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The Hebrew University of Jerusalem



המרכז למחקר בכלכלה חקלאית
The Center for Agricultural
Economic Research

המחלקה לכלכלה חקלאית ומנהל
The Department of Agricultural
Economics and Management

Discussion Paper No. 10.10

**The Burkinabe Cotton Story 1992-2007:
Sustainable Success or Sub-Saharan Mirage?**

by

Jonathan Kaminski, Derek Headey and Tanguy Bernard

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P.O. Box 12, Rehovot 76100

ת.ד. 12, רחובות 76100

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Abstract

Like many other African countries in the 1980s, Burkina Faso was urged to engage in a far-reaching liberalization of its state-led cotton sector. Yet unlike most of its neighbors, the Burkinabè government rejected both the status quo and wholesale liberalization, and instead embarked on a more gradual and sequenced reform path characterized by institutional innovations and partial privatization. Whether the reforms contained genuinely successful elements is therefore an important question, but also a difficult one given the absence of a counterfactual, the confounding influence of exogenous shocks and the recent financial troubles of the sector. To unravel this puzzle, this paper reviews existing evidence linking the reforms to various outcomes, but also develops a novel counterfactual analysis to more rigorously assess the impacts of these reforms. Our analysis shows that while many elements of the reform process did achieve important economic objectives, return migration from Cote d'Ivoire explains a third of production growth, financial elements of the reforms were not fully sustainable, and institutional arrangements failed to fully empower cotton farmers. This provides both positive and negative lessons for other would-be cotton reformers.

Keywords: Burkina Faso, Cotton, Poverty Reduction, Counterfactual analysis, Production Growth, Political Sustainability

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 working paper version. We are indebted to Thomas Bassett, Renata Serra, Leslie Gray, and William Moseley for many insightful discussions, and to the participants of the Food and Resource Economics Seminar at the University of Florida. The authors are also grateful to the Ministry of Agriculture in Burkina Faso for allowing access and use of the DGPSA database.

Introduction

The task of identifying and understanding genuine economic success stories in development policies is fraught with difficulties.¹ Evaluators examining apparent “economic miracles” need to be particularly careful not to simply rationalize events (the *ex post propter hoc* fallacy), particularly when what looks like good policy could actually be good luck (Easterly et al., 1993), or an unsustainable boom preceding an inevitable bust (Hausman, Pritchett and Rodrik, 2005). Many case studies of success stories do not even consider the hypothetical counterfactual of what could have happened if the “successful” policies in question had not been adopted (perhaps other policies would have achieved even better results) and relatively few studies rigorously try to estimate counterfactual scenarios. External validity issues are also an important concern given the complex interaction between “good policies” and a variety of social, economic, political and geographical circumstances that may be preconditions for the success of the chosen policies (Headey, 2009).

The reform of Burkina Faso’s cotton sector from the mid 1990s to today is a particularly interesting case study in this regard for a number of reasons. Firstly, Burkina Faso’s cotton sector has undoubtedly produced some impressive statistics since the mid 1990s. The reforms have spurred a massive expansion of cotton area, generated thousands of jobs, and propelled Burkina Faso from being Africa’s fourth largest cotton exporter to the largest in the space of a few years. Cotton’s success in Burkina Faso would therefore appear to at least be welfare-improving for cotton producers themselves, but there are also clear macroeconomic spillovers given that cotton export earnings have comprised as much as 70 percent of Burkina Faso foreign exchange earnings. These impressive statistics, and the fact that they coincide with a period of substantial microeconomic reform of the sector, are certainly strong enough to attract attention as a possible policy success story.

A second point of interest relates to the unusually high degree of external validity that this case presents. This follows from the fact that cotton producing countries in Francophone West Africa not only face a common global market, but also share remarkably similar institutional histories as well as relatively

homogenous biophysical conditions. On this last commonality, West African cotton production stretches across an agroecological zone (the Sudanian) running from the Western coast (Senegal) all the way to Chad. The less trivial institutional commonalities between Francophone countries stem not only from their shared colonial history (including language, culture and currency), but also from the ubiquitous involvement of the French government and French private sector in the postcolonial cotton sector. In all Francophone countries French companies played a leading role in cotton research, and typically owned a significant share of country-specific cotton parastatals.² This in turn meant that Francophone cotton countries adopted very similar development strategies comprised of French-led research and state-led contract farming via parastatal monopolies/monopsonies. Moreover, nearly all of these countries came under significant pressure, chiefly from the World Bank, to liberalize their cotton sectors in the 1980s and 1990s. Francophone countries also share a common currency (including a common devaluation of the CFA Franc in 1994), and face common world market conditions for cotton. In short, these commonalities do not only provide a quasi-experimental backdrop by which to compare the various Francophone cotton producers in Africa, they also suggest that there is significant scope for cross-country learning in the region.

Of course, for cross-country learning to be feasible, countries starting from relatively similar conditions prior to reform would need to have pursued quite different reform strategies. This is indeed the case. Several non-Francophone African countries provide extreme cases, in that they more or less followed the wholesale liberalization path (Ghana, Zambia, Uganda, Mozambique). In contrast, Francophone West African countries were more resistant to reform for both political and economic reasons. On the political front, the cotton sector was important for domestic political support and because the sector was such a lucrative source of foreign exchange earnings. But resistance to the liberalization agenda also had a genuine economic rationale. Prior to the financial difficulties of the 1980s, the state-led Francophone cotton sector had experienced considerable success in the post-independence era (World Bank, 2004). This success could be attributed to the state's role in overcoming a series of critical market failures: the public good nature of agricultural R&D and marketing, the coordination failures and

contractual problems that plague more competitive private sector contract farming schemes, and the fundamental credit and input market failures that pervade most of rural Africa. For these reasons several Francophone African countries justifiably sought to implement heterodox reforms that aimed to keep the best elements of the state-led approach whilst still introducing a degree of competition (Burkina Faso, Bénin), while others more or less resisted reform altogether (Mali, Niger, Chad, Cameroon).

Finally, although there is a quasi-experimental aspect to comparisons between Burkina Faso and other cotton producing countries in Africa, establishing whether Burkina Faso is a genuine success story requires us to address the very challenging questions of internal validity (did the “treatment” produce the outcomes observed?) and sustainability (are those observed outcomes sustainable?). Both of these questions are particularly complex in this case. On the internal validity question, exogenous shocks such as higher international cotton prices, the large influx of return migrants from conflict-torn Côte d’Ivoire and the possible smuggling of Ivorian cotton through Burkina Faso, may all have inflated Burkina Faso’s cotton statistics.

But perhaps the most serious possibility of a “false positive” in this case relates to the sustainability of the reforms. Sustainability has obvious financial dimensions in this context, but also environmental and political dimensions.³ Cash crop sectors in Africa have witnessed many booms and busts, largely because of poor financial management related to unsustainable smoothing funds (designed to provide a buffer for farmers from volatile international prices) and profligate fiscal policies. In 2007 Burkina Faso’s cotton sector suffered a serious financial collapse precisely related to problems with the pricing arrangements and the smoothing fund, and production and exports suffered accordingly. This sharp turnaround led many observers to dismiss Burkina Faso’s success as a red herring, although another view is that the problem is technical, specific and remediable. Perhaps more worryingly is that anecdotal evidence also suggests that the reforms have become politically unsustainable, with many farmers apparently unhappy with the reform institutions that were, in principle, designed to empower them.

These complexities move us to adopt a multi-pronged strategy for assessing whether Burkina Faso’s cotton reforms (reviewed in Section 2) are a genuine success or simply a mirage. In addition to the cross-

country comparisons warranted by the quasi-experimental conditions discussed above, we attempt to more rigorously assess the internal validity and sustainability issues through econometric evidence linking farm-level outcomes to government policies (Section 3), as well as through a partial equilibrium model (outlined in Section 4) that we use to compare actual events to some important counterfactual situations (i.e. a no reform scenarios, less generous farmgate prices, and no return migration from Burkina Faso) (Section 5). We find that all these counterfactual scenarios produce significantly different economic outcomes, indicating that although the reforms produced tangible benefits, return migration and unsustainable farmgate prices also contributed to the cotton boom. Finally, we also piece together more recent evidence on the complex issues of financial and political sustainability, and discuss the evidently unfinished business of reform in Burkina Faso (Section 6).

2. Background: the cotton story in Burkina Faso

2.1 From traditional cultivation to the crisis of early nineties

Cotton has a long and complex history in West Africa. 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).⁴ Cotton then became a coercive tool of the French Upper Volta colony with cultivation becoming compulsory in the 1920s, even though farmers often circumvented the “forced corvée” through out-migration, and by selling their cotton on the local parallel market or by exporting it to Ghana (the Gold Coast).⁵ In 1947, Upper Volta was re-established as an autonomous colony and cotton was again the focus of the colony’s development strategy. The *Compagnie des Fibres Textiles* (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 CFDT and IRCT (*Institut de Recherche du Coton et des Textiles exotiques*)

allowed substantial improvements in cotton varieties, and marketing became profitable through the progressive recognition of CFDT quality standards on the world market.

Due to substantial increases in yields and to growing interests among farmers, cotton areas increased very rapidly after Upper Volta's independence in 1960. The CFDT remained a key player, associated through a partnership with the new government and with bilateral donors who funded several development projects for cotton in the 1970s. This association was then replaced by SOFITEX—*Société des Fibres Textiles*—in 1979, a new parastatal, which, importantly, was also left in charge of a number of broader rural development projects. Meanwhile, the rural communities were progressively organized under a cooperative mode through village groups, called GVs, that 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 (e.g. the ox-plow, mineral fertilization, and pesticides) and high-yielding seeds, together with relatively higher cotton prices, contributed to a two-fold increase in cotton yields from the late 1970s to the 1980s, as well as to increased cereal production and improved food security among cotton smallholders. With ample cotton profits, both SOFITEX and the State invested in rural infrastructure (roads, education, health), further improving farmers' living standards. For most of the post-independence era, cotton was also the most important source of foreign exchange earnings in countries such as Mali and Burkina Faso (Baffes, 2007).

However, falling cotton prices in the late 1980s revealed serious structural problems that were overlooked under better circumstances. As a result, the prices paid to producers declined from 1988 to 1992, GVs accumulated large debts, and production started to collapse at the beginning of the 1990s. In collaboration with donors, governments initiated a series of financial and management audits of the 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). Furthermore, 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 contribute 50-70% of total export earnings in Burkina Faso). There was thus an urgent

need to reform the sector, exacerbated on the political side by the “Dédougou riot” and the partial boycotting of production by growers in 1991, which eventually led to the establishment of the first growers’ union, the FENOP—*Fédération Nationale des Organisations Paysannes*—to defend their interests against the growing corruption among officials and SOFITEX executives. The World Bank and French Aid (AFD) also strongly supported a reform process, acknowledging that the cotton sector was too important to ignore.

Setting up the reform agenda, however, required overcoming a number of disagreements between donors, farmers and the government. Policymakers in Burkina Faso and the AFD advocated partial privatization of the sector through the idea of local monopsonies. The World Bank did not support the idea, arguing that it would fail “to generate the competitive pressures that are the linchpin of this system” (ICAC, 1998). The AFD—*Agence Française de développement*—disagreed with the World 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, and formerly CFDT) in SOFITEX, cooperation between both donors was essential for meaningful reform to take place. For its part, the State’s primary interest was in streamlining the sector to make it financially viable, whilst also being in compliance with aid conditionality requirements. Hence the State had a strong interest in at least ensuring the success of the reforms, especially in terms of export earnings.

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), and further viewed the incorporation of farmers as a necessary step for bringing the World Bank on board. However, a fairly close alignment of interests between the Burkinabè government and AFD 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—*Union Nationale des Producteurs de Coton du Burkina Faso*—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. Establishment of cotton co-operatives and UNPCB were then supported by AFD capacity-building programs.

Because of these negotiations and institutional changes, 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.⁶ A consensus for the reform was finally reached among national stakeholders, CNCA (the national agricultural bank), farmers, the AFD, 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.

2.2. The reforms: a piecemeal approach

Table 1 shows the chronology and basic content of the reforms. The principal conclusion is that Burkina Faso's reform process combined a mix of gradualism, sequencing, and institution building. The gradualism is self evident given the 15-year period (1992 to 2007) over which reforms were carried out in a step by step fashion (Bourdet, 2004). The interrelated importance of sequencing and strengthening institutions requires a more careful appraisal, including an assessment of alternative reform paths.

A particularly tempting avenue of reform for donors could have been wholesale liberalization given that, with varying degrees of structure and speed, this path was pursued by many other cotton-producing countries in Africa under the active support of the World Bank and other donors (Tschirley et al., 2009). Nevertheless, liberalized sectors were already noted to suffer from the inherent trade-off between competition and a series of market failures linked to information asymmetries and principal-agent problems in credit markets. These failures could have quickly resulted in 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 given the sector's crisis. So while some degree of public or private monopsony may be necessary for contract farming in the prevailing institutional setting, strengthening smallholder participation was also vital to

avoiding the exploitation of farmers. The latter position, at least, was supported by both the AFD and the World Bank.

Hence the first stage of reform focused on building up farmer organizations rather than immediately introducing competition into the sector. In 1996 the government legally replaced involuntary multi-purpose village groups (GVs) 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 GV groups 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, GV groups were formed at the level of the entire village, despite a high degree of heterogeneity within villages and limited capacity for members to monitor each other. This eventually led to very high default rates across the GV groups due to low repayment incentives, as well as financial diversion from the GV activities to local rural development projects rather than cotton projects specifically. Furthermore, the joint-liability system for credit repayment left the door open for all kinds of abuses, such as fertilizer and farm equipment being misappropriated for either resale or use for other crops. By the end of September 1995, GV groups' debt to the CNCA had reached 2.1 billion CFA francs, not including internal outstanding debts (ICAC, 1998).

[Insert Table 1 about here]

Thus, the creation of GPCs aimed to address 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, with a higher level of trust between members and a higher capacity to monitor each other. In fact, new GPCs have adopted tight member policies (through high membership fees, refusal of certain

individuals for weak reputation, exclusion of defaulters), particularly when compared to non-cotton groups in the same regions, which are 60% larger on average (25 and 42 members respectively).⁷

Once the reform of farmers' groups was underway, reform efforts focused on the parastatal. 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 proposed solution was to grant regional monopolies/monopsonies to private firms (other aspects of the sector were also privatized in a piecemeal fashion, including transportation). This "zoning" was essentially a compromise⁸ 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.⁹ In fact, while zoning can induce a low 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) or Côte d'Ivoire—it can nevertheless reduce coordination failures since regulatory schemes need only coordinate and negotiate with the relatively small number of market players. So what started out as an interprofessional agreement between SOFITEX and the UNPCB later led to the interprofessional committee (AICB) when other key market players were integrated into the process (especially the regional monopsonies, SOCOMA and FASOCOTON). 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.

3. What did the reforms achieve? A review of the *prima facie* evidence

In this section we review secondary evidence that attempts to link cotton sector outcomes to the various reforms. We examine a variety of evidence, including comparative analytics of various Francophone

cotton sectors, macroeconomic evidence relating to production and employment, and microeconomic evidence on the welfare outcomes of the reforms.

3.1 Institutional outcomes of the reform process

As we noted in our introduction (see also Fok, 2008; and Bingen, 1998), the Francophone cotton model addressed a number of sources of market failures, especially farmers' liquidity constraints, risk aversion, high transaction costs, shortage of public goods, as well as international factors related to establishing a reputation sufficiently good to attract higher international prices and better access to international finance. These quite successful elements of the model also explain why the Francophone countries all sorted some degree of gradualism in their reforms (skeptics would call it obstructionism) and piecemeal rather than wholesale liberalization. For example, farmers' groups and regional and national unions were also set up in Bénin in 1993 (three years before Burkina Faso) and in Cameroon in 2000, while the process is still under way in Mali. There, conservative leanings and strong ties to existing farmers' groups hampered the emergence of more flexible groups that could help increase repayment rates on credit (as per the GPCs in Burkina Faso),¹⁰ while the more contestable democratic environment has also slowed down the reform process further supporting a situation of status quo.¹¹

However, apart from Burkina Faso, only Bénin (in 1995) and Côte d'Ivoire (in 1998)¹² have so far permitted private control of cotton companies, although both countries have precluded competition for the purchase of seed cotton, whereas the rights to purchase seed cotton in Burkina Faso are allocated to three regional monopolies. Specifically, the approach in Bénin was to give responsibility for activities at different stages of the supply chain to separate private firms, and 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 of Bénin's experience also point to the continued favoritism towards the poorly managed

parastatal (Bourdet, 2004), which is estimated to add an extra cost of 65 CFA franc per kilogram of cotton sold (Salé et al., 2001). Bourdet (2004) also mentions the possibility of excessive entry into the sector, which reduced profits. Another factor in Bénin may be the more limited capacity to expand cotton areas, although we note that Bénin has other advantages relative to Mali and Burkina Faso (e.g. lower transport costs because of its coastal access). So, in spite of more competitive markets in Bénin, SOFITEX remained more cost-efficient than its Beninese counterparts thanks to a better institutional framework (see previous section) and better market coordination among the stakeholders. Note that increasing production costs of the CMDT in Mali are also well documented by several audits (e.g. 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).

We would argue that Burkina Faso's success (until recently, at least) was related to the financial streamlining of the sector thanks to improvement in the parastatal management and in the higher credit repayment rates of Burkinabè smallholders. The latter was a direct result of the formation of GPCs, which also reduced the costs of collection by centralizing members' products (eventually gathering products from other local GPCs as well), checking weights and grades with purchasers, and even engaging in legal action in case of disagreements. An estimated 12,000 such groups have thus emerged over the past decade (up until 2009) and the number of GPCs has increased at a much faster rate than the number of producers, suggesting that smaller average group sizes may be related to an increasingly effective process of matching members through self-selection. Overall, more than 80% of GPCs are engaged in input provision, and nearly 100% 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% of them considered as inactive (compared to 10% for other groups in the region). GPCs also comprise the grassroots link in the broader five-part chain of farmer participation in the cotton sector, which extends all the way up to the cotton farmers union, the UNPCB (Goreux and Macrae, 2003). From repayment rates of around 40% before the reform, repayment rates have risen to around 95% (under standard climatic conditions) thanks to a better management of outgrower schemes and more cohesive

farmer groups. Input use was already quite high among cotton growers before the reform, so input use per hectare has not risen markedly.¹³ However, many new farmers have benefited from the expansion of cotton cultivation, and idle land has been more fully exploited.

More recently, however, there are signs that Burkina Faso's institutional reforms have run into problems. 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. More 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% had warehouse facilities,¹⁴ and less than 2% provided their members with an occasional access to a tractor. This lack of resources is enhanced by the GPCs' environment and their partners. First, they can be constrained by their own village environment. As shown in Bernard et al. (2010), 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 rather 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*, whereas non-cotton farmers, traders and civil servants are less expected to do so.

There are also doubts about the role of the UNPCB and its effective representation of cotton farmers' interests. 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 US 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 and Bambio (2009) report 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* (the financial funds aimed to cover the administrative costs of GPCs) are not redistributed to 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). Perhaps one indicator of these problems is that the long term leader of the UNPCB, Francois Traoré, resigned in January 2010 after having proposed the establishment of a new union for maize growers. UNPCB representatives complained that Traoré did not respect presidency turnover and that the establishment of a maize union would have weakened their movement.

As for SOFITEX, despite some improvements in production and management costs, governance problems with the parastatal remain an important issue. Farmers complain of the lack of transparency, while late payments have deteriorated the trust relationships between GPCs and other cotton firms. In 2009, for example, farmers ordered inputs without having information about the price they will be charged (Kaminski and Bambio, 2009).

3.2 Cotton production, growth, and employment creation

Increases in cotton production are labor-intensive processes, so cotton growth is an effective generator of employment. This is certainly true in Burkina Faso where the share of cotton farmers (and related household members) in the total farming population has almost doubled between 1994 and 2003, from 11.3% to 19.9% of agricultural employment. This acceleration in cotton production has absorbed more than 200,000 new farmers,¹⁵ including existing non-cotton farmers, but also return migrants. Overall, it is estimated that cotton growth in Burkina Faso has created around 235,000 full time jobs, such that cotton farmers represented almost 1/6 of all rural households in Burkina Faso towards the end of the reform process (2006), making them the largest employment group in the country.

[Insert Table 2 about here]

Another *prima facie* indicator of the success of the reforms is that Burkina Faso has overtaken Mali 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 (Figure 1).¹⁶ In fact, neighboring countries' production has followed very different patterns than that of Burkina Faso. Mali and Bénin experienced modest production growth at rates much slower than those of Burkina Faso. Note also that cotton yields have remained constant in Burkina Faso (together with the entry of less-performing land and labor) while decreasing in Mali and Bénin (FAO, 2009).

[Insert Figure 1 about here]

After a short-term positive effect following early reforms, production collapsed in Bénin 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 has 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.

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 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 the reforms significantly improved incentives for cotton production through better contractual relationships within farmer groups, and between farmer groups and cotton firms. Kaminski and Thomas (2010) 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 Faso's success. However, the nature of the extensive growth process means that the exogenous shock of a large influx of return migrants must be taken into consideration when assessing the true impact of the reform. Hence, our counterfactual estimates of land expansion and production growth with and

without the Ivorian crisis are the only real means of separating the reform's effects from the effects of return migration.

Another potential source of growth lies in the pricing issue. As observed by Baffes (2007), West and Central African Francophone countries typically went from taxing producers to a more or less neutral stance (except in the late eighties). The shift from taxation to supportive governmental policies is often explained by world prices levels (when international prices fell in the mid 1980s the parastatal could no longer continue paying such modest margins to farmers), 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 partly explains why farmgate prices in Francophone Africa often share no correlation with international prices

In Figure 2, we look at the pricing issue in more detail by comparing various nominal cotton prices. From this we observe the following. First, as Baffes (2007) observes, there is very little correlation between farmgate prices in Burkina Faso and international prices, even in Euros (to which the CFA is linked). In fact the correlation between the two is negative over this timeframe (-0.22). Second, the period of reform is generally one of rising farmgate prices. These higher farmgate prices partly relate to the CFA devaluation of 1994, but thereafter result from the pricing decisions of the Burkinabè government, and later the interprofessional committee (IPC). Third, Figure 2 shows that there was a strong lag between international prices and farmgate prices in recent years. Specifically, the 2004/2005 season was characterized by a large drop in international prices, yet farmgate prices peaked, and were still high relative to international prices in the following season.

[Insert Figure 2 about here]

These unsustainably high prices were largely the result of the misapplication of a new pricing formula designed to better link farmgate prices to international prices. One hypothesis is that the formula was deliberately misapplied to offer cotton farmers higher prices before national elections, indicating that the sector is still not sufficiently independent from government manipulation. In any event, the excessively

high farmgate prices resulted in significant losses for the cotton companies and in the depletion of the sector's smoothing fund, both of which eventually necessitated a large government bailout of the sector—on the order of \$72 million—which we estimate to have accounted for around 4% of the government budget. The fiscal effects of the cotton crisis might have been even worse had not a variety of domestic and international banks also contributed to the bailout. So effectively, some of the financial problems of the late 1980s (when world prices also declined) were repeated 20 years later. Indeed, as in the 1980s, there were once again allegations of corruption related to the insufficient replenishment of funds during the high-price years.

These events have led some authors to significantly downplay the earlier success of Burkina Faso's cotton sector. In Figure 3, for example, we draw from Tschirley et al. (2009), who report what they term “net budgetary losses per capita” for a number of cotton producing countries in Africa. The figure shows that unlike the neutral government stance adopted in competitive cotton sector models (mostly outside Francophone West Africa) the cotton sector was a significant drain on public resources in Burkina Faso and Mali in 2006.

However, Figure 3 also shows that value added per capita—also drawn from Tschirley et al. (2009)—in Burkina Faso in 2006 was the largest in Africa, and easily dwarfed the losses of SOFITEX. This means that for every dollar of value added generated, the Burkinabè government had only to pay roughly 8 cents. This high value added per capita stems chiefly from the great expansion of cotton areas in Burkina Faso, from higher yields, and from the (unsustainably) high prices paid to farmers (hence high prices show up in value added as well as the public company losses). Overall, while the cotton sector substantially added to the government deficit in 2006, its contribution to the Burkinabè economy was still large and positive.

[Insert Figure 3 about here]

In summary, the *prima facie* evidence on the macroeconomic impacts of the reform suggest that policy and institutional changes spurred some large positive effects—land expansion, production growth, job creation and higher farmgate prices—but fell short of achieving financial sustainability of the sector in the

face of international volatility. Moreover, unsustainably high prices could well explain the continued growth in production in 2005 and 2006 when international prices fell. It is therefore critically important to assess the counterfactual of what production levels would have been under more sustainable prices.

3.3 Agricultural incomes and poverty¹⁷

While macroeconomic outcomes are important in themselves, in a country as poor as Burkina Faso one obviously hopes that successful reforms also reduce poverty. The fact that so many farmers voluntarily chose to engage in cotton farming rather than other activities is an indirect indicator of welfare benefits, but this “revealed preference” tells us nothing about the magnitudes of the reform’s impact. Unfortunately, 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 probably been distorted by the effects of the political crisis in Côte d'Ivoire,¹⁸ decreasing cotton world prices, increasing inputs prices (especially fertilizers), as well as by the positive effect of the unusually large (and perhaps unsustainable) price margins received by farmers. These caveats in mind, tentative evidence converges towards a positive effect of the reform on poverty, at least for cotton producing households themselves.

For instance, Grimm and Gunther (2004) find that consumption expenditures for cotton households has risen by 20 to 40% (depending on the deflator used) between 1995 and 2003, far above economic groups such as subsistence farmers, informal workers, and public and private sector employees. Although poverty increased from 1994 to 1998, headcount poverty over 1998-2003 fell from 62% to 48% (or 68.7% to 53.3% in rural areas). Furthermore, they find that headcount poverty among cotton farmers reduced by a quarter over 1995-2003, from 62.1% of cotton producers in 1994 to 46.8% in 2003. In contrast, incomes of other occupations increased minimally or even declined, depending on the deflator used. Data from Kaminski (2006) offer evidence consistent with Grimm and Gunther’s (2004) findings, showing a headcount poverty rate among cotton households of around 47% in 2006.¹⁹ This evidence is

complemented by indicators of subjective wealth that indicate large welfare gains for cotton households during the reform period (Kaminski, 2009).

The distribution of income among cotton producers was also found to be reasonably equal after the reforms (a Gini coefficient of 0.41), with a relatively small subset of large landholders occupying the highest quintiles of the distribution (Kaminski, 2006). This would seem to imply that the cotton boom has not had regressive effects on income distribution among cotton households. There is, however, limited evidence that the growth of the cotton sector has positively affected poverty for non-cotton growers. For instance, one does not find stronger poverty declines in cotton producing zones than elsewhere in the country.

3.4 Food production and food security

The rapid growth in cotton production could also impact food security and nutrition through its induced spillover into more rapid growth in food production. In fact, the expansion of modern inputs for cotton has also contributed to increased availability of inputs for cereal production (through cotton input credit), which were cautiously managed by the UNPCB from early 2000s to 2007.

Thanks to the new institutional framework for input credit schemes, fertilizer application to maize increased by 20 kg/ha among cotton producers (see DGPSA, 2008). 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 (2010) estimated the evolution of land use (cotton vs. food crops) by cotton households. We note, however, that a significant share (10% of total cultivated cotton areas in 2006, and 20% 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 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% or so,²⁰ 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.

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 cereal production is used to acquire cash at harvest times when food prices and marginal revenue are relatively low, before income is spent during lean seasons when food prices are higher. Hence, both net cotton production and net food production (i.e. minus the input costs) determine food security. Cotton incomes may also 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 threshold²¹ of household food security and then estimate the evolution of food security across households over the reform period. We find that a large share of cotton households appear to have improved their food security situation. In 1996, around 40 to 45% of the population who cultivated cotton in 2006 was food secure while 70% can be declared as such in 2006. Of these, around 49% have increased their consumption in cereals, while 3% of the remaining 31% who are food insecure have decreased cereal consumption. Overall, an improvement in food security is likely to characterize up to 46% of households in the case of cereals. Focusing on the households located close to the food security curve, we also found that 12% of the population move above the line during the reform while 2% fell below (based on cereal consumption).²² On average, it is likely that food security improved for 30% of the cotton population, and deteriorated for 4 to 5%.

Hence, the rural population dependent on cotton cultivation appears to have become much less vulnerable in terms of food needs. Regarding nutrition, the question of any improvement is more complex

since it involves the issue of dietary diversification and micronutrient consumption especially. There is some evidence that food regimes diversified slightly among cotton households but not for the broader population (Kaminski, 2006). Indeed, anthropometric trends for Burkina Faso are not particularly impressive, although there were modest gains in childhood anthropometric scores during this period (DHS 2009). In summary, the cotton success story has principally only influenced food consumption among cotton households themselves.

4. A methodology for conducting counterfactual simulations of the Burkinabè cotton sector

As we noted in previous sections, the cotton sector in Burkina Faso has been subjected to both exogenous shocks (return migration) and unsustainable farmgate prices, either or both of which may distort any *prima facie* assessment of the impacts of the cotton sector reforms. In this section we outline a methodology for plausibly simulating what would have happened to Burkinabè cotton production without the reforms, without the Ivorian crisis, and with more sustainable prices.

The first step of our counterfactual approach is to consider the most important and most tangible benefits of the reforms, as well as what the impact the Ivorian crisis would have had on the various determinants of farm production and of profitability. The characteristics of the reform and counterfactual scenarios are listed in Table 3. Figure 4 summarizes the methodology, which is effectively a partial equilibrium model based on estimates of land use and production function models. 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).

[Insert Figure 4 about here]

The land-use model is based on Kaminski and Thomas (2010) and estimates joint probabilities of having changed land-use patterns and total cultivated land areas over the reform period, accounting for market and institutional features of cotton households (incomplete rural markets, input and credit access for cotton growing) as well as income and food security preferences. The key model is described by:

$$\begin{cases} \Delta l_k = b_0 + \alpha_k \Delta X + \beta_k \Delta Y + \gamma_k \Delta L + \Delta \lambda^v + \mu_k, \\ \Delta L = b_1 + A \Delta X + B \Delta Y + \Delta \eta^v + u, \end{cases} \quad (1)$$

where X and Y are two vectors of all-crop and household characteristics, respectively. X is composed of crop prices and price-variability profiles, production risk (including institutional components such as outlet guarantees, pricing mechanism, contracting, input access, extension services, cash payments, and so on), and cost components. Y comprises households' crop technologies, human and farm capital, risk aversion, labor force, social status, cotton experience, ethnic background (used as an instrument in the second equation to identify (1)), and off-farm opportunities. l_k and L are respectively the cotton land share and total cultivated land of a cotton household, and λ^v and η^v village fixed effects. $\Delta(\cdot)$ is the in-difference operator between years t_0 and t , assuming transformed regressors are constant except for village effects. Note that the normally iid error terms (μ_k and u) may be correlated, motivating in this case the joint estimation of the system equations. Combining estimates of the probability distribution of regimes of changes in land-use patterns (marginal effects) with observed changes enables us to derive cotton-land elasticities along price, technological, and institutional dimensions.

Production and yields are derived from an agricultural production function in the spirit of Fan (1991), both based on a representative pseudo-panel dataset of rural Burkinabè farmers (DGPSA: 1996-2004). The DGPSA database represents several years of the permanent agricultural survey led by the Ministry of Agriculture in Burkina Faso and covers a large representative sample of rural farmers and land in Burkina Faso. For the sake of our counterfactual construction, we select a sub-sample panel containing households producing cotton in 2004. This is to be consistent with the sample used in the previous land-use model and to capture all the effects related to the reform including efficiency effects (input use and scale efficiency) due to the entry of less performing farmers and more marginal land.

Crop yields are estimated through a Cobb-Douglas production function for plot-level observations, according to available information on plot characteristics, input use, and production:

$$\ln Y_{it} = A + \alpha_{00}t + \alpha_{01}t^2 + \sum \alpha_{1k} \ln I_{ikt} + \sum \alpha_{2k} \ln I_{ikt} + \beta X_{it} + u_{it} \quad (2)$$

where Y_{it} is the production of plot i at time t , I_{ikt} is the quantity of input k applied on plot i at time t , X_{it} is a vector of plot i 's characteristics at time t , and u_{it} is a standard residual term following a centered normal law and containing a within-household random effect for plot i . Note that quantity of land is considered as one input of production in order to estimate land productivity. The production function is estimated for the main crops cultivated by cotton households of 2004, which are cotton, maize, groundnuts, white sorghum, and millet. Production-factor elasticities of output are time-varying, enabling us 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. We are then able to estimate these elasticities through household-level random effects Maximum likelihood estimation (RE ML)²³ and use the hypotheses on the counterfactual scenarios (input levels and efficiencies) to compute counterfactual crop yields (see appendix, Table A1).

Under no Ivorian crisis scenarios, population effects are taken into account in the land-use and productivity models. These scenarios entail a lower active labor force per rural household, less cultivated land and less cotton land, as well as changes in factor efficiencies. This last assumption follows from the fact that returning migrants are typically endowed with less experience in cotton growing, and also because they were typically utilizing more marginal land. This is taken into account by an increase of 3% in the land elasticity of production and by 2% in the constant of model (2). Regarding the sustainable reform scenario, lower cotton prices induce a decrease in cotton land according to model (1) and an exit of low-performing farmers from cotton growing. This translates into higher factor efficiencies for cotton but lower efficiencies and lower input use for food crops.

Two important caveats are worth mentioning. First, we are well aware that the differences between the counterfactual and reform scenarios are a matter of judgment. That said, we believe the previous two sections, and existing research (Kaminski and Thomas, 2010; Brambilla and Porto, 2005; Savadogo and Sakurai, 2007; Gray and Kevane, 2001), have provided a sound basis for the assumptions listed in Table 4. This is notably the case for the number of hypothetical entrants and leavers, which was estimated

according to Brambilla and Porto (2005). Each scenario considers only those households producing cotton in 2006 (not necessarily in 1996) including new entrants, but excluding those who exited since no reliable information on them. This results in a lower bound estimate on income effects of the reform scenario, since most of the households exiting cotton production must have derived lower incomes than the population under consideration in the counterfactual scenarios. For the sake of simplicity, we only consider leavers to have maintained a constant level of income after exiting cotton production. Another implication of the different samples of cotton households under each scenario is that absolute levels of variables in the initial year (1996) will not be comparable. Hence we focus on changes and rates of changes rather than levels.

[Insert Table 3 about here]

5. Counterfactual results

In this section we present our simulation results based on the model described above. We focus on six scenarios, bilateral comparisons of which can be used to net out the confounding effects of return migration from the Ivorian crisis or unsustainable prices. With respect to the former, around 500,000 migrants returned to Burkina Faso from Côte d'Ivoire from 2002 to 2006. Of these, 50,000 active workers are estimated to have joined already-settled households in cotton regions, while return migrants started 13,800 new households (which often comprised non-migrants too). Together these figures represent at least 20% of the entire influx of returnees. For this reason, it is worth understanding how return migration interacted with the cotton reform in the observed outcomes (these interactions are evident from the fact that the differences between scenarios (3) and (4) do not add up to the difference between scenarios (1) and (2)). Nevertheless, the signs and relative magnitude of the results of the two intermediate scenarios provide valuable insights on the contribution of the reforms and the crisis to the overall changes. Finally, two additional scenarios presented in section 5.2 consider what would have happened had the reforms

been implemented through a more financially sustainable pattern, with (5) and without (6) the Ivorian crisis.

[Insert Table 4 about here]

5.1 Impact of the reforms as implemented

Our first finding is that much more new land, about 254,000 additional hectares, was cultivated because of both the intervention and the Ivorian crisis (e.g. differences between scenario 1 and scenario 2). Looking at results from scenarios (3) and (4), it is clear that although the crisis by itself led to an increase in overall cultivation (of about 36,000 hectares), most of the changes were driven by the reforms: an increase of 154,000 hectares is directly linked to the reforms, and another 64,000 ha increase is due to the interaction of returning migrants and the reform process (30%). Overall, we estimate that the reforms contributed to an increase of an additional 218,000 of land that would have remained uncultivated in a scenario with the crisis only hectares (i.e. comparing (1) to (4)).

Applying similar calculations, we find that around 578,000 additional hectares of cotton were cultivated because of the combined effects of the Ivorian crisis and the intervention. However, cotton land would have slightly decreased without the reforms—although less than in scenario (2). This is because without reform the slower rate of mechanization and lower quality level of technical assistance would have counterbalanced 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% of all potential arable land according to the FAO and IIASA (2009)), making greater use of land (in a sustainable fashion) constitutes an efficient development strategy.²⁴ That said, most new land suitable for cotton and cereal production appears to be of lower quality, which certainly poses an environmental challenge for the future.

The reform-driven expansion of land in Burkina is in marked contrast to 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. However, in the other three countries (Mali, Bénin 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 (FAO 2009). Overall, we estimate that the reforms therefore contributed to an increase of cotton production of about 515,000 additional hectares (i.e. (1)-(4)). Of this amount, 65% resulted from the direct effect of the reforms while 35% were due to interacting effects with the crisis. Perhaps the main caveat to the success of the intervention's impact on land use is that in (1), the area allocated to food crops in the cotton-growing areas of Burkina Faso would have been around 292,000 hectares more than in (4). 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.

Table 4 also displays estimated crop production under different scenarios, while Figure 5 shows the estimated annual growth in crop yields in cotton areas. Here again, results indicate that the reform was a decisive factor in the significant increase in farm yields in cotton producing areas, irrespective of the crop considered. As noted above, stagnant yields of cotton probably reflect an increase in yields for the most experienced farmers counterbalanced by the entry of marginal land and less experienced farmers. Another interesting finding is that cereal yields increased much more rapidly because of the cotton reform, notably for maize and sorghum, the two crops that naturally benefit more from rotation with cotton ("background effects"). Spillover effects due to learning about input use or soil management techniques may also be relevant all crops.

[Insert Figure 5 about here]

Turning to the production results (Table 4), the reform scenarios are characterized by a slight decrease in food production which—in monetary terms—was more than compensated for by a substantial increase in cotton production. This increase is partly due to the interacting effects of the Ivorian crisis, which accounted for about one third of the growth rate in cotton production, with the direct reform effects accounting for the remaining two-thirds. This directly follows from the fact that land expansion was driving production increases. It is also interesting to note that had the Ivorian crisis not taken place,

Burkina Faso would only have slightly exceeded Mali's production levels in 2006, rather than being an outright leader in African cotton production, as we observed in Figure 1.

The extent of the net benefit of the reforms is measured through our counterfactual estimates of farm incomes. 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 (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 (excluding livestock) for the average household.

The results indicate that the impacts of the intervention alone accounts for a significant change in the agricultural incomes generated by cotton households. With no reform and no crisis the average income per worker in 2006 would have been around USD 23 higher than 1996 levels, while adding the crisis it would have been around USD 25 higher. However, just adding the reform pushes this figure up to USD 97 (direct effect of USD 74), while adding both the crisis and the reform (i.e. actual events) pushes it up to USD 81 (combined effects of USD 58). So in this case there is not a strong interaction effect and it is a negative one: without the Ivorian crisis, there would have been 22% additional income gains associated with actual events. This is because additional labor force from Côte d'Ivoire was less efficient and cultivated more marginal land, so that overall returns to labor were decreasing. A final point of note is that these changes are reasonably large in absolute size. The rural poverty line was set at USD 203 per adult equivalent in 2006, so 36% of all basic needs were derived from the net increase in agricultural incomes that directly resulted from the reform.

As for food security outcomes, in the previous section we estimated that 70% of the cotton households were food-secure in 2006, but that only 40 to 45% were food-secure before the reform. Using the counterfactual estimations on agricultural incomes, we compute the counterfactual rates of food-security among cotton households. The results indicate that the cotton reform played an extremely positive role in the reduction of food insecurity among cotton producing households, benefiting around 470,000 additional people if we also account for the effects of the Ivorian crisis. Overall, that means at least 7% of

the 7 million highly and moderately food-insecure population of Burkina Faso became food-secure because of the reforms alone. It is a minimal estimate for the impact of the reform; our upper bound of the estimated impact of the reform on food-security is around 10% of the food-insecure national population. The difference comes from the translation of moderate and high food insecurity thresholds in monetary terms when comparing official figures to our results.

In conclusion, counterfactual simulations do indicate clear positive effects of the reforms pursued on cotton production and yields. Results in terms of food production are more nuanced, despite significant gains in yields, due to lower land allocation to food crops. Overall, however, the reforms seem to have had clear positive effects on cotton farmers' well-being, irrespective of the effects of the Ivorian crisis. In fact, our results show that the main effect of the Ivorian crisis was not smuggling *per se* (see note 16), but the increase in the size of the cotton sector labor force, cotton areas and, commensurately, total cotton production. One might also speculate as to what other effects the Ivorian crisis would have had in the absence of reforms that encouraged the absorption of labor into the cotton sector ((1) vs. (4)). Since Burkina Faso is still a relatively small player in international cotton markets, demand for Burkinabè cotton was effectively perfectly elastic, meaning that under favorable domestic conditions the sector could absorb any amount of additional labor, barring major land constraints. It would be fair to say that no other formal sector (farm or nonfarm) would have been capable of absorbing such a sudden influx of labor because other export sectors are relatively small, and because increased production in nontradables (e.g. domestic food staples) would result in falling prices. We also note that in other instances of large scale return migration in the result has been rising unemployment and substantial civil unrest. For example, around one million Ghanaians were expelled from Nigeria in 1983, and the crisis-hit Ghanaian economy was unable to absorb them. In contrast, cotton-led growth in Burkina Faso absorbed these migrants without any rise in discernable unemployment or serious civil unrest. Hence we believe that our partial equilibrium counterfactuals might significantly underestimate the broader benefits of reform given the Ivorian crisis.

5.2 Simulated impact of more financially sustainable reforms

As we noted in section 3, part of the reform's objectives was to allow farmers to receive a more equitable share of the sector profit margins, chiefly via higher farmgate prices. While higher farmgate prices were certainly achieved, the prices received in the 2005/2006 and 2006/2007 seasons were excessively high given the sharp drop in international cotton prices from 2004 onwards (refer back to Figure 2). Based on international price movements (in CFAF) we estimate that producers' prices in 2005/2006 should have fallen by 30% lower than their actual levels to ensure financial sustainability, although here we assume that sustainable pricing (with an operational smoothing fund) would have ensured a contained fall around 20%. According to our estimates of the elasticity of planted cotton area with respect to prices, this 20% price drop would have induced a fall of 10.4% in cotton land (relative to 2006 actual levels), while yields would have fared a bit better because of the exit of some low-performing farmers in the sector. In the simulation model, only 25% of abandoned cotton land would have reverted to food cultivation, with very limited effect on aggregate food production (since yields on these areas would probably be lower given that input access is chiefly affordable through cotton outgrower schemes). From these figures we conclude that 9 to 10% of the cotton production boom in 2005/2006 and 2006/2007 must be considered as artificially driven by unsustainable prices. Accounting for the Ivorian crisis in the *sustainable reform + no crisis* scenario, we get an overall idea about the joint effect of unsustainable price and Ivorian crisis on cotton production. Altogether, more than 27% of the production peak level in 2006/2007 is due to these confounding factors, which explain the inflation in the production outcomes.

With regard to agricultural incomes, the evidence is even more disconcerting. Compared to actual 2006 levels, the combination of land acreage decisions and cotton price would have induced an overall drop of 33% in cotton incomes whilst providing only a 10% saving in credit costs. With slightly lower food yields and constant prices (even considering minimal changes due to supply and demand changes), food incomes would have remained around the same levels. Altogether, this entails a 25% decline in agricultural incomes levels relative to the actual income levels observed in 2006. Put in difference terms, this means that almost all of the income benefits driven by the reform were not sustainable in 2006.

Of course, looking only at 2006 yields a somewhat bleaker picture than looking at incomes over the entire reform period (1996-2006) since farmgate prices in most of these years were sustainable. Moreover, a smoothing mechanism that was well managed over the whole period might well have produced prices that still allowed significant gains in farmer incomes. To see whether this is the case we computed the average net yearly cotton income (cotton sales minus input credit cost) for the average active rural worker over 1996 to 2006 under actual and *sustainable reform* scenarios (food incomes remain roughly at constant levels for all these scenarios). Despite a significant decline in cotton incomes in 2005/2006 and 2006/2007, sustainable pricing would have only induced a slight decrease in these long-run average incomes. So while the cotton boom was partly artificial and sustainable pricing would have induced a sharp decline in cotton households' incomes, the long-run income benefits provided solely by the intervention do look sustainable. On this basis we conclude that the production boom was *mostly* financially sustainable as it was (up until 2004, at least) due to the upgraded institutional set-up, but that the income benefits provided to farmers were not sustainable given prevailing world conditions between 2005 and 2007. Given that the proper implementation of pricing formula should not have been difficult in purely technical terms, one can only assume that political interference was still a significant constraint on the cotton sector.

6. Conclusions: Burkina Faso's ambiguous and unfinished story

In the introduction to this paper we noted the difficulties of identifying true success stories, particularly the challenges of linking policies to economic outcomes, of making comparisons to counterfactuals, and of establishing sustainability along financial and political lines (as well as the question of environmental sustainability, not considered here). Our relatively sophisticated counterfactual analysis shows that Burkina Faso's story yields a fairly ambivalent appraisal. On the one hand we see existing evidence and our own counterfactual evidence as convincingly establishing that farmers themselves benefited from the creation of new institutions, that Burkina Faso's reforms were the main driver of the impressive

production growth over 1996-2006, and that economic outcomes would almost certainly have been worse without the reforms (and perhaps political outcomes, too, given the Ivorian crisis). But in addition to establishing the important influence of exogenous shocks—particularly the production growth facilitated by the large influx of return migrants from Côte d'Ivoire—we also find that the reforms were not financially sustainable, especially over 2004-2006 when the prices paid to farmers were excessively high relative to international prices.

Moving forward, then, there are clearly still a number of challenges facing the Burkinabè cotton sector. First, the further strengthening of the GPCs and other farmer organizations is still vitally important. While considerable social capital has been built up over the last ten years, there is a long way to go to fully professionalize and capitalize farmers groups to fulfill their true potential. In principle, these groups could be leading the way not only on representing farmers at higher levels, but also on providing extension services, storage facilities, tractor services, and so on. But Burkina Faso's agricultural sector as a whole also faces some daunting challenges, notably climate change and soil degradation. GPCs and the institutions above them could therefore be a vital means of both exploiting opportunities and overcoming emerging environmental constraints.

Another major step forward will be the proper implementation of the pricing formula and, if necessary, further adjustments to that formula in the future. As Baffes (2007) has noted, virtually all state-led cotton sectors report pricing formulae that supposedly tie farmgate prices to international prices, yet there is rarely any correlation between the two in practice. But the pricing problem is obviously only the tip of the iceberg; the underlying constraint in the cotton sector is still the manipulation of the sector by powerful political interests. These institutional weaknesses make the cotton sector less attractive for both farmers and private sector firms (domestic and foreign). Worse still, they seriously impede the ability of the sector to respond to exogenous shocks, such as the volatility in international prices. Depoliticizing the implementation of the pricing formula and smoothing fund is an essential task that the government has already undertaken in the wake of the sector's financial difficulties (Section 2), but of course these new arrangements have yet to stand the test of time, particularly future economic shocks to the sector.

Moreover, the underlying problem of political interference in the cotton sector could obviously manifest itself in other ways.

This experience demonstrates that even well designed microeconomic reforms can still be constrained by broader governance problems. Since the Burkina Faso's political system is highly oligarchic (a strong collusion of autocratic politicians with urban elites), farmers have few means of influencing policy outcomes if the UNPCB fails to voice their concerns (or indeed, if the UNPCB is itself a problem). Such a situation is certainly a cause for concern because greater farmer representation in the sector, including representation at the highest level of decision-making, was a key objective of the reforms. Clearly the lesson here is that would-be reformers still need to push for greater transparency, accountability and political independence within the sector, particularly the UNPCB, SOFITEX and interprofessional committee. We acknowledge, of course, that achieving these outcomes is easier said than done.

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Table 1: The chronology of cotton reforms in Burkina Faso

Institution building –up	<p>1992-1993: a formal commitment was made by SOFITEX to let producers’ representatives participate in the reform debate. The “Contrat-Plan Etat SOFITEX” in which the State committed not to interfere with the management of SOFITEX established a plan to streamline the accumulated debts of producers and of the parastatal.</p> <p>1994: amendment on the laws pertaining to the establishment of farmer groups.</p> <p>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 (sub-village-level) GPCs, with the implementation of new local governance rules.</p> <p>1996-2001: progressive establishment of the national cotton union (UNPCB), with the support of the AFD, the government, and SOFITEX (the national cotton parastatal company), based on the membership of local groups and their integration into regional unions.</p> <p>1998: Establishment of the Accord Inter-professionnel (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.</p>
Progressive reallocation of responsibilities towards new institutions	<p>1999: Partial withdrawal of the state, through partial privatization of SOFITEX. Half of the government’s share in SOFITEX is transferred to UNPCB.</p> <p>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).</p> <p>2002-2006: progressive introduction of new players: private input providers, new regional private cotton monopsonies (SOCOMA, and FASOCOTON) in 2004, and private transport companies.</p> <p>2004-2006: establishment of an inter-professional association (AICB) with cooperation among well-represented stakeholders: cotton farmers, banks, private stakeholders, government, and research institutes. Establishment of an association of cotton firms (APROCOB) interacting with UNPCB.</p> <p>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.</p>

Source: Constructed by the authors.

Notes: a. Each stakeholder has representatives in the two committees of the Inter Professional Committee: 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. b. This smoothing 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. AFD originally put money into the fund in 2008 and the mechanism involves the smoothing of the set price of cotton purchased 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 BOAD (*Banque Ouest Africaine de Développement*) is in charge of the management of the smoothing fund to ensure a balanced budget in the long run.

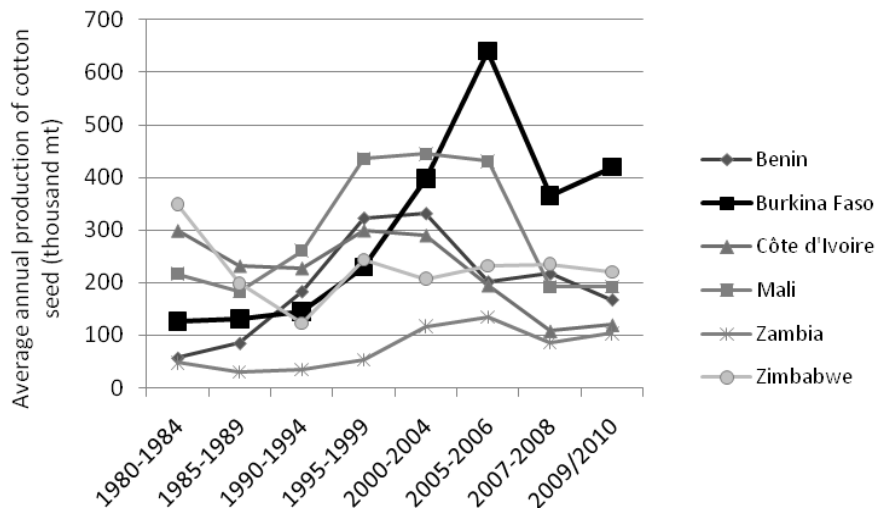
Table 2: Estimates of the number of beneficiaries of the reforms

Indicators	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

Sources: Based on a survey of representative households in cotton areas of Burkina Faso (Kaminski, 2006) and official data (DGPSA, 2008).

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 has 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.

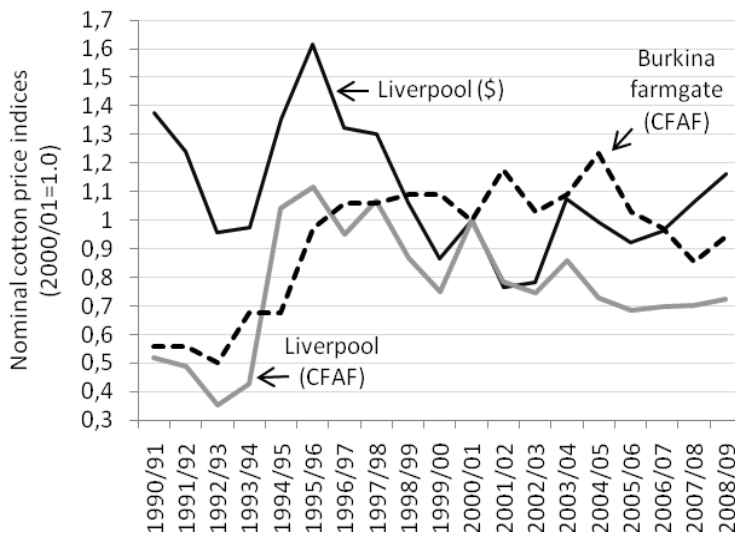
Figure 1: Seed cotton production in six sub-Saharan African countries: 1980-84 to 2005-2007



Source: USDA (2010).

Notes: Note that the seasons generally refer from August in year t to July in year t+1. Data for the year 2009/2010 are provisional estimates only.

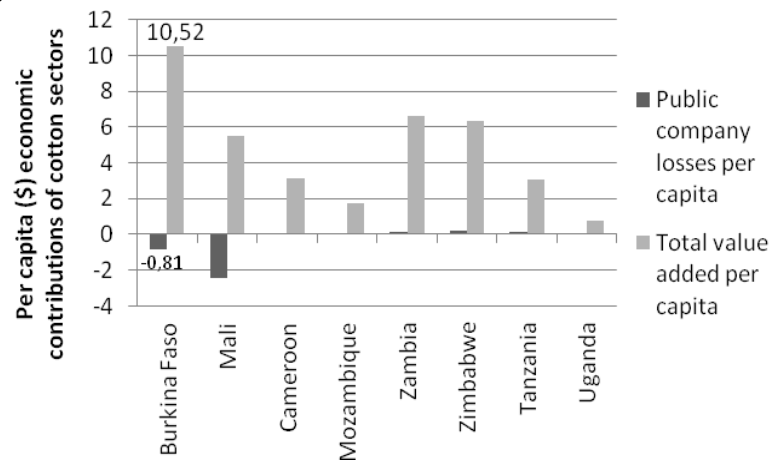
Figure 2: Trends in nominal prices, international and farmgate



Source: Authors' construction from IMF (2010) monthly data on international prices and exchange rates, and Burkina Faso national sources.

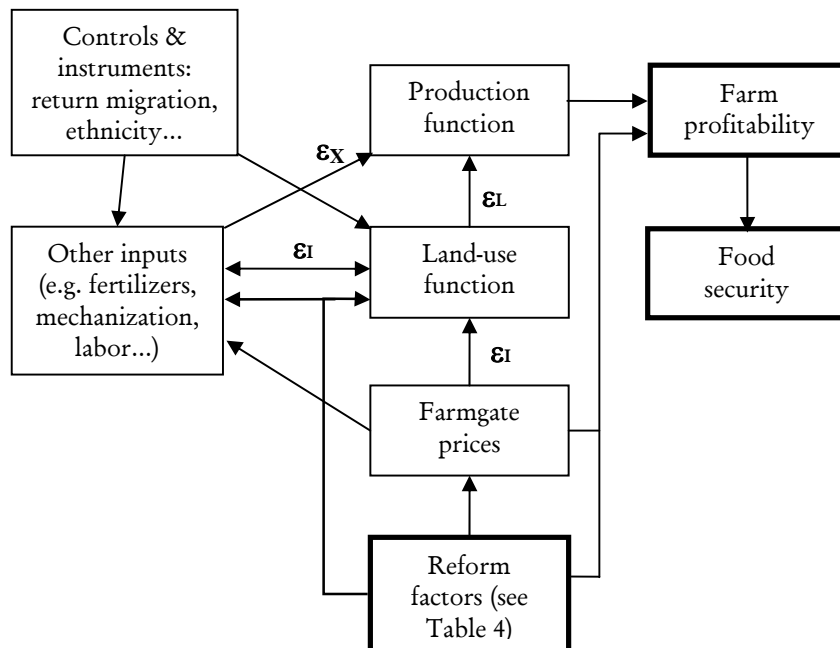
Notes: "Liverpool" is the Liverpool cotton price index, denominated either in dollars or CFA Francs. "Burkina farmgate" relates to the prices paid to farmers in Burkina Faso. All series have been calculated from averages of monthly data covering the period February to January, which is the production year for Burkina Faso's cotton sector.

Figure 3: Economic contributions of cotton sectors in nine Africa countries: 2006



Source: Authors' adaptation from Tschirley et al. (2009).

Figure 4: A methodology for estimating counterfactual scenarios



Notes: ϵ_X is the elasticity of output with respect to other inputs, ϵ_L is the elasticity of output with respect to land, and ϵ_I is the cotton land elasticity with respect to agricultural farmgate prices, institutional and technological variables. In the simulations, these elasticities transmit the effect of the various assumptions that we make in Table 3 about the benefits of reform, namely prices, institutional and technological options.

Table 3: Main hypotheses for the counterfactual and the reform scenarios, with and without the Ivorian crisis

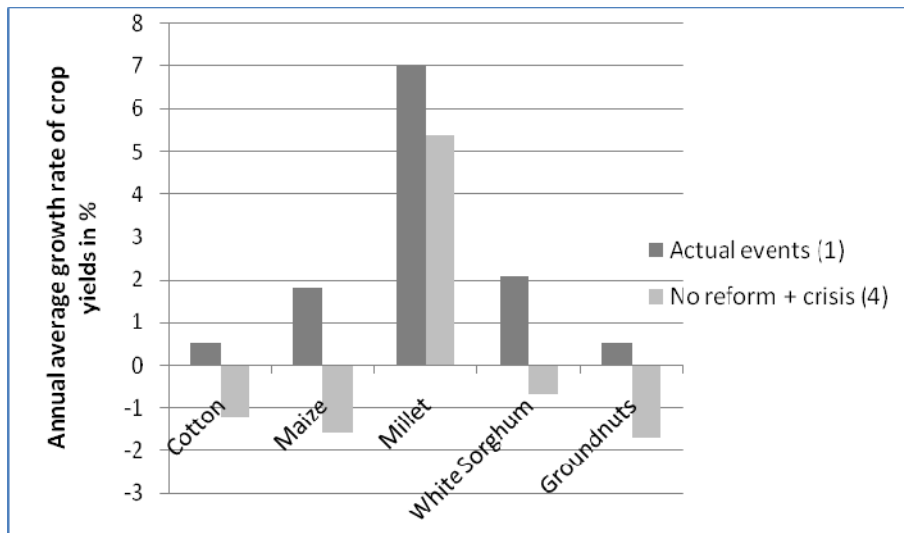
Channels of impact	Counterfactual no-reform scenario (C)	Actual: Reform scenario (R)	Comments
Purchase price of cotton	Decrease in 5% in real value	Increase in 5% in real value	The difference is due to the lack of farmers' influence in C
Food local prices	Increase in 20% real value	Increase in 10% real value	The difference is due to less production & more demand in C
Input access & use	Input credit decreasing by farm of experienced cotton growers; marginal input access for cereals & new cotton growers	Opportunity to borrow inputs for new land under cotton, & 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 & weighing	Earlier payment of cotton seed, earlier delivery of inputs, better quality-grading process & transparent weighing	The conditions in C were those prevailing before the reform
Technical assistance	Encourages farmers to increase their cotton areas, but no effect on labor & land productivity	Encourages moderate land allocation to cotton & improves farming systems	These statements are drawn on Kaminski & Thomas (2008) estimations & interviews by Kaminski (2006)
Mechanization	Only experienced farmers who pursued cotton farming adopting animal farming at a 50% lower rate	Mechanization is correlated to experience in cotton growing, livestock assets, & technical assistance.	The slower rate of mechanization is due to less capital accumulation & lower farmer incomes
Number of cotton households	With Ivorian crisis: 110,000 in 2006. Without Ivorian crisis: 99,000 in 2006 (10,000 exit & 10,000 new cotton households)	With Ivorian crisis: 98,500 in 1996; 176,600 in 2006 Without Ivorian crisis: 164,800 in 2006	According to the estimates of Brambilla & Porto (2005) for entry & exit in cotton production, Savadogo & 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	With Ivorian crisis: 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 & to the influx of returnees
Ethnicity effects	Significant for input access but less for land access (less demographic pressure)	Affects access to land, more difficult for non-resident ethnic groups & migrants	Non-resident ethnic groups have a limited access to land in R & to input in C

Table 4: Comparing actual events to various counterfactual scenarios

	(1) Actual events Reform + crisis			(2) Counterfactual No reform + no crisis	(3) Counterfactual Reform + no crisis	(4) Counterfactual No reform + crisis	(5) Counterfactual Sustainable reform + crisis	(6) Counterfactual Sustainable reform + no crisis
Outcomes	1996	2006	Change	Change	Change	Change	Change	Change
Cultivated land of HHs (ha)	5.51	6.92	+1.4	-0.03	+0.94	+0.33	+1.11	+0.75
Total cultivated land (1000s ha)	973.1	1222.1	+249	-5.1	+154.7	+36.3	+195.2	+123.6
Cotton land share of HHs %	20%	56%	+36%	-15%	+28%	-5%	+32%	+25%
Cotton areas (1000s ha)	194.6	684.4	+489.8	-88.2	+336.2	-25.1	+418.6	+289.6
Food areas (1000s ha)	778.5	537.7	-240.8	+83.1	-181.5	+51.4	-223.4	-166.0
Cotton production (1000s tons)	208.1	766.0	+557.9	-111.5	+390.7	-45.6	+484.8	+347.3
Maize production (1000s tons)	459.7	380.7	-79.0	-6.3	-54.9	-17.7	-85.5	-54.4
Millet production (1000s tons)	159.4	218.4	+59.0	+91.6	+71.0	+96.7	+61.8	+74.3
Groundnut production (tons)	89.7	65.0	-24.7	+2.0	-18.5	-3.1	-23.9	-17.4
Sorghum production (tons)	286.4	243.9	-42.5	+20.8	-24.3	+9.7	-46.6	-23.4
One-year cotton income (2006 \$US)	418.3	1627.6	+1209.3	-418.9	+916.8	-171.8	+815.3	+573.5
One-year food income (2006 \$US)	975.8	983.6	+7.8	+485.0	+197.4	+420.7	-29.3	+8.2
Credit cost of one year (2006 \$US)	156.4	668.2	+511.8	-140.4	+389.5	-32.4	+442.3	+340.6
Agricultural one-year income (2006 \$US)	1237.7	1943.0	+705.3	+206.5	+724.7	+281.3	+343.7	+241.1
“ “ -per active worker (2006 \$US)	213.4	294.4	+81.0	+23.1	+96.8	+24.5	+26.2	+20.6
Average active worker yearly net cotton income over 1996-06			80.2	50.8	72.8	58.7	74.2	76.0
% food-secure HHs (% 2006 cotton HHs)	45%	70%	+25%	+3%	+25%	+5%	+6%	+3%
Number of food-secure people (1000s)	675.5	1291.8	+616.3	+79.7	+520.7	+146.6	+265.7	+119.5

Note: These estimates are computed for the average cotton household cultivating cotton in 2006, including those who were outside cotton production in 1996 to derive total net effects. 1996 levels are different across scenarios since they include cotton households who entered cotton production during the reform and exclude those who exited. Income results apply to households. Intra-food crop allocation on food areas is assumed to be constant over time and across scenarios.

**Figure 5: Reform vs. no-reform counterfactual estimates of crop yields in cotton areas
(average annual growth rate over 1996-2006)**



Source: Authors' estimates based on counterfactual simulations.

Appendix Table A1: Production function estimates

LN (production)	Millet	Maize	Cotton	Groundnuts	White sorghum
LN (Land)	1.089 (.031)***	1.125 (.032)***	1.067 (.032)***	1.026 (.027)***	1.140 (.022)***
t*LN(Land)	-.003 (.005)	-.012 (.006)**	-.007 (.005)	.005 (.005)	-.006 (.004)
LN(NPK)	-.010 (.010)	-.000 (.025)	.046 (.021)**	.146 (.099)	.045 (.033)
t*LN(NPK)	.010 (.010)	.014 (.004)***	.009 (.004)**	-.024 (.016)	-.004 (.007)
LN(UREA)	.002 (.066)	.128 (.026)***	.069 (.015)***	.078 (.165)	.019 (.061)
t*LN(UREA)	-.003 (.013)	-.017 (.004)***	-.008 (.003)***	.007 (.027)	.007 (.011)
LN(Phosphates)	-.289 (.204)	-.074 (.104)	.090 (.059)	-.194 (.303)	.162 (.088)*
t*LN(Phosphates)	.044 (.034)	.021 (.016)	-.009 (.010)	.025 (.054)	-.010 (.027)
LN(Powd)	.073 (.028)***	-.054 (.032)*	.022 (.030)	-.055 (.049)	.024 (.020)
t*LN(Powd)	-.017 (.005)***	.006 (.005)	-.004 (.004)	.014 (.008)*	-.005 (.004)
LN(Pesticides)	.015 (.150)	.131 (.074)*	.055 (.031)*	-.287 (.467)	-.202 (.187)
t*LN(Pesticides)	.016 (.035)	-.015 (.012)	.004 (.006)	.016 (.067)	.023 (.031)
Manure	.168 (.112)	.140 (.070)**	-.014 (.065)	.452 (.154)***	-.019 (.075)
t*Manure	-.014 (.021)	.012 (.012)	.009 (.012)	-.053 (.030)*	.033 (.016)**
t	.147 (.058)***	.105 (.052)**	.042 (.049)	.023 (.042)	.056 (.046)
t ²	-.010 (.004)***	-.003 (.004)	.001 (.003)	-.007 (.003)	-.000 (.003)
Pure	.027 (.035)	-.061 (.034)*	-.013 (.026)	-.080 (.027)***	-.023 (.029)
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. *** means significance at 1%, ** at 5%, and * at 10%.

Source: Authors' estimates.

End Notes

¹ See, for example, research on the East Asian miracle (World Bank 1993), and more pertinently to this context, case studies of agricultural success stories (Gabre-Madhin and Haggblade 2004, Spielman and Pandya-Lorch 2009).

² Note that the Benin State company, SONAPRA, is an exception in that they broke away from French ownership in the 1970s.

³ However, in this version of the paper we do not consider environmental sustainability for lack of space. In our working paper version we found contradictory evidence on the matter, although we tended to conclude that the reform were mostly sustainable on this front. Burkina Faso still appears to have large quantities of arable land suitable for cotton production, such that extensive nature of the sector's growth path made use of the country's comparative advantage. The reforms also encouraged more fertilizer use, which helps maintain the fertility of the land. Of greater concern is the still relatively low use of other land care practices, particularly given that climate change already seems to be affecting Burkina Faso.

⁴ 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 (e.g. the Sénoufo and the Bwa) and processing (e.g. 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.

⁵ Similar patterns can be found in Mali (Roberts, 1997), Côte d'Ivoire (Bassett, 2001) and elsewhere in the region (Isaacman and Roberts, 1995).

⁶ To do so, SOFITEX and producers' representatives (those from the FENOP notably) were invited on mission trips in Bénin, Côte d'Ivoire and Mali. 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 Compaoré himself to the main cotton-growing areas (ICAC, 1998).

⁷ Statistics are based on a 2002 survey of 84 GPC and 149 other formal groups within the cotton zone. See Bernard et al. (2008).

⁸ 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).

⁹ 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.

¹⁰ 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.

¹¹ As of today however, Mali is trying to follow the Burkinabè model by allocating a significant share of the capital of privatized cotton companies to the farmers union, and to transfer more responsibilities for input supply and/or extension services onto farmers groups or the farmers unions.

¹² The disastrous effect of the political crisis in Cote d'Ivoire however makes the country less relevant for comparison purposes.

¹³ 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% 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.

¹⁴ Rainfall can negatively damage cotton quality once harvested, and therefore the price paid by collectors.

¹⁵ This figure is measured in terms of full-time employment in the agricultural sector where active men have a coefficient of one, women, and children from 6 to 18 years have a coefficient of 0.5 as for old people within households.

¹⁶ One significant concern in interpreting Burkina Faso's cotton growth 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 have been sold to Burkinabè and Malian cotton firms from 2002 to 2006. According to the *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 were 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 is unchanged.

¹⁷ In recent times cotton has developed a poor reputation with respect to poverty reduction because of the so-called Sikasso Paradox, which states that even though cotton producers reside in fertile areas (e.g. Sikasso, Mali) and produce a lucrative export crop that receives a large share of public agricultural support in West Africa, Sikasso is the country's poorest rural region and that cotton producers are on average poorer than all other farmers in the country. In fact, this paradox, seemingly incompatible with field observations (e.g. AFD 2008) 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. In Burkina Faso also, several poverty studies at the national level have also found measurement problems, which partly explain why several poverty indicators showed rising poverty, especially in the 1990s (Lachaud, 2005 for instance; and Grimm and Gunther, 2004).

¹⁸ 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% in 1998 to 12.7% in 2003 (rural: 24.6% to 14.6%; urban: 7.0% to 5.3%). 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% in real terms between 1998 and 2003 from approximately 4% to 1.3% 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.

¹⁹ Conventional poverty statistics arguably underestimate poverty reduction because cotton producers in 2006 include new entrants with higher poverty rates than more experienced cotton farmers.

²⁰ 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% larger than in 2007. This is because cotton still comprises a relatively small share of total land use.

²¹ 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. 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, following Kaminski (2006).

²² If we base the estimates on consumption of animal proteins, we obtain an upward move of 10% of the population, and a downward move of 3%.

²³ The random-effect specification is consistent and was tested against the fixed-effect one.

²⁴ The notion of land abundance in Burkina Faso's cotton areas is disputed. Gray and Kevane (2001) claim that cotton regions are subject to demographic pressure on land due to the extensive form of agricultural growth and to migration. This could, in turn, lead to conflict among ethnic groups.

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