Economics* 73 (2): 266–275.

FAO (Food and Agriculture Organization of the United Nations). 2009a. *AGROSTAT*. Rome: FAO.

_____. 2009b. *TERRASTAT: Land resource potential and constraints at regional and country levels*. Rome: FAO.

FAO and IIASA (International Institute for Applied Systems Analysis). 2009. *Global agro-ecological zones database*. Rome: FAO and IIASA.

Fok, M. 2008. Cotton policy in Sub-Saharan Africa: A matter of institutional arrangements related to farmers' constraints. Presented at the conference on "Integrating Social Sciences into Cotton Reform Implementation: Rationales of Cotton Policies," CIRAD, Montpellier, France.

Gergely, N. 2004. *Etude comparative sur les coûts de production des sociétés cotonnières au Mali, au Burkina Faso et au Cameroun*. Paris: Agence Française de Développement.

Goreux, L., and J. Macrae. 2003. *Reforming the cotton sector in Sub-Saharan Africa*. Africa Region Working Paper Series 47. Washington, D.C.: World Bank.

Gouse, M., B. Shankar, and C. Thirtle, 2008. The decline of Bt cotton in KwaZulu-Natal: Technology and institutions. In *Hanging by a thread*, ed. W. G. Moseley and L. Gray. Athens, Ohio, U.S.A.: Ohio University Press.

Gray, L. C. 2008. Cotton production in Burkina Faso: International rhetoric versus local realities. In *Hanging by a thread*, ed. W. G. Moseley and L. Gray. Athens, Ohio, U.S.A.: Ohio University Press.

Gray, L. C., and M. Kevane. 2001. Evolving tenure rights and agricultural intensification in Southwestern Burkina Faso. *World Development* 29 (4): 573–587.

Grimm, M., and I. Gunther. 2004. *A country case study on Burkina Faso*. Research Paper for the "Operationalising Pro- Poor Growth" project. A joint initiative of AFD, BMZ (GTZ, KfW Development Bank), DFID, and the World Bank, University of Gottingen, Germany.

ICAC (International Cotton Advisory Committee). 1998. Statements of France and the World Bank. Statements of the International Cotton Advisory Committee at the 57th Plenary meeting in Santa Cruz, Bolivia.

INSD (*Institut National des Statistiques et de la Démographie*). 2006. National demographics census and living standards survey data. Ouagadougou, Burkina Faso: INSD.

Isaacman, A., and R. Roberts, eds. 1995. *Cotton, colonialism, and social history in Sub-Saharan Africa*. Portsmouth, New Hampshire, U.S.A., and London: Heineman and James Currey Ltd.

Jayne, T., J. D. Shaffer, J. M Staatz, and T. Reardon. 1997. *Improving the impact of market reform on agricultural productivity in Africa: How institutional design make a difference*. MSU International Development Working Paper 66. East Lansing. Michigan, U.S.A.: Michigan State University.

Kaminski, J. 2006. *Retrospective survey on ten years of changes in the cotton sector of Burkina Faso: Interviews of stakeholders, field survey of representative producers and GPCs, and price information on local markets*. Toulouse, France: Toulouse School of Economics.

_____. 2009a. *Subjective wealth and rural development: Evidence from the cotton reform in Burkina Faso*. CAER Working Paper. Jerusalem, Israel: Hebrew University.

_____. 2009b. *Survey of individual cotton farms, GPCs, leaders of 5 cotton villages in Burkina Faso, and exchanges with Malian officials in Bamako for the "Power and Politics in Africa" Project*. London: Overseas Development Institute.

Kaminski, J., and A. Thomas. 2008. *Commodity reform and extensive production growth: Evidence from Burkinabè cotton farmers*. CAER and INRA Working Paper. Hebrew University of Jerusalem, Israel, and Toulouse School of Economics, France.

Kherallah, M., C. Delgado, E. Gabre-Madhin, N. Minot, and M. Johnson. 2002. Reforming agricultural markets in Africa. Baltimore, Maryland, U.S.A.: John Hopkins University Press.

Lachaud, J-P. 2005. A la recherche de l'insaisissable dynamique de pauvreté au Burkina Faso. Une nouvelle évidence empirique. Documents de travail 117. Bordeaux, France: Centre d'Economie du Développement de l'Université Montesquieu Bordeaux IV.

Lele, U., N. Van de Walle, and M. Gbetiobouo. 1989. *Cotton in Africa: An analysis of differences in performance*. MADIA Discussion Paper 7. Washington, D.C.: World Bank.

Lipsey, R. G., and K. Lancaster. 1956. The general theory of second best. *The Review of Economic Studies* 24 (1): 11–32.

Mazzucato, V., and D. Niemeijer. 2000. *Rethinking soil and water conservation in a changing society: A case study in Eastern Burkina Faso*. Tropical Resource Management Papers 32. Wageningen, The Netherlands: Wageningen University.

Moseley, W. G., and L. Gray, eds. 2008. *Hanging by a thread*. Athens, Ohio, U.S.A.: Ohio University Press.

Poulton, C., P. Gibbon, B. Hanyani-Mlambo, J. Kydd, W. Maro, M. N. Larsen, A. Osorio, D. Tschirley, and B. Zulu. 2004. Competition and coordination in liberalized African cotton market systems. *World Development* 32 (3): 519–536.

Roberts, R. L. 1997. *Two worlds of cotton: Colonialism and the regional economy in French Sudan, 1800–1946*. Cambridge, U.K.: Cambridge University Press.

Rodrik, D. 1996. Understanding economic policy reform. *Journal of Economic Literature* 34: 9–41.

_____. 1999. Where did all the growth go? External shocks, social conflict, and growth collapses. *Journal of Economic Growth* 4: 385–412.

Salé, M., R. Togbé, and A. Waddell. 2001. É*tude sur la crise financière cotonnière*. Cotonou, Benin: Association Interprofessionnelle du Coton.

Savadogo, K., and T. Sakurai. 2007. *War induced covariate shocks and natural resource degradation in Burkina Faso: Evidence from the Ivorian crisis*. Working paper. University of Ouagadougou, Burkina Faso.

Schwartz, A. 1996. Attitudes to cotton growing in Burkina Faso: Different farmers, different behaviours. In *Economics of agricultural policies in developing countries*, ed. M. Benoit-Cattin, M. Griffon, and P. Guillaumont. Paris: Revue Française d'Economie.

Tefft, J. 2008. Mali's white revolution: Smallholder cotton from 1960 to 2006. In *Successes in African agriculture: Lessons for the future*, ed. S. Haggblade and P. Hazell. Washington, D.C.: International Food Policy Research Institute.

Traoré, D., and D. Sanfo. 2001. Limits on the use of genetically modified cotton in Africa: The case of Burkina Faso. *The ICAC Recorder*, Institute of Clean Air Companies, Washington, D.C.

Tschirley, D., C. Poulton, and P. Labaste. 2009. *Organization and performance of cotton sectors in Africa: Learning from Reform Experience*. Washington, D.C: World Bank.

World Bank. 1993. *The East Asian miracle: Economic growth and public policy*. New York: Oxford University Press.

World Bank. 2004. Cotton cultivation in Burkina Faso, a 30-year success story. Paper presented at the Conference on "Scaling up Poverty Reduction, a Global Learning Process," Shanghai, China.

IFPRI DISCUSSION PAPERS
Prepared for the "Millions Fed: Proven Successes in Agricultural Development"

910. *Combating stem and leaf rust of wheat: Historical perspective, impacts, and lessons learned.* H. J. Dubin and John P. Brennan, 2009.

911. *The Asian Green Revolution*. Peter B. R. Hazell, 2009.

912. *Controlling cassava mosaic virus and cassava mealybug in Sub-Saharan Africa.* Felix Nweke, 2009.

913. *Community forestry in Nepal: A policy innovation for local livelihoods.* Hemant Ojha, Lauren Persha, and Ashwini Chhatre, 2009.

914. *Agro-environmental transformation in the Sahel: Another kind of "Green Revolution."* Chris Reij, Gray Tappan, and Melinda Smale, 2009.

915. *The case of zero-tillage technology in Argentina.* Eduardo Trigo, Eugenio Cap, Valeria Malach, and Federico Villarreal, 2009.

916. *Zero tillage in the rice-wheat systems of the Indo-Gangetic plains: A review of impacts and sustainability implications.* Olaf Erenstein, 2009.

917. *The impact of shallow tubewells and boro rice on food security in Bangladesh.* Mahabub Hossain, 2009.

918. *Hybrid rice technology development: Ensuring China's food security.* Jiming Li, Yeyun Xin, and Longping Yuan, 2009.

919. *Pearl millet and sorghum improvement in India.* Carl E. Pray and Latha Nagarajan, 2009.

920. *Institutional reform in the Burkinabè cotton sector and its impacts on incomes and food security: 1996–2006.* Jonathan Kaminski, Derek Headey, and Tanguy Bernard, 2009.

921. *Private sector responses to public investments and policy reforms: The case of fertilizer and maize market development in Kenya*. Joshua Ariga and T. S. Jayne, 2009.

922. *The mungbean transformation: Diversifying crops, defeating malnutrition.* Subramanyan Shanmugasundaram, J. D. H. Keatinge, and Jacqueline d'Arros Hughes, 2009.

923. *The global effort to eradicate rinderpest*. Peter Roeder and Karl Rich, 2009.

924. *Rural and urban linkages: Operation Flood's role in India's dairy development.* Kenda Cunningham, 2009.

925. *Rich food for poor people: Genetically improved tilapia in the Philippines*. Sivan Yosef, 2009.

926. *"Crossing the river while feeling the rocks:" Incremental land reform and its impact on rural welfare in China.* John W. Bruce and Zongmin Li, 2009.

927. *Land-tenure policy reforms: Decollectivization and the Doi Moi System in Vietnam.* Michael Kirk and Tuan Nguyen, 2009.

928. *Improving diet quality and micronutrient nutrition: Homestead food production in Bangladesh.* Lora Iannotti, Kenda Cunningham, and Marie Ruel, 2009.

929. *Improving the proof: Evolution of and emerging trends in impact assessment methods and approaches in agricultural development.* Mywish K. Maredia, 2009.

For all discussion papers, please go to www.ifpri.org/pubs/pubs.htm#dp.
All discussion papers can be downloaded free of charge.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

www.ifpri.org

IFPRI HEADQUARTERS

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org