THE COTTON PRICE SMOOTHING SCHEME OF BURKINA FASO

FORWARD

The attached paper summarizes the main features of the price smoothing scheme adopted by the sector (AICB) March 29, 2006 and presents the findings of a series of simulations conducted afterwards. The simulations indicate that the size of the non-intervention tunnel and the maximum size of the fund selected in March are appropriate. Simulations of shocks whether foreseen or unforeseen show that the system is fairly robust. The main difference with the March AICB document is the emphasis on an externally financed credit line.

The fund has to be combined with a credit line because the two instruments are complementary. When prices fall sharply, the fund cannot help if it is empty. When prices rise strongly, the credit line cannot help either if there is nothing to be repaid.

The credit line should be externally financed. It should not be financed by cotton companies because companies and growers are both adversely affected simultaneously by a fall in cotton prices. Risks have to be diversified and they are when the credit line is financed externally. The external agencies which would finance the cotton credit line do encounter financial risks, but those are unrelated to the fluctuations of cotton prices expressed in euros.

Louis Goreux
June 15, 2006

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1. The new scheme of Burkina Faso

When SOFITEX had a monopoly, profits and losses of the cotton sector were calculated after closing the books of the company. If profits were made in a given year, producers received a *ristourne* in the following year. With two new private cotton companies, this procedure was not any more applicable. It had to be amended and a new scheme was adopted by the *Association Interprofessionnelle du Coton du Burkina* (AICB) in a meeting held on March 28-29, 2006. It was presented by the President of AICB to the Burkinabé authorities in a meeting chaired by Benoit Ouattara (minister of trade) on March 30 and to partners in a meeting chaired by Mrs. Sari (EU Representative in Burkina) on March 31. The new scheme was very well received by producers when it was presented to them in a ten days road show and the new floor price of CFAF 165 per Kg of seed cotton was announced on April 8 following the annual meeting of the *Union Nationale des Producteurs Burkinabé*s (UNPCP) held April 5-7. The new floor price is CFAF 10 lower than the one which had been set for 2006/07 in the *Protocole d'Accord*.

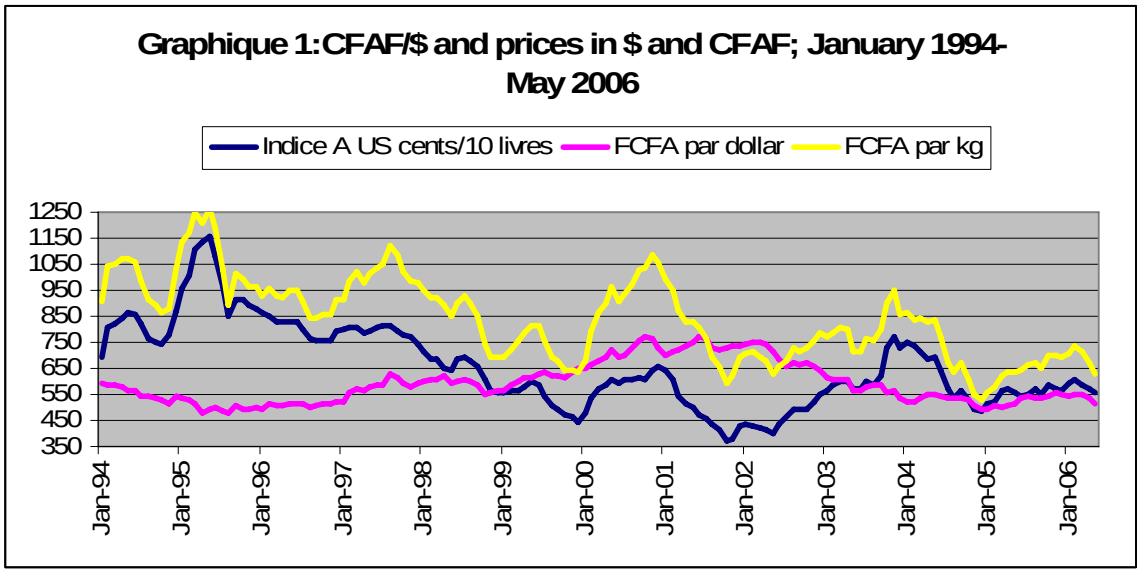
Since producers are attached to a floor price announced before sowing, this feature was preserved. As before, the floor price is announced early April and producers are paid on delivery at the floor price after deduction of the cost of inputs. If the actual price exceeds the floor price announced in April of year t, producers receive a supplement in May of year t+1, before the end of the cotton year during which the profit had been generated. This is a change from previous practices which was appreciated by all parties concerned: producers, cotton companies and partners.

This change could be made because the profit or loss of the cotton sector is now calculated by reference to the average daily value of Cotlook Index A expressed in CFAF over the 12 month period ending March 31, t+1. This average cannot be contested since it is derived from quotations of Index A and exchange rates published daily. April 1, t+1, the AICB announces the average value of Index A, the quantities of fiber expected to be produced in year t/t+1 by each of the three cotton companies and the amount held in the fund on March 31, t+1.[1] Entering these five numbers in a computer indicates what has to be paid by whom. Stakeholders, including partners contributing to the scheme, will be able to check these numbers from the program provided to them and will have three weeks to contest any number. All financial transactions should be completed with perfect transparency by May, t+1.

When a cotton company sells FOB, the contracted price is expressed in euros, but the price offered by the trader is arrived at by dividing the value of Index A in US cents per pound by the euro/dollar rate. Since the CFA franc is at fixed parity with the euro, the fluctuations of the export price of cotton expressed in CFAF are affected by those of two

[1] Numbers quoted in the document relate to Cotlook A Northern Europe. They could later adjusted to the Far East Index.

exogenous variables: the euro/dollar rate and the value of Index A expressed in US cents per pound (Chart 1). From October 2001 to November 2003, CFAF prices increased less than dollar prices due to the weakening of the dollar. But, during the thirty following months, fluctuations were greater in CFAF than in dollars. On the one hand, fluctuations of the euro/dollar rate are not expected to be affected by variations in cotton prices. On the other hand, any change in the euro/dollar rate is not expected to have much impact on the world cotton price expressed in dollars because Europe is now playing a marginal role in the world cotton market. The US accounts for 40% of world exports and major importers (notably, China) have currencies linked to the US dollar. Fluctuations in dollar prices and euro/rates are likely to be independent of each other, and fluctuations of cotton prices expressed in CFAF are expected to remain large.



2. Objectives and Basic Principles

The objective of the scheme is to reduce the amplitude of yearly fluctuations in producer prices, not to eliminate them, nor to modify the trend. This is why the *fonds de soutien* (support fund) is now called *fonds de lissage* (price smoothing fund). The determination of the floor price and the management of the fund are based on six principles:

1. **The fund cannot change the medium term price trend** calculated as the centered seven-year moving average of Index A. [2] A seven year moving average was

[2] Primary exporting countries have been compensated for export earnings shortfalls under the IMF Compensatory Financing Facility (CFF). The facility has been widely used after the 12/24/75 decision: "From January 1976 through March 1980, there were 107 drawings totaling SDR 4.0 billion under the facility; these accounted for 31 per cent of the total credit extended by the Fund to all its members; and 45 per cent of the total if the United Kingdom is excluded, during this period (Table 1)." The shortfall was measured as the downward deviation from the five-year average centered on the shortfall year using export forecasts for the two post-shortfall years. By early 1980, actual values of export earnings in the two post-shortfall years were known for the majority of the drawings made under the new decision. The impact of

chosen instead of five year because it leads to better smoothening. With a declining price trend, the sector cannot remain competitive without raising yields and labour productivity. Means of doing it have to be implemented today, but their impact will not be felt in the short term (Annex II). GM seeds may reduce production costs and raise yields but, even if more resources were devoted today to incorporate the BT gene in local varieties, the impact would be felt only three years from now.

2. **The non intervention tunnel should not be symmetrical.** Taking the trend value as 100 and the floor price as 95, when the price falls to 85, the shortfall of 10 has to be covered in its entirety by the fund. With a symmetrical tunnel, the ceiling would be set at 105 and, when the price reaches 115, the entire surplus of 10 would have to go to the fund in order to preserve its financial equilibrium. But this would not satisfy producers and companies who want a piece of the cake when prices are high. If the ceiling of the tunnel is set at 101 instead of 105, the surplus becomes 14 when the price reaches 115; after using 10 to replenish the fund, it remains 4, of which 2.4 (60%) go to producers and 1.6 (40%) go to the companies. Floor and ceiling were taken 5.1% below and 1.3% above the trend value.[3] The floor price will change from year to year since it is derived from a seven-year moving average which changes from year to year as shown on chart 2.

3. **The fraction of the surplus going to the fund is modulated according to the resources accumulated in the fund at the end of the previous year and the size of the surplus in the current year.** On the one hand, replenishing the fund is more urgent when the fund is empty than when it is almost full. On the other hand, replenishing the fund is easier when the surplus is large than when it is small. This practice was more acceptable to producers than devoting the entire surplus to replenishment until the fund is full. Moreover it leads to a better smoothening by avoiding a sharp shift in the allocation of the surplus at the point where the fund reaches its maximum.

The percentage (Z) of the surplus used to replenish the fund is given by a matrix similar to income tax tables by income brackets (Table 1). Along each line, Z increases from left to right with X which measures the surplus as a percentage of the tunnel ceiling. Along each column, Z declines from top to bottom with Y which defines the level of replenishment reached at the end of the previous year as percentage of the maximum size of the fund. While table 1 gives the percentage applicable to a particular surplus bracket, table 2 gives the average percentage (Z') for a given size of the surplus. By analogy with income tax schedules, table 1 gives the tax rate by income bracket and table 2 the average tax rate by income level. However, in view of the linearity assumption made for the evolution of X and Y, Z and Z' can and have been expressed as continuous functions of X and Y.

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forecasting errors on these drawings was then be measured. With perfect forecasting, drawings would have been lowered in 21% of the cases, raised in 9% and remained unchanged in the other 70%; the total amount drawn under the facility would have been lowered by 9%. The impact of forecasting errors on the size of drawings was therefore small. Compensatory Financing Facility by Louis Goreux, IMF Pamphlet Series No. 34, 1980, pages 2, 3 and 30.

[3] Decimal were added to obtain round numbers in CFAF per kg of seed cotton.

Table 1: Z Percentage of surplus replenishing the fund by surplus bracket
Z = 80 + X - 0.8 Y -0.01 X Y

Y: Fund resources	X: Surplus as % of tunnel ceiling							
as % maximum	0	5	10	15	20	25	30	35
0	80	85	90	95	100			
10	72	76.5	81	85.5	90	94.5	99	
20	64	68	72	76	80	84	88	92
30	56	59.5	63	66.5	70	73.5	77	80.5
40	48	51	54	57	60	63	66	69
50	40	42.5	45	47.5	50	52.5	55	57.5
60	32	34	36	38	40	42	44	46
70	24	25.5	27	28.5	30	31.5	33	34.5
80	16	17	18	19	20	21	22	23
90	8	8.5	9	9.5	10	10.5	11	11.5
100	0	0	0	0	0	0	0	0

Table 2: Z' Average percentage of surplus replenishing the fund by surplus level
Z = 80 + 0.5 X - 0.8 Y -0.005 X Y

Y: Fund resources	X: Surplus as % of tunnel ceiling							
as % maximum	0	5	10	15	20	25	30	35
0	80	82.5	85	87.5	90	92.5		
10	72	74.25	76.5	78.75	81	83.25	85.5	
20	64	66	68	70	72	74	76	78
30	56	57.75	59.5	61.25	63	64.75	66.5	68.25
40	48	49.5	51	52.5	54	55.5	57	58.5
50	40	41.25	42.5	43.75	45	46.25	47.5	48.75
60	32	33	34	35	36	37	38	39
70	24	24.75	25.5	26.25	27	27.75	28.5	29.25
80	16	16.5	17	17.5	18	18.5	19	19.5
90	8	8.25	8.5	8.75	9	9.25	9.5	9.75
100	0	0	0	0	0	0	0	0

4. **The fund should be combined with a line of credit externally financed.** A prominent place is given here to the external credit line which was not the case in the document adopted by the AICB in March 2006. Putting it simply, the fund has to be combined with a credit line because the two instruments are complementary. When prices are low the fund cannot help if it is empty. When prices are high, the credit line cannot help if there is nothing to be repaid. Recourse to the credit line can be reduced by raising fund reserves, but the reduction thus obtained is lower than the increase needed in reserves and the total amount immobilized in the smoothing scheme increases (section 3 of Annex II). It therefore appears appropriate to limit the maximum size of the fund to 10% of production valued at trend price, as was done in the scheme adopted by the AICB.

The credit line should be financed externally to diversify the price risk. When a deficit occurs because cotton prices fall, cotton companies loose money; this is not the right time for them to extend a loan to cover the cotton deficit; cotton companies and cotton producers are facing the same price risks. The external agencies which would be financing the cotton credit line are also facing risks, but those risks are unrelated to the fluctuations of cotton prices. Simulations covering a 22 year period show that the present value of the drawings expected to be made on the credit line would not be very large and

would be much smaller than the present value of a grant having the same smoothening effect.

5. Narrowing the price tunnel leads to better smoothening but requires more generous credit lines. A [-5.1% + 1.3%] tunnel was chosen after making several simulations. The wider tunnel [-8 +2] was not selected because it had not enough smoothing effect. The narrower one [-2.5% + 0.6%] was not selected either because the size of the largest drawing from the credit line would have doubled (Table 6, Annex I).

6. The shares of the FOB price going to producers and cotton companies should reflect what is considered to be fair by both parties. Producers and cotton companies considered that the sector would be in financial equilibrium with a FCFA 685 FOB price and that, at this level, FCFA 175 per kg of seed cotton would provide a fair return to producers for FCFA 685 per kg of fiber FOB. With a 0.42 ginning ratio, producers would then receive 60.8% of the FOB price. This percentage was rounded to 60 and it was decided that, when prices go up, producers receive 60% of the amount distributed and companies receive the remaining 40%. By symmetry, when prices go down, producers absorb 60% of the losses and companies the remaining 40%.

Producers gain from the application of this new procedure. Previously, when a surplus occurred, it was shared equally between producers and companies, and producers had to replenish the fund from the 50% of the surplus they had received. Now, when a surplus arises, the credit line is cleared first, and the remaining surplus is shared into three parts: the one used to replenish the fund is calculated by a formula and, if 10 remain, 6 go to producers and 4 to cotton companies. When prices decline, cotton companies have to absorb 40% of the loss.

The model is first solved in terms of FOB prices per kg of fiber (F); the corresponding value of producer prices per kg of seed cotton (S) is then derived from F by applying the formula shown in table 1A. By fiber definition, when the FOB price is 685, the producer price is 175 and producers receive 60.83% of the FOB price. When the FOB price rises to 785, the producer price rises to 200 and producers receive 60.72% of the FOB price. Vice versa, when the fiber price falls to 585, the producer price falls to 150 and producers receive 60.97% of the FOB price. Whatever happens to the FOB price, the share received by producers remains about the same.

Table 1A: Going from FOB fiber prices to producers prices

Prices in CFAF per kg FOB		PS: Producers'
F: fiber	S: seed cotton	share in %
785	200	60.72
685	175	60.83
585	150	60.97

F = 7 year centered average of Index A - 48 (cost FOB to CIF)
S =175 +(0.6*0.42)*(F-685)
PS=100*S/(0.42*F)

3. Operations

The transaction pattern may be summarized as follows:

(i) If prices remain in the non-intervention tunnel, there is no transaction with the fund, but companies have to pay producers for any excess over the floor price.

(ii) If prices fall below the tunnel, the fund has to finance the deficit by making transfers to each of the three companies, but producers do not receive anything. Once the resources of the fund have been depleted, the deficit is financed by drawing on the credit line.

(iii) If prices rise above the tunnel, the fund has to clear the credit line if any amount remains outstanding. Each company has to make a transfer to the fund and supplementary payments to producers.

The resources of the fund have to be held securely in a special account in a bank located in the UMEOA or in the euro zone. Companies have to provide a reliable estimate of their fiber production by the end of March. But each company is free to sell its fiber how it wants (selling spot or forward, or buying put options,) and when it wants, without having to report the nature of its sales. If a company sells better than the others or improves its productivity faster, it makes more profits which provides an incentive to reduce costs.

The scheme provides good visibility. A 12% forecasting error on the February and March values of Index A expressed in CFAF would affect the yearly average by only 2%. By end January 2007, it would therefore be possible to know whether a deficit was likely to occur in 2006/07 and whether financing problems would arise. By end January 2009, results will be known for almost three years and the scheme will be thoroughly reviewed and amended before announcing the floor price in April 2009.

The scheme presents some similarities with the three-year contracts made in industrialized countries between labor and private companies. But the Burkina scheme is being launched when cotton companies are in a difficult financial situation after the heavy losses incurred in 2004/05 and when the fund is empty.

The financial outcome of the 2006/07 campaign will be affected by the amount of fiber produced, taken below as equal to 315 thousands tons. But it will mainly depend on the levels of Index A in US cents per pound and of the euro/dollar ratio. This is illustrated by tables 3 and 4, which are taken from the document adopted by the AICB.

The first table shows what producers would receive inclusive of the supplement under 110 different combinations of dollar prices and euro values. When prices expressed in CFAF are below the tunnel (south-east triangle), they receive the floor price (165 CFAF per kg of seed cotton). When prices are above the floor (north –west triangle), they receive more.

Table 3: Producer price in CFAF per kg of seed cotton, 2006/07

	CFAF per dollar										
	625	**596**	**570**	**558**	**547**	**536**	**525**	**515**	**505**	**495**	**486**
US cent	Dollars per euro										
per pound	**1.05**	**1.1**	**1.15**	**1.175**	**1.2**	**1.225**	**1.25**	**1.275**	**1.3**	**1.325**	**1.35**
75	**234**	**222**	**211**	**206**	**201**	**196**	**192**	**188**	**183**	**179**	**179**
70	**216**	**205**	**195**	**190**	**186**	**181**	**179**	**178**	**178**	**177**	**177**
65	**199**	**189**	**179**	**179**	**178**	**177**	**177**	**176**	**173**	**169**	**166**
63	**192**	**182**	**178**	**178**	**177**	**176**	**174**	**170**	**167**	165	165
61.5	**187**	**179**	**177**	**177**	**176**	**173**	**170**	**166**	165	165	165
60	**181**	**178**	**177**	**176**	**173**	**169**	165	165	165	165	165
58.5	**179**	**177**	**176**	**172**	**168**	165	165	165	165	165	165
57	**178**	**177**	**171**	**167**	165	165	165	165	165	165	165
55	**177**	**173**	165	165	165	165	165	165	165	165	165
50	165	165	165	165	165	165	165	165	165	165	165

Table 4: Deficit in billions CFAF

	CFAF per dollar										
	625	**596**	**570**	**558**	**547**	**536**	**525**	**515**	**505**	**495**	**486**
US cent	Dollars per euro										
per pound	**1.05**	**1.1**	**1.15**	**1.175**	**1.2**	**1.225**	**1.25**	**1.275**	**1.3**	**1.325**	**1.35**
65									0	0	0
63							0	0	0	**1.8**	**5.8**
61.5						0	0	0	**2.9**	**7.0**	**10.9**
60					0	0	0	**4.0**	**8.1**	**12.1**	**15.9**
58.5					0	**0.9**	**5.2**	**9.3**	**13.4**	**17.3**	**21.0**
57				0.0	**2.0**	**6.4**	**10.6**	**14.7**	**18.6**	**24.3**	**26.1**
55			0	**5.2**	**9.6**	**13.9**	**18.0**	**21.9**	**25.7**	**29.3**	**32.8**
50	**1.4**	**11.3**	**20.3**	**24.5**	**28.6**	**32.4**	**36.2**	**39.8**	**43.2**	**46.5**	**49.6**

The second table is of particular interest because it illustrates potential problems by showing the size of the deficit which would occur by combining 11 values of the euro (going from 1.05 to 1.35 dollars) with 7 values of Index A (going from 50 to 65 US cents per pound). When a cell is empty, prices are above the tunnel. When a zero appears, prices are within the tunnel. When prices are below the tunnel, the number in the cell shows the size of the deficit to be covered by the fund and/or the credit line. With the euro equal to $ 1,175 and Index A equal to 57 cents, the price slightly exceeds the floor of the tunnel (165 CFAF) and producers receive a complement of 2 CFAF per kg of seed cotton. When the euro rises to $1.35 and Index A falls to 50 US cents, the deficit reaches CFAF 50 billions.

4. The exchange rate risk

Attention has been devoted so far mainly to fluctuations in dollar prices, but the euro/dollar rate may raise a major problem in 2006/07. Deficits (or surpluses) are shown in table 5 with six different values of A which stands for Index A (Northern Europe expressed in CFAF) averaged over the period going from April 1, 2006 to March 31, 2007. (i) If A were equal to the average of the 75 months ending March 2006 (first row), producers would receive a CFAF 11 supplement per kg of seed cotton and CFAF 7.4 billion would be credited to the fund. (ii) If A were equal to the January-March 2006 average (second row), the fund would not intervene. (iii) If A were equal to the April 2006 average (third row), a CFAF 6.7 billion deficit would arise. (iv) If A were equal to the May 2006 average (fourth row), the deficit would rise to 20 billions. (v) If the euro were equal to 1.35 dollars and Index A to 55 cents (fifth row), the deficit would reach CFAF 32.8 billion. (vi) If the euro reached 1.4 dollars and Index A was equal to 55cents, the deficit would reach CFAF 39.3 billion. In all cases, dollar price would remain at about the same (ranging from 55 to 59 cents per pound), but the outcome would range from a 7 CFAF billion surplus for a 1.05 rate to a 39 CFAF billion deficit for a 1.4 rate.

Table 5: 2006/07 surplus or deficit depending on the average euro value of Index A from April 06 to March 07.

	Hypotheses					Results	
				A:7y av Ind A	A-58, FOB	Produc price	Deficit
	Cent/pound	$/euro	CFAF/$	CFAF / kg of fiber		CFAF/kg sc	**CFAF Billions**
Average Jan 00-March 06	55.7	1.05	626	762	714	176	**-7.4**
Average Jan 06-March 06	59.5	1.2	548	718	670	167	**0**
Average April 06	57.2	1.23	533	672	624	165	**6.7**
Average May 06	55.4	1.28	514	629	581	165	**20**
	55	1.35	486	589	541	165	**32.8**
	55	1.4	469	568	520	165	**39.3**

Historically, the proxy for the euro/dollar rate fluctuated along cycles without showing clear long term trends. During the late seventies, following the Vietnam war and the increase in oil prices, the ratio exceeded 1.4. It fell to 0.7 in 1984/85 and averaged 1.1 in the last 15 years. During the IMF/WB meetings held late April 2006, a major concern was the disequilibrium between the balance of payments of critical countries and the IMF was asked to facilitate a soft landing. But a soft landing may last several years and, if the euro were to reach 1.4 for two consecutive years, cotton cultivation could virtually disappear in Burkina with dramatic consequences on poverty since there is nothing to replace cotton in the short or medium term. This would be most unfortunate since cotton could have returned to profitability a few years later.

In 2005, the fall in cotton prices was aggravated by the increase in oil prices and Burkina's terms of trade fell to its lowest level since the 1994 devaluation. When the deterioration in the terms of trade is not expected to be reversed in the short term, depreciating the currency may be the best option. But this option is not available to

Burkina because the CFA franc is the currency used by 13 other countries: five of them are oil exporters and Côte d'Ivoire has other more pressing concerns. The CFA parity is therefore unlikely to change in the near future.

When the cotton companies met on March 8 to review what could be the floor price for the coming year, the euro was equal to 1.19 dollar. It had risen to 1.23 by the time of the IMF spring meeting when an inquiry was made on possible ways of buying a protection against further appreciation of the euro. The most appropriate way was to purchase an option on the average value of the euro over the twelve following months and such an option on the money could be acquired for 2.51% of the amount purchased. When the euro was at 1.23, the sector could have been protected against an appreciation of the euro exceeding 1.26 dollars by disbursing 7.5 million euros in front. If, in April 2007, the average value of the euro had exceeded 1.26, the operation would have been profitable. At 1.26, it would have been neutral. Below 1.23, the option would not have been exercised and the 7.5 million euros would have been lost; it would have been similar to the insurance premium paid to be protected against an accident which did not occur. In any case, the transaction was not made.

With a 1.3 or 1.4 euro/dollar ratio, the import sector is subsidized at the expense of the export sector. In Burkina, the value of imports is twice that of exports and cotton accounts for three quarters of export earnings. The cotton sector is penalized while the informal sector selling goods imported without duties is subsidized. Although the financial position of the treasury was better than foreseen in the IMF program, by May 2006, the treasury had not yet transferred the CFAF 10 billion due for TVA rebates to cotton companies. In presenting the new scheme to the government and to partners, the AICB emphasized that payment was needed by October 2006 when the 2006/07 was to be in place and, by June 2006, it was expected that the payment would be received in time.

Burkina's current PRGF program with the IMF expires in August 2006. It could be followed by a PSI program under which Burkina would appear to be an excellent candidate for drawing under the new Exogenous Shock Facility.

In its March meeting in Brussels, the cotton club considered possible ways of protecting African countries against the volatility of world cotton prices. Among the various proposals made was the establishment of a line of credit externally financed. The new scheme presented to partners on March 31 included a credit line financed by cotton companies which could be replaced by a credit line externally financed. Work conducted in the following months concluded that the line should not be financed by the cotton companies because companies and producers were simultaneously subjected to the same price risks. An externally financed line of credit would diversify the risks because the external agencies financing this line would not be subject to price risks correlated with the fluctuation of the world price of cotton expressed in euros. The simulations presented in Annex I show that, even if drawings were interest free, the present value of the costs incurred by the financing agencies would not be high. The problem is not the interest rate which could be charged on drawings. It is the belief that the scheme could work and that

drawings will be repaid. For this reason, the scheme has to be perfectly transparent and emphasis was placed on transparency.

The price smoothing scheme just described should obviously not divert attention from the need to raise productivity since it is the only way to raise income in the medium and long terms (section 2 of Annex II).

Annex I: Simulations

1. The Model

1.1 Broad presentation

In order to select the key parameters and to test the robustness of the price smoothing scheme, a 28 year series was constructed using historical data for the first 12 years and extrapolations for the 16 following years, with yearly prices t/t+1 calculated as averages April 1, t through March 30, t+1 . The historical series starts in 1994/95 (to avoid the problems arising from linking pre- and post-devaluation series) and ends in 2005/06 (the last year for which reliable estimates were available).

When the seven year average of Index A centred on 2006/07 was calculated in March 2006, the first three years were known and the last four had to be extrapolated. Taking into account ICAC projections, the average value of Index A was taken at 60.5 cents per pound for the 2006/07 -2009/10 period and the average value of the euro was taken as 1.19 dollar which was the rate prevailing at the time. This led to 736 CFAF per kg for Index A. Deducting 48 CFAF to go from FOB to CIF gave CFAF 680 for the FOB price which is the proxy used to define the medium term trend. Deducting 5.1% from the trend gave CFAF 165 per kg of seed cotton for the floor; adding 1.32% gave 176 CFAF for the ceiling of the price tunnel.

Starting in 2006/07, the price trend was assumed to decline by 1% a year in most simulations and to remain flat in others. In the extrapolation period, fluctuations from the trend line are equal percentage-wise to those calculated for the historical period and their sequence is the same as in the historical period.[4] As a result, a sizable surplus occurred in the first year, which provided favourable conditions for starting the price smoothing operations. Unfavourable conditions were also simulated by shifting the first year into third position so that smoothing operations would start with two deficit years before a surplus year. This applies to many of the simulations reported below.

Price shocks were also simulated by superimposing a shock on the extrapolated price series previously described. In one case, the shock was reversible starting with lower prices in 2006/07 and 2007/08 offset by higher prices in the three following years. In the other case, prices were lowered as before in 2006/07 and 2007/08 with no offsetting effects in later years.

The trend value is calculated as a seven-year centred moving average T assuming perfect foresight. Since three years are lost at the beginning of the series and another three at the

[1] The trend line was calculated using a linear least-squares regression line.

end, the model is solved for 22 consecutive years. The seven-year moving average of the smoothed prices T' differs slightly from the seven-year moving average of unsmoothed prices T. As could be expected, the second seven year average T' is smoother than the first T, it was therefore used as the norm for measuring the smoothing effect. The second seven-year average T' can however be calculated for only 16 (=22-3-3) years since three years were lost at the beginning and at the end of the series. Deviations from this second seven-year average T' were calculated for prices before and after smoothing. These deviations were squared and added up over the 16 years to compare variances before and after smoothing. When an 80% smoothening effect is reported in the tables below, it means that the variance of the deviations from the trend line T' is five times larger before than after smoothing.

With perfect foresight, the shock is fully accounted for and trend values T are calculated as seven year averages of prices inclusive of shocks. With imperfect foresight, trend values T' start differing from T three years before the shock occurs, since the seven year average T't includes the price without shock for year t+3, while T include the price with shock for that year. With perfect and imperfect foresights, prices before smoothening are the same, but estimated trends, floor prices, drawings and, consequently, prices after smoothening differ (Table 9).

1.2 Determination of the medium term trend

A seven-year moving average provides a satisfactory smoothening effect and the average centred on year t appears appropriate to determine the value of the medium term trend in year t. The problem is that, on April of year t, prices are known for the three previous years but not for the four following years. One solution is to calculate the unknown values by applying a given formula, another is to make a forecast. The issue may be illustrated by drawing on the experience of the IMF with the Compensatory Financing Facility (CFF) which is well documented. The objectives of the price smoothing fund are somewhat comparable to those of the CFF, as appears from the following IMF quote:

"The CFF was established by the IMF to provide additional assistance to member countries experiencing balance of payments difficulties arising from export shortfalls, provided the latter are temporary and largely attributable to circumstances beyond the member's control. Ideally, the facility should enable a member to borrow when its export earnings and financial reserves are low and to repay when they are high, so that its import capacity is unaffected by fluctuations in export earnings caused by external events."[5]

The amount of the CFF drawing was based on the shortfall experienced in year t defined as the downward deviation from the trend value calculated as the five-year moving average centred in year t. When the amount of the drawing was calculated, the values of export earnings in the two post-shortfall years were not known. Initially, these values were derived from a formula. In 1975, it became clear that the application of the formula led to unsatisfactory results and, after a series of the Board meetings, the facility was

[5] IMF, Pamphlet Series No. 34, page 3.

revised and the formula was replaced by "judgmental forecasts". Following the decision adopted December 24, 1975, 53 purchases were made in 1976 and 1977. By April 1980, the actual value of export earnings in the two post-shortfall years was known for these 53 drawings and it was possible to compare the amounts drawn in these two years with the amounts which members would have drawn with perfect foresight. The results are summarized in the following quote:

"In 37 of these (53 purchases), the amounts purchased would have been unchanged if the forecasts had been completely accurate; in 11 instances members were overcompensated because post-shortfall earnings had been overestimated, and in the remaining 5 cases members were undercompensated because post-shortfall earnings had been underestimated. The total amount drawn in these 53 cases was SDR 2.5 billion; it would have been SDR 2.3 had there been no forecasting errors.

One country accounted for more than a third of total overcompensation and another for almost two thirds of total undercompensation. For the first country, growth of 13.8 percent a year had been projected for the two post-shortfall years, but actual growth was only 11.2 percent a year. For the second country, growth of 15.4 per cent had been projected, but the actual growth rate was 19.9 per cent a year." [6]

This comparison suggests that forecasts may be used to estimate the medium term trend. A forecast by the AICB could be affected by pressures for raising the floor price. This bias would be eliminated by relying on forecasts made by neutral agencies (such as the World Bank, the IMF or ICAC).

1.3 Simulations

The model contains 14 parameters which can take various numerical values.

Seven of them affect the 2006/07 -2022/23 price series: five define the amplitude of the shock in 2006/07 and the four following years, one defines the price trend and the other the production trend.

The other seven characterize the smoothening strategy: two define the size of the tunnel (positioning of the floor and the ceiling in relation to the trend); three define the maximum size of the fund as percentage of production valued at trend prices and the levels of endowment in 1997/98 and 2004/05 ; the last two define the fund replenishment coefficients which are a function of the level of the fund reached at the end of the previous year and the surplus of the current year.

The model can be solved by starting with a surplus year or with two deficit years. It can be solved by assuming perfect or imperfect foresight.[7]

[6] "Compensatory Financing Facility" Louis M. Goreux, Pamphlet Series No. 34, pages 30 and 31, IMF.
[7] The model consists of five spread-sheets. The first provides monthly values of Index A in US cents per pound and the exchange rate. The second provides the trend value FOB in CFAF per kg of fiber and the corresponding value of producer price per kg of seed cotton before smoothening (Table 2A). In the third

Three types of simulations are reported here. The first deals with the size of the tunnel, the second with the size of the fund and the third with the impact of shocks and forecasting errors.

2. Size of the tunnel (**Table 6)**

The tunnel selected (-5.1% to 1.32%) is compared with a wider one (-8% to 2%) and a narrower one (-1.5% to 0.4%). The model is solved with a flat price trend and one declining by 1% a year, starting with two deficit years in one case and one surplus year in the other. This leads to the 24 simulations reported in Table 6.

With a flat price trend, the floor price is equal to CFAF 165 in 2006/07 and at the end of the projection period when the medium size of tunnel selected (Table 6). The floor price is lower when the tunnel is wider and higher when the tunnel is narrower. When the price trend starts declining by 1% a year in 2006/07, the floor price declines by CFAF 2 in that year and by CFAF 19 by the end of the projection period.

In all cases, the smoothening effect is much greater with a narrow than with a wide tunnel (Chart 2). When the tunnel becomes narrower, a number of observations previously inside the tunnel fall below it, the frequency of deficits increases (from 36% to 50% in one case and from 32% to 52% in the other) , an increasing share of the deficits is covered by the credit line and drawings from the credit line increase sharply. Because resources held in the fund are remunerated at 6% while 9% is charged on credit line drawings, the interest balance become negative when more than 40% of all resources immobilized in the scheme are drawn from the credit line. In all cases, when the tunnel becomes narrower, the interest balance declines, which means that financial charges increase.

When operations start with two deficit years instead of a surplus year, the credit line is used more frequently and covers a larger part of the deficit. Because a larger part of the surplus is used to clear the credit line, a smaller part is available for distribution; it accounts for 41% to 50% with a wide tunnel, 18% to 29% for the tunnel selected and for 5% to 15% with the narrow tunnel.

The wide tunnel was not selected because the smoothening effect was too small. The narrow tunnel was not selected either because the risk of large drawings from the credit line was too high: the two largest drawings were twice as big with the narrow tunnel as they were with the selected one. Such a risk could not be encountered in view of the tight financial situation of cotton companies. Moreover, the share of earnings distributed was lower than considered as desirable by producers and companies.

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sheet, the first three years are inverted so that a deficit occurs in the first two years of operations. The fourth sheet provides the coefficient of fund replenishment. The fifth is the model proper which contains about 70 columns.

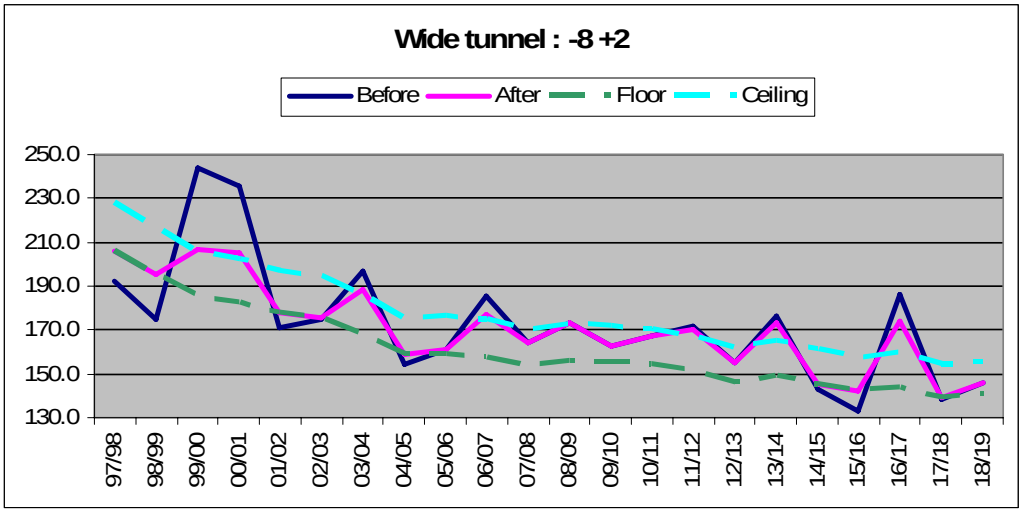
Table 6: Wide, selected and narrow tunnels with flat and declining price trends starting with 2 deficits and one surplus years

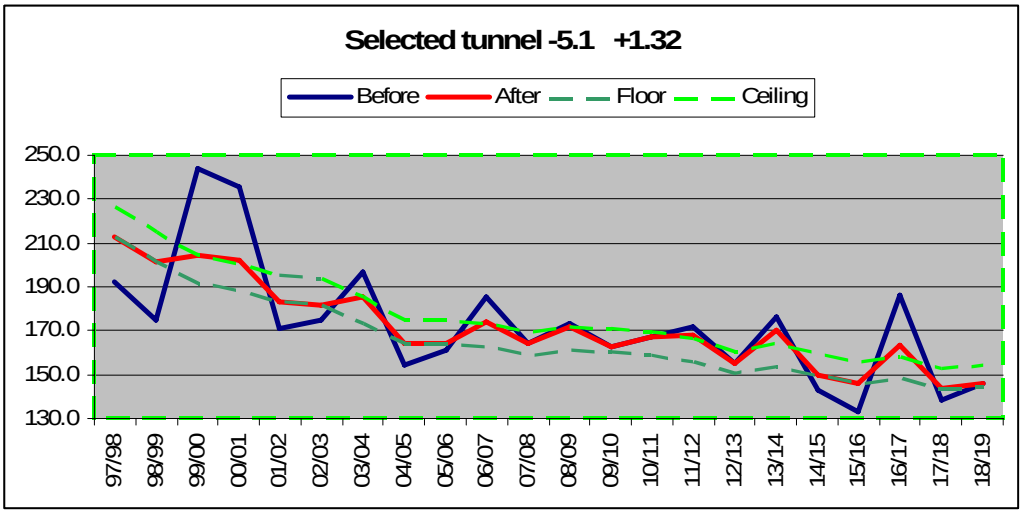
Maximum fund size equal to 10% of cotton production valued at trend price of previous year and no initial fund endowment

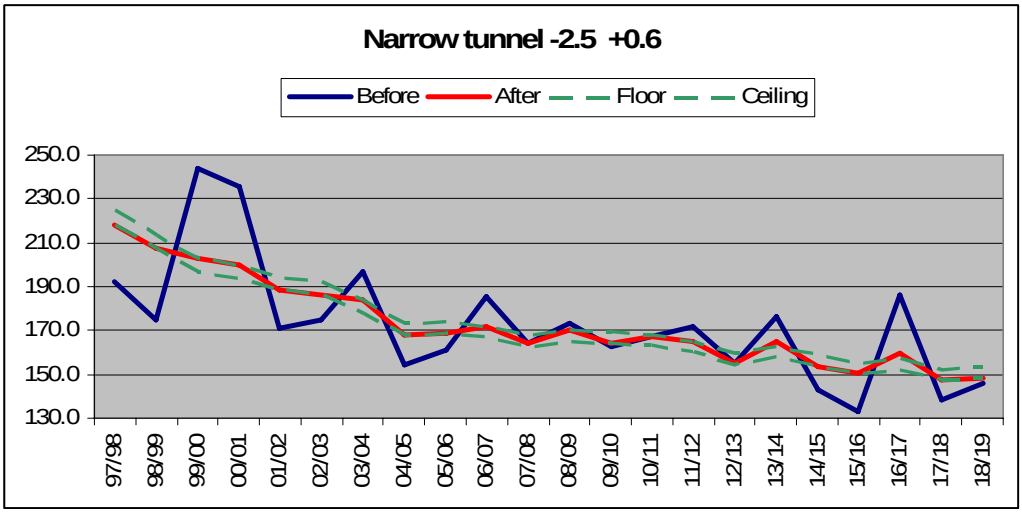
		Deficits years 1 and 2, surplus year 3						**Surplus year 1, deficits years 2 and 3**					
		Flat			**Declining**			**Flat**			**Declining**		
Floor below trend line	**%**	**8**	**5.1**	**2.5**	**8**	**5.1**	**2.5**	**8**	**5.1**	**2.5**	**8**	**5.1**	**2.5**
Ceiling above trend line	%	2	1.32	0.6	2	1.32	0.6	2	1.32	0.6	2	1.32	0.6
Price trend decline starting in 06/07	% per year	1	1	1	0.99	0.99	0.99	1	1	1	0.99	0.99	0.99
Reduction in variance	**%**	**68.4**	**85.4**	**94.4**	**69.5**	**85.3**	**94.7**	**64.6**	**80.8**	**91.3**	**65.6**	**80.5**	**94.7**
06/07 floor level	CFAF/ kg seed cotton	160	165	169	158	163	167	160	165	169	158	163	167
16/17 - 18/19 average floor	CFAF/ kg seed cotton	160	165	170	141	146	149	160	165	170	141	146	149
Average fund resources	Billions CFAF	12.5	7.3	1.8	12.2	7.6	1.9	14.1	10.0	4.3	13.8	10.3	4.5
Average Cred Line drawing	Billions CFAF	1.1	3.7	12.7	1.1	3.4	10.8	0.0	1.3	3.8	0.0	1.0	2.9
Average total use of resources	Billions CFAF	13.6	11.0	14.5	13.3	11.1	12.7	14.1	11.3	8.1	13.8	11.4	7.5
Average gain from interest	Billions CFAF	2.4	-2.9	-12.6	2.6	-2.2	-11.4	6.1	3.2	-0.9	6.2	3.8	0.0
Closing gain from interest	Billions CFAF	12.1	0.9	-21.8	12.0	2.0	-18.4	16.6	9.2	-1.6	16.4	10.3	0.4
Maximum drawing from credit line	**Billions CFAF**	**18**	**24**	**41**	**18**	**24**	**35**	**0**	**17**	**35**	**0**	**15**	**31**
Frequency of	%	100	100	100	100	100	100	100	100	100	100	100	100
Deficit	**%**	**36**	**41**	**50**	**36**	**41**	**50**	**32**	**36**	**50**	**32**	**36**	**50**
Tunnel	**%**	**27**	**23**	**14**	**27**	**23**	**14**	**32**	**27**	**14**	**32**	**27**	**14**
Surplus	%	36	36	36	36	36	36	36	36	36	36	36	36
Credit line use	%	9	27	50	9	27	50	0	18	32	0	18	27
Share of deficit covered by	%	100	100	100	100	100	100	100	100	100	100	100	100
Fund	%	66	45	25	65	46	27	100	67	52	100	71	55
Credit line	**%**	**34**	**55**	**75**	**35**	**54**	**73**	**0**	**33**	**48**	**0**	**29**	**45**
Share of surplus going to	%	100	100	100	100	100	100	100	100	100	100	100	100
Clearing credit Line	%	11	36	71	12	37	69	0	20	42	0	17	38
Fund replenisment	%	48	43	24	46	45	26	52	55	45	50	54	47
Distribution	**%**	**41**	**20**	**5**	**42**	**18**	**5**	**48**	**26**	**13**	**50**	**29**	**15**

Chart 2: The wide, selected and narrow tunnels

Deficits in years 1 and 2, price trend declining by 1% a year, production increasing by 5% a year, maximum fund size 10%, no initial endowment.







3. Size of the fund and of the credit line (Table 7)

Since the first set of simulations suggested that the size of the tunnel selected was about right, this size has been retained in the following simulations. In the ten simulations reported in table 7, the price trend declines by 1% a year and production rises by 1% a year starting from 2006/07. In the first simulation, the maximum size of the fund is equal to 10% of the production valued at trend prices and the fund does not receive any initial endowment. In the second simulation, the maximum size is unchanged, but the fund receives an initial endowment equal to 5% of the production value. Maximum size and initial endowment are both raised by 5 percentage points when going from the second to the third simulation, from the third to the fourth simulation and from the fourth to the fifth simulation.

Let us start with the first set of five simulations, when deficits occur in the first and in the second year of operations (upper part of Table 7). When the fund size increases, the smoothening effect does not improve; the amount drawn under the credit line declines but the decline does not offset the increase in the use of fund resources; as a result, the total amount immobilized in the smoothing scheme rises by 40% from the left to the right of table 7. In each case, the largest amount outstanding under the credit line occurs in year 3 after two consecutive shortfalls. In that year, the debit position reaches CFAF 23.9 b without initial endowment and this position is reduced by CFAF 3.8 b each time the endowment is raised by that amount.

When the surplus occurs in year 1 instead of year 3 (lower part of Table 7), the smoothening effect is significantly lower; drawings under the credit line are considerably reduced, but the reduction is more than compensated by the increase in fund resources. When the level of initial endowment is raised from 5% to 15%, the credit line ceases to be used and the average amount resources standing in the fund increases by 75%.

The comparison between the first two columns in the upper part of Table 7 deserves particular attention because it illustrates the consequences of a choice that partners may have to make before March 2007. [8] The comparison is relevant with two assumptions. First, the 2006/07 exercise ends up with a sizable deficit which cotton companies cannot finance in view of their tight financial situation. Second, the deficit can be financed externally and an external credit line has been established. Given these two assumptions, should the deficit be financed only by drawing on the credit line (column 1) or by combining a grant to the fund (called initial endowment in the model) with a drawing on the credit line (column 2)?

[8] It is not known at this stage whether fund resources will be held in CFAF or in euros and whether endowments will be in the form of grants, soft loans or commercial loans and average rates would vary considerably depending on the assumptions made. An interest balance was calculated for information assuming 6% remuneration on credit positions and 9% on debit positions, but this balance was not integrated in the levels of the fund and the credit line reported here. The simulations results assume endowments are grants and drawings are interest free.

A comparison between the scenarios with and without endowment is presented in Table 7A for the first five years of operations. In both cases, the credit line has to be used in each of the first three years: in year 1, the CFAF 3.8 b endowment is not large enough to cover the deficit; in year 2, the deficit has to be entirely financed by drawing on the credit line and, in year 3, the surplus is not large enough to clear the credit line. By the end of year 3, the outcomes of the two scenarios are the same: producers have received the same price and partners have disbursed the same amount.

The situation changes in year 4 when credit lines are cleared in both scenarios. In the scenario without endowment, partners have been fully repaid. In the other scenario, they have disbursed CFAF 3.8 b in extending the grant. What happens to these CFAF 3.8 billions? The amount is used to raise fund reserves by CFAF 1.7 b and to increase distributions to producers and cotton companies by CFAF 2.1 b. Because fund reserves are higher in the endowment scenario, the deficit occurring in year 5 can be covered without drawing on the credit line, while CFAF 0.6 b has to be drawn from the credit line in the scenario without endowment. But the amount distributed has gone out of the system; it cannot be used anymore to lower drawings on the credit line when deficits will occur.

The difference between the scenario with a CFAF 3.8 b endowment and the scenario without appears on Table 7B. It shows that the initial endowment may result into lower drawings on the credit line, higher fund reserves and/or larger distributions to producers and cotton companies. In each year, the endowment is equal to the sum of the three items. But in this identity, the first two items measure yearly changes because an increase in fund reserves may permit to lower drawings in later years, while the third item measures cumulated amounts because when money has been distributed it has gone out of the system. In year 4, 55% of the initial endowment is lost. The next loss occurs in year 10 and the last in year 19. By then, the sum of the increases in distributions reaches the amount initially endowed and the two scenarios merge together. With different sets of fluctuations and different parametrical values, losses would occur in different years. But the initial endowment will ultimately be consumed and we return to square one.

Obviously, producers and cotton companies would be better off with a grant than with a drawing which would have to be repaid as soon as a surplus arises. But the grant would not provide a perennial solution and it could be too small to cover large deficits. The external credit line would provide a better solution, as appears from a comparison between the present values of the costs incurred by partners in the two scenarios. Using a 7% interest rate on drawings outstanding and a 7% discount rate, the present value of the drawings made over the 22 year period would amount to CFAF 4 b in the scenario without endowment. This cost is virtually the same as that of the scenario with a CFAF 3.8 b endowment and, in that case, a sizable credit line is still needed.

The present value of drawings would be lower if large drawings were made towards the end instead of the beginning of the period; but an external credit line would be unlikely to be established at a time when its need is not clearly perceived. This is why the test was made when sizable deficits occur in the first two years (top of Table 7).

Table 7 : Effect of raising maximum fund size and initial endowment

Tunnel -5.1% +1.32, Production rising 1% a year and price trend falling 1% a year

Maximum size of the fund	% cot prod valued at trend price	10	10	15	20	25
Initial fund endowment made in 1997/98	% cot prod valued at trend price	0	5	10	15	20
Initial fund endowment made in 1997/98	Billions CFAF	0	3.8	7.7	11.5	15.3
		Deficits in years 2 and 3, surplus in year 3				
Reduction in variance	**%**	**85.9**	**85.3**	**85.5**	**85.3**	**85.0**
Average fund resources valued at current prices	Billions CFAF	5.6	6.3	9.5	10.7	12.3
Average Cred Line drawing valued at current prices	Billions CFAF	3.5	2.7	1.5	0.9	0.6
Average total use of resources valued at cur prices	**Billions CFAF**	**9.1**	**8.9**	**10.9**	**11.6**	**12.8**
Maximum drawing	**Billions CFAF**	**23.9**	**20.1**	**16.3**	**12.4**	**8.6**
Share of deficit covered by	%	100.0	100.0	100.0	100.0	100.0
Fund	%	40.5	49.5	67.9	76.5	85.3
Credit line	%	59.5	50.5	32.1	23.5	14.7
Frequency of						
Drawing on credit line	%	31.8	27.3	22.7	18.2	13.6
Credit line debit position	%	36.4	31.8	22.7	18.2	13.6
Reaching fund maximum	%	36.4	9.1	22.7	18.2	13.6
Share of surplus distributed to producers and CC	%	**19.2**	**22.4**	20.5	21.6	22.8
		Surplus in year 1, deficits in years 2 and 3				
Reduction in variance	**%**	**78.3**	**78.3**	**80.7**	**81.5**	**81.8**
Average fund resources valued at current prices	Billions CFAF	9.8	9.8	15.1	18.2	20.7
Average Cred Line drawing valued at current prices	Billions CFAF	0.6	0.6	0.1	0.0	0.0
Average total use of resources valued at cur prices	**Billions CFAF**	**10.5**	**10.4**	**15.2**	**18.2**	**20.7**
Maximum drawing	**Billions CFAF**	**5.9**	**5.9**	**1.4**	**0.0**	**0.0**
Share of deficit covered by	%	100.0	100.0	100.0	100.0	100.0
Fund	%	78.5	78.2	96.9	100.0	100.0
Credit line	%	21.5	21.8	3.1	0.0	0.0
Frequency of						
Drawing on credit line	%	18.2	18.2	9.1	0.0	0.0
Credit line debit position	%	18.2	18.2	9.1	0.0	0.0
Reaching fund maximum	%	18.2	18.2	9.1	0.0	0.0
Share of surplus distributed to producers and CC	%	**45.0**	**47.7**	42.8	42.3	42.6

Table 7A:Effect of a CFAF 3.8 billion endowment

Tunnel -5.1 +1.32, production increasing 1% and price trend declining 1% a year, max fund size 10%, deficits in first two years.

	Deficit	Financing deficit by		Cred Line	Surplus	Using suplus for			Fund	Producer price	
		Fund	Credit Line	level		Clearing CL	Replenishing	Distribution	level	Before	After
	CFAF billions									CFAF/kg seed cotton	
Endowment CFAF 3.8 billion											
97/98	-11.3	3.8	7.5	7.5	0.0	0.0	0.0	0.0	0.0	192.0	212.4
98/99	-12.6	0.0	12.6	20.1	0.0	0.0	0.0	0.0	0.0	175.0	201.7
99/00	0.0	0.0	0.0	3.1	17.0	17.0	0.0	0.0	0.0	243.7	204.4
00/01	0.0	0.0	0.0	0.0	16.0	3.1	9.0	3.9	9.0	235.7	203.3
01/02	-7.9	7.9	0.0	0.0	0.0	0.0	0.0	0.0	1.1	170.7	183.3
No endowment											
97/98	-11.3	0.0	11.3	11.3	0.0	0.0	0.0	0.0	0.0	192.0	212.4
98/99	-12.6	0.0	12.6	23.9	0.0	0.0	0.0	0.0	0.0	175.0	201.7
99/00	0.0	0.0	0.0	6.9	17.0	17.0	0.0	0.0	0.0	243.7	204.4
00/01	0.0	0.0	0.0	0.0	16.0	6.9	7.3	1.8	7.3	235.7	202.0
01/02	-7.9	7.3	0.6	0.6	0.0	0.0	0.0	0.0	0.0	170.7	183.3
CFAF 3.8 b endowment minus no endowment											
97/98	0.0	3.8	-3.8	**-3.8**	0.0	0.0	0.0	**0.0**	**0.0**	0.0	0.0
98/99	0.0	0.0	0.0	**-3.8**	0.0	0.0	0.0	**0.0**	**0.0**	0.0	0.0
99/00	0.0	0.0	0.0	**-3.8**	0.0	0.0	0.0	**0.0**	**0.0**	0.0	0.0
00/01	0.0	0.0	0.0	**0.0**	0.0	-3.8	1.7	**2.1**	**1.7**	0.0	**1.3**
01/02	0.0	0.6	-0.6	**-0.6**	0.0	0.0	0.0	**0.0**	**1.1**	0.0	0.0

Table 7B: Effect of an initial CFAF 3.8 billion endowment

Tunnel -5.1 +1.32, production increasing 1% and price trend declining 1% a year, max fund size 10%, deficits in the first two years

	Distribution cummulated	Lower drawings 0n Credit Line	Higher fund Reserves	Use of initial endowment
	CFAF billions			
97/98	0.0	3.8	0.0	3.8
98/99	0.0	3.8	0.0	3.8
99/00	0.0	3.8	0.0	3.8
00/01	2.1	0.0	1.7	3.8
01/02	2.1	0.6	1.1	3.8
02/03	2.1	1.7	0.0	3.8
03/04	2.1	0.0	1.7	3.8
04/05	2.1	1.7	0.0	3.8
05/06	2.1	1.7	0.0	3.8
06/07	2.4	0.0	1.4	3.8
07/08	2.4	0.0	1.4	3.8
08/09	2.5	0.0	1.3	3.8
09/10	2.5	0.0	1.3	3.8
10/11	2.5	0.0	1.3	3.8
11/12	2.8	0.0	1.0	3.8
12/13	2.8	0.0	1.0	3.8
13/14	3.5	0.0	0.4	3.8
14/15	3.5	0.0	0.4	3.8
15/16	3.5	0.4	0.0	3.8
16/17	3.8	0.0	0.0	3.8

An appreciation of the euro in relation to the dollar would penalize the cotton sector which provides 75% of Burkina's export earnings. Burkina could qualify for a drawing under the new IMF exogenous shock facility and the amount drawn could be used to finance the cotton credit line. A drawing of 18 million euro would obviously not affect the liquidity position of the IMF, or that of any financial agency contributing to the financing of the credit line. What would have been a large price risk for the cotton sector in Burkina would have been spread among agencies encountering risks unrelated to the fluctuations of world cotton prices expressed in euros.

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4. Shocks and forecasting errors (Table 8)

It has been assumed so far that price fluctuations in the 16 years starting in 2006/07 would be the same as they were in the 12 preceding years. Since it is unlikely to occur, the impact of a shock has to be simulated. The shock consists in reducing the previous value of Index A (expressed in CFAF) by 15% in both 2006/07 and 2007/08. Historically, the lowest value of Index A (expressed in CFAF) occurred in 2004/05; with the shock, the 2007/08 value of Index A falls 10% below its historical 2004/05 low. In one case, the shock ends in 2007/08 and prices return to pre-shock levels in 2008/09 (Chart 3) . In the other case, the 2006/07 and 2007/08 price falls are reversed in the three following years (Chart 4).

Chart 3 :Impact of a reversible price shock

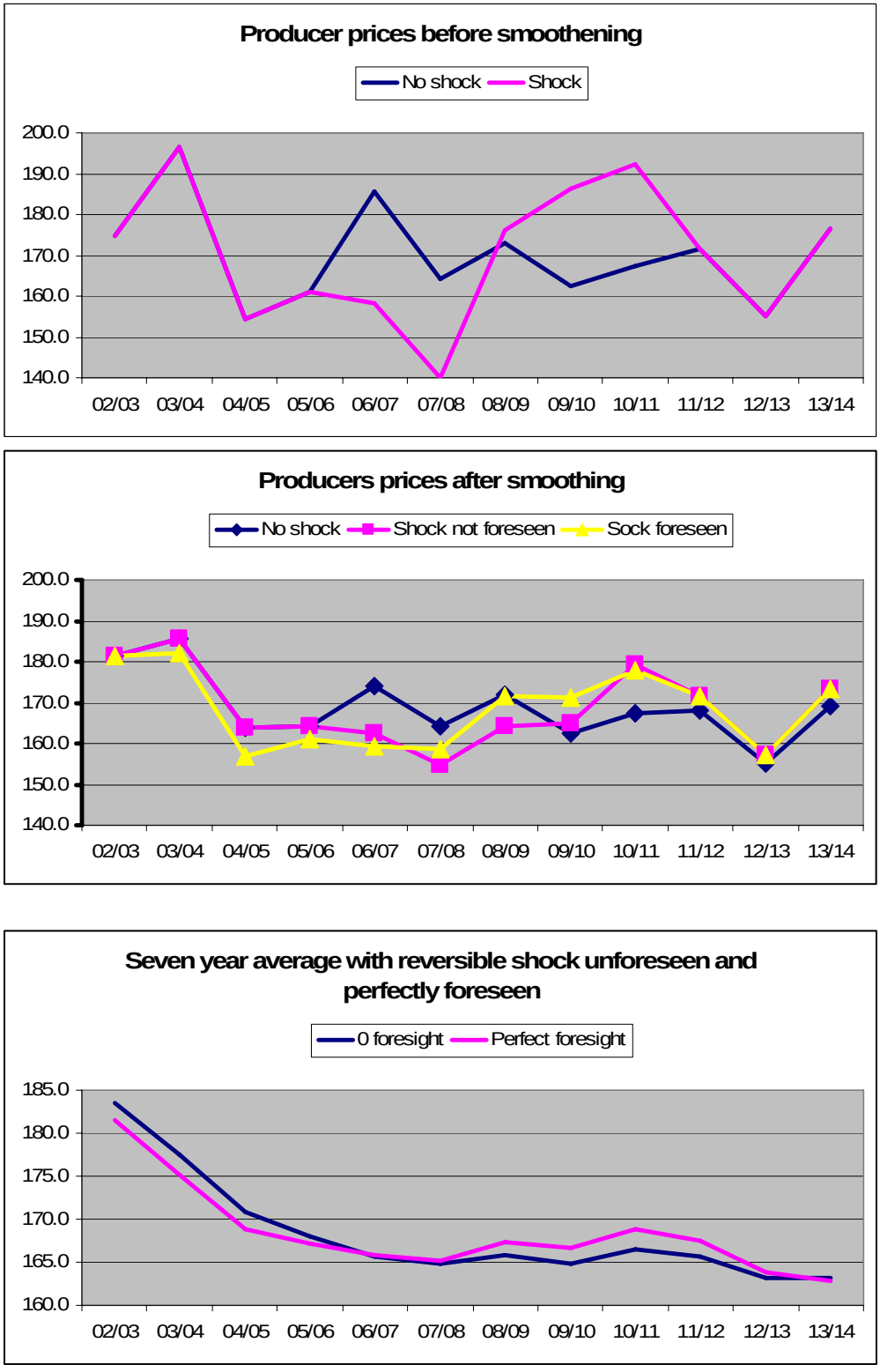
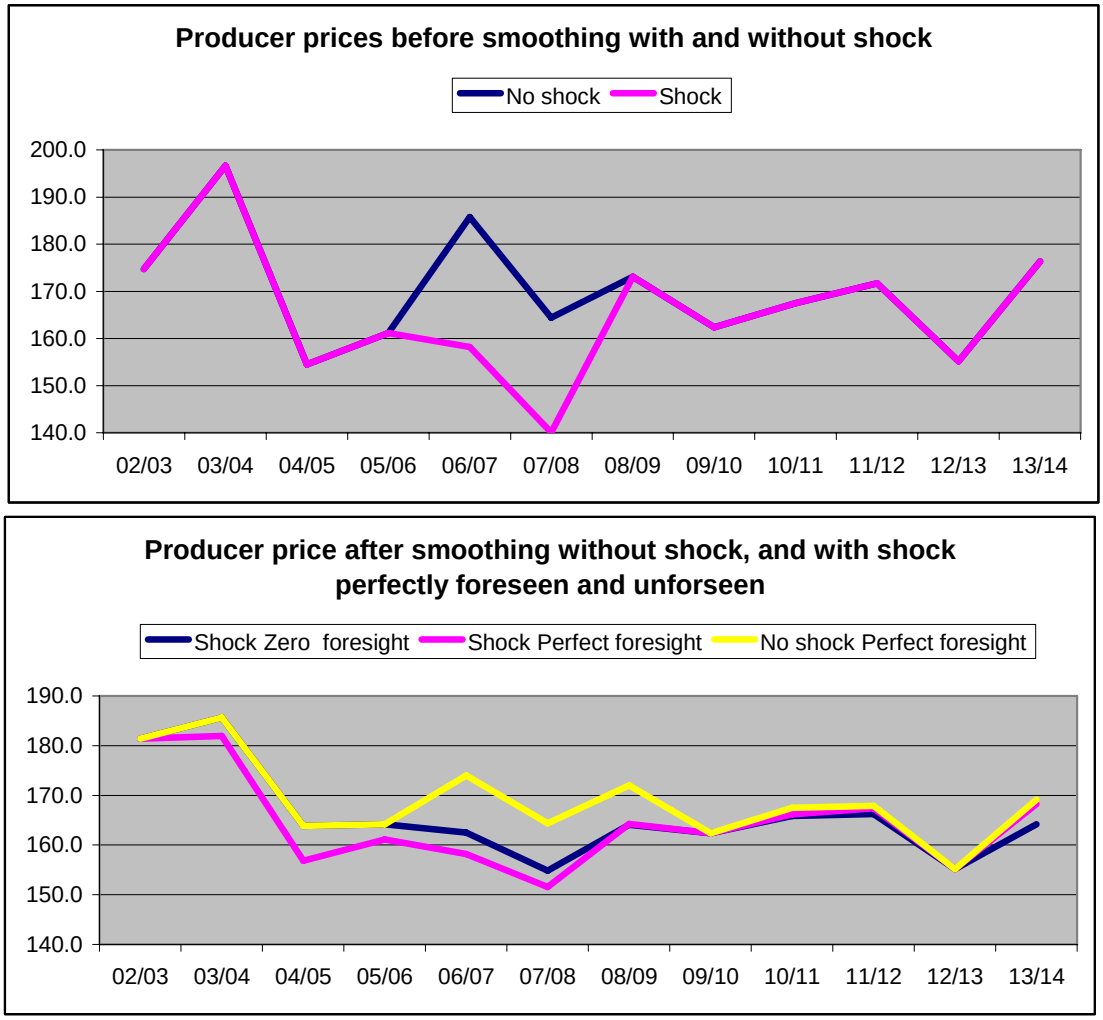


Chart 4: Impact of a non-reversible price shock



The reversible shock could result from a temporary increase in the dollar value of the euro. From an equilibrium value of 1.15, the euro would rise to 1.35 in 2006/07 and 2007/08, falls to 1.13 in 2008/09 and to 0.98 in 2009/10 and 2010/11 before returning to pre-shock levels. This would be the typical reversible exogenous shock for which the new IMF facility was designed.

Table 8: Effects of shocks and forecasting errors

Selected tunnel, no production increase from 2005/06, price trend declining 1% a year, maximum fund size 10%, no initial endowment

Floor below trend line	%	-5.1	Reversible Price shock			Non Reversible	
Ceiling above trend line	%	1.32	06/07	-15%		-15%	
Production increase starting in 06/07	% per year	0	07/08	-15%		-15%	
Price trend decline starting in 06/07	% per year	-1	08/09	1.78%		0	
Maximum size of the fund	% cot prod valued at trend price	10	09/10	15%		0	
Initial fund endowment	% cot prod valued at trend price	0	10/11	15%		0	
		No shock	Reversible Shock			Non Reversible shock	
			Foreseen	Half forese	Unforeseer	Foreseen	Unforeseer
		Deficit in first two years					
Reduction in variance	%	86.1	84.9	85.4	85.7	86.3	90.2
Average total use of resources	Billions CFAF	9.0	11.4	11.5	13.1	8.2	11.8
Average outstanding under credit line	Billions CFAF	3.1	3.8	4.3	6.0	2.9	10.4
Maximum outstanding under credit line	Billions CFAF	23.9	23.9	24.8	33.3	23.9	33.3
Share of deficit covered by credit line	%	56.1	54.9	57.7	61.9	55.5	80.1
Frequency of drawing on credit line	%	27.3	22.7	31.8	36.4	22.7	40.9
Frequency of credit line debit position	%	31.8	31.8	45.5	45.5	27.3	68.2
		Surplus in first year					
Reduction in variance	%	79.9	78.6	78.7	78.4	80.4	85.7
Average total use of resources	Billions CFAF	9.8	10.7	10.1	10.7	9.7	11.1
Average outstanding under credit line	Billions CFAF	0.6	1.6	1.7	2.9	0.7	4.5
Maximum outstanding under credit line	Billions CFAF	5.1	15.5	19.7	27.7	5.5	27.7
Share of deficit covered by credit line	%	21.2	32.8	36.8	43.0	22.8	45.4
Frequency of drawing on credit line	%	18.2	13.6	13.6	27.3	13.6	27.3
Frequency of credit line debit position	%	18.2	18.2	18.2	31.8	13.6	40.9

The impact of the shock is assessed by solving the model in four ways.[9] In scenario 1 the model is solved without shock to provide the reference basis. In the three other scenarios, a shock occurs but it is perceived in three different ways. In scenario 2 (perfect foresight), the shock is accurately foreseen and the floor price is set accordingly. In scenario 3 (imperfect foresight), the shock is perceived but only half of its amplitude is foreseen. In scenario 4 (no foresight), the shock is unforeseen and it is taken into account only after it has occurred.

The most interesting finding is that smoothening is almost as good with shock as without shock and that smoothening may even be better when the shock is not foreseen than when it is foreseen (Charts 3 and 4, and Table 8). This occurs with a reversible shock because the downward shift in the medium term price trend is slightly reduced before the shock when the shock is not foreseen and the opposite occurs after the shock (lower part of Chart 3). With a non-reversible shock, the residual variance with the shock foreseen is only 64% of what it is when the shock is accurately foreseen. But there is a price to pay: much larger amounts have to be drawn from the credit line.

With a non-reversible shock, the price downfall is reduced and the smoothing effect improved when the shock is not foreseen, but drawings on the credit line greatly increase (Chart 4 and Table 8). The model reacts well to shocks but requires a solid externally funded credit line. In most simulations, the credit line is clear two years out of three.

With perfect foresight, the floor price starts being reduced three years before the shock occurs. With no foresight, the shock is not foreseen and the floor price starts being reduced one year after the shock. Once the shock is over, floor prices become the same in both cases. With a five year reversible shock, the floor price is lower with perfect foresight than with zero foresight in the first four years and the opposite occurs in the next four years (Table 9). While the impact of the shock on the floor price is exactly reversed, the same does not apply to fund levels, drawings and distributions. Those are affected by the level of the fund before the shock and by limits on fund size. [10]

[9] Following the selections made in the two previous series of experiments, the model is solved with the medium tunnel size (-5.1% and +1.32%), a 10% maximum fund level and no initial endowment. From 2005/06, the price trend declines by 1% a year and production remains unchanged. In previous experiments, production was declining; it was assumed to remain flat here to illustrate the impact of a fully reversible shock. As before, the model is solved with deficits in the first two years in one case and with a surplus in the first year in the other case.

[10] Calling At the average value of Cotlook Index A expressed in CFAF in year t and
Tt = (1/7)*(At-3 + At-2 + At-1+ At + At+1 + At+2 +At+3) the trend value in year t, Tt=Tt+1 would require At+4 = At-3.

Table 9: Impact of not being able to forecast the shock

Selected tunnel, no production increase from 2005/06, price trend declining 1% a year, maximum fund size 10%, no initial endowment, deficit in the first two years.

	Shock unforeseen minus shock perfectly foreseen			
	Price used for 7 year average	Trend used for setting floor	Fund level + Credit line -	Producer price after smoothing
	CFAF/kg fiber		CFAF billions	CFAF/kg seed c.
02/03	0	0	0	0
03/04	0	**15.6**	**-2.7**	**3.7**
04/05	0	**29.4**	**-10.1**	**7.0**
05/06	0	**27.6**	**-13.8**	**3.0**
06/07	**109.1**	**14.0**	**-18.0**	**3.4**
07/08	**96.4**	**-15.6**	**-13.4**	**-3.7**
08/09	**-12.0**	**-29.4**	**-4.0**	**-7.5**
09/10	**-95.2**	**-27.6**	**4.1**	**-6.6**
10/11	**-98.3**	**-14.0**	**0.1**	**1.5**
11/12	0	0	**0.1**	0
12/13	0	0	**0.1**	0
13/14	0	0	0	0
Total	**0**	**0**	**-57.8**	**0.8**

5. Cost of the credit line

It has been shown that financing a credit line would be less costly than extending a grant to the fund. The cost of the credit line appears on table 10 for nine different scenarios in terms of present values with a 7% discount rate. It is assumed that drawings are provided interest free and that providers incur a cost of 7 % a year on the amounts outstanding. In the last scenario, operations start with a surplus year while they start with two deficit years in the previous eight scenarios.

With the wide tunnel (first column), the credit line is used only in the first three years. With the narrow tunnel (third column) it is used in every year but three and the present value reaches its highest level (CFAF 10.7 b or euros 16.3 m).

The medium size tunnel is retained in the six following columns with a shock starting in 2006/07. The shock is reversible in the fourth and fifth columns and non-reversible in the last four columns. With a shock starting in 2006/07, drawings with zero foresight start exceeding drawings with perfect foresight in 2004/05; for this reason present values in 2004/05 have also been calculated. The maximum (CFAF 10 b or euros 15.3 m) is reached for non reversible shock with zero foresight.

In the penultimate column, a grant (equivalent 5% of the value of current production) is made in 2004/05. The CFAF 9 b grant reduces the 2004/05 present value of the series of drawings from CFAF 9.3 b to CFAF 6.3 b or CFAF 3 b, which is only one third of the present value of the grant. This confirms the fact that the credit line is more cost efficient than the grant from the donors' view point.

The last column differs from the previous one by starting operations in a surplus year instead of two deficit years which considerably reduces the present value of drawings.

Table 10: Drawings on credit line and present values with a 7% discount rate in billions CFAF

	Amount outstanding under credit line								
	Size of tunnel			Sh rev def1, 10%, 0		Non reversible		N rev NF,06 endow,	
	Wide	Medium	Narrow	no forec	perf for	no forec	perf for	5% def 1,2	5% surp 1
97/98	7.78	11.35	14.54	11.35	11.35	11.35	11.35	11.35	0.00
98/99	17.50	23.95	29.72	23.95	23.95	23.95	23.95	23.95	0.00
99/00	1.14	6.92	12.07	6.92	6.92	6.92	6.92	6.92	3.78
00/01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/02	0.00	0.57	7.88	0.57	0.57	0.57	0.57	0.57	0.00
02/03	0.00	5.07	15.69	5.07	5.07	5.07	5.07	5.07	0.00
03/04	0.00	0.00	7.05	0.00	0.00	0.00	0.00	0.00	0.00
04/05	0.00	7.28	21.61	7.28	0.00	7.28	0.00	0.00	0.00
05/06	0.00	10.96	30.66	10.96	0.00	10.96	0.00	1.98	0.00
06/07	0.00	0.00	14.21	16.32	0.00	16.32	0.00	7.34	0.23
07/08	0.00	0.00	14.21	34.95	21.67	34.95	11.64	25.97	18.85
08/09	0.00	0.00	10.83	19.79	15.98	23.62	0.32	14.64	7.53
09/10	0.00	0.00	13.46	0.00	0.00	23.62	0.32	14.64	7.53
10/11	0.00	0.00	13.46	0.00	0.00	21.53	0.00	12.55	5.44
11/12	0.00	0.00	4.86	0.00	0.00	14.45	0.00	5.47	0.00
12/13	0.00	0.00	4.86	0.00	0.00	14.45	0.00	5.47	0.00
13/14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14/15	0.00	0.00	4.12	0.00	0.00	8.03	0.00	0.50	0.00
15/16	0.00	9.99	27.07	6.81	6.93	25.59	10.83	18.06	5.91
16/17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17/18	0.00	0.00	1.79	0.00	0.00	0.00	0.00	0.00	0.00
18/19	0.00	0.00	5.95	0.00	0.00	0.00	0.00	0.00	0.00
	Present values of the cost of drawings calculated from 97/98 and 04/05								
97/98	1.76	4.04	10.68	6.50	4.51	9.31	3.73	6.33	1.68
04/05	0.00	1.56	8.75	5.50	2.32	10.02	1.06	5.24	2.32

Table 10A: Parameters used in the simulations reported in table 10

Endow 04/								5	5
Frecasting				0	1	0	1	0	0
Shock 06/				-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
Shock 07/				-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
Shock 08/				0.017782	0.017782				
Shock 09/				0.15	0.15				
Shock 10/				0.15	0.15				
Floor	8	5.1	2.5	5.1	5.1	5.1	5.1	5.1	5.1
Ceiling	2	1.32	0.6	1.32	1.32	1.32	1.32	1.32	1.32
Production	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Trend price	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Size fund	10	10	10	10	10	10	10	10	10
Init Endow	0	0	0	0	0	0	0	0	0

With the medium size tunnel, the present value of drawings reaches a peak of CFAF 10 b (euros 15.3 m) with a non reversible shock and zero foresight assuming the amount outstanding in the credit line costs 7% to partners who do earn any interest on the outstanding amounts. If the AICB had been charged 7% on the amounts outstanding, partners would not have incurred any cost. Could the credit line operation be carried out by a commercial bank?

In the sixth column, the line is used for 9 consecutive years and the amount outstanding reaches euros 53 m in 2007/08. It is unlikely that a commercial bank would enter into such an operation, unless a strong institution provided a repayment guaranty for most of the principal or the bank charged a very high risk premium which would render the scheme unfeasible.

The present value has been calculated assuming that drawings were interest free, which is unlikely to be the case; it is nevertheless useful since it provides an upper limit for present values. If the government received a concessional loan or a grant to finance the cotton credit line, the government in conjunction with donors may decide lending the money at a rate close to prevailing market rates with the margin remaining as treasury's revenues.

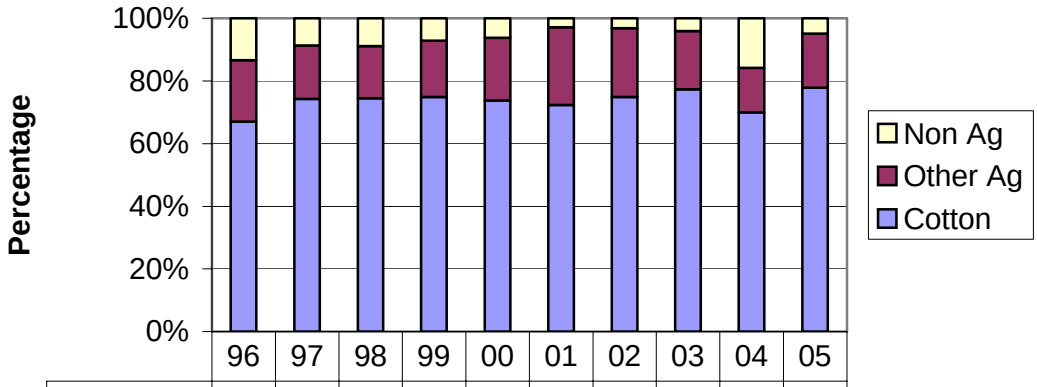
The present values appearing in Table 10 are not alarming; the risk of the credit line not being cleared is the problem. This is why the scheme has to be fully transparent and partners have to be convinced that the scheme can work and will contribute to poverty reduction.

Annex II: Diversification and productivity improvement

1. Diversifying from cotton

It has been argued that Burkina should diversify from cotton because it became too dependant from it. Burkina did try to diversify with the assistance of partners, but without much success. The share of exports of agricultural commodities other than cotton in total export earnings declined from 25% in 2001 to 14% in 2004 and 17% in 2005 (Chart 1-1 by S. Konate and D. Wilkock).[11] With cotton export earnings five times those from all other agricultural commodities, a substantial fall in cotton exports cannot be compensated in the short term by an increase in exports of other agricultural commodities. Moreover a fall in cotton production may lead to a reduction in maize production which largely relies on fertilizers acquired through the cotton credit. In a five-year horizon, the opening of gold mines will provide the largest gain in gross export earnings but a sizable part of these earnings will not remain in the country and gold mining will provide jobs to less than 1% of those presently employed in the cotton sector.

Chart 1-1: Cotton and Other Agriculture as Percent of Value of Burkina's Total Exports, 1996-2005



	96	97	98	99	00	01	02	03	04	05
Non Ag	13%	9%	9%	7%	6%	3%	3%	4%	16%	5%
Other Ag	20%	17%	17%	18%	20%	25%	22%	19%	14%	17%
Cotton	67%	74%	75%	75%	74%	72%	75%	77%	70%	78%

Years

[11] Diagnostic Trade Integration Study (DTIS) for Burkina Faso, Opportunities for Agricultural Trade Development by Califon Connate and David Winlock, second draft April, 2006, to be published by the World Bank.

It has also been argued that the C4 should transform a much greater share of their cotton production into textiles and garments. This has been tried for fifty years in years in Côte d'Ivoire and Senegal, and for more than thirty years in Benin, Burkina Faso, Mali, Niger and Togo; but results have been disappointing. In the four largest cotton producers (Benin, Burkina Faso, Côte d'Ivoire and Mali), less than 5% of cotton production is transformed locally today compared with 22% in 1981/82.

The Sahel has a comparative advantage in producing seed cotton, because it is cultivated manually in a region where the opportunity cost of family labor is very low. But the Sahel does not have a comparative advantage in transforming fiber into yarns, which is the first step of the transformation process. This first step is a capital intensive operation requiring a lot of electrical power which is very expensive in the Sahel and particularly so in Burkina Faso, but little unskilled labor.

In a study financed by the BOAD and presented in an UEOMA meeting on June 15, 2003, the authors argued that the textile industry failed in Western Africa because it had not been properly conceived. They designed a strategy for UEMOA as a whole after having identified clusters of activities - notably in garments and apparels - where the region could find profitable *niches*. The authors considered that, with such a strategy, the share of cotton production transformed locally could be raised from 5% to 25% by 2010. However, investors could not be attracted unless they received a 30% discount on their fiber purchases and the discount was guaranteed for at least fifteen years.[12]

A second study financed from the resources of the Japanese Trust Fund managed by the World Bank concluded that in addition to cotton subsidies, investors should receive investment grants, soft loans, tax holidays, duties concessions on imported inputs, transport and freight subsidies.[13] According to a third study issued by FAO in August 2005, the purchase of cotton fiber should be subsidized by 40% and electricity should also be subsidized. The authors noted: "The proposed strategy is both ambitious and risky, and the rate of internal return would be very low."[14]In a fourth study financed with the Japanese Trust Fund and released in February 2006, the findings were even gloomier, as appears from the following quotes: "Currently, most of the textile and garment producers in Cotton-4 countries are in a precarious position. Divestment is actually occurring. This puts the task ahead *attracting new investors to a region, which is loosing its current investments* into stark reality….. Yarn production for export markets could be 5-10 years away...and a full service garment industry for export markets 15-25 years away".

Filsah is the only spinning mill remaining in operation in Burkina; it transforms less than 1% of Burkina's fiber production into yarns and has to be subsidized. Faso Fani had been operating as a textile and garment factory for a number of years, but it was closed in the

[12] "Etude d'identification et de promotion d'unités industrielles régionales dans la filière coton de l'UEMOA" mars 2003, encadré 47, page 65.
[13] Executive summary page 2 in Padeco study Vol. 2 February 2004.
[14] Page 65, section 9.3.1 land page 66, section 9.3.5.

late nineties because it was money looser. The printing part of the factory was recently revived with government subsidies; but the equipment is out of date and raw materials have to be imported. In brief, the cotton sector cannot expect any release from textile industry in the near term.

2. Improving the productivity of the cotton sector

Following the C4 initiative submitted to the WTO three years ago, many workshops were held and many studies were conducted, but little has been achieved. Burkina was asked by the EU to present a strategic framework for the development of its cotton sector to the Paris Forum held in July 2004. The document was well received and was further elaborated with partners both formally and informally along six points.

2.1 Strengthening the capacities of producers

The UNPCB is probably the best organized and most efficient farmer organization in West Africa. It has expanded its activities and became a key player in the management of the cotton sector. It holds 30% of SOFITEX shares, and recently acquired 20% of SOCOMA shares and 10% of the shares of FASO COTON. But it had to borrow to acquire these shares and is now in tight financial situation. UNPCB received assistance from AFD (third phase of the PAP/OPC project) and other partners are considering the possibility of extending assistance (EU, BM, GTZ, IFDC and FAO). The World Bank could have an important impact though its five-year *Programme d'appui aux Filières Agro-Sylvo-Pastorales* (PAFASP). Synergies between the actions of the various partners should be exploited by sharing information in a timely and efficient manner.

2.2 Improving feeder roads and storage facilities

Although cotton areas have quadrupled in the last ten years, little has been done to expand feeder roads and storages facilities for cotton inputs. The need is particularly acute in the eastern zone. After having encountered heavy losses in 2004/05, cotton companies will not be able to contribute much to the financing in the near term. Burkina presented a request at the Paris forum in July 2004, but a concrete program has still to be formulated. The World Bank could help through its transport project (PST II).

2.3 Improving farm equipment

While yields average one ton of seed cotton per ha, some farms obtain yields in excess of two tons. The national average is low because yields are very low in many small farms which are not properly equipped. A package consisting of two oxen, a plow and a cart costs over one thousand dollars, which is the income earned from the cultivation of two hectares of cotton over two years. In a project financed several years ago, farmers covered one quarter of the cost, AFD covered another quarter and the bank was lending the remaining half at a yearly rate of about 15%. The bank loan was a precondition for AFD disbursement. Burkina had submitted a $ 30 million request for farm equipment.

2.4 Improving the input package, preserving soil fertility and the environment

One third of the world output is now generated from Genetically Modified (GM) cotton. Experiments conducted in Burkina suggest that, with the introduction of the BT gene in cotton seeds, applications of insecticide spraying could be reduced from 6 per season to 1 or 2, and that yields could be raised by one quarter without damaging fiber quality. Local varieties containing the BT gene will not be available before 2008/09. The experimental fields remain tiny; they should be expanded. The fertilizer package presently used is largely based on experiments conducted thirty years ago; it would be time to conduct new experiments.

Cotton research is made by the *Institut National de Recherche Agronomique* (INRA) which receives a CFAF 250 million (half a million dollars) annual contribution from SOFITEX for this purpose. With this limited budget, INRA cannot do much experimentation with GM seeds, new agricultural practices, nor deal with the complex problem of soil fertility losses and the environmental impact of cotton cultivation, although these problems are a source of major concern. Much more resources should be devoted to research. This is a public good which needs to be subsidized. . The amounts needed are small and the gains could be large. If yields were raised by 15% without increasing input costs, net producers' income would increase by 30%. Cotton research should not be limited to the national boundaries; it should have a regional dimension but it cannot be financed by the region; partners should play a major role in research financing. Another way to increase earnings from cotton would be to improve quality and to promote an African label.

2.5 Associating the cultivation of cotton with other speculations

Rotating cultivation of cotton with that of cereals (hybrid maize in particular) has been very successful and research on optimal rotation plans should be intensified. *Légumineuses* could be used more widely to provide nitrogen and reduce the need for imported fertilizers. In low lands (*bas fonds)*, the cultivation of cotton could be associated with that of fruits (mangoes, citrus, bananas) and vegetables (tomatoes, onions, green beans). Greater use of oxen would relieve the labor constraints at peak times and allow for timelier sowing which is of critical importance. Oxen would provide manure to preserve soil fertility and they could be fed in part from cotton seeds, cakes and other oil mill by products.