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ILLUSTRATED METHODOLOGY
FOR THE IMPACT ASSESSMENT OF POLICY REFORMS

AGRICULTURAL SECTOR DEVELOPMENT GRANT TO NIGER

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A

The purpose of this paper is to describe and illustrate the methodology used in the University of Michigan's assessment of the impact of the Agricultural Sector Development Grant (ASDG). The grant involved multi annual budgetary support conditional upon adjustment via sectoral policy reforms.

The paper is organized as follows:

General Methodology
Price and Marketing Policies in Product Markets
Price and Marketing Policies in Factor Markets

I. GENERAL METHODOLOGY

There are two related ways to assess the impact of economic changes from policy reforms: price effects, and economic efficiency. Marked currency devaluation or reorientation of trade policies can induce significant price changes. ASDG, however, focussed mostly on improving economic efficiency: allocation of scarce inputs in the agricultural sector, efficiency of grain markets, efficiency of market-oriented trade flows with Nigeria.

Our general approach to measuring the impact of policy reform includes four main steps:

1. The first step consists of **classifying relevant policies by type of policy instrument and economic impact.**

Certain policy reforms may have a sizable budgetary impact but induce only modest gains in economic efficiency. Conversely, some policy instruments with limited budgetary impact may significantly improve economic efficiency. This type of analysis was initiated at the ASDG design stage and was continued as the policy reform process unfolded.

Broad policy categories include, for example:

a) Domestic market price support

This type of policy puts a wedge between domestic and border prices, maintained by border measures (in Niger, cotton and, to a lesser extent, rice). The main problem is that price support with protective border measures sends distorted market signals back to producers. This policy also tends to raise consumer prices.

b) Minimum Target Prices

These are based on the difference between actual prices returned by the market for domestic coarse grains, and a target price set by public fiat(1). Depending on circumstances and implementation, government accommodation purchases and sales may emphasize either producer income support or price stabilization objectives. While the production impact of such deficiency payments does not in principle differ much from that of market price support, demand remains relatively undistorted; prices paid by consumers are not substantially raised. Also, to the extent that third countries are not denied access for their products, international resource allocation is not distorted

c) Input subsidies

By reducing the producer cost of inputs, such policies increase producers' gross margins. However, they modify relative input prices and the overall allocation of resources in agriculture.

For ASDG, we make the distinction between input subsidies involving:

- Explicit government budget outlays (for fertilizer up to 1986);

- Foregone revenues (tax exemptions or foregone deposits into a counterpart fund) in the case of donor-supplied inputs;

- Strong positive externalities from input use by individual farmers upon other producers: some types of crop protection, erosion control.

Some policy measures can be functionally linked, and should be considered jointly. For instance, the successful implementation of a domestic support price scheme usually depends on border restrictions. In Niger, the obvious example is rice, with producer prices, import tariffs and a proportional local purchase requirements. The complex "péréquation" scheme was designed to strike a balance between importers' rents, government tax revenue, producers and consumers(2).

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1. Equivalent to "deficiency payment" policies in OECD terminology.
2. In a straightforward import-tariff case, the consumer burden of a producer price support program can be greater than the value of the price support itself. This is the case when self-sufficiency of the imported good is well below 100%.

This classification provides a "first cut" assessment of the impact of policy changes on:

- Quantities produced, consumed or traded;
- Transfers between producers, consumers, the national budget;
- Efficiency gains or losses in production or consumption.

For example, reducing export restrictions, other things being equal, tends to increase domestic production, decrease domestic consumption, increase the amount traded, promote a transfer from consumers to producers, change government revenues, and lead to efficiency gains both in production and consumption.

2. The second step is **to determine to what extent former policies were implemented and effective.** This is a matter of establishing whether policies were mostly:

- political statements,
- institutional objectives,
- actually implemented actions.

Classification is partly determined by the primacy of political over institutional or economic objectives, and by the management capacity of national institutions.

The 1985 livestock export ban is a good example. This policy was a clear political statement of concern about rising meat prices following the 1984/85 drought. The ban was not **efficient** since export bans and meat price controls don't promote herd rebuilding(3). The policy was not **effective** either. Officials recognize their inability to control livestock flows along the 1,000-mile border with Nigeria.

The second step also requires a study of the structure of relevant factor and product markets, to see "the extent of damage" through former policies, and amenability to change. It also reveals important exogenous factors.

Cereals provide an excellent product market example. The impact of removing official prices, restricting state marketing boards, and liberalizing trade depends partly on the structure of existing private grain markets. In factor markets, efficiency gains through better pricing or distribution policies depend very much on the public and private sectors' shares of the inputs market. In both cases, the private sector's capacity to "take up the slack" after a

3. The main reasons are that herders don't willingly sell reproductive females, and higher domestic meat prices would have induced livestock movements **into** Niger rather than away from it.

reduction of state intervention is crucial. Exogenous variables which can be integrated into this analysis include: the CFA/Naira free market exchange rate, Nigerian input subsidy policies, and donors' food and input grant policies.

3. The third step consists of determining the **actual extent of policy reform implementation.** This draws on joint "tranche" evaluations of ASDG conditions precedent, and on the analysis of institutional and market conditions described in step 2.

A main problem at this stage, is that government policy implementation is not very consistent over time. For example, government peanut purchases at an official price were equivalent to either a price support program for Nigerien farmers, or an export subsidy to Nigerian producers, depending on implementation and circumstances. Thus, improvement has to be gauged not with respect to a given policy, but rather by comparison with a small set of reference situations.

4. The fourth step relies on **partial equilibrium economic analysis**, refining the first-cut analysis of step 1 to take into account:

a) the structure of relevant factor and product markets;
b) the extent and effectiveness of policy reform implementation;
c) the effect of strong exogenous factors;
d) the availability and reliability of data.

II. PRICE AND MARKETING POLICIES IN PRODUCT MARKETS

A. Introduction

In this area, policy reforms consisted of:

- removing official prices for cereals;
- instituting a tenders and bids system for public grain purchases;
- promoting village-level grain storage;
- liberalizing grain trade in general;
- promoting collection and broadcasting of market information;
- Promoting cross-border trade of major exportables.

Our assessment of the economic impacts of marketing and price policy reforms partly relies on the use of the Structure-Conduct-Performance (SCP) framework(4).

The SCP paradigm posits causal links between market structure and market conduct and between market conduct and market performance, where:

- **Market structure** are those aspects of market organization that influence competition and pricing;

- **Market conduct** refers to methods used by firms to adjust to the markets in which they operate. These include price formation, sales promotion and co-ordination, and the degree of predatory or exclusionary tactics used against existing or potential rivals;

- **Market performance** is the economic result of market structure and conductm in particular the relation between distributive margins and the costs of marketing services.

The approach and methods used to measure the degree of improved market efficiency are discussed separately for cereals (Section B) and cowpeas and livestock (Section C).

4. Sherman J.R., Shapiro K. and Gilbert E. "The Dynamics of Grain Marketing in Burkina Faso" Vol. 1. University of Michigan, University of Wisconsin, 1987.

B. Cereals

Applying the general methodology to cereal policy reforms involves three main tasks:

i) Assessing the extent of distortions introduced by former official prices or marketing regulations;

ii) Estimating budgetary losses and economic distortions due to OPVN(5) market interventions, their reduction and resulting savings;

iii) Estimating the extent to which private market imperfections were reduced, and resulting economic benefits.

This analysis integrates the structure of grain markets (degree of concentration, efficiency of spatial and temporal arbitrage), and strong exogenous factors: CFA Naira exchange rate, Nigerian trade policies, Nigerien policies on rice imports, etc.

1. Official Price and Marketing Policies

a) Price support policies and supply response

The economic impact of an effective producer price policy designed to promote production can be assessed through the standard partial equilibrium model for food-grain price support. The elasticity of supply with respect to price is a critical parameter. Farmers' response to price incentives is almost always positive, especially in controlled production systems, and for cash crops. For instance, in Asia the price elasticity of supply is around 0.3 in traditional paddy production. Most studies of African small holder response to relative prices focus on cash crops: cocoa, coffee, palm kernels or oil, and cotton. Estimates of short run elasticities of supply with respect to cotton prices in Nigeria vary between 0.25 and 0.67.

Price responsiveness for annual crops may be estimated from acreage and yield functions(6) :

Acreage equations

$At^{D} = a + a1\ Pt^{e} + a2\ Zt + ut$ (desired acreage)

$Pt^{e} = Pt-1 + b(Pt-1 - Pt^{e}-1)$ (adjustment in price expectation)

$At = At-1 + g(At^{D} - At-1)$ (actual acreage)

5. National grain marketing board.
6. See for example, Marian E. Bond, "Agricultural Responses to Prices in Sub-Saharan Countries" International Monetary Fund Staff Paper Vol. 30 No. 4, 1983.

Yield equations

$Yt^* = d(At-1)$ (potential yield)

$Yt = bo + b1Yt + b2\ Pt^e + b3\ Zt + ut$ (actual yield)

Where

At^D = acreage desired to be under cultivation at time t

At = actual acreage under cultivation at time t

Pt^e = expected real producer price at time t

Pt = actual real producer price at time t

Zt = exogenous factors, including prices of substitutes and complementary crops affecting supply at time t

Yt^* = potential yield at time t

Yt = actual yield at time t

d = potential yield per hectare in year t

b,g = expectations and adjustment coefficients

In effect, acreage cultivated at time t is a function of acreage previously cultivated with an adjustment for compensated price expectations, and exogenous factors. Yield is a function of acreage adjusted for previous yield and price expectations, and exogenous factors. The model recognizes that both acreage and yield are influenced by price and exogenous variables.

How well doest this apply to coarse grain production in Niger?

The effect of price on cereal production has been swamped by climatic determinants, the Z variable in equations listed above. For a basic rainfed crop which is the basic staple, acreage at t depends more on the extent of self-sufficiency at t-1 than on the expected price. Furthermore, the spread between official and market prices for cereals (when positive) was generally marginal. Price support policies for rainfed cereals were therefore ineffective as a production incentive.

b) Price stabilization policies

Government purchases and sales of cereals are designed to support producer prices at harvest time by buying cereals above market-clearing level. Higher millet prices induce a response by grain holders so that the quantity of grain marketed is greater than it would otherwise be. By releasing them later on in the season, the average seasonal wholesale price is lowered.

The most common analytical approach to partial seasonal price stabilization(7) requires estimates of constant elasticity supply and demand curves, transportation, storage and processing costs in the private and public sectors. It provides estimates of government cost, producer and con-

7. Tolley, Thomas and Wong, "Agricultural Price Policies and the Developing Countries". World Bank, 1982.

sumer surpluses, and net losses to the economy as a function of the degree of price stabilization sought.

In the ASDG case, the effectiveness of such a stabilization policy can be assessed through:

- The timing of announcements for official prices in the farming calendar;
- The relative levels of official and free market prices, especially in surplus areas;
- The timing and targeting of official purchases (e.g. from wholesalers, small traders, producers);
- The share of official purchases compared to total product marketed;
- The extent to which imports are purchased at the official price.

According to the above criteria, the consensus from a number of cereal market studies done over the last fifteen years is that price support policies had no significant impact on producers. Their interruption resulted mostly in budgetary savings to the state and a loss of rent to a small number of wholesalers. We describe below the methodology used to calculate budgetary savings from this policy reform, using the following symbols:

Pij : the free market price of the relevant grain in Arrondissement i at time period j (monthly average in CFA/Kg).

Cij : the OPVN contract price for grain purchases in Arrondissement i at time period j, in CFA/Kg.

Qij : the quantity bought by OPVN in Arrondissement i at time period j, in kilograms.

The analysis must be done separately for millet and sorghum.

We first compared the cost of actual tender and bids with procurement at an official price for the 1985/86 campaign. The official price was arbitrarily set at 75 FCFA/Kg as this was the price negotiated between OPVN and the UNC(8) for direct purchases. This provided a measure of the budgetary impact of switching from official prices to tenders and bids:

$$(\Sigma Qij \times 75) - (\Sigma Qij \times Cij)$$

8. National cooperative union.

In the first year, OPVN tender and bid purchases cost 117 million CFA more than procurement at the official price.

We then compared the financial cost of OPVN tenders and bids purchases with the cost of buying equivalent amounts of grain at free market prices at the corresponding times and places. This required building an extensive multi-annual database of OPVN purchases and average monthly cereal prices for the 36 "arrondissements" of Niger. In this case, open market prices served as a proxy for the lowest bids in a perfectly competitive situation(9). The result was an estimate of the combined cost of remaining imperfections in grain markets and OPVN procedures:

$$(\Sigma Qij \times Cij) - (\Sigma Qij \times Pij)$$

For the 1985/86 campaign this cost amounted to 531 millions CFA. The estimation of budgetary savings from efficiency gains between two periods must be expressed in relative terms to account for changes in market prices over time. The best indicator is the weighted average percent paid over market price per ton. Note that this estimate incorporates the effect of changes in the timing of OPVN purchases. A simple way to isolate the timing effect is discussed below.

Gains in private cereal market efficiency were also estimated through a study of changes in the structure and degree of concentration in wholesale grain markets. This relied on comparisons of the number, and tonnages offered in wholesale bids to OPVN at different points in time. A larger number of geographically distributed bidders suggests an improvement in wholesale market competition and/or OPVN procedures, although one cannot determine the actual number of bidders working on behalf of larger operators.

The Lorenz curve approach can provide a comparative measure of the degree of market concentration among wholesalers for two time periods. The first step consists of tallying bids received in various regions to establish a list of bidders and the global amount submitted by each trader. Several points on the curve may be then be plotted from the quintile distribution of quantities offered by traders. For instance, in the November 1985 bid these were:

9. Actually, open market prices are lower than purely competitive bids. The reason is that most wholesalers follow temporal arbitrage strategies, so that the discounted value of grain they would have sold late in the year is often above current spot levels.

No. of Traders in quintile	Percentage of total bid by traders in the quintile
1st Quintile	2.1 %
2nd Quintile	7.3 %
3rd Quintile	13.2 %
4th Quintile	23.3 %
5th Quintile	54.1 %

Ideally, this methodology should be used with actual awards rather than on the basis of wholesalers' bids. The quintile distributions at different periods can also be compared. This approach, however, requires very detailed data on bids and contracts, which is not always readily available.

An important measure of OPVN efficiency is the timing of purchases. By rotating a third of its security stock every year OPVN could in principle contribute to total temporal arbitrage and thus, intra-annual price stability.

Partial-equilibrium analysis indicates that in an ideal situation OPVN would buy grain at harvest time. Purchases would be made from farmers or from perfectly competitive traders who would pass on to farmers some of the benefits from OPVN interventions. By buying at the lowest price level, OPVN would normally:

- Maximize the spread between its purchase and resale prices, thus minimizing any losses due to a stabilization operation or to emergency food assistance;

- Maximize the quantities handled for stabilization or food relief within a given budget constraint;

- Maximize the income distribution effect of a price support policy by buying at a time when a majority of sellers are from low-income or even grain deficit households(10);

The application of standard price stabilization models often requires significant adjustments. In this case one must allow for several factors:

- Wholesale grain markets are far from being perfectly competitive;

10. Note that even if the supply elasticity of grain is virtually inelastic, as may be the case at harvest time, an increase in demand resulting in a rise in the market price increases the producer surplus without changing the quantity supplied.

- OPVN's financial resources are very limited, and the costs of grain purchases, transportation and storage are mainly borne by donors;

- Due to OPVN's past management failures, its legal share of the national cereal market has been reduced.

Even with these modifications of the basic model, the principle of buying grain as close to harvest time as possible still applies. The timing of purchases remains a valid indicator of OPVN effectiveness in management and coping with wholesalers' strategies. Using the same symbols as above, and denoting the harvest time period as h, one can derive a relative timing efficiency factor based on free market prices:

$$\frac{(\Sigma Qij \times Pij) - (\Sigma Qih \times Pih)}{(\Sigma Qih \times Pih)}$$

An improvement in the timing of public purchases brings this factor comes closer to zero.

2. Efficiency of Cereal Markets

Good spatial integration of market prices indicates that significant price changes are not, beyond the very short-run, limited to a given area, but rapidly "spread over" several markets through spatial arbitrage. Well integrated markets reflect a situation where information on localized demand and supply flows rapidly (although not necessarily widely), and where there are no major obstacles to cereal transport and trade.

One can compare degrees of spatial integration of grain markets before and after the onset of policy reforms. This can be done through least-squares correlation analysis of seasonally matched monthly price averages between markets. We first tested for spatial integration between major markets. Coefficients of determination were:

	Dosso	Maradi	Niamey	Zinder
Dosso	1			
Maradi	0.713	1		
Niamey	0.749	0.829	1	
Zinder	0.684	0.893	0.824	1

We then tested for spatial integration between secondary markets in the Dosso Département. Coefficients of determination for major markets were then compared for the 1982-85 and the 1985-88 periods.

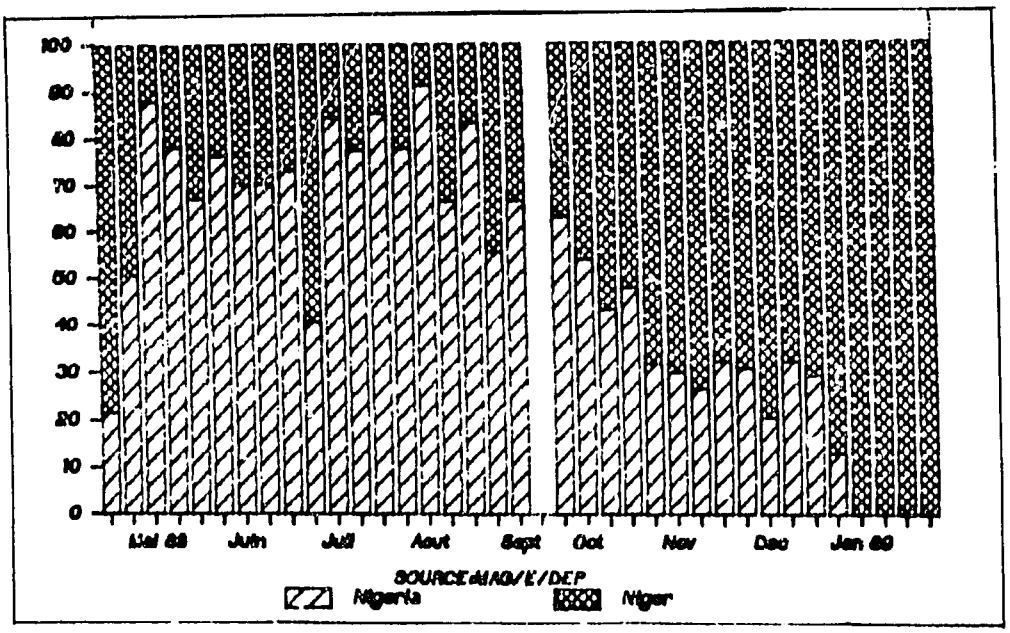
A statistical note of caution appears in order. Intra- and inter-annual fluctuations of grain prices are sizable, even over the long term and in constant prices. Least-

squares correlation coefficients may be biased by the extent to which related variables fluctuate over time. One must also choose periods for analysis in which inflation was moderate, or correct for the effects of inflation by correlating monthly price changes rather than actual prices.

Another approach is to test for changes in relative size of marketing margins on the basis of seasonally matched price differences between connected markets before and after the policy reforms. The same monthly regional price data used for correlation analysis allowed a comparison of seasonally matched margins between Niamey and Zinder. Analysis of variance was done on two subsets (1982-85 vs. 1985-88). The hypothesis was that more efficient grain markets would display relatively narrower margins between main markets. Such a reduction would represent a quantifiable economic gain. Here again, we caution that this kind of analysis applies only when there is a clear trade connection between markets, and when one allows for any change in the direction of trade over time.

The degree of integration between Nigerien and Nigerian cereal markets cannot be directly assessed from external trade statistics, which are fragmentary, not wholly reliable, and published with several years' delay. We derived a rough measure of the penetration of Nigerian millet on the Niamey market from daily interviews with wholesalers on the price and origin of millet sold in the capital. Since quantities imported could not be reliably determined, the analysis is based on the absolute and relative frequencies of origins in traders' responses for each week (millet coming from various regions of Niger or from Nigeria). The last step in the analysis was to determine how the frequency of the various origins changed with the weekly average market price, with the evolution of the CFA/Naira exchange rate, and with Nigerian trade policies. Figure 1 presents an illustration of the main results for the period of April 1988 through January 1989.

FIGURE 1



Another method to assess the integration of Nigerien and Nigerian grain markets is currently being tested (April 1989). It is a retrospective study of official agro-pastoral trade flows recorded at Nigerien border posts for the past four years. These are much more complete and detailed than currently available statistics. This technique works well for imported goods like cereals or fertilizer, which are, according to wholesalers, shipped in large quantities and go virtually untaxed by Nigerien customs. In such cases, there is little reason to circumvent border posts located along the main road axes. However, this approach works less well for produce exported in small lots such as cowpeas, and least well for livestock.

Reductions in administrative, legal and physical obstacles to domestic and cross-border trade contribute to market efficiency. However, one must overcome several difficulties:

- Many administrative and legal changes are not readily quantifiable. While a decrease in the number of police roadblocks on a major road axis can be a valid indicator, changes in time and resources spent on various formalities are more difficult to quantify. One must often rely mostly on the qualitative appreciation of traders.

- Temporary changes in trade policy by Niger or Nigeria are not always formalized. Niamey grain wholesalers

report that in December 1988, they were "given to understand" by the authorities that they should stop importing millet from Nigeria until further notice. Apparently, no official act sanctioned this decision, but in traders' responses on the origin of millet "Nigeria" disappeared in January of 1989 either because the unofficial measure was respected, or because traders would not admit they violated it. In such cases the combination of trader interviews and surveys of primary data on trade flows at border posts is a practical way to monitor policy implementation and impact(11).

The economic impact of reducing transaction costs on international trade is discussed in the section on cowpeas and livestock.

3. Village-Level Storage

The ASDG rationale was that the food security and price stabilization effects of public and private storage strategies could be supported by additional village-level grain storage.

All village-level storage done in addition to private granaries has been by way of project-sponsored cereal banks. Their impact can be analyzed either in a global cereal market or micro economic sense.

Cereal banks can have a global market stabilization effect to the extent that quantities bought by these projects significantly increase aggregate demand at harvest time. The partial seasonal stabilization model previously mentioned can apply to such interventions. However, the quantities involved each year are much too small (less than 2,000 tons) to have a significant global market impact.

At the micro economic level, we first tested the extent and effectiveness of this policy through surveys of cereal banks.

We first considered the relative share of cereal bank stocks in total estimated stocks, and its evolution over time. Financial analysis was then applied to a sample of cereal banks to ascertain their viability: amounts deposited, lending and reimbursement rates, value of assets over time, receipts from sales, expenses and profit margins excluding depreciation on infrastructure.

The food security impact can be assessed by considering the relative importance of cereal bank stocks versus

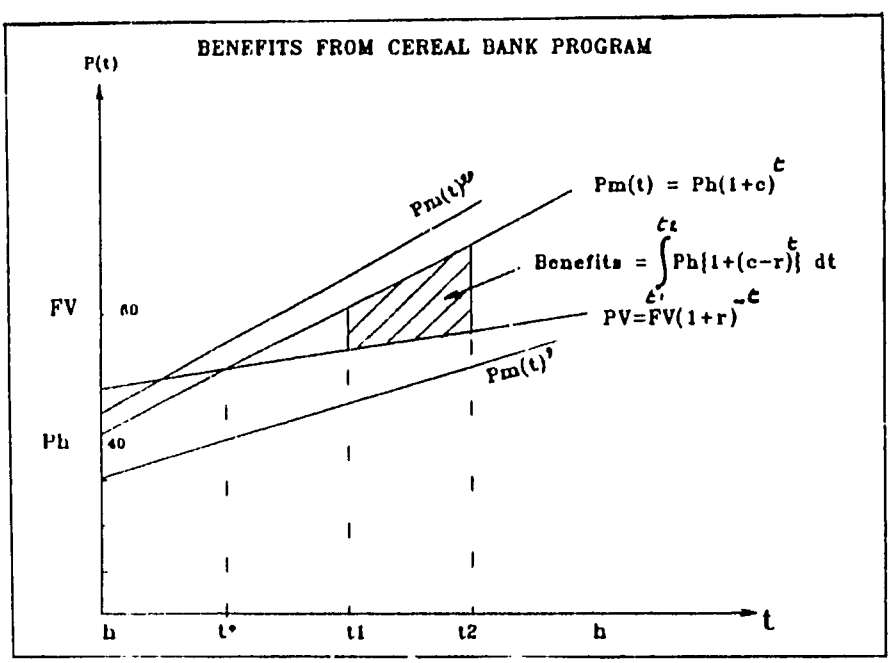
11. This approach is superior to one of relying on the number of import and export licenses delivered, which only reflect trade intentions.

estimated private household stocks, and the timing and rate of cereal loans. Observed lending, interest and reimbursement rates supported our working hypothesis that in a year of mediocre production, cereal banks stocks represent a cereal "line of credit" eagerly used by some villagers, even at relatively high interest rates(12).

A grain deficit rural household with a good "credit rating" normally has two main sources of cereals: grain surplus households, and traders. Grain surplus households are defined as having either more than sufficient grain production, or enough income from other sources to buy surplus grain at harvest time. Typically such households extend cereal "credit" to others, to be repaid in kind with interest at harvest time. Traders sell grain either for cash or on credit.

Figure 2 illustrates a simple model to calculate benefits to borrowers from a cereal bank under a variety of assumptions.

FIGURE 2



12. Casey F. "The Contribution of Cereal Banks to Food Security and Grain Price Stabilization in Niger". University of Michigan, Sept. 1987.

In our model the local market price for grain increases between harvests as a function of storage costs and growing scarcity: $P_m(t) = Ph\ (1+c)^t$ where Ph is harvest price, and c is the rate of increase over time.

The implicit price of grain borrowed from the cereal bank is determined both by the bank's interest rate, and the borrower's private discount rate. The future per unit value of grain borrowed from the bank is $FV = Ph\ (1+i)^t$, where i is the bank's interest rate on grain loans. At any point in time, one can express this as a present-valued implicit price by discounting this FV by the borrower's private discount rate (r). There is no reason to borrow grain while the market price Pm(t) is lower than the implicit price of borrowed cereals. The benefits accruing to those consuming grain from the bank any time after t* are equal to the difference between the market price and the present value of borrowed grain. Benefits per household thus partly depend on when borrowed grain is consumed, and the quantity allocated to borrowers. In general terms, the size of benefits equals:

$$\int_{t_1}^{t_2} Ph\ (1+c)^t - FV\ (1+r)^t\ dt$$

where timing of cereal loans (t1) is set by cereal bank management, and the time lapse (t1-t2) is equal to quantity per household divided by consumption per unit of time.

Obviously, the intercept and slope of the market price curve depends on yearly production. In a good year, Pm(t)' prevails, and no grain is borrowed from the bank. In a bad year, Pm(t)'' is such that grain could profitably be borrowed from the bank before t*, and the value of benefits to borrowers is higher.

Simple simulations yield estimates of benefits from cereal bank programs under various assumptions. We show a typical run below:

Harvest price : 40 CFA/Kg
Cereal bank interest rate: 50% p.a.
Rate of market price increase: 6% per month
Private farm discount rate: 2 % per month
The bank loans 18 tons, a 3-month supply to 50 households.

In this case, the implicit present value price of borrowed grain becomes lower than the market rate after five full months (t*). If all deficit households need to consume the borrowed grain immediately after t*, benefits from the program equal 62,100 FCFA. However, if they have enough of their own reserves to defer consumption of borrowed grain to the last three months of the year, total benefits increase to 254,700 FCFA.

Benefits from improved market information collection and broadcasting are discussed below; the methodology applies to all commodities considered.

C. Cowpeas and Livestock

The chronology of relevant policy reforms covers the period from 1985 to the present and includes closely related policy decisions made under NEPRP.

I. Market Structure: Gains in Competitiveness

a) Removing the Cowpea Marketing Board's Privilege

The economic impact of former official price policies for cowpeas can be expressed either in terms of production oriented price support, or producer deficiency payment. There is an important difference with the cereal case: cowpeas are a major export to Nigeria.

There are two basic questions here:

- How does one measure the benefits from cowpea trade with Nigeria?

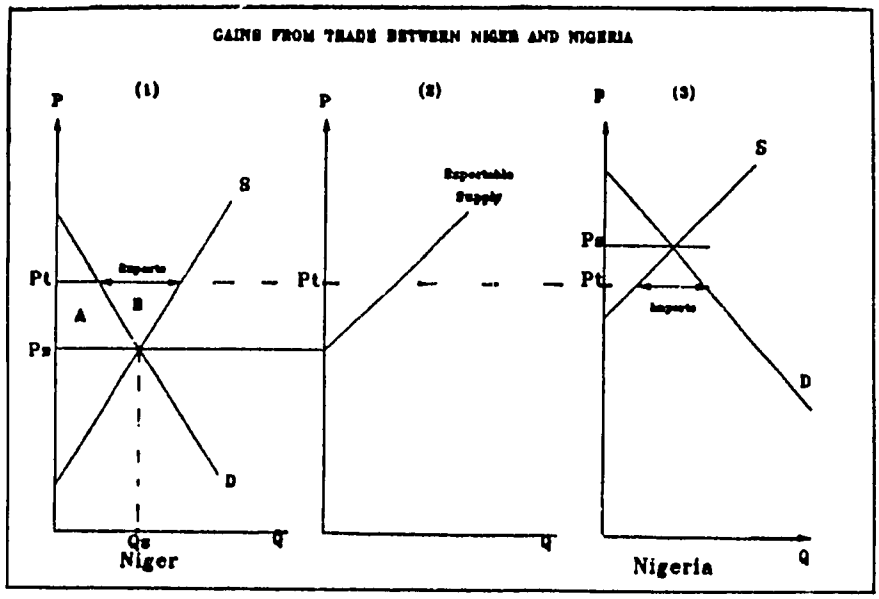
- To what extent did the national marketing board distort the free trade model and reduce its benefits to both countries?

Benefits to Niger and Nigeria in cowpea trade are shown in Figure 3 through a standard gains-from-trade approach. Supply and demand conditions for cowpeas in Niger and Nigeria are shown in panels 1 and 3. Respective self-sufficiency equilibrium prices are Ps. Panel 2 shows the exportable cowpea surplus from Niger at various free trade prices. At this stage, one can simplify the model by leaving out transaction costs without loss of applicability.

Under free trade conditions, a common equilibrium price is reached, at Pt, where quantities exported from Niger exactly match Nigerian imports(13). In Niger, the loss in consumer surplus (A) is transferred to producers; producers receive an additional gain from trade of B, a net gain to Niger's economy. In Nigeria, the loss in producer surplus (A) is transferred to consumers, who also receive (B) as benefits from trade, a net gain to Nigeria.

13. The model can easily be modified to reflect the differences in Pt Niger and Pt Nigeria due to normal transaction costs, or the effect of exchange rates. However, the basic principles apply equally.

FIGURE 3



If SONARA(14) had been able to control the cowpea export market, they could have modified or redistributed differently some of the benefits from trade. For instance, an export quota could have been imposed to prevent the domestic price from rising all the way up to Pt. Alternatively, by paying domestic producers more than Pt (an export subsidy) SONARA could have expanded the size of the transfer from Nigerien consumers to producers.

Actually, the share of total cowpea marketing and exports handled by the public sector does not indicate that SONARA ever had a significant impact on cowpea trade. Therefore, the interruption of the official price support policies resulted mostly in budgetary savings to the government and a loss of rent to a small number of intermediaries. Calculations of savings resulting from purchases at market rather than at the higher official prices may be done as in the case of cereals.

b) Broadcasting Agricultural Market Information

A major feature of a competitive market is that all actors have adequate knowledge of the forces which influence supply and demand, including prices. Consequently, better market information should:

14. Niger's cowpea and peanut marketing board.

- Help producers and small traders make marketing decisions on the basis of wider market information;

- Promote competition;

- Help the government carry out more economical accommodation purchases and sales.

To assess the impact of a market information system, several basic questions must be addressed:

- Is there a rapid and wide flow of information in the private sector?

- If not, is the problem due to market infrastructure, structure or conduct?

- Depending on the answer, should the public sector:

  - improve infrastructure
  - reduce administrative or legal obstacles to trade
  - reduce barriers to entry (e.g. lack of marketing credit or of legal status for cooperatives)
  - establish a public system of price collection and broadcasting

- Finally, how does one measure improvements in market information, and assess its benefits?

The first analytical step is to differentiate commodity markets. The structure, conduct and performance of millet and rice markets, for instance, are significantly different. Furthermore, the size of gains from improved information would be greater for commodities with high marketed shares of production (livestock, cowpeas, onions), while gains on basic cereals would have a greater distributional impact.

The second step is to examine each commodity market in terms of the SCP framework, relying on the various marketing studies available. For traditional coarse grains in Niger, this analysis indicates that:

- Among <u>traders</u> information flows very rapidly but narrowly. Information is negotiable, not freely disseminated. Market information does contribute to marketing efficiency, but it is endogenously determined by the industry's structure and conduct.

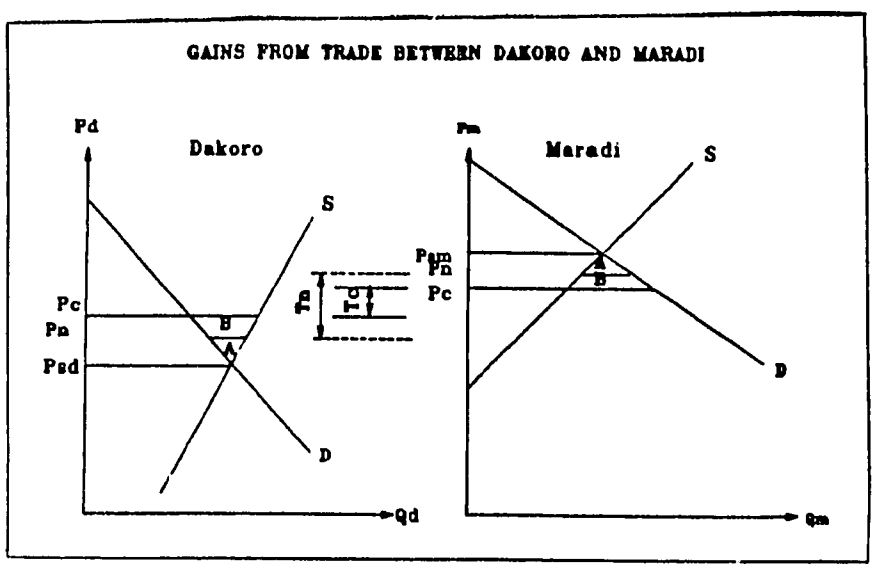
- In the <u>public sector</u> information flows much more slowly, and appears less reliable overall, but coverage is nationwide. In this case, better market information lead mostly to budgetary savings on public market interventions.

- Among <u>producers</u>, the extent and potential usefulness of market information remain open to question. However, the experience from AID's Small Farmer Marketing Project in various countries clearly suggests that farmers don't benefit simply from a knowledge of product prices in various markets.

In other words, the impact of a better flow of information on market efficiency depends upon and cannot be separated from the effects of other measures taken to improve market efficiency.

Benefits from market information can be analyzed with a variation of the basic gains-from-trade model. For instance, at a given point in time, Dakoro and Maradi are a grain surplus and a grain deficit area. Local supply and demand conditions are depicted in Figure 4, with self-sufficiency prices Psd and Psm. We now introduce transaction costs into the model (transport, handling, normal profits to intermediaries).

FIGURE 4



Market information induces trade. If information circulates widely, trade between Dakoro and Maradi takes place in a competitive environment, with minimal transaction costs (Tc). Local market prices are now at Pc (competitive), there are net benefits of (A+B) in each region.

However, if trade between Dakoro and Maradi is not competitive, transaction costs increase to Tn, driving local prices to Pn in each market. Some of the benefits from trade are now captured by intermediaries (areas B).

This kind of situation can arise when a small number of traders have access to privileged information. More commonly, however, their market power rests on the ability to apply exclusionary tactics. The extent to which dissemination of information can set things right depends on the structure of the market, and the exact nature of constraints to competitive trade.

2. Market Conduct: Reducing Transaction Costs and Export Taxes

Reducing trade-related formalities and controls lowers transaction costs. In a competitive environment gains accrue to consumers and producers alike. For domestic trade in cowpea and livestock, such gains may be measured through reduction of marketing margins, as we did in the case of cereals. However, most of Niger's trade in cowpea and livestock is export-oriented, so that gains from lower export costs accrue mostly to producers and traders going through official channels.

Since export tax and administrative reforms are being implemented sequentially it is possible to analyze their impacts separately.

a) Elimination of Export Taxes

There are several possible approaches for measuring the impacts of eliminating export taxes. One relies on a standard excess supply (Niger) and excess demand (Nigeria) model to estimate negative and positive effects on official and unofficial trade from levying export taxes. This method was used in a recent study on cowpea marketing(15), and the model applies equally to livestock exports.

The effects of lowering an export tax include:

- an increase in official exports;
- a gain in income for official exporters; and
- decreased government revenue.

For **unofficial exports** the estimated effects are:

15. See "Rapid Appraisal of Cowpea Marketing in Niger". Abt Associates, Inc. February, 1989.

- lower per unit marketing costs due to the cost of eluding the tax, including loss of economies of scale in individual transactions;

- gains in competitiveness, and higher exports and production.

This approach works well in a situation where most exports go through official channels. However, we are more interested in estimating the impact of reducing the cost of doing business officially, in a situation where most exports are unofficial. We suggest an alternative approach: measuring the benefit of lower export costs on the basis of the exporters' willingness to pay for official export status.

In this model, total cowpea or livestock exports are still determined by respective supply and demand conditions in Niger and Nigeria. Nigerien exporters have basically two options. They can incur the costs of formalities of the export tax, and benefit from official export status. This implies more secure, larger and more timely shipments, and better access to financial institutions. Alternatively, they can save these costs, but spend time and resources on evasive tactics, and bear the cost of risk (the probability of being caught multiplied by the amount of the fine). We consider therefore that there is a downward-sloping demand curve for export services, and a virtually infinitely price-inelastic supply curve from the government administration for official export status.

Figure 5 shows supply and demand curves for official export services. P1 represents the minimum possible cost of official export services. Additional costs, which could be reduced, bring up the price to P2. Finally, the unit export taxes and fees bring the cost up to a total of P3.

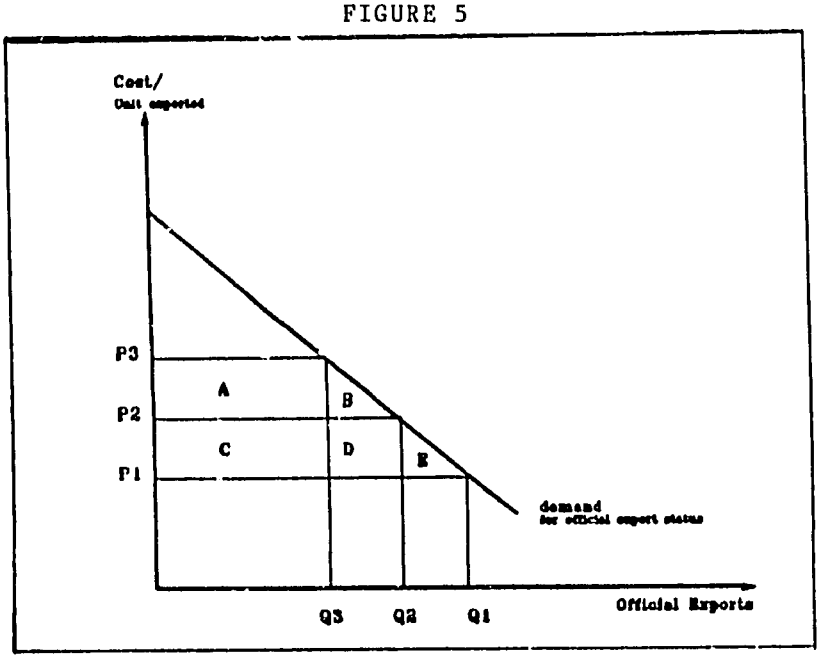
P3 and Q3 show unit export cost and quantity officially exported before policy reform and represents the baseline situation. These can be quantified as official export costs and quantities prior to October 1988.

P2 and Q2 represent unit export cost and quantity demanded of official export services after the elimination of export taxes and fees, but before the reduction in administrative costs. Q2-Q3 reflects the shift of some exporters from unofficial to official exporter status.

The gain to official exporters is equal to area A + B. Prior to the elimination of export taxes and fees, area B was a deadweight loss to exporters and the government. If the government eliminated export taxes by its own accord, the loss in government revenue (A) would be a direct transfer to exporters. However, under the NEPRP program, AID makes up lost government export tax revenues. In this case

the government is as well off as before, "old" exporters obtain A and "new" exporters receive B, a net gain to the economy(16).

FIGURE 5

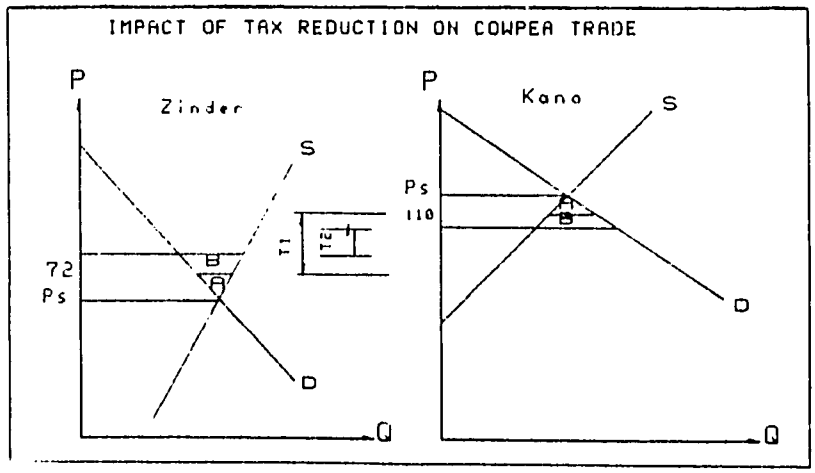


The gains-from-trade model can provide an alternative to estimate the scale of benefits from export tax reduction. We take the December 1988 Zinder-Kano cowpea trade as an example, using data from the Abt study(17). In this case, Pt is 72 and 110 FCFA/Kg in Zinder and Kano, respectively. In terms of the Figure 6, the reduction in tax reduces transaction costs from T1 to T2 (27.5 to 7.5 CFA/Kg), inducing gains of B in each country. A complete numerical approximation requires estimates of quantities traded, and demand and supply elasticities with respect to price in both markets.

16. Note that for any segment of the demand curve where price elasticity is greater than 1, a decrease in the export tax increases both official exports and government revenue.

17. See "Rapid Appraisal of Cowpea Marketing in Niger". Abt Associates, Inc. February, 1989.

FIGURE 6



b) Reduction of non-tax export costs

P1 and Q1 represent the price and quantity demanded for official export services following the reduction of administrative costs which did not contribute to government revenue. The number of exporters using official channels has further increased by Q1 - Q2.

The additional gain in consumer surplus for exporters is equivalent to area C + D + E.

c) Quantitative Approximation

Data requirements include export market prices, quantities exported through official marketing channels, and the costs of administrative compliance required for official export status(18).

18. Export costs for livestock and cowpea exported through official channels for the "before policy reform" case have been calculated in "Politique d'Exportation du Bétail du Niger". Ministère des Ressources Animales et de l'Hydraulique, and Tufts University. 1988. and in "Study of Constraints to Increased Exports of Agro-Pastoral Products in Niger". Development Alternatives, Inc. USAID/Niger. 1988.

Official exports can be measured in two ways:

- from licenses issued to private producers and traders for official exports Q3, Q2 and Q1.

- from actual flows shown in individual customs posts records.

Note that total exports at various points in time are exogenous to the model of willingness-to-pay for official status. Any gains in the share of official exports must therefore be seen in a relative sense. For example, a 10 percent decrease in official exports after the removal of a tax would not really be a setback if total exports had fallen by 50 percent due to a change in relative prices or the effect of a drought. It is therefore essential to estimate unrecorded as well as official exports to make comparisons over time. Methods to estimate cowpeas and large ruminants exports are presented below.

Cowpeas

Unlike millet, cowpeas cannot be stored for several years. For unofficial cowpea exports we therefore followed the same residual export method as was used in the recent cowpea marketing study(19). The estimate is equal to:

$$Xu = P - (Xo + S + L + C) \quad \text{where:}$$

Xu: Unofficial exports P: Production

Xo: Official exports S: Quantity saved for seed

L: Losses C: Domestic consumption

Large Ruminants (cattle, camels)

The approach is somewhat similar for large ruminants. Key parameters for estimating unrecorded exports include herd size, rates of herd growth and offtake, and domestic slaughters or meat consumption.

One first ascertains the average net growth rate of the national herd. In most countries, livestock services have derived long-term growth rate approximations by extrapolation from the age and sex distribution of the standing herd at various points in time. In the Sahel, the average net growth rate for
cattle is around 3% p.a.

19. See "Rapid Appraisal of Cowpea Marketing in Niger". Abt Associates, Inc. February 1989.

One then estimates the number of potentially marketable animals. For cattle: steers from age 4 and reformed cows. The offtake rate represents the percentage of animals potentially marketable in a standing herd. Depending on species and market circumstances this rate ranges from 8 to 12 % p.a. for cattle in Sahelian conditions.

One can then calculate unofficial exports as the residual of marketable animals minus domestic consumption and official exports:

$$Xu = M - Sd - Xo$$

where:
Xu = Residual (or estimated unofficial exports)
M = Potentially marketable animals
Sd = Domestic slaughters
Xo = Official exports

We provide a numerical example below for the 1983-1986 period. Cattle offtake rates are chosen to reflect normal, destocking and rebuilding conditions according to the year. Official exports were particularly high in the 1984 and 1985 drought years due to the major government export promotion program.

Herd Size	Offtake rate	Slaughters No.		Official Exports	Residual Exports	%
3,524,000	0.1	352,400	115,305	70,000	167,095	70
2,000,000	0.15	300,000	121,458	177,000	1,542	1
1,832,000	0.15	274,800	130,000	147,200	(4,453)	0
1,980,000	0.08	158,400	76,590	8,025	73,785	90

Small Ruminants (sheep, goats)

The application of this methodology to small ruminant exports is much less reliable. Small ruminants herd dynamics are much more pronounced than for large ruminants, so that estimates of standing herd at any time are very rough approximations.

Better estimates of offtake rates in Niger for cattle, small ruminants and camels should now be possible through the Livestock Management Information System (20).

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20. Cook, A. and Gray J. "Evaluation of Niger's Livestock Marketing Information Service", Ministère des Ressources Animales et de l'Hydraulique. USAID/NILPP/ASDG I. October, 1988. The LMIS system is collecting data in a sample of livestock markets on animal sales, presentations, prices, fodder availability and prices, and the source and destination of livestock. Presentation data includes breed and species, live and carcass weights, ages, health characteristics, and reproductive status.

4. Market Performance

a) Spatial integration

As in the case of cereals, one method to measure improved cowpea and livestock market efficiency is to rely on changes in the degree of spatial integration. This analysis relies on market price series for livestock and cowpeas in Niger and Nigeria, and free market CFA/Naira exchange rates.

b) Marketing margins

Here too, improved market efficiency resulting from policy reforms can be estimated through reduction of marketing margins.

Baseline data and calculations of export marketing costs, revenues, and margins are available for cowpeas and livestock before policy reform implementation. These values can be compared to similar estimates after policy reforms. However, one should wait until reduced export taxes and administrative costs have been in effect for at least one year.

III. PRICE AND MARKETING POLICIES IN FACTOR MARKETS

A. Introduction

The main constraints related to former input price and marketing policies were that:

- Subsidy and price policies put a strain on the budget and reduced the quantity of inputs available to farmers;

- Subsidies on agricultural inputs led to inefficient use of public and private resources;

- State monopolies and indirect subsidies contributed to or hid the extent of inefficiencies.

Following the general methodology, our first step is to categorize input price and marketing policies, and their types of economic impact. We distinguish between:

a) Direct and indirect input subsidies involving actual government outlays, and;

b) Direct and indirect subsidies reducing revenues from inputs supplied by donors.

The first category applies to fertilizer, farm implements, crop protection chemicals and seeds prior to 1986, when the government purchased inputs. The second category applies especially to fertilizer and crop protection chemicals in the post-1986 period, when various donors began to assume most of the subsidy elements. For any given amount of subsidy, both types of policies introduce similar distortions in resource allocation, while the budgetary impact may be different.

The economic evaluation of an input price subsidy usually includes:

- The cost of the program to the government;

- The efficiency of the program in terms of the total benefits to the society relative to program costs;

- The distribution of benefits and costs among various sectors of the economy, and;

- Savings/losses in foreign exchange.

The unit cost of the input subsidy is the difference between what the government pays for the input, its handling, storage and delivery (input cost), and what it sells to users (input revenue).

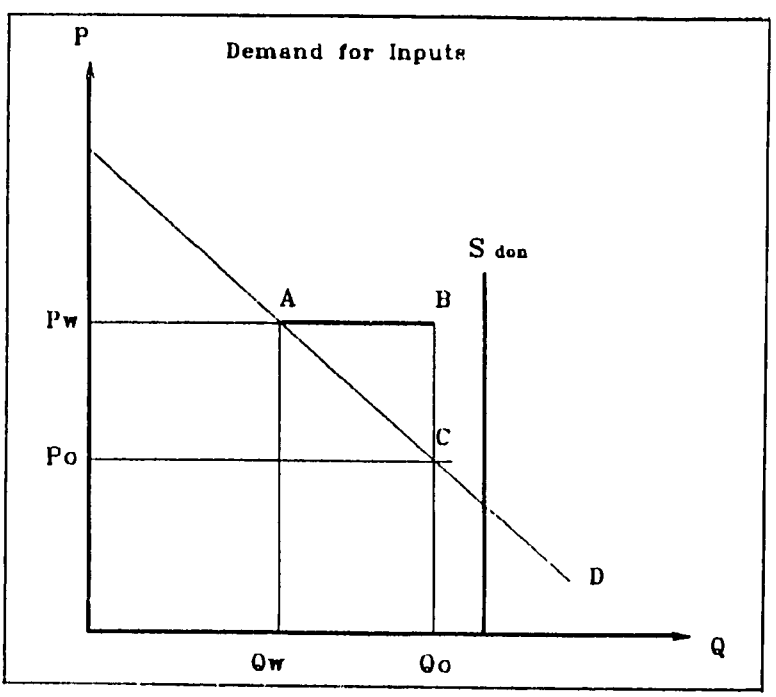
Input users benefit first through the saving on the amount of input used before the subsidy comes into effect. The size of their consumer surplus depends further on the difference between the quantity of input which would be demanded at the subsidized price and the quantity actually supplied by the government.

Also, increased domestic production of a tradable due to subsidized input use can lead to a decrease in imports (e.g. millet or rice for Niger). The net saving in foreign exchange is equal to the saving achieved by importing less of the product, minus the marginal expenditure of importing more of the input under the subsidy program.

Standard partial equilibrium analysis for input subsidies can take several approaches. One is a subsidy-induced downward shift in the supply curve for the commodity receiving the input. It emphasizes the increase in production and lower equilibrium price for the commodity receiving the input, and changes in consumer and producer surplus.

An alternative approach emphasizes the government cost of the program vs. benefits to input users and net loss to the economy by looking at demand and supply for the input itself, as in Figure 7:

FIGURE 7



Pw= border price for the input
Po= official user price (may be set at a minimum level by the supplying donor)
Qw= quantity of input demanded at the border price
Qo= quantity of input demanded at the subsidized price Po.

Case where Po>0:

We first look at inputs given to the government and sold at 0<Po<Pw (e.g. fertilizer). At the subsidized price, PwACPo is transferred to producers using subsidized fertilizer. Netting this transfer from the government cost (PwBCPo) yields ABC as the resource cost.

Foregone revenue from the donated input is minimized when the state sells the input at the price equating quantity demanded and the amount available from donors.

For Po significantly greater than zero, foregone revenue is modest when the demand for the input is relatively elastic in the relevant price range(21). In this case, the budgetary impact of the joint government/donor subsidy is limited. There is a gain in input users' consumer surplus but more resources are allocated to the input than would normally be the case.

Case where Po=0:

In some cases, however, inputs are distributed to users at no direct cost. Taking Sdon as the quantity supplied by a donor with no minimum price requirement, the foregone revenue equals Sdon multiplied by the market price which would normally equate Sdon and quantity demanded. Depending on the size of Sdon, foregone revenues and economic inefficieacies can be quite large. The main problem is that estimates of demand for inputs are very difficult in situations where they've been distributed freely for several years.

B. Extent of Former Policy Effectiveness

We first assess the extent of subsidy for each type of input (Po-Pw). We then address two fundamental questions:

- Was the supply of inputs actually constrained by the government's ability to extend subsidies? In other words, can we find evidence of an excess of demand over supply at subsidized prices?

21. Revenues can in fact increase where price elasticity of demand for the input is greater than 1.

- Did the difference between the subsidized prices and economic costs of inputs lead to significant inefficiencies in input use?

1. Fertilizer

Extent of Subsidy:

The standard reference is the cost of the input in international markets, expressed as a CIF import price. Several issues must be considered. What is the relevant price in the world market, and what foreign exchange rate do we use to convert it into a domestic price equivalent? Finally, one must distinguish between direct and indirect subsidies, and allow for the fact that the subsidized input may be used to produce a tradable.

In this case, we must choose between two possible shadow prices for fertilizer: (i) the border price of fertilizer from Nigeria, reflecting the federal government subsidy, (ii) and the border price of fertilizer from Nigeria, net of federal government subsidy, which would be equivalent to a world market price. Finally, a proper exchange rate must be selected.

We believe the full delivered cost of fertilizer commercially imported from Nigeria (Pw) represents the most practical short- or medium-term measure of domestic resources and foreign exchange foregone. This is what the government was actually paying up to 1986. This is what private farmers have been paying for non-official supplies (at least half of all fertilizer used in Niger).

Since the relative share of fertilizer in total Niger/Nigeria transactions is quite small(22), the proper rate of exchange is the daily free market Naira/CFA rate on the large markets of southern Niger.

Usually, indirect subsidies occur when an input supply agency does not recover through input sales some of its fixed or variable costs. Since 1986, over 90% of officially distributed fertilizer has come from foreign grants. Sale proceeds, minus a fee for handling and transportation, go into a fertilizer counterpart fund, used mostly for rural development investments. Under the new system the incidence of indirect subsilies is more complex. For any given subsidized fertilizer price, there are two possible cases.

In the first case, handling and transportation costs are entirely covered by the fee. The counterpart fund pro-

22. When the share of a subsidized good in total transactions is very large, the free market exchange rate may not reflect the true opportunity cost of foreign exchange spent on that good.

ceeds from fertilizer sales are thus reduced by the full amount. In the second case, the government subsidizes part of the handling and transportation costs. This implies a transfer from the economy in general to recipients of the counterpart fund. There is not necessarily any impact on users of subsidized fertilizer unless they are also counterpart fund beneficiaries. However, to the extent that the government could increase fertilizer prices to cover full handling and transportation costs, there is a transfer from counterpart fund recipients to fertilizer users.

Finally, we must consider the extent to which the subsidized crop is a tradable. A fertilizer subsidy lowers the producers' input costs so that domestic production of the tradable rises. With a shift to the right in the domestic supply curve, domestic production rises, and the equilibrium price decreases. In the case of an imported good, imports fall and foreign exchange is saved. If the commodity is exported, additional foreign exchange is earned(23).

Supply constraint Issue:

Lump sum subsidy allocations to fertilizer were in effect up to 1986. Under certain circumstances, this could induce an input supply constraint. For example, with 500 millions CFA the government could sell at 50 CFA/Kg 10 thousand tons of fertilizer priced at 100 CFA/Kg in real terms. With the same budget allocation, they could sell only 8,333 tons at 40 CFA/Kg. The higher subsidy would have had the unusual effect of bringing fertilizer consumption closer to what it would have been at world prices, without any real gain in efficiency, however. Depending on the rationing system, it may have further concentrated the benefits of the subsidy among users.

In fact, the budgetary constraint was not strictly binding on overall fertilizer use in Niger. Several recent studies have confirmed that large supplies of inexpensive fertilizer have been available from Nigeria, imported by the private sector every year. In southern Niger it is cheaper than government fertilizer. In areas further removed from the border, Nigerian fertilizer remains a viable alternative to official supplies.

Resource Allocation Issue:

We first ascertain the allocation of subsidized fertilizer over production systems and crops, and the major rationale behind the existing pattern. We then look at the relative share of the subsidized input in farm budgets.

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23. Actually, the net gain in foreign exchange is equivalent to savings from reduced agricultural imports or increased exports, minus the foreign exchange cost of importing additional amounts of the input.

In Niger, most subsidized fertilizer is used on large irrigated rice perimeters. The reason is that irrigated rice production is reliable and highly responsive to fertilizer applications. Furthermore, there is a producer support price for paddy, and most perimeters are closer to Niamey than to Nigerian sources of commercial fertilizer.

Without a clearly better alternative use of fertilizer, our conclusion is that the allocative impact of the subsidy was negative in absolute rather than in relative terms. Without a subsidy, most fertilizer would still have been allocated to rice, although producers would have used less fertilizer and more of some other inputs per hectare. Considering that fertilizer makes up only 7 to 9.5 percent of total paddy production costs, the efficiency loss due to fertilizer subsidies must have been quite small(24).

2. Farm Implements

Extent of Subsidy:

Inputs are significantly different from fertilizer and crop protection chemicals in the sense that they were mostly produced locally. One must therefore distinguish subsidies to **input production**, and subsidies to **input use.**

The government subsidized input production through partial protection of local implement manufacture or assembly. This naturally raised the economic cost of farm implements (both in terms of resources and quality of design).

The government subsidized input use directly by charging users less than production cost, and indirectly through a complex credit and extension program.

Supply Constraint Issue:

Direct and indirect subsidies did not create an effective constraint to the supply of farm implements. There has been since the mid-1980s a large excess of supply over demand at official prices. In fact, after 1986, official supplies of farm equipment exceeded demand even though user prices were reduced by one half or more during the 1986-1988 "vente promotionnelle".

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24. A more relevant resource allocation issue is whether rice should be produced in Niger, and under what type of farming system. However, as we point out, the small relative share of fertilizer in farm budgets does not strongly influence decisions on this issue.

Resource Allocation Issue:

Since farmers have largely stopped using most government farm implements, subsidy-induced losses in resource allocation by producers are very slight. The relevant question is: what was the cost of distorting resource allocation through production subsidies?

This cost had two main elements:

a) losses in the production of patently inadequate implements, which can readily be inferred from unsold inventories; and,

b) the value of additional agricultural production which could have been derived if the same resources had been used to make more adequate farm equipment.

A more general measure of the second element is the opportunity cost of these resources based on the average return on public investments.

3. Crop Protection Chemicals

Extent of Subsidy:

Food Crops

Most crop protection chemicals have been distributed freely. The government considers large-scale crop protection as an essential public investment designed to protect the nation's basic food supply. Given the devastating power of pest attacks by crickets, locusts, rodents, etc. crop protection for basic food crops is considered a matter of survival rather than a productivity enhancement. The experience of the last few years in North Africa and the Sahel supports this view.

An individual farmer can buy fertilizer and apply it to his crops. Similarly, he can purchase an implement and use it on his fields. Crop protection, however, requires rapid application with specialized equipment, often on a scale well beyond the individual farmer's holding. The argument for a public rather than private approach is rather compelling. Finally, there are strong externalities: if a few farmers in a given area don't use crop protection, the private investments of other farmers (including crop protection chemicals) can be completely lost.

As far as food crops are concerned, the government argument is economically sound, especially since rural popu-

lations are very eager to undertake training(25) and provide labor for pest monitoring and control. However, some of the crop protection chemicals (pesticides) have been freely distributed for use on irrigated cotton.

Cotton

The analysis must take into account the fact that cotton is bought at an official price, and that there are two different production systems: irrigated and rainfed. Financial and economic costs from price and subsidy policies are compounded because the subsidy increases the quantity on which the government has to pay the difference between the border and domestic prices.

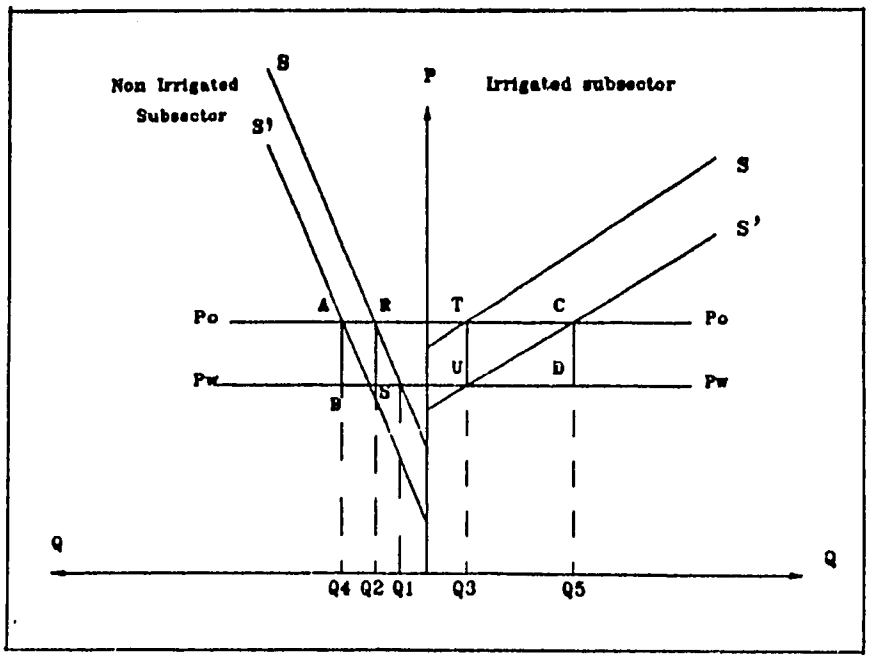
We derived cotton farm budgets in both irrigated and non-irrigated systems. Basic statistics for the 1987 campaign are as follows:

	IRRIGATED SECTOR	NON-IRRIGATED SECTOR
Area cultivated (Hectares)	1,991	7,430
Percent of area treated with pesticide	96	24
Quantity Marketed (tons/yr)	3,580	4,557
Yield (Kg/ha)	1,798	613

Cotton production systems and farm budgets can be analyzed from Figure 8:

25. There are currently (Feb. 1989) 26,364 farmers trained in modern crop protection techniques.

FIGURE 8



Cotton comes from both the irrigated and rainfed sectors. The supply curve for the non-irrigated sector (Sn) is lower, reflecting lower input requirements, but rises more steeply, due to limited access to extension, inferior productivity, and constraints on suitable land. The pesticide subsidy lowers the supply curves to Si' and Sn' respectively(26).

Demand at either world price (Pw) or official domestic price (Po) is quite price inelastic, given the size of domestic production.

At Pw, and without pesticide subsidies, only a small number of farmers in non-irrigated perimeters would produce cotton (Q1). The remainder of domestic requirements could be imported at a cost of Pw per unit.

At the support price Po, still without subsidy, non-irrigated production increases to Q2, while irrigated production reaches Q3.

The marginal cost to the Nigerien Government of buying domestic cotton production at Po rather than from the world market is represented by the area RSTU.

26. Strictly speaking, lower productivity in the non-irrigated sector makes the subsidy per ton produced about three times greater than in the irrigated system.

The effect of the pesticide subsidy, given the current price policy, is to raise production to Q4 in one sector and Q5 in the other. The combined cost of price and subsidy policies becomes the rectangle ABCD. This cost equivalent to:

$$(Q4+Q5) \times (Po-Pw) + (Q4+Q5) \times \text{pesticide subs./ton}$$

Weight-averaging the subsidy per ton by production in the two sectors yields a subsidy/ton of 26,400 FCFA. The difference between border and official cotton prices for 1987 was about 30 CFA/Kg.

The total cost of combined price and subsidy policies was therefore approximately:

$$8{,}000 \times (30{,}000 + 26{,}400) = 451.2 \text{ million FCFA.}$$

Supply Constraint Issue:

Protection of Food Crops

Because of the need to respond promptly to widely scattered alerts, a crop protection network must be decentralized, though linked by good communications and transport. Even in a less than ideal situation, such a network is quite expensive, in terms of infrastructure. If the government had to rely only on its own budget, there could be a serious supply constraint. However, several foreign donors have been financing the establishment and maintenance of the basic network, as well as equipment and chemicals. The real constraint lies not in the availability of products, but in means of communications to report attacks, and in the number of trained farmers.

Cotton

There are two related questions:

- Is there a supply constraint due to the combined effect of official price and subsidy policies?

- Which of the two policies contributes most to the constraint.

The government loses significant amounts of money every year on uneconomic cotton production. Pesticide, however, is donated to the state and represents foregone revenue. The amount of money the state is willing to lose on cotton determines the spread between Po-Pw (holding subsidy policy constant) rather than the amount of pesticide available to farmers. This implies that the budgetary constraint applies mostly to price policy.

Resource Allocation Issue:

Protection of Food Crops

Crop protection chemicals are used mostly in response to widespread attacks. Even so, many areas remain untreated and suffer heavy losses to insects and other pests. It would thus be difficult to argue that their allocation among various food crops would be different if farmers had to pay for these products, or that the difference between accounting and economic prices leads to excessive application and gross waste.

Cotton

In the case of cotton, we showed above that combined government price and subsidy policies promoted an inefficient use of resources which could have been more profitably invested (e.g. protection of food crops).

C. Extent of Policy reform Implementation and Impact

1. Fertilizer:

There are two basic issues:

i) how does one measure changes in direct and indirect subsidies, and

ii) what are the budgetary and economic impacts of such changes.

Direct subsidy calculation was simply:

Subsidy = (Delivered cost + Transport) - (User price)

After 1985, the reduction in direct fertilizer subsidy, calculated on the basis of delivered cost from commercial suppliers, led to fertilizer price increases. Demand for subsidized fertilizer fell drastically, with a corresponding increase in the market share private traders selling Nigerian fertilizer.

This direct subsidy estimate continued to apply when foreign donors came to replace private traders as major government suppliers. The CA (27) continued to use private traders' supply costs as the basis for calculation. However, they did not allow for the fact that over the last three years the market value of the Nigerian Naira has

27. Centrale d'Approvisionnement, national input supply agency.

fallen by at least half. Adjusting for the relative fall in the Naira yields a direct subsidy rate close to zero.

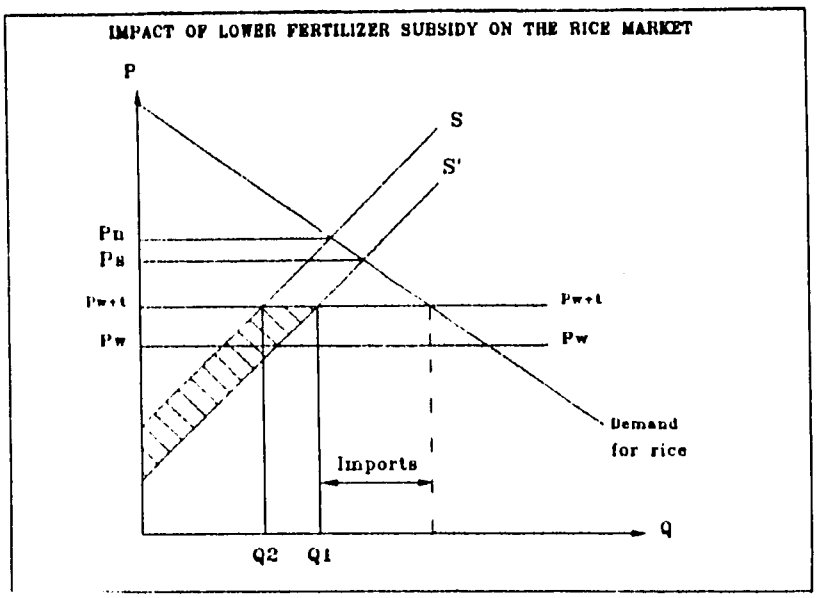
Changes in indirect subsidies can be measured through government appropriations to the CA, and the effects of improvements in management, stock monitoring and accounting through the evolution of the CA's balance sheet.

The budgetary effect of reducing direct and indirect subsidies usually includes two elements. The first one is the change in government outlay required to subsidize existing fertilizer sales. The second element is the saved subsidy on units of fertilizer no longer demanded as a result of the price change.

In some cases, there is a further impact through the cost of price support or stabilization programs for the commodity produced with the subsidized input. A decrease on fertilizer subsidies and consumption can induce a rise in prices for the commodity. The state may have to readjust its price support or stabilization policies accordingly.

The economic impact of reducing fertilizer subsidies is depicted in Figure 9 mostly in terms of the national rice market. Imported rice competes with and complements domestic production. Although there is a tax on imported rice, the cost of imported rice (Pw+t) is still significantly below the subsidized or unsubsidized domestic levels which would prevail under complete protection (self-sufficiency prices Pn and Ps).

FIGURE 9



Under such conditions, the impact on the national rice market of reducing fertilizer subsidies involved:

- a loss in rice producer surplus (hatched area)
- a budgetary savings of (Q1-Q2) x subsidy reduction per unit
- no change in equilibrium price or consumer surplus
- an increase in rice imports equivalent to (Q1-Q2)
- an increase in government revenue (Q1-Q2) x tax per unit imported
- a foreign exchange saving from lower demand for imported fertilizer
- a foreign exchange loss from increased rice imports.

Considering that the fall in the Naira decreased the amount of effective subsidy, the low share of fertilizer in rice production budgets and the rising availability of private commercial supplies on rice perimeters, the vertical distance S-S' is quite small. The economic impact of the subsidy reduction on production in the rice subsector must therefore have been quite modest. To provide some perspective, the impact on production of a fertilizer price increase from 40 to 65 FCFA/Kg can be estimated as follows:

Fertilizer applications to irrigated rice are about 350 Kg/hectare/campaign. At Pw+t annual production in two campaigns is about 46,000 tons, another 45 to 50,000 tons being imported to complement domestic supply. On the basis of rice farm budget studies we derive:

- Total costs excluding fertilizer: 291,500 CFA/ha
- Total costs with fertilizer at 40 CFA/Kg: 305,500 CFA/ha
- Total costs with fertilizer at 65 CFA/Kg: 314,500 CFA/ha

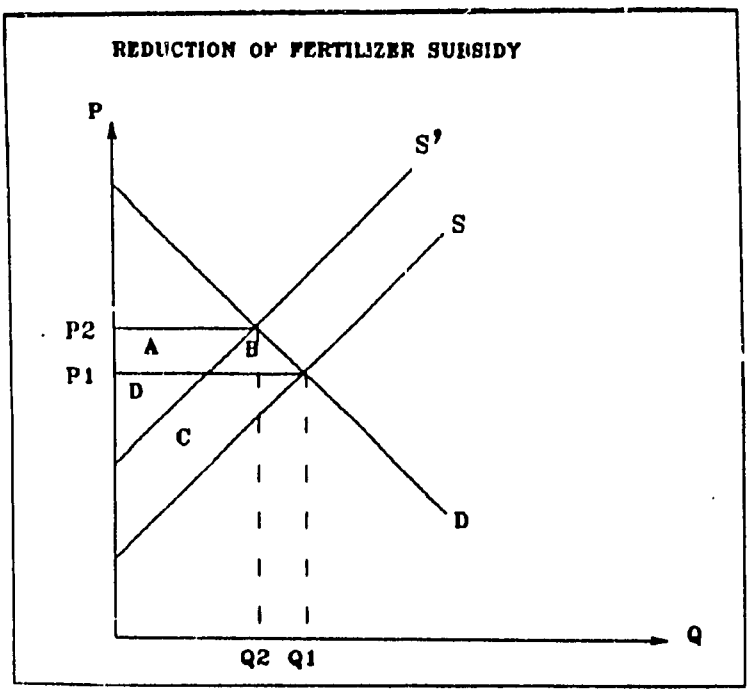
The fertilizer price increase therefore translates into a 2.86% increase in production costs, which we may consider, in the relevant range of the supply curve, as the proportion of the vertical shift due to subsidy reduction. In a self-sufficiency case, the effects of this shift on domestic price, production and producer surplus depend on the respective price elasticities of the supply and demand curves for rice in the relevant area. In this case, the openness of the economy to taxable imported rice means that the upward shift in domestic supply induces a reduction in domestic production directly related to the elasticity of the domestic supply curve. With a supply elasticity of 0.3, the decrease in domestic output is about 0.9 percent.

To assess the impact of fertilizer subsidy reduction on various other crops, one needs to know which crops receive most of the remaining fertilizer, and whether they are tradable(28).

Figure 10 illustrates this analysis. The reduction in subsidy applied to crop X shifts the domestic supply curve of X upward, resulting in a higher price and a lower quantity produced. Consumers lose areas B, and A, the latter being transferred to producers. Producers gain A but lose C. The net combined producer and consumer losses B and C, are contrasted with budgetary savings to the state. The respective sizes of areas A through D depend on the price elasticities of demand and supply for the crop.

28. National averages for application of officially supplied fertilizer per cultivated hectare in the early 1980s were: Millet 1.8 Kg, Sorghum 0.5 Kg, Peanuts 10 Kg, Cowpeas 0.5 Kg, Rice 285 kg.

FIGURE 10



Here too, if the commodity is a tradable (e.g. cowpeas, onions) the savings in foreign exchange from reduced fertilizer demand is offset by the decrease in export earnings due to lower production.

2. Farm implements:

The first question is: how and to what extent did the government reduce indirect subsidies to <u>implement production</u>?

This reduction occurred mostly through decentralization of management and reorientation in design and production. Workshops started producing items for which demand was strong (fencing, gardening tools, carts, as well as non-agricultural items). With donor support the government has also continued to develop and field test prototypes of equipment more suitable to farmers' needs, and readily manufactured or repaired by artisans. The extent of progress can be assessed from the workshops' balance sheets, including size and composition of inventories.

The second question is: how and to what extent did the government reduce indirect subsidies to implement use?

The former UNCC implement credit/extension program represented the major subsidy to input use. It was completely eliminated upon the disbanding of the UNCC in late 1984, and the interruption of CNCA activities(29) in 1985/86. From that time on, implement sales virtually ceased, even with a 50 to 66% discount ("vente promotionnelle"). This suggests that the indirect subsidy to input use extended through the former credit program dwarfed any subsidy effect from implement pricing. Collection rates by the UNCC for implements delivered on credit were indeed so low that the effective input cost to farmers was much below the official price level.

This is illustrated in Figure 11, in terms of supply and demand for multipurpose towbars, a typical implement.

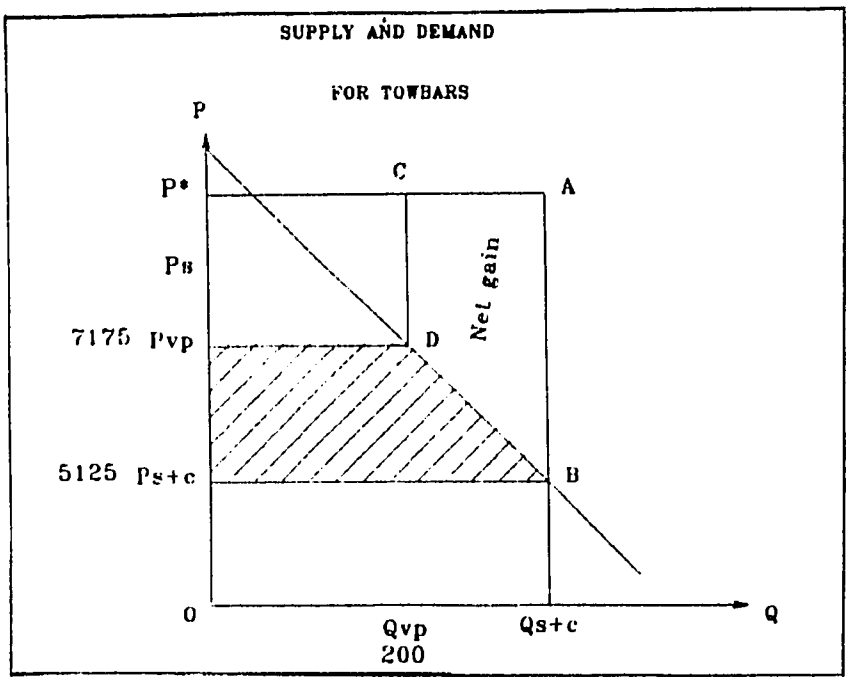
P* and Ps are the unsubsidized and subsidized prices. Ps+c is the farmer's perceived private input cost, including the UNCC credit element. S represents the 1985 short-term supply curve for the input. Up to 1985 sales of Qs+c took place because of the overwhelming effect of the UNCC program. When this program ended, the subsidized price became Ps, where little or no sales took place. The "vente promotionnelle" brought the price back down to Pvp, with sales of Qvp. S-Qvp represents unsold workshop inventories at the end of 1986.

The impact of main policy changes can be analyzed by comparing the pre- and post-1985/86 situations. Up to 1985 the budgetary cost of the subsidy was the difference between production costs and actual revenues for inputs sold (Qs+c). In this case, actual revenues reflect the low collection rates. The budgetary loss was equivalent to the rectangle Ps+c P* A B.

In 1985, after the end of the UNCC program, the "vente promotionnelle" came into effect(30). The effective user price became Pvp, and demand fell to Qvp. The budgetary cost of subsidies remained positive, but much smaller: rectangle P* C D Pvp. The savings realized came partly from reduced consumer surplus of input users (hatched area Pvp D B Ps+c), the remainder being a net saving (area ABCD).

29. Caisse Nationale de Crédit Agricole.
30. The "vente promotionnelle" officially ended in May 1988.

FIGURE 11



One cannot precisely estimate demand for implements from historical prices and quantities demanded, partly due to the "noise" introduced by the credit/extension program, weather, and other factors. To gain a sense of perspective, however, we made a rough estimate of subsidies on towbars. This requires deriving Ps+c from the general price/demand relationship and a rather heroic assumption about the relevant price elasticity of implement demand.

When the UNCC program was in effect demand for towbars averaged 1,000 per year. The 1986 Ps was 19,335 FCFA, while Pvp was 7,175 FCFA. At "vente promotionnelle" prices, demand fell to about 200 p.a. Other things being equal, arc price elasticities of demand between 2 and 3 in the relevant range yield Ps+c values of 5,125 to 5,650 FCFA. We conclude that the former UNCC program was a substantial indirect subsidy to input use.

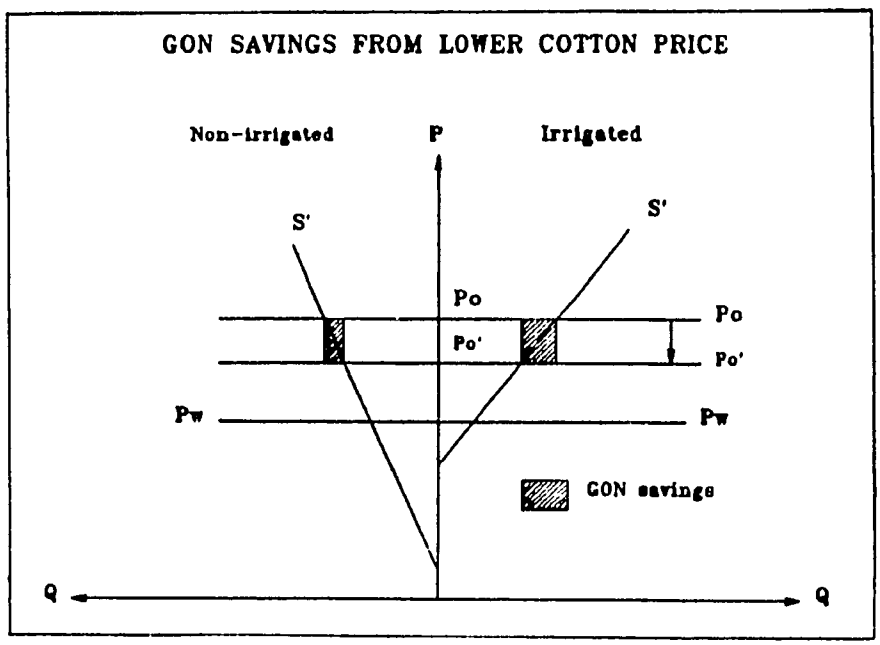
3. Crop Protection Chemicals

The government transferred responsibility for crop protection to a single, specialized agency (DPV) operating with major donor support, including AID. ASDG had no other impact on crop protection of food crops.

In the case of cotton, free distribution of pesticide continued. However, the ASDG-induced reform environment had

a positive impact on official price and quality control policies. Cotton producer prices decreased over the last few years, becoming closer to world market levels (31). The price paid for cotton also became tied to observed quality rather than to the delivery date. These actions reduced the combined cost of price and subsidy policies. The budgetary savings may be assessed as follows:

FIGURE 12



Between 1986 and 1987, official cotton prices fell from 130 to 110 CFA/Kg, a 15.4% decrease. Production in the irrigated and rainfed sectors was 3,688 tons and 3,633 tons, respectively, for a total of 7,321 tons. A rough estimate of government savings from this modification of price policy can be made, taking 0.5 and 0.2 as elasticities of supply with respect to price in the irrigated and non-irrigated sectors. The change in price would induce a decrease in global production to 6,943 tons, and a modest budgetary saving of 7.5 millions FCFA.

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31. Domestic production and processing costs for fiber, in CFA/ton, are contrasted below with the amount paid by the textile plant, CIF Niamey at world prices:

	1982/83	83/84	84/85	85/86	86/87	87/88
Domestic cost	628	618	583	536	521	530
Border price	249	628	506	305	289	526
NPC	2.5	.98	1.15	1.75	1.8	1