# Estimating the Impacts of Liberalization in West Africa:

# The Malian Case

**By**

**Jeffrey D. Vitale,John H. Sanders**[*]

---

[*] Authors are Research Associate and Professor at Purdue University Dept. of Agricultural Economics, respectively. Correspondence with authors: jvitale@purdue.edu and jsander1@purdue.edu.

**ABSTRACT**

Cotton has been a success story in West Africa since independence swept the region in the early 1960's. Today, however, "white gold" is struggling to maintain its allure. Recent declines in world cotton markets have created a crisis in the region's cotton sectors. Cotton is still being produced within an institutional structure that dates back to the independence era of the early 1960's. The new era of volatile cotton markets, new technological frontiers, and global challenges are placing demands on institutional change. This paper uses an economic model of the agricultural sector to predict the impacts of cotton liberalization. Shifting control from the state into the hands of the private sector would provide significant benefits to society. Farmers in particular, hard hit by the cotton crisis, would receive long-needed relief from prior policies that kept cotton incomes artificially below world price levels.

**INTRODUCTION**

In West Africa, cotton has been one of the more successful stories in agricultural development. New technology has advanced steadily since the early 1960's, quadrupling cotton yields. King cotton still reigns as the most important source of agricultural earnings in many countries. Cotton exports constitute major shares of export earnings in Mali (25%), Benin (38%), Burkina Faso (51%), and Chad (36%). Selling cotton on the world markets is the primary source of hard currency in these countries. As elsewhere the cotton surplus is a vital catalyst to economic development. In West Africa cotton has fueled development in both urban and rural areas.

Despite advances the West African cotton sector has become vulnerable to world price shocks. The recent deterioration of world cotton markets has created a crisis in many West African cotton sectors. Three of the largest producers in the region, Mali, Benin, and Cote D'Ivoire, became temporarily insolvent during the cotton price collapse of 2000. Tangible concerns are growing that the region's cotton sector could be lost.

Cotton farmers have been particularly hard hit; the plight of smallholder West African cotton farmers has received international attention. Cotton incomes have fallen dramatically over the past decade. Low cotton prices and rising production costs threaten to drive farmers out of cotton. With few if any alternatives to growing cotton, farmers in this region are particularly vulnerable. Farmers who remain in cotton are moving closer to poverty.

Tension that has always run high between farmers and state owned cotton parastatals boiled over during the recent price collapse. Unable to pay farmers agreed upon prices, cotton parastatals in many countries reneged on cotton prices. In protest Mali cotton farmers organized a boycott. In the following year cotton production plummeted by about one-third (CMDT 2001). Cotton producers are responding through organization and getting their message out. In many cotton producing countries farmers have become a

vocal and increasingly well-organized segment of society. Their demands for higher cotton prices have gained sympathetic ears in Western media.

It has been argued that the West African cotton crisis is a "North vs. South" problem (Watkins and Sul 2002). Cotton subsidies in developed nations have allowed their farmers to produce at artificially low costs. The glut of cotton reaching world markets has pushed cotton prices low enough to question whether the West African cotton sector can compete internationally. Price cutting is seen as one way to erode West Africa's comparative advantage in cotton production. Household labor and animal traction are more than adequate substitutes for mechanization; West African farmers produce at lower costs than industrialized countries. Developed countries have no advantage in cotton quality or characteristics: West African cotton farmers produce some of the highest quality fibers traded in world markets.

Alternatively it can be argued that farmers' problems stem as much from within the borders of their own country (CARITAS 2004). Cotton sectors in West Africa have been under state control since independence took hold of the region in the early 1960's. Parastatals are well known for being inefficient and rent seeking. Monopoly power exerted by parastatals has disempowered cotton farmers. Cotton farmers in West Africa receive the lowest cotton prices in the world, typically about one-third of the world cotton price. Unlike cotton farmers in the developed world, institutional forces create disincentives for West African cotton farmers.

The recent financial recent crisis in the cotton sector has given renewed impetus for enacting liberalization and reform. Initial cotton reform measures were part of a general movement to purge government control in a variety of sectors, including cotton. Typically they were one part of bilateral structural adjustment programs. Governments were reluctant and often hostile to these initial reforms; they were viewed as obtrusive and unnecessary. Following the recent crises and other changes within the world cotton markets governments' attitudes have changed. Fears over losing their cotton sector have grown tangible. Restructuring the cotton sector to better meet challenges is now viewed as necessary.

A leading objective of cotton sector reform is "getting cotton prices right". Practically speaking this means giving farmers a greater share of the world cotton price[1]. Higher cotton prices aspire towards both normative and positive goals: giving farmers a larger slice of the economic pie as well as making the pie bigger for everyone. The normative aspects of liberalization are unambiguous: higher cotton prices will shift more of the cotton income towards farmers[2]. There has been much public outcry to give farmers an

---

[1] Reform measures target reducing parastatal control of the cotton sector and replacing it with the private sector. In theory, with price competition and increased efficiency, private ginning firms are expected to pay farmers higher prices for their cotton fiber. On the ground, however, private sector performance has been somewhat disappointing. Getting higher cotton prices to farmers has been more elusive than hoped. Privately operated input channels have been slow to develop, driving up input costs, and leaving many farmers without necessary inputs.

[2] There is considerable wealth locked-up inside the Ricardian rents earned by cotton parastatals. Giving farmers a greater share of the world cotton price redistributes wealth in a more equitable manner.

increased share, even though it goes against the grain of the traditional political economy within the region[3].

Support will be reduced if liberalization turns out be a zero sum game. Sentimental concerns over farmers' welfare will generate only limited political capital. Shifting income from state control to farmers will not be politically attractive. Political barriers will be lessened if farmers can adequately respond to higher cotton prices and produce more cotton: a larger economic pie eases the tension of finding new ways to share it.

With greater price incentives cotton farmers are expected to shift to more intensive practices. Opportunities to expand farm size are limited since land is becoming increasingly scarce throughout the region; increasing cotton acreage is further limited by crop rotations. By West African standards cotton is already intensively produced; further intensification could produce only marginal yield gains.

It's left as an empirical issue to determine just how large of a supply response farmers are able to levy. An economic model was developed. One purpose of the model is to predict the cotton supply response to higher cotton prices. A second is to determine the economic impacts of alternative cotton liberalization policies. The impacts provide normative implications of the policies on farmers, ginners, consumers, and the state. The modeling activities are presented for Mali. Mali is considered an appropriate choice since it well represents the current issues facing cotton producing SSA nations and is in the beginning stages of its cotton reform.

This paper begins with a background section on cotton in West Africa. Following this is a section that describes recent experiences with cotton liberalization in SSA. The economic used to analyze the impacts of liberalization is next presented. Model results are put forth and discussed. The paper closes with conclusions and suggested policy measures.


**BACKGROUND**

By West African standards cotton production is advanced. New technology has steadily been introduced since the removal of colonial control in the early 1960's. Cotton lint yields have progressed in similar manner to US (Meredith and Bridge 1984). Yields quadrupled from 250 kg/ha following independence to 1,200 kg/ha by the early 1990's. As in the US, there is growing evidence that cotton yields have begun to decline. Natural resource management has grown in importance. Farmers are now using and developing a variety of techniques to better husband their resources.

Mali is the leading cotton producer in West Africa (Figure 1). Over the past 10 years Mali has farmed an average of 378,000 ha of cotton. Benin has the second largest cotton production base; it farmed an average of 328,000 ha of cotton. Cote D'Ivoire and Burkina

---

[3] Implicit taxes levied on export crops such as cotton have been justified as necessary for the social good. Typically agriculture has been taxed to develop urban industries.

Faso are the other major producers in the region; they averaged 255,000 and 252,000 ha of cotton over the same 10 year period. Some of the other players in the region, such as Togo and Nigeria, have significant cultivated areas but yields are marginal. Those countries lag behind the C-4 countries in production, if not area.

West Africa is becoming a bigger player in the world cotton markets. Lead by the big four countries of Burkina, Mali, Benin, and Cote D'Ivoire, its share of world cotton exports rise from 2.4 to 9.4 percent over the past 20 years (Goreux 2003). It is still unlikely to possess any significant market power, even if cooperating as a region. World cotton market remains dominated by the US, who owns 40 percent of world cotton exports. Competition from other regions of the world is also growing, further reducing market concentration.

World cotton markets have been on the decline over the past few decades: this will be an on-going challenge to newly reformed cotton sectors. In constant terms[4], world cotton prices have fallen by 75 percent between 1970 and 2002 (Figure 2). This is a trend that has held steady for several decades and can be traced to both supply and demand effects. Synthetic fibers have cut into cotton's share of the textile industry. Market shares for synthetic fibers have nearly tripled, increasing from 22 to 59 percent, since the early 1960's (Goreux 2003). Cotton retains only a 40 percent share of the world textile fiber markets, which will be increasingly difficult to maintain (Gillson et al. 2004). Weak growth in world cotton fiber demand is forecasted over the future; it is expected to only maintain levels with population growth, corresponding to 1.8 percent annual growth. In essence cotton behaves like a basic food commodity: its income elasticity of demand is low.

All of the major supply trends point towards more cotton entering the marketplace. Farm subsidies paid to cotton farmers in the developed world (US, EU, and China) have had significant impacts on world supply. Subsidies have been linked to the recent glut of cotton reaching the world market. More than 20 percent of world cotton producer earnings can be traced back to farm subsidies of one kind or another. In 2001, US cotton subsidies totaled 2.3 billion and averaged about 61 cents per kilo of cotton between 1999 and 2002 (Gillson et al. 2004).

The number of countries producing and exporting cotton has increased dramatically. Over the past 40 years cotton production has doubled from 9.5 to 19.1 million tons: most of this increase has been from new producers. Supply has continued to outpace demand. On average cotton supply has increased by about 2 percent per year, slightly higher than the 1.7 percent growth in demand. Downward pressure has been maintained on world cotton prices (Figure 1).

The impact of biotechnology on world cotton markets is growing in importance. Bt cotton boosts yields and cuts costs. Worldwide adoption of Bt cotton has been impressive. In less than a decade over 40 percent of cotton acreage is sown under biotechnology crops. Declining production costs from Bt cotton threatens to weaken

---

[4] The fall in cotton price is given in terms of constant prices referenced using 1995 as the base year.
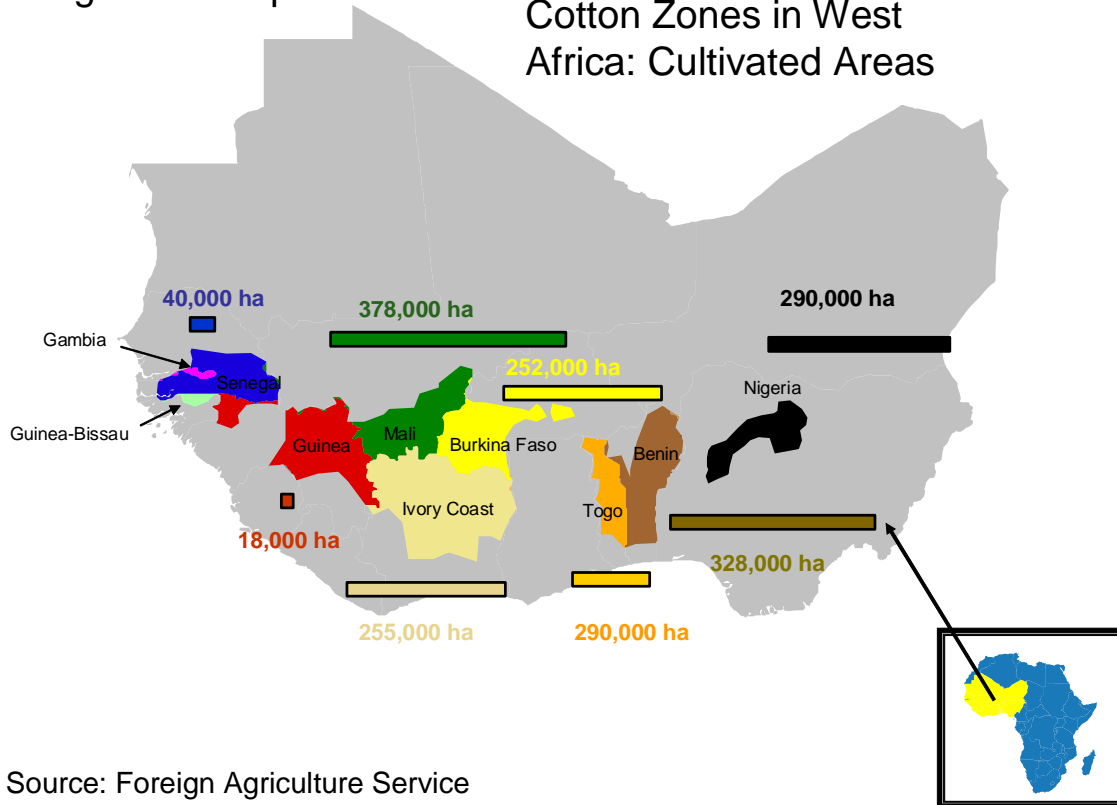
SSA's comparative advantage in cotton production. The opportunity cost of not adopting Bt cotton has been estimated[5] to be as large as $60 million per year (Cabanilla et al. 2003).

Even while declining world cotton markets have maintained their volatile nature. Erratic trade patterns create strong fluctuations in world cotton prices. For the most part this is explained by the whims of Asian import and exports. Markets are driven in large measure by China, Pakistan, and India's participation. In years of favorable weather those countries are able to satisfy domestic demand and export surplus cotton to world markets. When climatic conditions turn bad production is inadequate and those countries import cotton to supplement domestic demand.

---

[5] This was an ex-ante study of Bt cotton adoption in Mali. The opportunity cost would be even larger if lost market shares were factored in.

# Regional Perspectives

## Cotton Zones in West Africa: Cultivated Areas

**40,000 ha**

**378,000 ha**

**290,000 ha**

Gambia

Senegal

Guinea-Bissau

**252,000 ha**

Nigeria

Guinea

Mali

Burkina Faso

Benin

Ivory Coast

Togo

**18,000 ha**

**328,000 ha**

**255,000 ha**

**290,000 ha**

Source: Foreign Agriculture Service

Figure 1 Cotton Production in West Africa
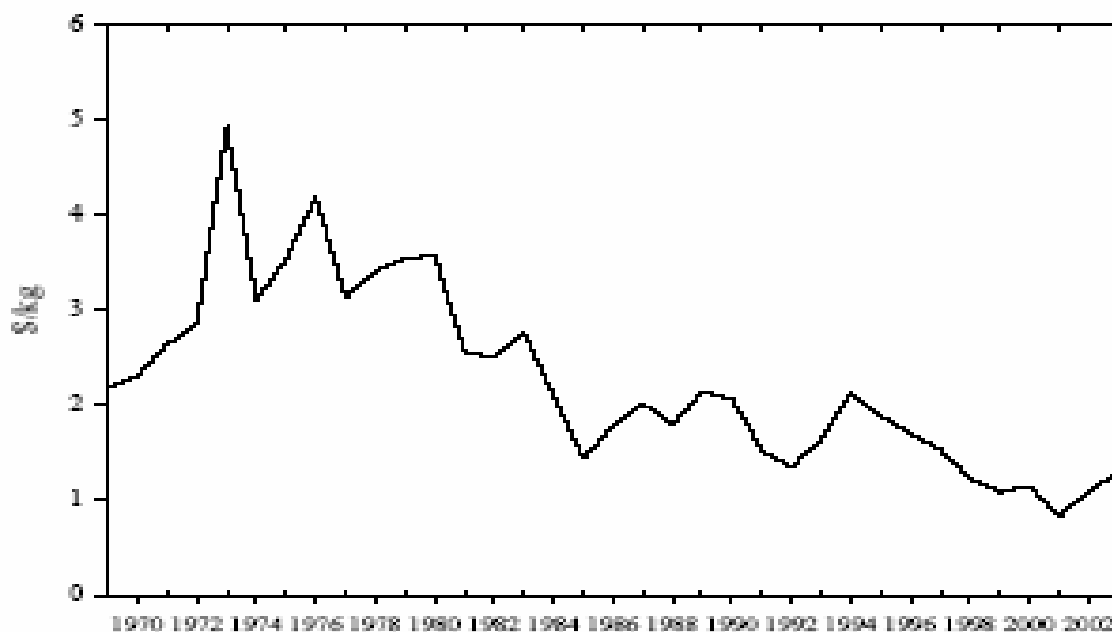
Figure 2 World Cotton Prices: Downward Trends and Volatility (constant 1995 dollars)


## COTTON LIBERALIZATION IN SSA

Structural adjustment and other bilateral initiatives have targeted the removal of government control over cotton sectors in many Anglophone, Lusophone, and Francophone countries[6]. Reform policies have been varied in nature. Anglophone countries have tended to shift more control to the private sector than in the Francophone countries. Private ginning companies have been given rights to operate and purchase cotton directly from farmers. Cotton prices are market determined and typically not guaranteed. Francophone countries have generally adopted more modest reform measures. Existing parastatal structures have tended to remain intact, either partially or fully. As a substitute for privatization farmers have been given greater bargaining power as in Burkina Faso and Benin. Cotton prices are negotiated between farmers and the parastatal. Prices are announced prior to the growing season and guaranteed. Country-specific reform policies are described below, including Mali (Appendix).

Results throughout SSA have been mixed. Only in selected cases have cotton farmers been made better off. Without adequate planning it's apparent that privatization can create as many problems as it fixed. Creating competition has proven to be more difficult than perhaps imagined. Even luring the private agents into the cotton sector can be

---

[6] In many ways cotton reforms parallel similar efforts in the cereal sector.

challenging and shouldn't be taken for granted. In Ghana, Tanzania, and Mali private companies did not step in as quickly or as effectively as thought[7].

Determining the optimal number of ginning firms to replace state run monopolies, and assigning property rights, have been complicating factors. A large number of firms appears to create "too much" competition. Poaching by ginning firms with only short-term interests has taken place in Ghana[8]. This led to ineffective provision of inputs and too little concern to maintain lint quality. Fierce competition amongst ginning companies often weakens their resolve to provide inputs: without a vested interest in the cotton sector firms are unlikely to make much of an effort to develop input channels. A small number of firms, that were granted regional monopolies, provide too little competition. Cotton prices have not performed any better under that arrangement either.

The private sector has had difficulty, or been unwilling, to take over many of the roles performed by the parastatals. Some would argue that the parastatals have been taken for granted[9]. Cotton is a crop that requires significant investments. Investments are required to provide inputs on an annual basis, in the medium term to provide credit for animal traction/equipment, and in the long-term for R&D to maintain productivity and to manage the natural resource base. If any of the financial and input channel mechanisms are interrupted, production systems can falter overnight. This was the experience in Ghana where ginning firms were short-sighted and only interested in purchasing cotton fiber. They were unwilling to make long-term investments that were needed to maintain cotton production beyond a season or two. Interestingly, the cotton sectors with concentrated ginning firms, a small number of large firms, provided the best mixture of price competition and input provision. Often the concentrated industries invoked price leadership strategies that benefited farmers and outperformed the competitive pricing found in the sectors with large numbers of ginners.

The empirical evidence points out the critical need to maintain an input credit system. It seems best to directly tie together inputs and outputs: provide farmers with next years inputs when they bring their harvest to the ginnery. Fragmenting the delivery system among different input and out put suppliers has been ineffective and at times catastrophic. Farmers' capacity to secure inputs in a private system is weak; formal lending is nearly non-existent. Field data confirms a much lower use of inputs and technology in crops that are privately financed.

---

[7] This is seemingly paradoxical since staple have been more successful in liberalizing and in drawing in the private sector even though cereals on the surface would appear less profitable.
[8] This analysis presumes perfect competition in both the short and long run; poaching will not appear. Assuring that ginning firms have sufficiently long planning horizons should be addressed by liberalization. This likely will require incentives.
[9] Though criticized parastatals provided some positive aspects. Namely they were largely responsible for the cotton "success story" mentioned in the introduction. They secured input channels for farmers by providing credit for input purchases in areas where financial markets are typically "missing". They were successful in using scale effects and reduced transaction costs to maintained lower input prices than those found in private markets. Extension services were adequate for cotton, although overly paternalistic (Bingen and Dembele 2002). They also provided a variety of social services including schools, public health, veterinary services, and feeder roads.

Extension services cannot be ignored (Bingen and Dembele 2002). Extension needs to meet the demanding, specialized, and changing needs of cotton producers. The public sector is unlikely to be able to provide adequate extension services, so privatization is likely to be the best option. Cooperation between producer groups and other entities further up the supply chain such as ginners will need to be strengthened. Zimbabwe's training center is one innovative model to consider; farmers are able to attend training sessions at various times throughout the calendar year to learn about new techniques and practices.

The private sector will need to find ways to augment the capacity of research and development in the cotton sector. Governments generally have not invested enough in cotton R&D and there has been reliance in West Africa on outside institutions such as CIRAD. Privatization will provide new opportunities open up input markets to include outside firms since it is doubtful that CIRAD by itself will be able to adequately modernize production systems. Producers and ginners must have a voice in R&D to express and fulfill their needs. This needs to be particularly emphasized as the cotton sector opens up to include new seed and input supply companies as "outside" technology will need to be adapted to local conditions to maximize their potential

Hence experience has shown no simple way to reform cotton sectors. The "invisible hands" of the open market is not a magic wand: too much competition can be just as bad as too little. This paper considers a generic scenario to reflect the different manners in which parastatal control can be handed over to the private sector.

## METHODS

Existing institutions capture a Ricardian rent, area RIC, from monopoly control over input and output markets (Figure 3). Monopoly price paid to farmers, $P_M$, is guided by production costs. The implicit nature of farmer has created a tenuous bargaining game between the state and farmers. Factor costs are only well established for inputs; household land and labor are valued implicitly and efforts to agree upon their values have proven difficult. Ricardian rents are maximized by policies that subsidize inputs to shift out the cotton supply curve.

The social cost of existing institutional structure is indicated by the area DWL (Figure 3). Under perfect competition cotton farmers would receive a higher price, $P_{WC}$. The Ricardian Rent would be transferred into producer surplus. Social welfare would increase by the area DWL. The price elasticity of the cotton supply curve determines the severity of the social cost. Reform measures that give cotton farmers a greater share of the world cotton price will have greater impacts if cotton supply is elastic. Inelastic cotton supply curves will merely produce a zero-sum game, shifting wealth between the state and farmers.

In practical settings reform measures are likely to be only partially successful in getting competitive prices to cotton farmers. Prices would lie somewhere between monopolistic, $P_M$, and perfect competition, $P_{WC}$, prices (Figure 1). The ginning industry would receive an additional surplus, the portion of the area DWL contained between $P_M$ and $P_{WC}$. Only under perfect competition would all of the DWL be captured by producers.

*Economic Model: Agricultural Sector*
A sector model has been developed to estimate the impacts from alternative cotton liberalization scenarios. This is an economic model that maximizes economic surplus within the Malian agricultural sector (Alston et al. 1995). In practical terms the model is used to estimate DWL, the dead weight loss (Figure 3). It represents the economic value to society of adopting liberalization and reform in the cotton sector. This is an equilibrium model that details how markets would respond to higher domestic cotton prices. It determines the new equilibrium following cotton liberalization and the shift to privatization. Equilibrium is governed by well-established economic theory: it achieves the best outcomes for society (Samuelson 1952). This is the long-run equilibrium that does not detail the dynamics of how equilibrium was established.

The sector model includes four main components of economic surplus: smallholder farmers' profits, ginning company profits, government revenues from cotton fiber exports, and consumers' food expenditures. In addition to cotton, the model contains the major cereal and legume crops (maize, millet, and sorghum, cowpeas, and peanuts.)

The sector model determines the supply response to liberalization's higher cotton prices. Farmers can respond to higher cotton prices through intensifying input use and placing more land into cotton production. Alternative cotton technologies are included in the model; this allows farmers input use to respond to the higher cotton prices. There also can be acreage shifts towards cotton. Primarily this would be achieved through substitution with cereals; introducing new fields into cultivation is generally not an option as the supply of quality land is limited in most areas. Cotton is nutrient demanding; fallow requirements further limit the amount of cotton area that can be increased.

The distinguishing features of this model are its micro level treatment of household decision making and an explicit treatment of the cotton ginning industry. Farm programming models are embedded within the sector model using mixed complementary programming. This provides a more accurate reflection of farming conditions than sector models that are based upon regionally aggregated measures of farming. Farmers' decision making objectives are explicitly included. Farmers maximize profits but are subject to socio-economic and production constraints: harvest income requirements, food production for family subsistence needs, liquidity for inputs, and cotton rotation. Household's implicit values on food, labor, and inputs can be different than market values (DeJanvry et al. 1991).

A couple aspects of the model's empirical structure are worth noting. Nearly all of the cotton produced in the region (98 %) is sold in the world market. Mali is a "small

country" and does not have market power; higher cotton prices paid to farmers in the West Africa region are not expected to affect world cotton prices. Cotton demand is presumed to be perfectly price elastic: cotton prices paid to farmers remain constant under the liberalization scenarios. Staple food markets are much the opposite of cotton. There are limited export opportunities; nearly all of the staple food produced is traded in domestic markets. Staple food imports are infrequent. Staple food demand is largely price inelastic: prices can rise (fall) quickly with supply decreases (increases). Higher cotton prices could ripple into the food markets. This is not expected to be a large effect as it would under new technology scenarios. In such cases impacts are likely to accrue more to consumers; producers' impacts will be governed more by cost reductions.

Adoption profiles are determined endogenously within the model. Adoption of Bt cotton and Bt maize is determined based on profits. Bt cotton and Bt maize are introduced into the model under the biotech scenarios. The embedded farm models determine whether adoption would take place or not. The extent of adoption, hence, is dictated by farmers' decision making preferences and constraints. This assumes perfect information on yield increases; in practical terms it requires sound extension services.

Each group maximizes their surplus under perfect competition. Private ginning companies have no monopsony control over farmers; cotton prices paid to farmers are determined competitively using world cotton prices.

GIS methods were used to provide agro-ecological perspectives within the model (Vitale and Sanders 2005). The sector model has supply responses that are specific to each of the agro-ecological production zones. This accounts for differences in climate, soils, productivity, and farming systems. The agro-ecological zones are included for: traditional cotton zone, semi-humid cotton zone, frontier cotton zone, sorghum zone, and a millet zone.


*Data/Scenarios*
The model's technical coefficients have been obtained from various sources. Field interviews with farmers were used to obtain farmers' decision making preferences for harvest income and food subsistence levels. Crop yields have been obtained from interviews with breeders and agricultural extension researchers. Farming alternatives are included as decision variables in the model; they include intensive practices that could be chosen under higher prices. GIS was used to characterize the spatial parameters the sector model.

The sector model is solved under alternative cotton liberalization policies. Each represents a different method for privatizing the cotton parastatal. The scenarios include those that have already been implemented in liberalization programs in other sub-Saharan countries. These include small, medium, and large number of ginning companies.

Under existing conditions farmers receive guaranteed prices of 200 fcfa/kg to cover costs. Supplement payments have pushed the price paid to farmers to somewhere between one-

third and one-half of the world price. With liberalization higher cotton prices will be paid to farmers. Transportation costs and ginning margins set upper limits on how high cotton prices could reach. Export costs associated with shipping cotton to world markets have averaged about 127 fcfa/kg; gross ginning costs have average about 300 fcfa/kg (CMDT 2001).

Restored world cotton markets would bring cotton prices back to around 1,000 fcfa/kg. This is the price level that existed during the mid 1990's. Increased competition from the sector and enhanced efficiency would reduce transportation costs and gross ginning margins. This would leave much larger shares of the world price for farmers. Three logical price scenarios emerge. One is under the existing institutional framework. This scenario maintains cotton prices at one-third of the world price, roughly conditions that prevailed prior to the 2001 price collapse. Modest reform measures are presumed to maintain prices consistently at one-half of the world cotton price. That price level has from time-to-time been achieved under existing institutional structure. Successful reform that achieves fully competitive markets could give cotton farmers three-quarters of the world price. This would be a new price-frontier for West African cotton farmers.
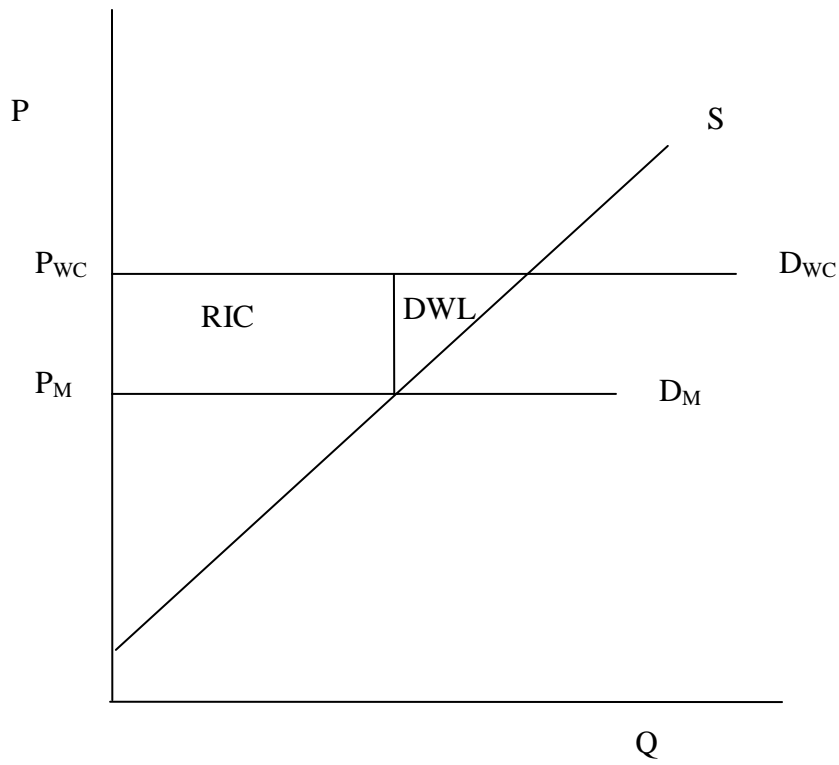
Figure 1 Efficiency Gains and Wealth Transfers from Cotton Liberalization

**RESULTS**

The sector model results indicate cotton liberalization would provide only limited gains under modest reforms (Table 1). Producer surplus in the cotton zone would increase by $59.6 million per year. Cotton farmers would gain $12.7 million per year in dead weight loss. Another $25.4 million in dead weight loss would be removed, but with only partial reform it would be captured by the ginning industry. Social welfare would increase by 39.1 million, corresponding to a 9.3 percent increase in social welfare. The embedded farm models indicated that cotton farm incomes would increase by an average of 17 percent, with the largest increase was in the semi-humid cotton producing region of Sikasso.

Under full competition the model results indicate cotton liberalization would provide much more significant gains for farmers (Table 1). Producer surplus in the cotton zone would increase by $99.3 million per year. For cotton farmers this is literally the ideal case: with perfect competition there would be a complete transfer of income from the state to the farmers. This transfer would total about $66.1 million per year. Producers would obtain 38.1 million of their surplus from removing dead weight losses. With perfect competition the producers capture the entire dead weight loss from the ginning industry. Social welfare would increase by $39.6 million per year. This is not much of a change from the modest reform scenario. Nearly all of the increase in producer surplus is from state to cotton farmer transfers.

All of the dead weight loss would be removed with only modest reforms. Aggregate cotton production would increase dramatically from 120 to 205 million kg per year (Table 2). Further liberalization is a zero-sum game: increasing cotton prices would only transfer more of the cotton surplus from the parastatal to smallholder farmers. There would be no additional supply response to higher cotton prices beyond the levels achieved by modest reform (Table 2).

Cotton production would be increased in the frontier areas of the cotton zone: the Bougouni, Kadiolo, and Kita regions (Table 2). These are regions that have been recently opened up to farming. Their productivity is somewhat lower but they have lower population densities and an easier time in shifting to cash crops. Total production would be increased from about 14.1 million kg per year to about 87.4 million kg per year in Bougouni. Increases would be more modest in Kadiolo and Kita. Increases in those regions would be from 14.0 to 21.2 million kg per year in Kadiolo, and from 8.3 to 12.6 million kg per year in Kita. The traditional cotton producing regions would not respond to the higher prices. Cotton farmers are already using intensive production means. Further productivity increases could not be squeezed out of existing technology packages even with higher prices[10].

---

[10] The model included more intensive cotton technology, a higher use of chemical and organic fertilizers. These only provide marginal increases in productivity, yield increases in the range of 5 to 12 percent.

The model found some spillovers into the food markets. The increase in cotton farming would shift more of the food production into the cereal producing zone. In the cereal zone producer surplus was predicted to increase by as much as $9.9 million per year under the full competition scenario (Table 1). It would be about one-half that much, $5.5 million, with only modest reform. Most of the producer surplus increase in the cereal zone is a transfer from the consumers, who would pay higher prices for their food. With drier conditions productivity is lower in the cereal zone. To meet increased demand food prices would increase slightly, by about 4.5 percent.

*Discussion*
The model shows a supply response in the frontier areas but not in the traditional cotton production zones, Koutiala and Sikasso. This points-out the need to find better ways to improve productivity, since even in the frontier areas production was increased primarily through shifting from cereals to cotton. Existing cotton technology, though modern by West African standards, has only limited potential to increase yields even with higher prices. The role of 21$^{st}$ century cotton technology, for instance Bt cotton, is likely to be critical in raising yields and reducing production costs.

The gains to producers are significant when compared to similar "farmer-friendly" policy measures. In companion research this same modeling approach was used to predict potential impacts of introducing new technology in the cotton and cereal zones. Introducing Bt cotton would have potential economic impacts in the range between 30 and 45 US$ million per year. This is only about one-half of the gains that farmers could expect from liberalization. Changes in social welfare would be similar, with liberalization providing about $40 million per year. Bt maize would provide slightly less impacts than Bt cotton, with potential impacts between $20 and $30 million per year. The Bt gains are likely to be even less if technology fees are maintained at existing levels as they would erode adoption levels and cotton incomes (Qaim and DeJanvry 2004).

Conventional technology would provide producers with even more modest gains. Previous research estimated impacts from introducing new technology based on conventional maize and sorghum varieties. The potential impacts from introducing conventional new technology in maize were found to be only $ 8.7 million per year (Vitale and Sanders 2005). Introducing new sorghum technology using conventional varieties would be more, with potential impacts of $ US 14.4 million per year.

The embedded farm models indicate that implicit land and labor prices would increase significantly. Land prices, as given by embedded farm model's shadow values, would more than double throughout the cotton zone. The better cotton fields in Koutiala would increase in implicit value from $20/ha under the existing institutional framework to nearly $200/ha with fully competitive markets. Within the frontier areas implicit land prices would be slightly less. In Kadiolo, for instance, land prices would increase from 11 $/ha to 189 $/ha. Increased profitability shifts more of the limiting factor costs to labor as well. Implicit household labor costs would rise from $1.15 per day to $2.31 per day.

16

Higher land prices would signal farmers to invest more of their resources in their cotton fields. Better land management practices have been introduced for over a decade now, but still there is an on-going need to maintain adequate soil nutrient balances and to build up organic matter in soils. The shift in implicit labor costs implies that there could be upward pressure on external labor markets. Although external labor markets are informal and poorly organized, over time they are expected to grow in importance as household emigration to urban areas is on the rise.

Table 1 Consumer and producer surplus impacts under alternative institutional change scenarios in Mali

| | Scenario | | |
|---|---|---|---|
| Surplus Item ($ million) | Existing Institutional Structure[a] | Modest Reform[b] | Fully Competitive[c] |
| ΔProducer Surplus: Cotton Zone | 0 | 59.6 | 99.3 |
| ΔProducer Surplus: Cereal Zone | 0 | 5.53 | 9.91 |
| ΔConsumer Surplus | 0 | -4.54 | -8.42 |
| Dead Weight Loss | 0 | 12.7 | 38.1 |
| State-to-Producer Transfer | 0 | 46.9 | 61.2 |
| ΔGinning Industry Welfare | 0 | 25.4 | 0.0 |
| ΔSocial Welfare | 0 | 39.1 | 39.6 |

Source: Author's model results.
[a] Cotton price = 0.66 $/kg
[b] Cotton price = 1.00 $/kg
[c] Cotton price = 1.50 $/kg


Table 2 Mali cotton production in alternative institutional change scenarios

| | Liberalization Scenario | | |
|---|---|---|---|
| Region | Existing Institutional Structure (million kg) | Modest Reform (million kg) | Fully Competitive (million kg) |
| Bamako | 26.6 | 26.6 | 26.6 |
| Bougouni | 14.1 | 87.4 | 87.4 |
| Kadiolo | 14.0 | 21.2 | 21.2 |
| Sikasso | 34.6 | 34.6 | 34.6 |
| Koutiala | 22.7 | 22.7 | 22.7 |
| Kita | 8.3 | 12.6 | 12.6 |
| Total | 120.3 | 205.0 | 205.0 |

Source: Author's model results.

Table 3 Land price changes in Mali's cotton zone

| Region | | Liberalization Scenario | |
| | Existing Institutional Structure ($/ha) | Modest Reform ($/ha) | Fully Competitive ($/ha) |
| --- | --- | --- | --- |
| Bamako | 18 | 97 | 186 |
| Bougouni | 4 | 78 | 136 |
| Kadiolo | 11 | 93 | 189 |
| Sikasso | 21 | 112 | 197 |
| Koutiala | 20 | 114 | 200 |
| Kita | 24 | 106 | 189 |

Source: Author's model results.

**CONCLUSIONS**

Institutions should not be treated as static. The theory of induced institutional innovation reminds us of this. Over time institutions are subjected to new demands placed on them by economic and social forces that can induce change. Cotton is still being produced within an institutional framework largely designed in response to the immediate post-colonial period. New forces are placing demands for institutional change. Cotton is now being produced in an era of declining world cotton markets, the emerging frontiers of biotechnology, and globalization. Existing institutions have become obsolete. The economic model results of this paper indicate significant gains to society if institutional structures are shifted from the state to the private sector.

Institutional change will only occur if it can gain enough political and economic support. It is likely to be judged on whether the economic gains from liberalization are sufficient to justify existing institutions that have amassed significant political capital. The defense of state run cotton parasatals runs deep. While rightly criticized for its vertical domination, parastatals have performed well in providing effective means of delivering inputs and outputs and have maintained adequate research and development. The private sector has struggled in providing inputs to farmers, as evidenced by recent experiences. Transaction costs from adoption institutional change could grow large. The potential void created in long-term research and development (R&D) by the removal of parastatal control is a challenge to the private sector.

Privatization will likely reduce government's share of the cotton surplus. Government concern for handing control over to the private sector has some justification. If the private sector is afforded too much market power then the resulting imperfect competition would take as much away from the farmer as the parastatals did. Outside investment provides the lowest multiplier effect. With outside investment there would be even less of the surplus remaining within the country, reducing the ability to develop the urban and rural economies.

Even with institutional change a key issue will remain: who is the best steward of the cotton surplus? To maintain any semblance of social optimality, cotton income should be divided equitably. Under existing structures the cotton surplus is primarily divided between outside interests and national governments, with leakages to rent seeking bureaucrats. Farmers have been left with very little. This arrangement has been supported by arguments that cotton must be taxed in order for the government to generate hard currency to spur economic growth. Implicit in this is that government's "multiplier" effect on its surplus is much greater than farmers. This is debatable given recent financial difficulties and poor management of the surplus this should not be taken at face value.

The multiplier effect associated with shifting more of the surplus to farmers should not be overlooked[11]. Rural multiplier effects have recently been found to be larger than expected. Cotton in particular has been found to provide significant multiplier effects. Employment and income have both been linked to cash crop farming in the cotton zones (Badiane et al. 2002). In addition, farmers have an increasing need to improve their production systems. Further research could explore whether shifting more of the cotton surplus to farmers in the rural areas would increase social welfare more effectively than maintaining the surplus in urban areas.

There are additional issues to contend with. One is the future role of the government in the cotton sector, which at this point in time remains unclear. World cotton markets can be volatile as can be domestic cotton production. The private sector may not be better able to manage shocks such as the 2000 cotton price collapse or poor production years. Finding the proper role of government to oversee stabilization efforts may be warranted.

---

[11]

**REFERENCES**

Alston, J. M., G. W. Norton, and P. G. Pardey. 1995. *Science under scarcity: Principles and practice for agricultural research evaluation and priority setting.* Ithaca, N.Y., U.S.A.: Cornell University Press. Reprinted in 1998, Wallingford, U.K.: CAB International.

Badiane, O., Ghura, D., Goreux, L. and Masson, P. 2002. "Cotton Sector Strategies In West And Central Africa." *World Bank Policy Research Working Paper* 2867. Washington, DC.

Bingen, J. and Dembele, E., 2002. "The Business of Extension Reform: Cotton in Mali." A case study prepared for the workshop entitled "Extension and Rural Development: A Convergence of Views on International Approaches?", Washington, DC.

Cabanilla, Liborio S., Tahirou Abdoulaey, and John H. Sanders, 2003. "Economic Cost of Non-Adoption of Bt Cotton in West Africa: With Special Reference to Mali," presentation at 7th ICABR International Conference on Public Goods and Public Policy for Agricultural Biotechnology, June 29-July 3, Ravello, Italy.

CARITAS, 2004. *Unfair Trade and Cotton: Global Challenges, Local Challenges*. A CARITAS-CISDE Report.

Chapman, S. 1999. "The Cotton Industry: Its Growth and Impact, 1600-1935." Working Paper, University of Nottingham, Nottingham, England.

Compagnie Malienne pour le Développement des Textiles, 2001. "Filière cotonnière et fluctuations cours mondial." Bamako, Mali.

De Janvry, A., Fafchamps, M., and Sadoulet, E., 1991. "Peasant Household Behaviour with Missing Markets: Some Paradoxes Explained." *The Economic Journal* (101).

Goreux, L, 2003. "Reforming the Cotton Sector in Sub-Saharan Africa (Second Edition)." World Bank, Africa Region Working Paper Series No. 62. Washington, DC.

Gillson, I., Poulton, C., Balcombe, K. and Page, S. 2004. "Understanding the impact of Cotton Subsidies on developing countries." Working paper prepared for USAID WARP Project.

Meredith, W.R., Jr., and R.R. Bridge. 1984. "Genetic contributions to yield changes in upland cotton." In W.R. Fehr (ed.) *Genetic contributions to yield gains of major crop plants*. ASA Spec. Publ. AC32243. ASA, Madison, WI. p. 75-87.

Qaim M and A deJanvry. 2003. Genetically Modified Crops, Corporate Pricing Strategies, and Farmers' Adoption: The Case of Bt Cotton in Argentina. *American Journal of Agricultural Economics.*

Samuelson, P.A., 1952. "Spatial Price Equilibrium and Quadratic Programming." *Amer. Econ. Rev.*, 42 (1952):283-303.

Vitale, J. and Sanders, J., 2005. "New Markets and Technological Change for the Traditional Cereals in Sub-Saharan Africa: The Malian case." *Agricultural Economics,* 32: 111-129.

Watkins, K. and J. Sul, 2002. *Cultivating Poverty: The Impact of US Cotton Subsidies on Africa*. OXFAM Briefing Paper Number 30. Oxford, England.

**APPENDIX  Cotton Reform in Sub-Saharan Africa**

*West Africa*
Côte d'Ivoire has been broken up its parastatal into three regional monopolies; this is a concentrated organizational form[12]. Within the cotton sector, concessions have been granted to both public and private players in this arrangement.

In Benin it is the ginning industry itself that has been privatized. To increase competition several ginneries have been established to form a multiple small player type of organization. A distinguishing feature of this system is that although the cotton gins are private, a central board maintains some amount of control. Ginneries can purchase from farmers only the amounts of seed cotton that comply with administered quotas and at administratively fixed prices.

Burkina Faso has kept its parastatal system and a monopoly marketing system but has liberalized its operations through allowing producers, through farmers associations, to be stakeholders in the cotton sector. Some regard the Burkina sector as the having obtained the best cotton sector reform outcomes within the Francophone countries (Fok and Tazi 2003); another cites the reform measures as allowing Burkina to buffer the world price collapse in the 1999/2000 campaign that plagued Mali's CMDT (Goreux 2003.)

*Mozambique*
Mozambique's liberalization policies have created an institutional arrangement similar to the Francophone countries; it adopted a local monopoly structure among its ginning industry; its price structure closely resembles that found in Mali and Burkina Faso. After the cotton sector collapsed as a casualty of the civil war, it was brought back in 1989. Initially, three joint venture companies, including the Government of Mozambique and foreign investors, were established. The cotton producing region was divided among the three firms; within each sub-region firms were given monopoly control over cotton production. Following this, additional companies have been allowed to enter; this further carved up the cotton region yet maintained monopoly control within each firm's domain. The cotton price structure has evolved to introduce more competition into the cotton sector and to insulate farmers from monopoly. The seed-cotton price is announced each year and set administratively. The price is achieved through negotiations between the Ministry of Agriculture, ginning firms, and the Cotton Research Institute (IAM); there is limited input from farmers. Despite these efforts, seed cotton prices remain monopolistic; rarely do cotton prices rise above floor levels.

*Tanzania*
Tanzania has utilized a structure of multiple small players; its experience is typified by a failure of input markets. Similar to the Francophone countries, from the mid-1960s until 1994 Tanzania's cotton sector was controlled by a parastatal. Prior attempts to liberalize

---

[12] Poulton et al. (2004) categorizes the organization of post-liberalization cotton sectors as follows: Concentrated (dominated by two or three large players), multiple small players, and local monopoly.

the cotton sector, in 1976 and 1986, were unsuccessful. The most aggressive attempts began in 1994. Cotton markets were quickly privatized; firms soon established a dominant position. Although the multitude of players in the ginning industry created adequate competitive forces to raise seed cotton prices closer to world price levels and deliver quicker payments, input supply channels became fractured. Support services such as extension and input credit were poorly established by the private sector and quality control procedures suffered (Poulton et al., 2004). Following a crisis in the 1998/99 campaign, intervention by the Tanzania Cotton Board was required to fill gaps in the input supply channels and to enhance quality control. Despite these shortcomings, Tanzania's cotton sector handled the 2001/02 world cotton price collapse much better than the Francophone countries. There is cursory evidence that a recovery in cotton production has begun, as production increases have been the norm since 2000.

*Zimbabwe*
Zimbabwe's cotton reform policies are based around a concentrated ginning industry. The two principal players in the ginning industry have been Cottco, a successor to the previous parastatal CMB, and Cargill. Unlike conditions in Francophone countries, commercial farming constitutes a significant proportion of agricultural output; Zimbabwe farmers have considerable experience operating in free market environments; mechanisms have been developed to establish favorable prices for their principle crops (Jenkins, 1997). Price competition appears to be present; since the 1995 liberalization, Cottco (previously the parastatal CMB) has exercised price leadership with two other companies competing on prices and also on a range of services provided to cotton farmers (Larsen, 2002). Cotton pricing structures are much more flexible in Zimbabwe than in Francophone West Africa. Both of the major players in the ginning industry, Cottco and Cargill, employ a dynamic cotton payment system; following harvest prices fluctuate according to market conditions; more importantly, if prices rise after farmers have sold their cotton then they are entitled to backpayments. Similar to the Francophone system, prices are announced just prior to planting, which is typically the final price from the previous season; while not a guarantee, producers have a reasonably assured floor price.

*Ghana*
Ghana's liberalization structure was one of free entry; this lead to the entry of many small players in the ginning industry; primarily it has been a story of poaching. Ghana liberalized its cotton sector in 1985; it was one of the earliest sectors to liberalize. Initial outcomes were successful; cotton production increased by 40 percent in the years following liberalization. Initially input markets worked effectively; the major cotton company, GCCL, was the leader and initially provided inputs to farmers on credit; soon after competitive forces drove other cotton companies to follow suit. Production increased even further and reached its zenith in 1998/99. Ironically the seed cotton market became overly competitive; due to free entry, a corps of small cotton companies began to poach the sector; these poachers were myopic and reaped short-term profits; there was little concern to maintain investments in the input supply channels. Without

credit fertilizer and pesticide use dropped dramatically. By 2001/02, fiber production plummeted to six thousand tons in 2001/02; firms became increasingly indebted, with estimates in the range of $ 33 million. Nonetheless, cotton retains its allure as a money-maker; Ghana still has a dozen firms operating within its borders (as of March 2002) with applications pending for at least three more firms.