Agricultural Pricing in Togo

SWP-467

World Bank Staff Working Paper No. 467

July 1981

Prepared by: David Bovet and
Laurian Unnevehr
Country Programs Department II
West Africa Regional Office

WORLD BANK

Staff Working Paper No. 467

July 1981

AGRICULTURAL PRICING IN TOGO

This paper analyzes the pricing policies pursued by the Government of Togo for its export crops -- cocoa, coffee, and cotton -- and proposes an analytical framework which could be used in price-setting. Because these crops are handled through a marketing board system, the conflicting pricing policy objectives of government revenue maximization and of foreign exchange maximization determine the type of analysis used. Supply elasticities and measures of private and social profitability are computed, and the effects of competing foodcrop prices and cross-border trade are analyzed. The results suggest that in the case of cocoa, the policy of pursuing revenue maximization in the short-run means that special measures must be introduced to provide an incentive for cocoa replanting. For cotton, the effect of input subsidies is shown to be more than offset by the relatively low producer prices.

Prepared by: David Bovet and
Laurian Unnevehr
Country Programs Department II
West Africa Regional Office

PREFACE

This paper analyzes the price response of Togo's major cash crops, discusses options for pricing policy, and recommends a framework for price analysis which could be applied by the Government. The data gathering, analytical work, report writing and discussions with Government were carried out by Mr. David Bovet and Ms. Laurian Unnevehr, both of the West Africa Programs Department. Annex A was written in conjunction with Mr. Michael J. Hartley of the Development Economics Department. This review was carried out in consultation with the West Africa Projects Department, Agriculture Division.

AGRICULTURAL PRICING IN TOGO

Table of Contents

List of Text Tables and Figures

Table of Contents

The purpose of this study is to investigate the effects of past agricultural price policies in Togo on production incentives and to evaluate alternative pricing strategies against macroeconomic objectives. In addition, it is hoped that the analytical methods presented can be used by the authorities in carrying out their own analyses of agricultural prices in future years. The present study was prompted by the Government's and the Bank's desire to analyze cash crop pricing issues more closely in light of the emphasis now placed on agricultural development. This paper is specifically directed toward three major export crops, all of which have been the focus of Bank projects in Togo: cocoa, coffee and cotton. Incentives for growing these crops have been analyzed in relation to competing foodcrop prices. Attention has been focussed on the export crops, since their prices are set annually by the Government marketing agency.

Background

Agriculture is an important sector in Togo in terms of both economic product (30%) and employment (75%). It is a less important component of export earnings because of Togo's mineral resources (see Table 1).

TABLE I

COMPOSITION OF EXPORTS - % OF VALUE

	1970	1971	1972	1973	1974	1975
Phosphates	25	35	38	46	76	65
Cocoa	42	31	29	26	12	18
Coffee	18	18	21	13	4	6
Cotton	1	2	2	3	2	1

Agricultural institutions in Togo are divided between cash crops and foodcrops 1/. OPAT, a parastatal agency, serves as a marketing board in setting prices for cash crops (cocoa, coffee, cotton, groundnuts, palm kernels and others), providing domestic marketing and processing, and selling for export. TOGOGRAIN, a relatively new agency, is supposed to stabilize food grain prices by operation of a buffer stock. So far, its activities and impact have been small. There are also extension agencies: the ORPV's (ex-SORADS) are responsible for regional agricultural development but have been hampered by a lack of clearly defined goals. Agencies for individual cash crops have been more active: SRCC (cocoa and coffee), SOTOCO (cotton), and SONAPH (oil palm).

Currently, farmgate prices for cash crops are fixed by OPAT while prices of foodcrops are determined by market forces. Producer prices of cash crops have been about half of world market prices (based on F.O.B. Lome):

1/ "Cash" crops and "export" crops are used interchangeably in this paper to refer to those crops marketed by OPAT. Foodcrops are the foodgrains and starchy staples which may be produced both for subsistence consumption as well as for cash sale. This distinction is not absolute since groundnuts and palm oil are marketed both domestically and for export.

Nominal Protection Coefficient 1/

Cocoa (Avg. 1967-76)	.47
Coffee (Avg. 1967-76)	.45
Cotton (Avg. 1972-77)	.51
Palm Kernels (1977)	.57

Togo producer prices have tended to be lower than producer prices in other CFA zone countries (see Table 2), especially the Ivory Coast 2/. For cocoa, this is a reversal of the earlier situation (up to 1973-74) in which Togo's prices were above those of the Ivory Coast and Cameroon.

Foodcrop prices have exhibited a rising trend over the last 10 years, though with considerable cyclical fluctuations related to rainfall conditions. The drought in 1976-77 caused prices of staple food to triple, though they subsequently declined somewhat in response to heavy 1977 grain imports. A much better harvest in 1977-78 has brought foodcrop prices to very low levels. Increases in cash crop prices have not always kept up with trends in foodcrop prices (see Figure 1).

Cash crop production performance has been mixed (see Figure 2). Cocoa exports (Togo's major export crop) have declined sharply since 1971, due partly to aging trees and partly to lower smuggled volume from Ghana. Coffee exports have declined slightly since 1971, but recent efforts to expand the planted area have been quite successful. Cotton production fell off sharply in 1975 with the beginning of substantial foodcrop price increases, but there are indications that cotton outputs is up in 1978. Consistent times-series data are not available for foodcrop production, which seems to be trending upward at slightly less than the population growth rate. Foodcrop production suffered in recent drought years but has rebounded strongly with better rainfall in 1978.

The Bank Group has been involved in three projects in the rural sector so far. These are a Cocoa/Coffee Planting Project (approved in 1975), a Cotton Project that also promoted foodcrop production (1978), and a Rural Development Project in the Maritime Region (1976). A Second Cocoa/Coffee Project was appraised in September 1978 and future plans call for several more rural development projects.

The Togolese government's stated goals with respect to agriculture are (1) to increase the productivity of cash crops, (2) to promote self-sufficiency in foodcrop production, and (3) to promote regional development to mitigate regional disparities in income. There is presently considerable interest in water management as a necessary step in countering the marginal rainfall conditions prevalent over much of the country. Recent agricultural projects have tended to combine efforts directed toward cash crop with introduction of improved techniques and varieties for foodcrop production.

1/ $NPC = \frac{\text{Producer Price}}{\text{F.O.B. Lome price - internal marketing cost.}}$

2/ This is a superficial comparison of returns to producers since costs of production may vary among countries.

TABLE 2

COMPARISON OF PRODUCER PRICES IN CFA ZONE

COCOA

	Togo	Ivory Coast	Cameroon
70-71	93	85	85
71-72	93	85	90-75
72-73	93	85	90-75
73-74	95	110	100-80
74-75	115	175	120-100
75-76	120	175	130-120
76-77	130	180	150
77-78	150	250	220
78-79	200		

COFFEE

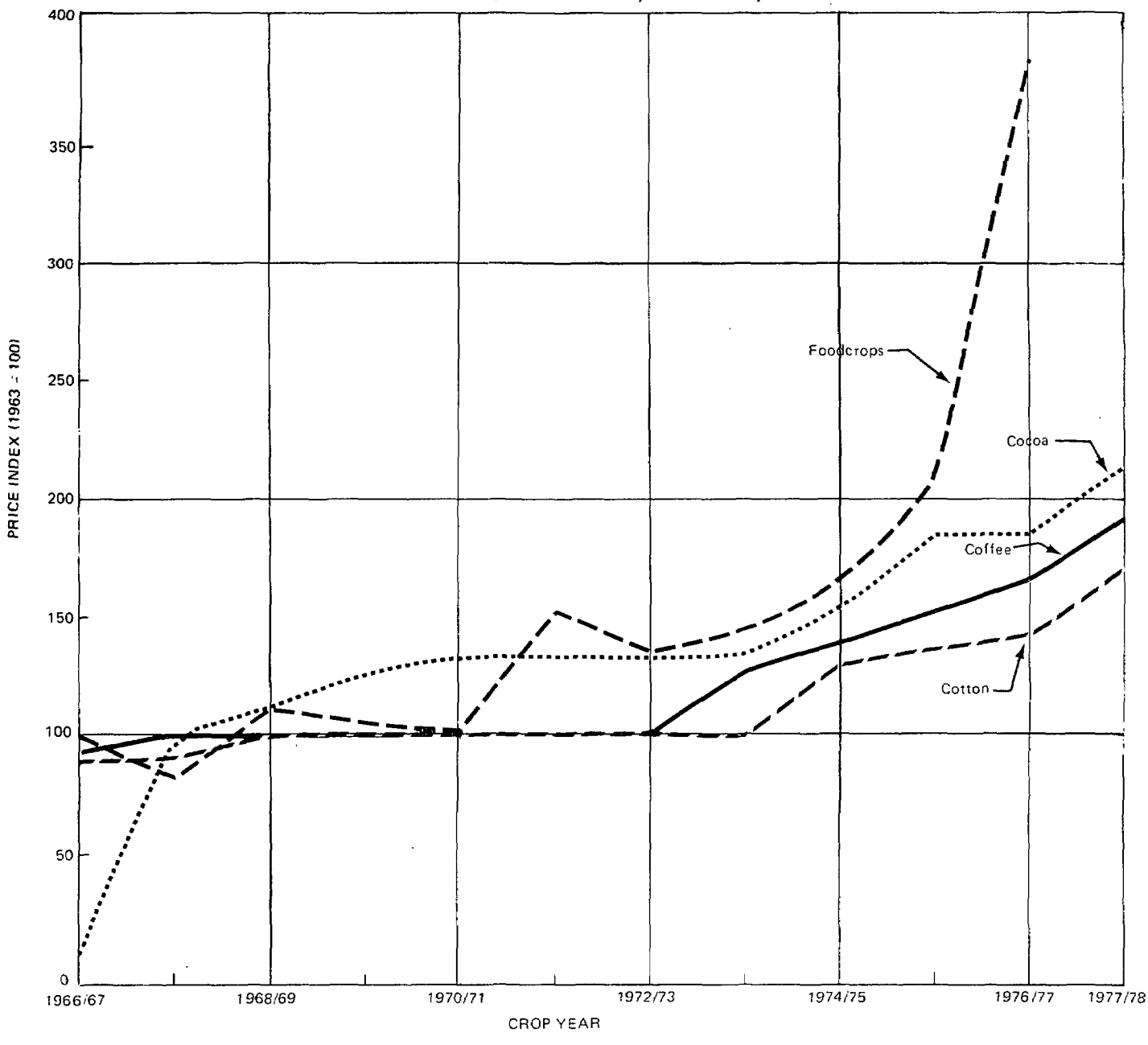
	Togo	Ivory Coast	Cameroon	Benin
70-71	75	105	125	
71-72	75	105	125	
72-73	80	105	125	
73-74	90/95	120	130	98
74-75	105	150	135	103
75-76	115	150	145	110
76-77	125	180	195	115
77-78	145	250	230	

COTTON

	Togo	Ivory Coast	Benin
72-73	35	40	36
73-74	37	45	36
74-75	46	70	40
75-76	48	70	45
76-77	50	80	50
77-78	60		

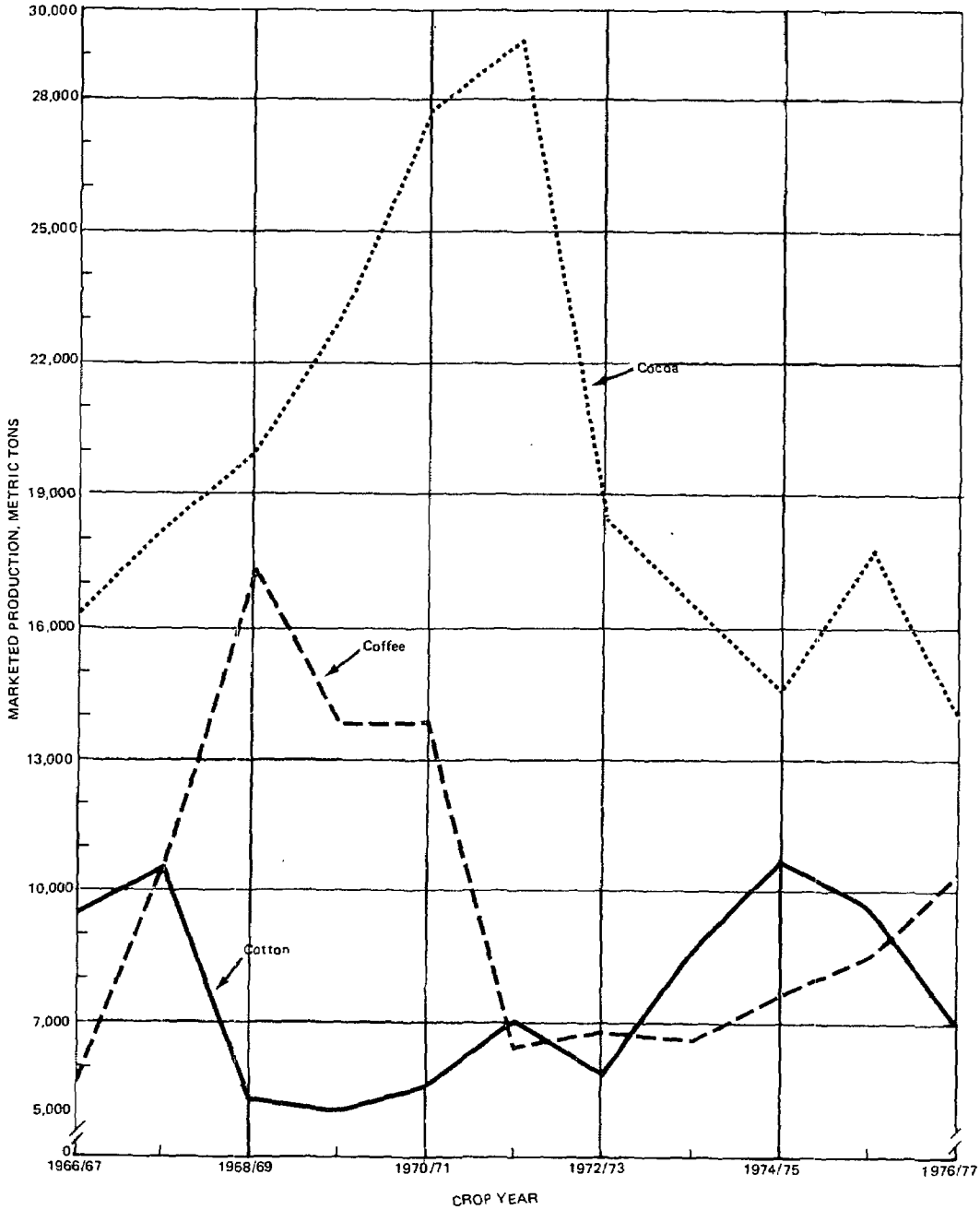
Source: BCEAO, UMOA: Conjoncture économique, fin 1977. No. 258, Feb., 1978 and Rapport d'Evaluation du Projet en Cours, SRCC.

FIGURE 1: AGRICULTURAL COMMODITY PRICE MOVEMENTS
(PRICE INDEX, 1963 = 100)



World Bank -- 20177

FIGURE 2: CASH CROP MARKETED PRODUCTION
(METRIC TONS)



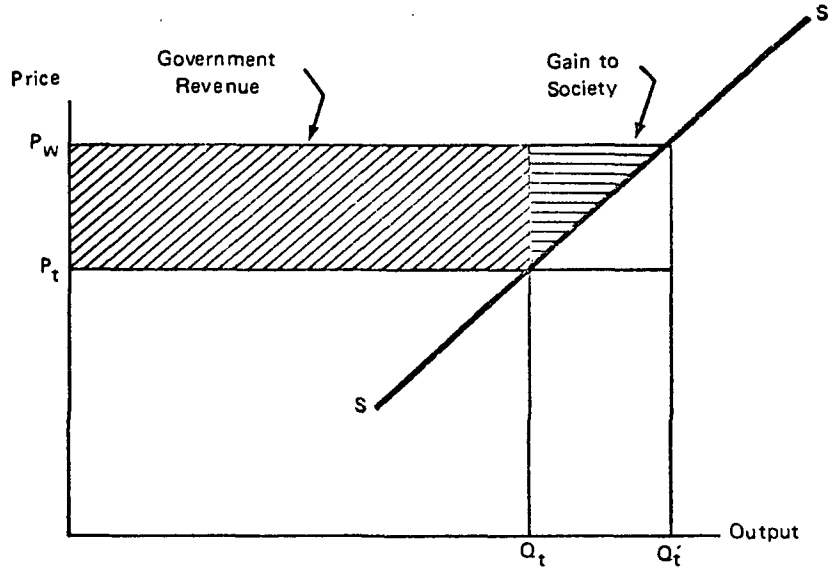
World Bank – 20178

Pricing Policy Objectives

In order to evaluate the effectiveness of pricing policies, it is useful first to define the objectives that the policies are intended to serve. Since this analysis is limited to export crops, the two primary objectives are likely to be the generation of foreign exchange earnings and the generation of government revenues. If the primary goal of the government is to maximize economic product (e.g., maximizing foreign exchange earned from export crops), then producer price should equal world price. 1/ However, for the government to maximize its revenues from the marketing of cash crops, the producer price should be considerably below the world price, the exact level depending on the characteristics of supply. There will be some trade off between maximizing economic efficiency and maximizing government revenue since a producer price below world price will reduce production.

(graph below)

FIGURE 3: OUTCOME OF ALTERNATIVE PRICING POLICIES FOR EXPORT CROPS



World Bank – 20179

This argument is illustrated in Figure 3. SS is the cash crop supply curve, Pw is world price and Pt is producer price. Qt is produced, purchased by OPAT at Pt, and resold at Pw. OPAT revenues are the diagonally-shaded area, which represents a transfer from producers to OPAT. If producer price were raised to world price levels, Qt′ would be produced and the net

1/ World price refers to the economic or border price at the farmgate; i.e., F.O.B. Lome price less domestic transport, marketing and handling charges.

gain to society of the extra production would be the horizontally-shaded triangle, which represents additional foreign exchange earnings. The size of this triangle will depend on the magnitude of the price distortion, Pw - Pt, and the elasticity of the long-run supply curve which will determine Qt´ - Qt. The cost of this foreign exchange-maximizing policy is the elimination of the surplus collected by OPAT.

In Togo, the marketing board collects revenues that the Government would be hard put to replace from other sources. For the case of a relatively inelastic supply curve, the loss of foreign exchange will be small relative to government revenue generated. One could argue that government revenues are preferable in this case if they can be invested more efficiently in an economic sense by OPAT than they could be by cash crop producers. This amounts to weighting government revenues more highly than private incomes, and may well correspond to present Togolese policy. Maximizing government revenue will depend on world prices and the elasticity of supply for the cash crop. The more elastic supply is, the greater the revenue-maximizing producer price will be, as given by this formula 1/: $Pt/Pw = \frac{EPT}{1+EPT}$, where EPT=elasticity of supply with respect to producer price.

The government revenue-maximizing producer price is shown as a function of supply elasticity in Figure 4 below. Thus, for a supply elasticity of 0.5, producer prices would be set at only 0.33 of the world market price in order to maximize government revenues under a marketing board situation. As suply elasticity increases, the revenue-maximizing producer price asymptotically approaches the world market price. Any rational producer price will be between the world price and the revenue-maximizing price. The higher government revenues are weighted in relation to private incomes, the closer producer prices should be to the revenue-maximizing price. This latter price can be regarded as a minimum rational producer price.

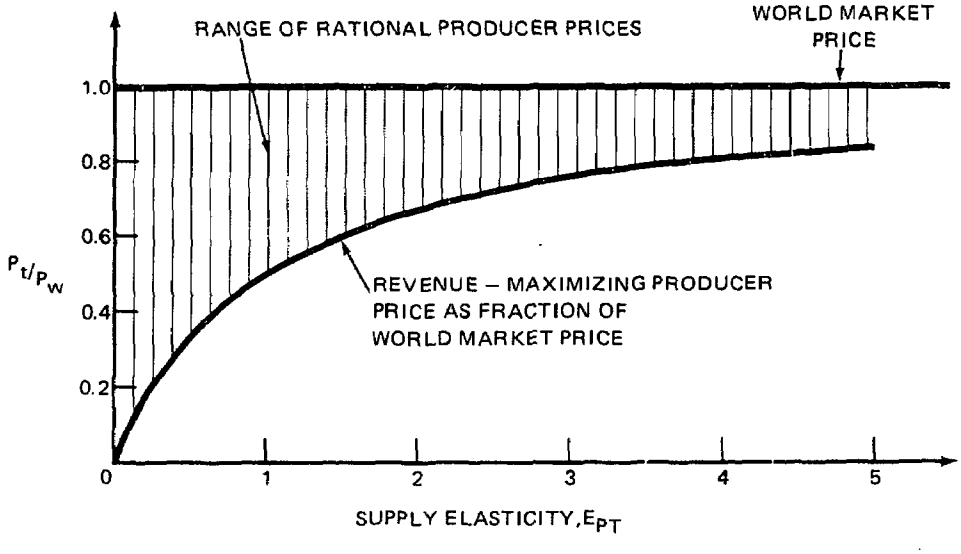
The extent to which any policy objectives can be realized will be constrained by the level of world prices, over which Togo has very little control since it produces at most 1% of the world supply of any crop. Another constraint is the cost of domestic resources used in production of the export crop which will be determined in part by prices of competing foodcrops. The level of world prices will affect the earning potential of export crops and the "shadow" or "economic" prices of land, labor and capital will determine which activities are the most efficient earners of foreign exchange. The spread between world prices and domestic costs will also affect the margin of profit that the government can capture through intervention in export markets.

It is clear that the objectives of maximizing foreign exchange earned by the economy and maximizing Government revenues from export crop marketing provide inherently conflicting signals for agricultural pricing

---

1/ For a mathematical derivation of the revenue maximizing producer price see Annex A.

FIGURE 4. GOVERNMENT REVENUE – MAXIMIZING PRODUCER PRICE AS A FUNCTION OF SUPPLY ELASTICITY



World Bank–22438

policy. Policy choices are further complicated by uncertainties associated with world markets and climatic conditions. This paper does not attempt to choose between objectives, but rather to quantify, as far as possible, the economic choices involved. The approach developed should provide the Government with better tools to analyze the policy options available.

Methodology

The methodology employed allows an evaluation of the effectiveness of pricing policies in achieving the objectives outlined above. The estimation of supply response, based on past production and price data, is used to determine the optimal producer price from a revenue-maximizing viewpoint. An analysis of farm budget data provides two important types of information. First, economic profitability can be computed to determine whether the crop does in fact utilize domestic resources to generate foreign exchange in an efficient manner. Second, the structure of incentives faced by private producers can be analyzed to check whether prices are sufficient to encourage production of the crop in question.

In order to determine supply response, supply functions were estimated for cocoa and cotton using historical data and standard statistical techniques. These functions give estimates of the supply elasticity, or change in production for a given price change, which quantifies the farmers' response to price incentives. Lack of accurate acreage data precludes estimation of the price responsiveness of acreage planted in perennial crops. Therefore, for cocoa, only estimates of short-term production response could be made assuming acreage as given. The estimates of short-term price response for cocoa production were also complicated by the presence of smuggling (see Annex A). Coffee supply response was not computed in detail as the techniques involved are similar to those applied to cocoa.

The estimated price elasticities are then used to stimulate revenue maximizing producer prices for cocoa and cotton. This allows an evaluation of past pricing strategies in terms of revenue maximization and provides an estimation procedure for future price-setting if this objective is of major importance.

Using the farm budgets, economic profitability is evaluated first, using the world price of the cash crop, world prices of tradeable inputs and opportunity costs of non-tradeable inputs. For perennial crops, future values of inputs and outputs are discounted to the present. Economic profitability calculations indicate the contribution of export crop production to economic product; in other words, from the national economic point of view, whether production of the crop represents a sensible use of resources or not.

Private profitability is then evaluated, also using farm budget data, except that the actual prices facing farmers (producer prices of outputs and market prices of inputs) are used in place of the economic (or efficiency) prices. Analysis of private profitability reveals whether current output prices and input subsidies encourage or discourage production by the farmer. Additional measures of comparative advantage and incentives have been used in the analysis of cotton (see Annex C).

Analytical Results

Cocoa

Cocoa is the major foreign exchange earner among agricultural exports and hence the most important source of OPAT profits. Between 1966 and 1975, cocoa provided an average of 27% of recorded export earnings, and 64% of OPAT profits.

A number of factors complicate an analysis of price response: (1) the nature of perennial crop production, (2) the existence of substantial smuggling from the Volta Region of Ghana, and (3) the lack of available land for new plantings.

There is an eight year lag between planting and production for cocoa trees, and once planted a tree will continue to produce for forty to sixty years. This means that production in any given year will be primarily determined by the existing stock of trees. Therefore current production will reflect the planting response to prices eight or more years ago.

Current production will also vary according to how intensively the existing trees are harvested. This will depend upon the opportunity cost of labor, which in turn will depend upon returns in foodcrop production.

In Togo, observed quantities include an unknown amount of smuggling from the Volta Region of Ghana. This may explain the abnormally high levels of marketed production observed in 1968-70. The existence of smuggling means that price response in any given year will be more elastic than is usually the case for a perennial crop.

The elasticity of short-term supply was estimated at .51. Using this elasticity optimal revenue maximizing prices were calculated for 1967-76. The results show that OPAT's policies have maximized government revenue taking acreage and age structure as given.

In other words, the short-term revenue maximization prices maximize revenue treating acreage as exogenous, but do not necessarily provide incentives for planting. In the long run, supply will be more elastic as acreage responds to price. The more elastic the supply curve, the higher the optimal price for revenue maximization. Hence the optimal price calculated on the basis of supply elasticity = .51 is somewhat lower than optimum from a public revenue point of view.

Forty-four percent of the cocoa trees in Togo are over 38 years old. This aged stock of trees implies declining production prospects. Suitable conditions for cocoa cultivation exist only in limited areas that have already been densely planted. This means that future increases in productive capacity will have to come about through replanting of very old trees. Since these trees still yield 150 kg/hectare, replanting entails opportunity cost of income foregone from cutting down the old trees.

In economic prices, the internal rate of return on replanting a hectare of cocoa is 15.8%. This is greater than the economic opportunity cost of capital in Togo, which has been estimated at 8%. An increase in labor costs of 20% only reduces the rate of return to 14.5%. Replanting thus appears to be economically profitable.

Two different types of budgets are used to evaluate private profitability. The first uses hired labor throughout and the second uses hired labor in the first six years and sharecroppers after new production begins. Table 3 shows discount rates for which replanting is privately profitable, under various assumptions of producer price. Because of the lost income in early years due to cutting down the old trees, very high private discount rates will make the investment decision appear unattractive. At lower discount rates, the higher value of output achieved in later years becomes more important. Depending upon producer price and labor cost assumptions, the investment will be privately profitable if discount rates below 15%-20% are assumed. Increases in producer price will make the replanting harvest more attractive unless very high discount rates apply.

TABLE 3

RANGE OF DISCOUNT RATES FOR WHICH REPLANTING SHOWS A POSITIVE RETURN

	Producer Prices (present price = 200 CFAF/kg)		
		200	250
Positive Return for all Discount Rates less than:			
Hired Labor	18%	20%	21%
Sharecropper	12%	14%	15%

Source: Annex A, Tables 2 and 3.

Perhaps the most important factor affecting private costs is the nature of labor markets in the cocoa producing region. Sharecroppers are employed on 85% of the plantations in the Litime area and 41% in the Kloto area. Of these, three-quarters are paid by taking a 1/3 share of the crop. 1/ As Table 3 shows, this type of arrangement does not make replanting very attractive to the plantation owner.

1/ "Sharecropping" takes two forms. The laborer may work on the harvest only and is paid a fixed rate (currently 600 CFAF) per bag. The more common arrangement is for the sharecropper to manage the farm and harvest the cocoa for a 1/3 share of the crop.

Sharecroppers are, of course, not interested in replanting since this deprives them of their income from the harvest of existing cocoa. Due to lack of land in the cocoa producing areas, many sharecroppers migrate to their homes in northern regions in order to plant foodcrops, and then return to harvest cocoa. Replanting would require year-round labor, which these sharecroppers could not provide even if economic incentives were right.

In order to strengthen productive capacity new trees must be planted. The Government must focus attention on alleviating institutional constraints to labor availability and providing economic incentives to replant cocoa.

Two options are available to government: (1) Raising the producer price substantially, thereby raising long run price expectations and encouraging replanting. (2) Continuing current price setting policies but using some revenues to subsidize replanting. Current price setting policies maximize revenue in the short run, taking into account inflation and foodcrop prices. The use of subsidies to encourage replanting would introduce a distortion to correct for already existing distortions and is therefore not desirable from a strictly economic point of view. However, it does have the advantage of being directed at a specific group of planters. The decision to raise the 1978/79 cocoa producer price to 200 CFAF per kg is in keeping with OPAT's price strategy which has maximized revenues in the short run. This increase should have some favorable effect on planting decisions. However since world cocoa prices are currently high, the government has considerable scope for implementing either of the above options, to further promote replanting.

Coffee

Coffee is Togo's second most important agricultural export, accounting for 15% of total export earnings between 1965 and 1976. While the very high recent world market prices have declined, the long-term outlook for coffee prices is quite favorable. An analysis of farm budget data and production characteristics, which differ substantially from cocoa, result in rather different implications for price policy.

Rainfall should be a more important factor in coffee production than cocoa production for two reasons. First, coffee yields are more susceptible to low rainfall combined with lack of maintenance. Second, coffee in Togo is planted in some areas that have marginal rainfall for tree crops. Average rainfall in the coffee producing areas is lower than average rainfall in cocoa areas.

There are several factors that make coffee replanting more profitable than cocoa replanting. First, the lag between planting and production is much shorter: 3-4 years instead of 7-8. Second, old coffee trees that could potentially be replanted have been abandoned and no longer produce. Bringing these areas back into production would not entail any opportunity cost of foregone production to either the producer or the economy. Finally, the Bank's projected world prices for coffee are much higher than those for cocoa.

Replanting coffee is highly profitable in both economic and private prices. At producer prices greater than 115 CFAF/kg, replanting has a return of greater than 20%.

During the years when the tree is bearing, coffee is a more labor-intensive crop than cocoa. Cocoa requires an average of 125 mandays/ha of labor while coffee requires 193 mandays/ha. As a result, the returns per manday for coffee are lower than for cocoa (590 CFAF vs 844 CFAF) at 1977/78 producer prices. For maintenance activities alone, the difference is even more striking. Cocoa requires 48 mandays/ha, while coffee requires 103 mandays/ha. This is due to higher labor requirements for weeding and pruning.

Perhaps due to higher labor requirements associated with coffee, more family labor is employed in coffee production. Fewer farms can rely on sharecroppers in the coffee producing areas. The sharecroppers who do work in these areas usually raise foodcrops also, in contrast to cocoa sharecroppers.

The factors outlined above lead to the conclusion that economic incentives will be more effective in promoting coffee production than they would be for cocoa production. Private producers do not face as long a lag between planting and production. There is no opportunity cost of income foregone from cutting down old coffee trees. Institutional constraints on labor availability are not as acute for coffee. Maintenance of coffee, especially when rainfall is deficient, will affect production. Higher prices will raise not only incentives to plant but also incentives to maintain existing trees, which will be more important for coffee production than for cocoa.

Cotton

In terms of government revenue or foreign exchange earnings, cotton is not as important as the perennial crops. However, cotton could be produced in all regions of Togo, and so the potential for significant expansion of cotton production is much greater. Cotton could provide cash income to a large segment of the agricultural population.

Until 1965, only the low-yielding mono variety of cotton was produced in Togo. This variety is intercropped with yams. Starting in 1965, single-stand production of allen variety cotton was promoted and mono production was discouraged. Lower prices were offered for mono cotton and marketing arrangements were less favorable. Fertilizer and insecticide inputs for allen cotton production are subsidized. Production of mono declined rapidly while allen production increased slowly. Then, rising foodcrop prices starting in 1975 and drought in 1976/77 caused allen cotton production to decline.

Data was available on allen cotton production by region for 1968/69 to 1977/78. Since production systems differ between regions, supply functions were estimated separately for the Plateaux and Centrale regions. These two regions account for more than 95% of all cotton production during this period. Each function was estimated using rainfall and foodcrop price data specific to the region. Rainfall was only significant for the Centrale Region.

It was difficult to separate effects of foodcrop prices and cotton prices since the two series moved closely together. The reported supply elasticities are for cotton prices deflated by an index of foodcrop price movements.

Elasticity of cotton supply with respect to producer price ÷ foodcrop prices

Plateaux Region	2.2
Centrale Region	3.4

These high elasticities demonstrate the importance of prices of competing activities in producer response. While these elasticities over-estimate price response due to the use of production rather than acreage data, it seems safe to conclude that supply response of cotton production in Togo is elastic with respect to relative cotton/foodcrop prices. 1/

Price responsiveness to competing crops is further illustrated by an analysis of farm budget data. First, it has been computed that returns per manday for cotton production in the Plateaux Region were higher than those in the Centrale Region, due to differences in the labor requirements. The greater profitability of cotton-growing in the Plateaux Region may partially explain the more rapid adoption of allen cotton in the Plateaux Region. Second, an analysis of the different technological levels of cotton production indicates that the higher stages (using fertilizer, insecticides, etc.) yield considerably higher returns per manday than the more basic techniques. This may explain the fact that during recent drought years, the farmers who abandoned cotton production were primarily those in Stage I, the least remunerative production technique.

Cotton production is economically profitable in Togo, and more sophisticated techniques of production are relatively more profitable. This is to be expected since the more advanced techniques use less labor (Togo's scarcest resource) per unit of output. Production in the Plateaux Region is relatively more profitable than in the Centrale Region, because of the greater rainfall which allows double-cropping and hence fewer labor inputs.

For cotton production in Togo, there are price distortions on both outputs and inputs. Fertilizer and insecticides are sold to farmers at prices below cost. Subsidized inputs do not offset the producer price distortion, however. The net effect of the price distortions is to discourage cotton production relative to the situation that would obtain with no price distortions.

1/ Estimates of cotton supply elasticities mentioned in "Price Prospects for Major Primary Commodities" are as follows: United States, 1.97; Greece, 1.00; aggregate for Mexico, Guatemala, El Salvador, Nicaragua, and Colombia, 1.55; Pakistan, 1.65; Turkey, 0.21; and Ivory Coast, 3.69.

It is argued that these subsidies are needed to overcome farmer resistance to modern techniques of production. Since the subsidized inputs do require less cash outlay, the risk to the farmer of adopting the new techniques may be lessened. The subsidies do have the effect of making the more advanced techniques slightly more profitable to the private producer. This is desirable since the advanced techniques are more economically profitable.

The subsidies are essentially costless to government since cotton output is heavily taxed. These subsidies may make sense for promotion of more modern techniques of production. However, this policy should be re-evaluated periodically as use of modern inputs becomes more common or extends to foodcrops.

The analysis above indicates that cotton supply response is elastic. This result coupled with a producer price that is on average only half of the world price will mean a substantial loss of earned foreign exchange. For example, taking only production in the Plateaux Region, and the estimated elasticity of 2.2, the loss of foreign exchange due to the price distortion in 1977 is 170,000 CFAF while government revenues are 197,000 CFAF. The loss to society is nearly as great as government revenues. This loss may be exaggerated if the estimated elasticity, 2.2, is higher than actual response would have been. However, this calculation demonstrates that when the supply curve is elastic, a large price distortion will cause large losses of foreign exchange.

In terms of government revenue, an optimal producer price can be found by using the estimated elasticity for the Plateaux Region and a world price equal to the economic farmgate value minus the cost of subsidies per kg of output for Technique I. This "world price" includes the value of both seed and lint.

	Simulated Producer Price (designed to maximize Government revenue)	Actual Producer Price
72	21-24	35
73	40-46	35
74	67-78	37
75	37-43	46
76	75-88	48
77	64-74	50
78	--	60

Actual prices in the last few years have tended to be too low to maximize government revenue, if we take the Plateaux Region as representative. Estimated price responsiveness in the Centrale Region has been even higher than in the Plateaux Region, which should raise the aggregate elasticity for the country as a whole. The higher price responsiveness is, the higher the optimal price from the point of view of government revenue.

It seems that low cotton producer prices have caused substantial losses of foreign exchange and may even have been too low to maximize government revenues. This is because producer response is very sensitive to prices of competing activities. If cotton prices are raised, providing higher incentives relative to foodcrop prices, cotton production should increase more than proportionally to the price increase. This means that government revenues will increase more than proportionately to the price increase, up to the revenue maximizing price. If the government provides greater incentives to cotton production this may pull resources out of foodcrop production, which may be undesirable if cotton producers are better off than foodcrop producers.

The risk of drought will constrain revenue maximization. In years of disastrous drought, the perceived risk of obtaining food may be so high that no cotton price will maintain production levels. In such situations, foodcrop production may be the best earner of foreign exchange by reducing the need for food imports. This implies that, in setting competitive cotton prices, OPAT must try to distinguish between longer-term trends in foodcrop prices and those which reflect drought conditions in a single year.

Suggestions for Future Study

Among the cash crops, it is recommended that further analysis of coffee price response be carried out. This could include an analysis of farm budgets to study private incentives to maintain existing trees in order to determine the scope for short-run price response. As more data becomes available on acreage planted, a supply analysis of planting response could be made.

Future study of price policy in Togo should also include analysis of foodcrops in terms of farm budget data, supply response and marketing. The specific types of analysis which could be carried out include: economic profitability, private profitability, and effective rates of protection. Returns per man-day are a useful measure of profitability if labor is the only scarce resource (which is the case in most of Togo). This type of analysis would provide information on which crops and which production techniques are economically profitable and what incentives private producers perceive. This information could provide guidance to the Government on which crops to encourage, through extension or integrated projects.

Supply response could be analyzed once sufficient time series of production data have been built up. The price data collected for a group of 7 markets throughout Togo from 1966-1976 are quite useful, and can be tied into the more detailed pricing series available from 1977 on. However, production and acreage data have only been gathered in detailed form since 1972. Supply analysis could not therefore begin until around 1982.

Marketing issues will be of interest if the Government becomes seriously involved in marketing foodcrops. The present series of foodcrop prices could provide two types of information: (1) Seasonal indices of price movements could be calculated. These would give some idea of storage costs

from harvest to harvest. (2) Differences in prices between towns would give some notion of transportation differentials. If seasonal or spatial differentials seem too high this may indicate some constraint on the marketing system such as lack of storage facilities or transportation.

The types of analysis outlined above will provide useful information on the effects of any given price policy. Choosing a price policy will depend on the objectives chosen and the constraints - political and social as well as economic - on achieving those objectives.

Conclusions and Recommendations

The results of the present study confirm, for the Togolese case, that agricultural production responds to economic incentives. Farmers will divert their attention from cash crops to foodcrops during periods of drought to assure a food supply and to benefit from higher foodcrop prices. Farmers will not make a heavy investment in perennial crops when positive returns are far away and substantial costs (whether opportunity or out-of-pocket costs) are foreseen over the medium-term. Depending upon relative prices in neighboring countries and the degree of border surveillance, agricultural commodities will move across boundaries in accordance with economic incentives.

Since producers respond to price and private prices diverge from economic prices, there will be a loss of foreign exchange entailed in OPAT's intervention in export markets. This intervention generates important public revenues that represent a substantial tax on the agricultural sector. These revenues have essentially been used to support the industrialization of Togo. Given Togo's difficult medium-term financial outlook, they are likely to remain critical in the years ahead.

In order for the agricultural crops to continue to generate revenues, production incentives must be adequate to ensure a growing supply. In the case of perennial crops, prices have not been sufficient to assure long run growth in supply. For cotton, prices have not been high enough to provide incentives to produce in the face of rising foodcrop prices.

The outcome of any price policy will of course be subject to the uncertainties of world markets and rainfall. In setting prices, these very real constraints on perfect knowledge must be recognized.

The analyses of individual crops show how price policies affect production incentives and how they serve the conflicting objectives of earning foreign exchange and of generating government revenue. The highlights of these analyses and the resulting recommendations are as follows:

(1) COCOA

The government has pursued a short-run revenue maximization policy, treating acreage as exogenous. Meanwhile, productive capacity has declined due to the aging stock of trees. Increased production can only come about

through replanting of existing acreage due to the lack of new land. Replanting was found to be economically profitable but may not be privately profitable due to the need to rip out still-bearing trees, coupled with high private discount rates and institutional constraints on labor. Subsidies may be the most cost effective method of overcoming institutional constraints and providing incentive to replant. The recent producer price increase from 150 CFAF/kg to 200 CFAF/kg is in line with the short-term public revenue maximizing policy pursued to date (see Figure 5), and does improve the private profitability of replanting. However, to assure the success of replanting programs, further economic incentives need to be provided to overcome high private discount rates. Subsidies would be most effective and could be used to provide incentives to sharecroppers. Another option would be further investigation of technical alternatives to replanting such as rehabilitation of old trees. However, any increase in productive capacity must come about through more labor intensive techniques, which means that increased private incentives will be necessary.

(2) COFFEE

The analysis of coffee shows that production is quite profitable in economic terms. Labor inputs are important in maintaining yields of mature trees, which means that producers can respond quickly to price incentives. Incentives to promote coffee production should be more effective than for cocoa production due to the importance of labor inputs, the shorter lag between planting and production, and the availability of new land. Bank projected prices for coffee are high (see Figure 6), indicating considerable latitude for price increases. Given the greater importance of labor inputs for coffee, the coffee producer price should be at least as high as the cocoa producer price. Increases in producer price could begin next year, allowing time for reevaluation if world market trends reverse.

(3) COTTON

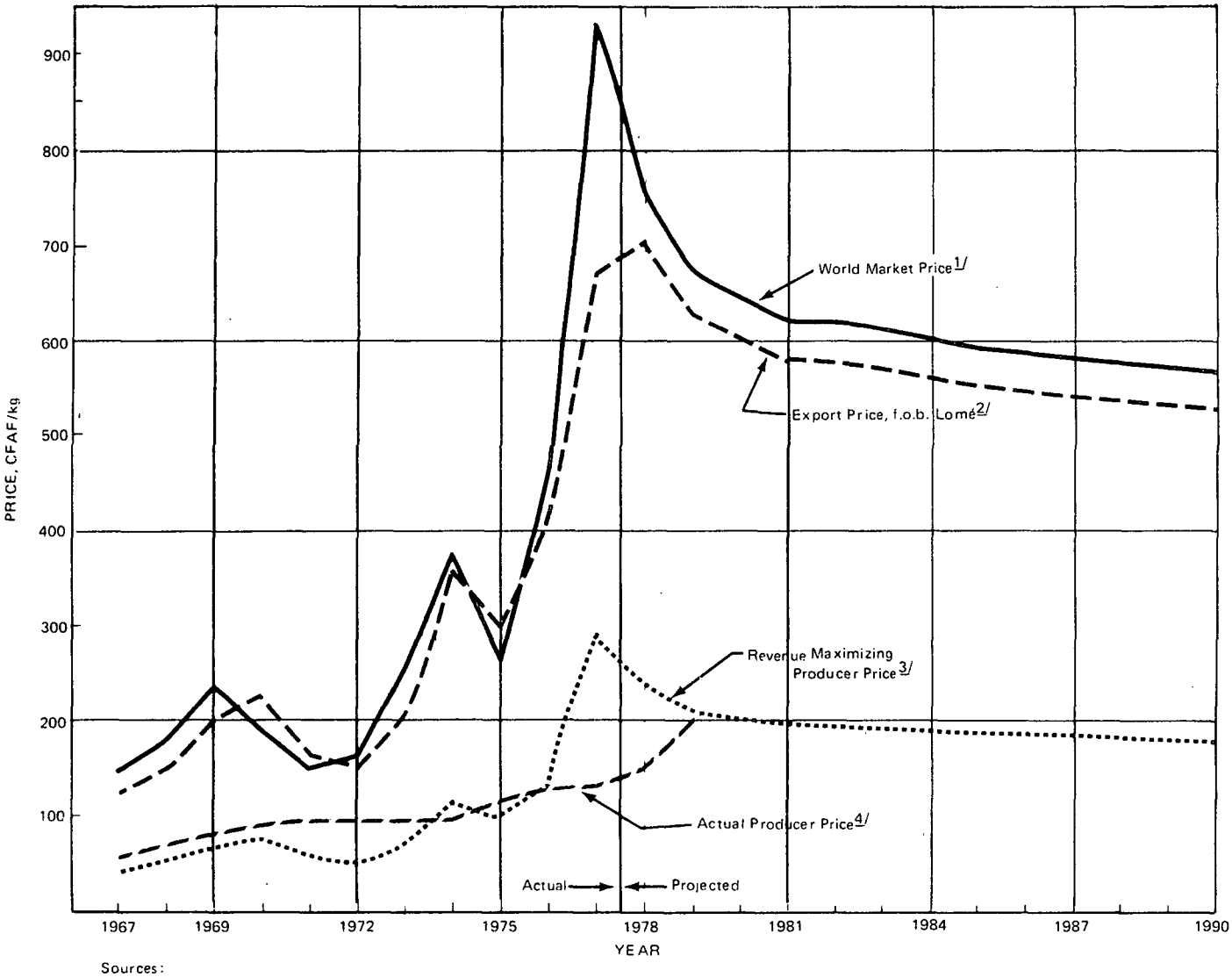
Cotton production is economically profitable, at least in the two regions analyzed (Plateaux and Centrale). Since the supply analysis shows that cotton production response to price is very elastic, there will be large losses of foreign exchange for a producer price below world price. This highly elastic price response also indicates that producer prices may have been too low to maximize government revenues.

World Bank cotton price projections indicate high world prices in the future (see Figure 7). Since present producer prices are low even from a revenue generating standpoint, an increase to at least 80 CFAF/kg is recommended. This increase could be accomplished in stages in order to allow for evaluation of market trends.

The techniques illustrated here--supply response analysis and farm budget evaluations of private and social profitability--could be applied by the Togolese Government on an annual basis as part of the price-setting exercise. These analyses would indicate explicitly the trade-offs involved and provide a rational basis for a pricing policy. OPAT would be the agency

primarily concerned with the results of the analysis. Branches of Government having the appropriate technical skills and data - such as the Directorate of Agricultural Statistics and the Rural Development Division of the Plan - should carry out the necessary calculations. The Bank can assist in familiarizing Togolese personnel with the analytical techniques and can provide projections of world market prices.

FIGURE 5: COCOA PRICES



Sources:

1/ ICCO Daily Price Average, from Price Prospects for Major Primary Commodities, IBRD Report No. 814/78, June 1978.

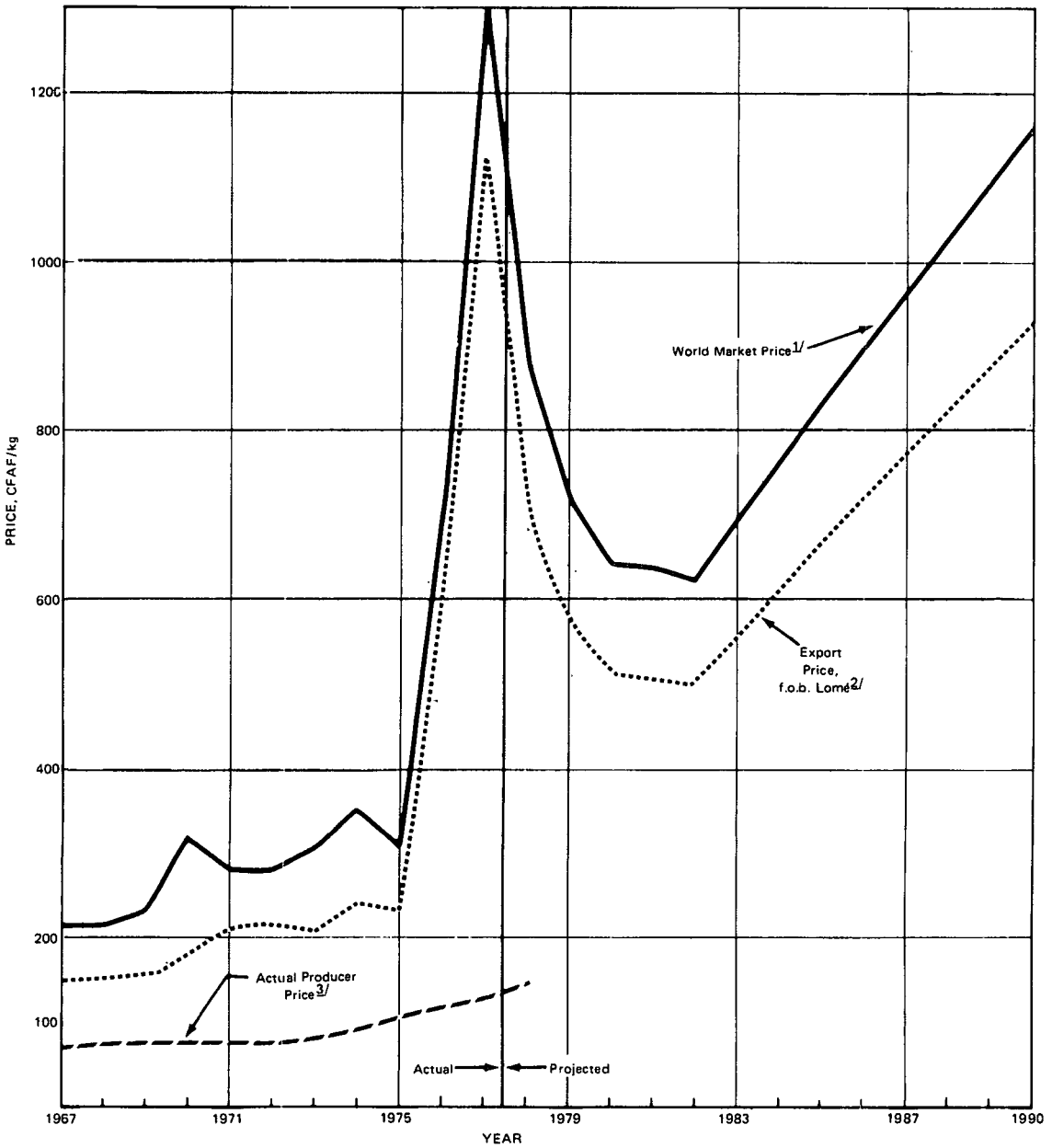
2/ OPAT. Projected Prices are assumed to be a Constant Proportion of Projected World Prices.

3/ Calculated using a Supply, Elasticity of 0.51 and f.o.b. Lomé Prices. For details, see Annex A.

4 OPAT.

World Bank – 20180

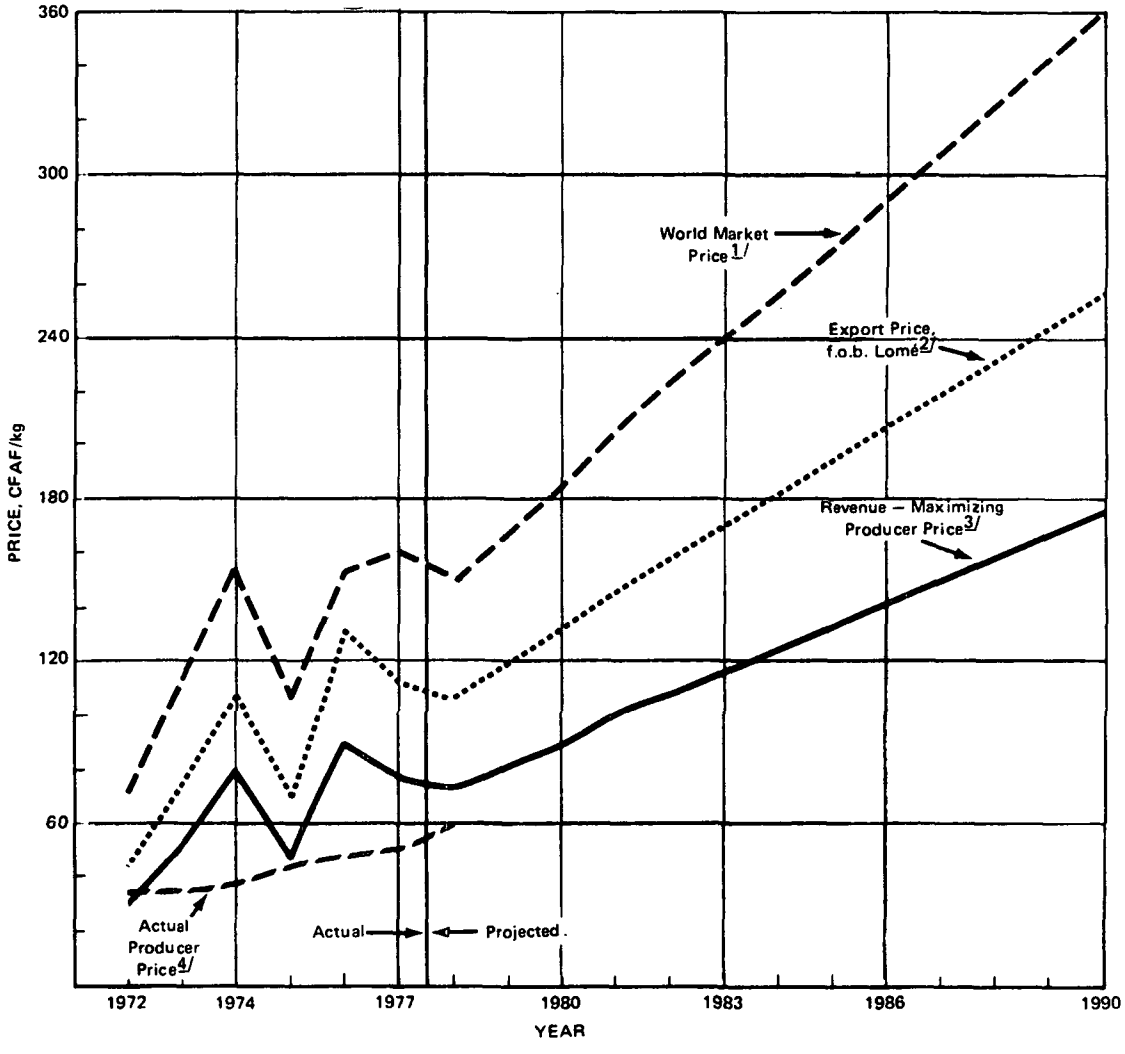
FIGURE 6: COFFEE PRICES



Sources:
1/ Guatemalan, Prime Washed, Spot New York, from Price Prospects for Major Primary Commodities, IBRD Report No. 814/78, June 1978.
2/ OPAT. Projected Prices are Assumed to be a Constant Proportion of Projected World Prices.
3/ OPAT.

World Bank – 20182

FIGURE 7: COTTON PRICES



1/ Economic Farmgate Value of Seed Cotton, Computed using Lint and Seed Prices from Price Prospects for Major Primary Commodities, IBRD Report No. 814/78, June 1978.

2/ OPAT. Projected Prices are Assumed to be a Constant Proportion of Projected World Prices.

3/ Calculated using a Supply Elasticity of 2.2 and f.o.b. Lomé Prices. For details, see Annex C.

4/ OPAT.

World Bank – 20181

TOGO

COCOA

Cocoa marketings are the most important source of foreign exchange among agricultural exports and hence the most important source of OPAT profits. Between 1966 and 1975, cocoa provided an average of 27% of total export earnings, and 64% of OPAT profits.

Cocoa is produced in the Kloto and Litime areas of the Plateaux Region. Current plantings are very old, with some 44% of plantings over 38 years old. The Togolese Government is naturally concerned with the declining production that this aging stock of trees implies. However, little area is available for new plantings. The current cocoa/coffee project has met with only limited success in replanting old cocoa, due partly to farmer reluctance to uproot old trees.

A large component of observed cocoa production in Togo has been smuggled from the Volta region of Ghana. A cursory examination of quantities purchased by OPAT between 1959 and the present reveals swings in production of up to 15,000 tons. Such variance in domestic production is not possible in so short a period due to the fixed nature of tree crops. Acreage planted in cocoa in the Volta region is three times that planted in Togo, indicating that smuggled quantities could be large relative to domestic production.

This paper will examine the supply response of cocoa harvestings, since not enough data is available to estimate acreage response. These estimates will take into account the effects of smuggling. Then, the private and economic profitability of replanting existing cocoa acreage will be examined along with the institutional factors that cause the two to diverge. Finally, an analysis of price policy in terms of government revenue and economic objectives will be made.

Supply Response

An investigation of determinants of cocoa supply in Togo must take into account smuggling from Ghana, and therefore production in Ghana. Random elements such as weather variations or pests will affect production on both sides of the border. By grouping the supply equations for production in Togo and Volta region together, it would be possible to utilize the existence of smuggling and the cross-equation correlation of errors to produce more efficient estimates. However, this is not possible due to lack of information about the Volta Region. Instead, estimates are made for Togo only of the price response of harvested quantities as well as the response of smuggled quantities to the price difference between the countries. Since these estimates are for Togo only without taking into account factors affecting production in Volta, they may be biased. However the results demonstrated that both smuggled and harvested quantities will respond to price changes.

Data on production and marketing board-determined producer prices is available for Togo from 1959/60 to 1976/77. This series is too short for an analysis of planted acreage response to price. Instead, the price responsiveness of harvested quantities from the existing trees was estimated, using data from 1959/60 to 1972/73.

The most important characteristic of perennial crop production is the long life of the trees and the lag between planting and production. Amelando, the type of cocoa planted in Togo, does not begin to bear until 18 years old. Yields increase until 10-15 years and then decline slowly (see graph). The tree may continue to produce until 60 or more depending upon weather and soil conditions. The fixed nature of the stock of trees means that in the short run the largest determinant of production will be acreage and the age structure of existing trees.

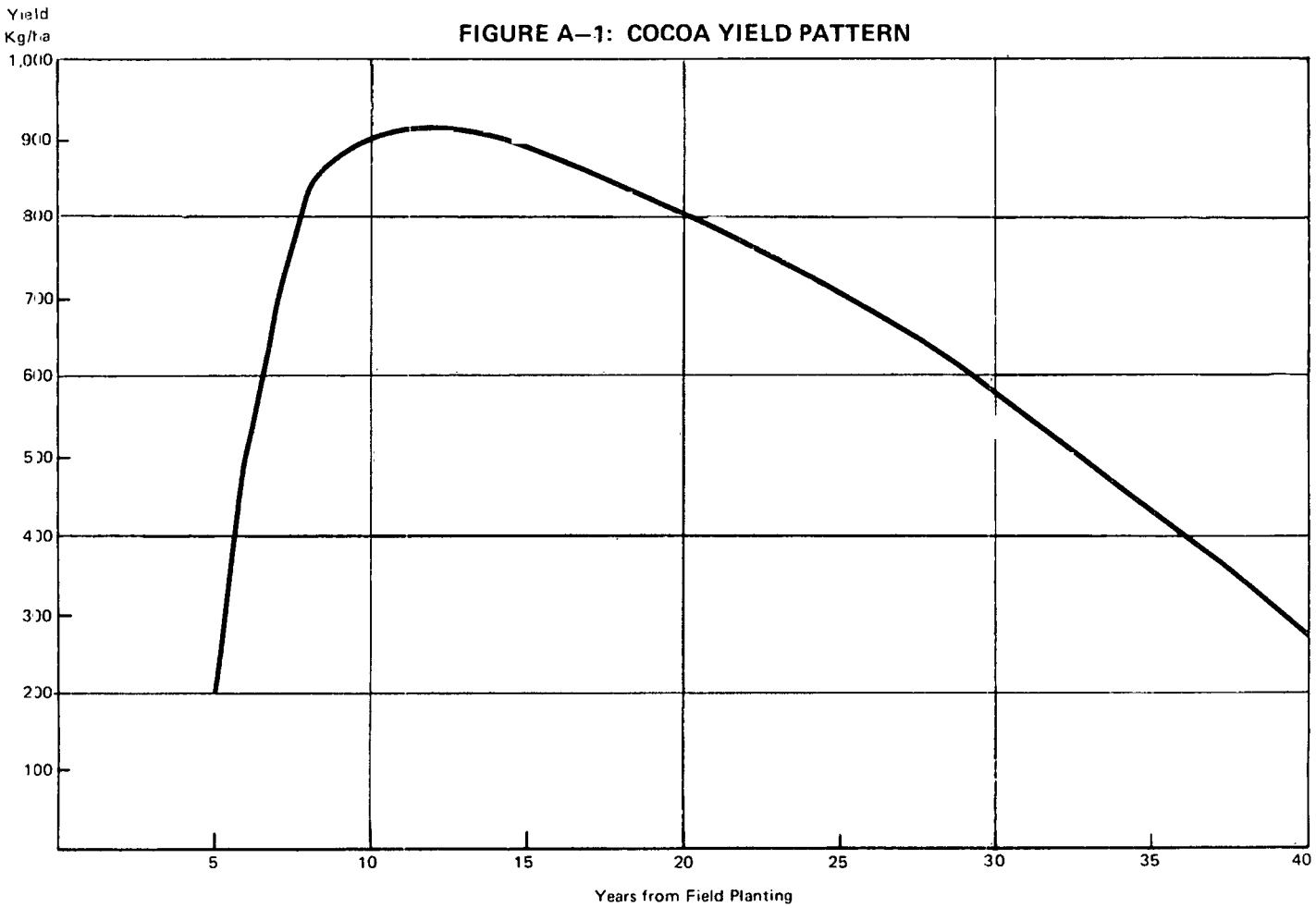
Nineteen hundred and seventy seven's hectarage by age of tree was available for Togo. Plantings were high after World War II, declining in the 60's to the present situation of virtually no new plantings. It was possible to estimate past hectarage and the age of the average hectare for the period under study. 1/. Average age over the period studied was always greater than 18 years. Age should have a negative relationship to production since 18 is past the peak bearing age.

The cost of harvesting cocoa will be determined by the opportunity cost of labor employed. An indirect method of evaluating the opportunity cost of labor is the price of foodcrops. The principal cocoa harvest occurs between September and December, and the smaller secondary harvest occurs in April. The principal harvest coincides with the second food season in the cocoa producing area. The secondary harvest coincides with land preparation for the principal foodcrop season.

In Togo the practice of sharecropping is very common. In the two principal cocoa producing areas of Litime and Kloto, respectively 64% and 31% of the cocoa farms are sharecropped. Sharecroppers maintain the farms and harvest cocoa in return for 1/3 of the harvest. The trade-off between time spent producing food and the returns from only 1/3 of the cocoa harvest may be significant.

1/ The data gives hectarage by age group. Total hectarage in an age group is assumed to be distributed equally across individual years. The number of hectares in age group one is subtracted from total hectares in 1977 to give total hectares in 1976, and so forth to 1959. It was assumed that no trees dropped out of production due to age.

FIGURE A–1: COCOA YIELD PATTERN



Source: IFCC Upper Amazon Hybrids. Assumptions proposed for Second IDA Cocoa/Coffee Project, Togo.

World Bank -- 20184

Foodcrop prices were averaged over the August to July cocoa season. An index of price movements was constructed for each crop. 1/ An average of these indices was used to deflate cocoa prices received by the farmer. The principal foodcrops in the region are maize, yams, and manioc.

Foodcrop prices are those reported in Palime, a major center in the cocoa producing region. The average index was constructed by weighting each crop index by the proportion of cultivated area in the Plateaux Region devoted to the crop. 2/ Due to lack of information, it was assumed that good crop prices were constant from 1959/60 to 1963/64.

It is difficult to specify Togolese and Ghanaian cocoa prices in commensurate units. Both prices must be expressed in a common unit of foreign exchange. The value of the Ghanaian cedi has fluctuated widely over the period studies, and black market rates have often diverged widely from official rates. 3/ Since historical data is not available on black market exchange rates, some way of estimating the real relative value of Ghanaian and Togolese currencies is needed. The exchange rate is specified as the ratio of the Ghanaian CPI to the Togolese CPI multipled by a constant official exchange rate. 4/ The exchange rate then depends upon relative movements in the rates of inflation. This measures the currencies in terms of relative purchasing power. It is assumed that smugglers respond to the proportional difference in price, which is the ratio of the price difference to the mean expected price (both prices expressed in commensurate units). The mean expected price is the production weighted average of Togolese and Ghanaian prices.

Rainfall data was available for Atakpame, a town in the Plateaux Region but outside the cocoa producing area. This rainfall variable did not produce significant results.

Actual production in Togo will be a function of the variables discussed above: the producer price deflated by foodcrop prices, acreage, and age of trees. Observed production will also contain a smuggled component which will vary in response to the difference between Ghanaian prices and Togolese prices.

1/ An average index of price movements was used rather than average prices because of the problem of averaging across non-homogenous goods.

2/ 1972-73 census.

3/ For instance, current black market rates are 5 to 6¢ to the dollar whereas the official rate is 1.3¢/$.

4/ 242 CFAF/1. Ghanaian CPI obtained from IMF statistics, Togolese CPI from Togo government.

The estimated equation is:

$$Q_T = -194695.8 + 39.6 \frac{P_T}{P_F} + 6.4\ ACR - 1333.9\ AGE + 6893.5 \frac{P_T - P_G}{aP_T + bP_G}$$

t-statistic (2.2) (1.0) (1.9) (1.0) (1.4)

$R^2 = .77$

where: Q_T = observed production in Togo

$\frac{P_T}{T_F}$ = cocoa price in Togo deflated by index of food crop prices

ACR = area planted in cocoa

AGE = median age of cocoa trees

$P_T - P_G$ = difference between Togolese and Ghanaian cocoa prices

a = .33

b = .66

The signs of the coefficients are all as expected and the equation provides a good fit. Both production and smuggling respond in a positive manner to price.

The response of harvested production to cocoa price deflated by foodcrop prices is very inelastic: .17. This would be expected since levels of production are very stable in the short run. The low t-statistics for $\frac{PT}{PFT}$ is to be expected due to the lack of information on foodcrop prices in the early '60s.

The response of smuggled quantities to relative prices is also inelastic: .34. This may reflect barriers to movement of production across borders. The estimated response to the price difference will be lowered by costs by eluding law enforcement barriers to movement of quantities and exchange of currencies.

The smuggling elasticity; .34, is much higher than the price elasticity for harvested production. Response of smuggled quantities to price should be more elastic than response of harvested production since the scope for smuggling response will be greater than the scope for production response. This means that price responsiveness of marketed quantities, Q_t, will be higher in Togo than would be the case without smuggling.

The objective of the government marketing board may be to maximize net revenue, NR, which is equal to marketed production times the difference between world price, Pw, and producer price, Pt.

NR = QT (Pw - Pt)

Since Togo's share of the world cocoa market is very small, Pw will not vary with Qt.

For a given Pw there should be a Pt that will maximize net revenue. Taking the derivative of the net revenue function and setting it equal to zero, a formula is obtained for Pt that will maximize net revenue:

$$Pt = \frac{Pw\ EPT}{1+EPT}$$

where: EPT = elasticity of supply with respect to producer price

Substituting the estimated elasticities (.34 and .17 = .51), it is possible to calculate an optimum Pt, for a given Pw.

Average price, F.O.B. Lome, is available beginning in 1967. Prices actually received in Togo are usually lower than world prices, but in an unsystematic fashion. The following table gives actual producer prices and optimal producer prices calculated on the basis of F.O.B. Lome price.

	Revenue Maximizing Producer Price Based on F.O.B. Lome	Actual Producer Price
1967	42	55
1968	50	70
1969	68	80
1970	76	88
1971	56	93
1972	51	93
1973	68	93
1974	121	95
1975	101	115
1976	136	130

Actual producer prices have followed the long run trend of simulated prices. In simulating these optimum producer prices, it has been assumed that acreage and age structure are given. In the long run, acreage, and hence age structure, will be some function of producer price. In other words, the revenue maximization strategy illustrated above maximizes revenue, treating acreage as exogenous, but does not necessarily provide incentives for replanting.

In the above formula for the optimum Pt, the more elastic response of Qt to Pt is, the higher Pt should be. If acreage responds to Pt, then this increases the elasticity of the long-run total supply curve and increases the optimum level for Pt.

It seems that OPAT has successfully maximized revenues, taking the productive capacity as given. However, the current age structure of trees reflects both a shortage of area available for new planting and a lack of incentives for replanting.

In order to maintain productive capacity, appropriate incentives to replant cocoa must be maintained. The next section will examine private and economic profitability of replanting cocoa.

Replanting

The above analysis has identified the determinants of production in a given year. In order to maintain or increase cocoa production over the long term, new trees must be planted. In Togo, little area is available for expansion of cocoa plantings. Increases in production must come from replanting areas currently occupied by old trees. Since old cocoa trees continue to bear indefinitely, there is an opportunity cost of earnings foregone from old cocoa when it is ripped out to provide room for new cocoa trees. This increases the costs associated with the six year period before the new cocoa trees begin to bear.

This section will evaluate the economic and financial profitability of replanting a hectare of old cocoa at the margin. As such, these calculations will differ from those performed in project appraisal, where a project will have a greater than marginal impact on the sector. The costs and benefits associated with replanting are presented in Table 5-A of the Statistical Appendix.

The alternative of inter-planting young trees among old, which decreases the opportunity cost of foregone cocoa production, has not been considered here. Evaluating alternative forms of project design is not the main focus of this analysis, but should be an important priority for further work.

Several comments are in order regarding the assumptions underlying the economic costs and benefits. Information on material inputs and required mandays is drawn from farm budgets used in appraisal of the IDA second cocoa/coffee project. Material costs have been valued at market prices. Labor inputs have been valued at 300 CFAF/day. This is the agricultural wage in cocoa producing areas and also accords with current returns per manday in foodcrop production.

In evaluating economic profitability, the cost of extension services per hectare was estimated. Using information from the first cocoa-coffee project, the cost of planting material, cocoa capsid control and extension workers has been estimated on a per hectare basis.

The opportunity cost of land used in replanting is equal to the value of the cocoa produced by the old trees at world prices minus the costs of inputs. It is assumed that the old trees continue to produce 150 kg per hectare for 20 years. 1/

The cocoa produced is valued at world prices. Two different assumption of future world prices have been tried: (1) world price is constant over the life of the project and equal to the average 1975/76 farmgate economic price, and (2) World Bank commodity price projections have been used.

In raising cocoa it is necessary to provide shade for the young trees in the first four years. Banana plantain plants are commonly used. If the plantains produced have market value, then their additional benefit should be included. The question of market value arises since the demand for plantain may be limited. Plantains were alternatively valued at zero or 15 CFAF/kg.

The results of the four cases are presented in Table 1. The internal economic rate of return in all four cases is greater than or equal to the social opportunity cost of capital in Togo, which has been estimated at 8%. The use of the World Bank projected prices lowers the returns. This is because prices are currently high and projected to fall, thereby increasing opportunity costs in the first six years and reducing returns from the new cocoa. The returns are also sensitive to the assumptions regarding the value of banana plantains. Sensitivity to variations in labor costs does not appear to be great.

Two different types of budgets have been constructed to evaluate private profitability. The first uses hired labor and the second uses hired labor in the first six years and sharecroppers after new production begins.

These budgets differ from the economic budgets in three respects: (1) the price of cocoa (which affects both costs and benefits); (2) the cost of labor; and (3) the exclusion of extension costs. Banana revenues are included in the private budgets. Only budgets employing wage labor were used due to the shortage of family labor in the cocoa producing region.

The first private budget values hired labor for replanting and maintenance at 300 CFAF/day. Harvest labor is paid 60 CFAF for each 30 kilograms of cocoa harvested. This gives an implicit wage of CFAF 240/day. Hence, harvest labor costs are lower than in the economic analysis.

1/ Observations of the appraisal mission for the current cocoa/coffee project indicate that this may underestimate yields of aged trees.

TABLE 1

Internal Rate of Return at Economic Prices

	Plantains	No Plantains
World Price = 334 CFA/kg.	20.5	16.5
World Price at Bank Projections	15.8	13.1

With a 20% Increase in Labor Costs:

	Plantains	No Plantains
World Price = 334 CFA/kg.	18.7	15.2
World Price at Bank Projections	14.5	12.0

A consistent internal rate of return cannot be obtained for the private budgets since the stream of net benefits changes sign more than once. However, the present value at various discount rates was calculated for the first budget under varying assumptions of producer price.

The results in Table 2 show that the profitability of replanting increases with increases in price. At 1978/79 price = 200 CFAF/kg, replanting is profitable at any discount rate below 20%. At price = 100 CFAF/kg, which is closer to historical levels, replanting is only profitable up to a discount rate of 12%. At higher private discount rates, the cost of foregone income in the near term outweighs the benefits of increased incomes in the long term.

Present values were calculated for the second private budget. Costs are identical to the first private budget in the first six years. After that, a sharecropper is given 1/3 of the cocoa in return for maintenance of the plantation and harvest labor. Net returns to the owner are the value of 2/3 of the crop. Present values for this budget at the 1977/78 producer price of 150 CFAF/kg are in Table 3. Under this arrangement, replanting of a hectare of old cocoa is not very appealing to the plantation owner since labor costs are effectively higher. Present value is only positive up to a discount rate of 10% as compared to 16% for the hired labor budget.

If replanting of cocoa is economically profitable and appears to be privately profitable in some circumstances, what are the factors that have made private entrepreneurs reluctant to replant? First, private entrepreneurs may have both a higher opportunity cost of capital and a different rate of time preference than society as a whole. Initial costs of replanting are high. The first year costs are three times the revenues from old cocoa. It may be difficult for farmers to sustain 7 or 8 years of losses no matter how high the potential gains. Farmers may also have a much higher rate of preference for present consumption than society or government. The advanced age of the majority of cocoa farmers could be a factor. In the Litime area, 47% of the plantation owners are older than 45. Presumably these farmers/owners are not very interested in an investment that has high initial costs and no substantial returns for the first 10 years.

Another factor affecting private interest in replanting is the price level and farmer expectations of future price movements. As prices increase, profitability of replanting increases. However, if prices are expected to fall in the future, then current losses oveshadow future gains.

Perhaps the most important factor affecting private costs is the nature of labor markets in the cocoa producing region. Sharecroppers are employed on 85% of the plantations in the Litime area and 41% in the Kloto area. Of these, three-quarters are paid by taking a 1/3 share of the crop. As was seen above, this type of arrangement does not make replanting very attractive to the plantation owner. Sharecroppers are of course not interested in replanting since this deprives them of their income from the cocoa harvest.

Annex A

TABLE 2

Present value of replanting 1 ha. of cocoa for varying producer prices using all hired labor (CFAF)

Discount Rate	Price = 100	Price = 150	Price = 200	Price = 250
8	134209	332683	531157	729630
10	71365	212458	353549	494641
12	27661	128597	229534	330470
14	-3321	68911	141143	213375
16	-25657	25664	76986	128307
18	-41999	-6166	29666	65499
20	-54108	-29915	-5723	18469
22	-63176	-47843	-32509	-17176
24	-70029	-61510	-52991	-44472
26	-75245	-72016	-68786	-65556

Annex A

TABLE 3

Present value of replanting cocoa using hired labor and sharecropper

Discount Rate	Price = 150
8	173967
10	65889
12	-8312
14	-60104
16	-96740
18	-122909
20	-141717
22	-155260
24	-164983
26	-171899

Many sharecroppers migrate to their homes in northern regions in order to plant foodcrops and return later in the year to harvest cocoa. From March to July, 45% of the labor force has migrated from the cocoa producing regions. The lack of opportunities for permanent settlement by sharecroppers constrains the amount of labor available for replanting.

In promoting replanting there are two problems that must be addressed. First, the constraint on labor availability caused by sharecropping arrangements. Some alternative form of land tenure or some method for compensating sharecroppers must be found. This problem must be solved before the second problem of economic incentives can be addressed. Economic incentives can be provided either by higher producer prices or subsidies to replanting. Higher producer prices increase the attractiveness of the replanting investment. Subsidies may have an advantage in that they will overcome the cocoa producer's preference for current consumption and could be divided between owner and sharecropper.

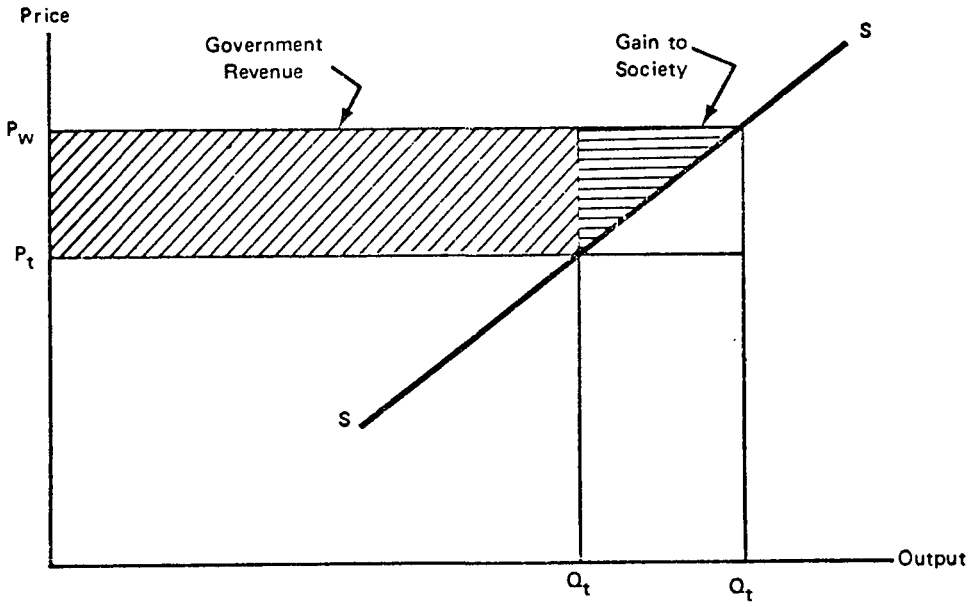
Policy Objectives and Strategies

OPAT policies set producer prices below world prices. Between 1967 and 1976 the average nominal protection coefficient (NPC) 1/ for cocoa was .47. This implies an export tax rate of .53. An NPC less than once means that production of cocoa is being discouraged by domestic policies which distort world market incentives. Producers have received only about half the economic value of their cocoa.

In discussing price policy alternatives for perennial cash crops such as cocoa it may be useful to step back and examine the overall objectives. In terms of economic efficiency, cocoa production does contribute to foreign exchange earnings and is economically profitable. If the primary goal of the government is to maximize economic product, then producer price should equal world price. However, the government also has the goal of obtaining revenues from marketing cocoa. There will be some trade off between maximizing economic efficiency and maximizing government revenue to the extent that a producer price below world price will reduce production.

1/ $NPC = \frac{\text{Producer Price}}{\text{World Price (Economic Farmgate Price)}}$

FIGURE A–2: OUTCOME OF ALTERNATIVE PRICING POLICIES FOR COCOA



World Bank – 20183

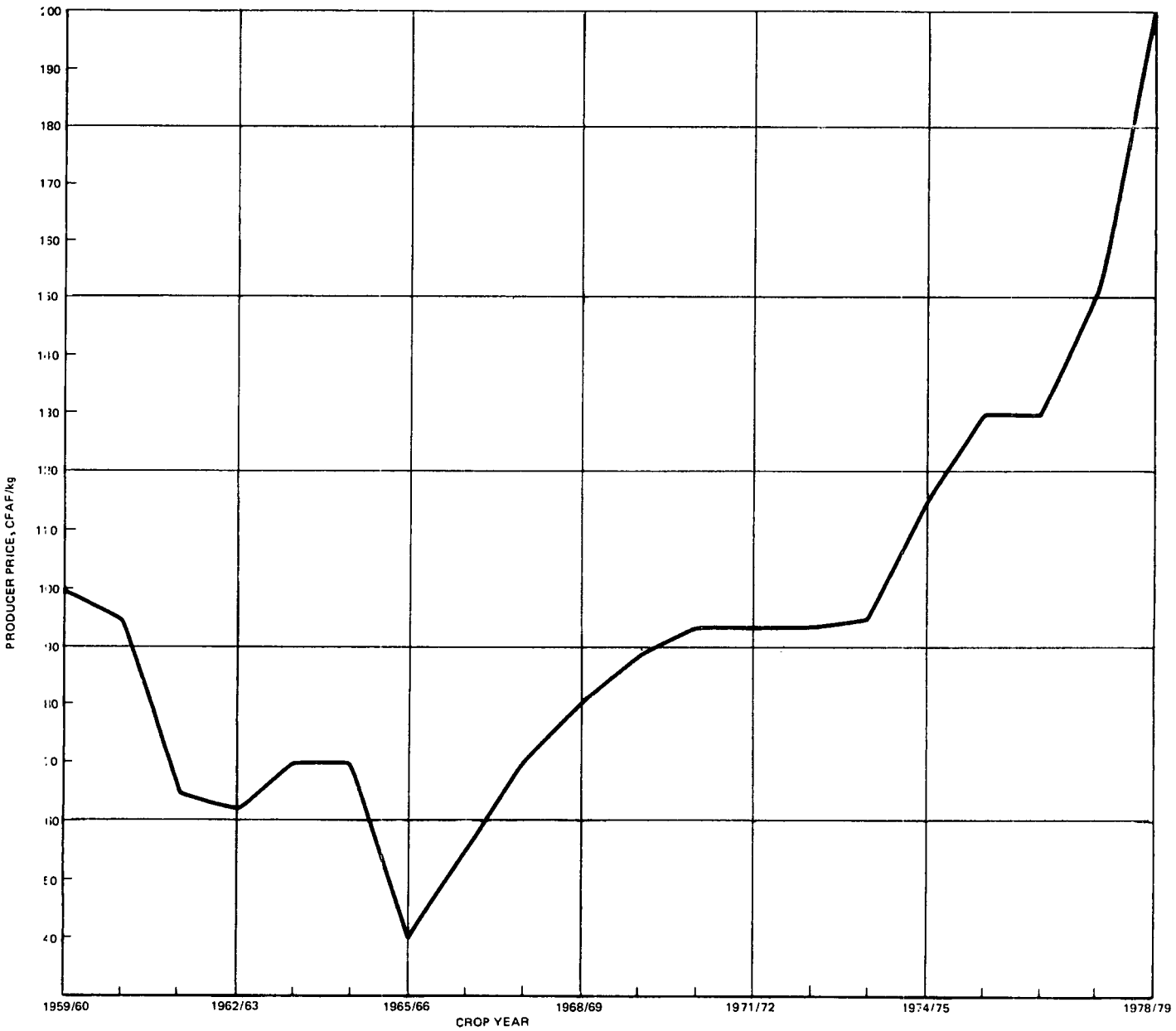
This argument can be formalized by the above graph. SS is the cocoa supply curve, Pw is world price and Pt is producer price. Qt is produced, purchased by OPAT at Pt, and resold at Pw. OPAT revenues are the shaded area. If producer price equaled world price, Qt′ would be produced. The area under the SS curve between Qt and Qt′ is the cost of producing more cocoa. The net gain to society of the extra production is the black triangle, which represents additional foreign exchange earnings. The size of this triangle will depend on the size of Pw-Pt and the elasticity of the long run supply curve.

What then are the arguments in favor of the implicit export tax that a marketing board imposes? One is that production is kept low in order to keep world price high and maximize foreign exchange earnings. This means that world demand is not infinitely elastic as in the above graph. This argument cannot reasonably be applied to Togo since Togo's share of the world cocoa market is only about 1%.

Another possible argument is that the marketing board will "stabilize" producer prices by losing money in years of high prices. This is true if stability of income is perceived to have some utility apart from the level of income. The fluctuations of world prices have not always been mitigated for the producer. Graph A shows producer price movements over time. Prices, even in current terms, fell sharply twice in the early 60's, before OPAT administration.

A marketing board does collect revenues that the government would be hard put to replace from other sources. One could argue that government revenues will contribute to economic growth if they are invested more efficiently by OPAT than they would have been by cocoa producers.

FIGURE A–3: ACTUAL COCOA PRODUCER PRICES



World Bank – 20185

In Togo, an income distribution argument could also be made. Since cocoa production is limited to a small area, monopoly rents accrue to a small number of farmers. If OPAT funds were reinvested in other parts of the rural sector, it could be argued that the cocoa price distortion served social ends. OPAT funds have been primarily invested in industry or tourism projects, however, so this argument would not apply.

It seems that OPAT's primary function has been collection of government revenues. If the current marketing board system is accepted as a political reality, then what course should OPAT and/or the government take to minimize the distorting effects on the economy? One important way would be to reinvest OPAT earnings from cocoa productively.

Another way would be to minimize the effect of the price distortion on production. Since cocoa production is economically profitable the question is how to provide private incentives to produce. At the present time long-run response to price in Togo will be limited by the availability of land. In Bateman's analysis of Ghanaian cocoa, he found that response to price varies inversely with the length of time that a region has been planted in cocoa.

Two options are available to government: (1) Raising the producer price substantially, thereby raising long-run price expectations and encouraging replanting. However, this may be expensive given the constraints to further supply. (2) Continue current price setting policies but use some revenues to subsidize replanting. Current price setting policies maximize revenue in the short run taking into account inflation and foodcrop prices. The use of subsidies to encourage replanting would introduce a distortion to correct for already existing distortions and is therefore not desirable from a strictly economic point of view. However, it does have the advantage of being directed at a specific group of planters.

The effectiveness of economic incentives will be constrained by the nature of labor institutions in the cocoa producing area. The ability of the government to both collect revenue and encourage replanting will be constrained by future levels of world prices.

In the past, OPAT has been successful in generating government revenue in the short run, ignoring implications of price for long-run productive capacity. But the objective of maximizing government revenue in the short run will not be served by a continuation of this policy. Neither will the objective of maximizing foreign exchange earnings for the economy as a whole. In order to strengthen productive capacity new trees must be planted. The Government must focus attention on alleviating institutional constraints to labor availability and providing economic incentives to replant cocoa.

T O G O

COFFEE

Coffee is the second most important agricultural export, accounting for 15% of total export earnings between 1965 and 1976. Coffee is primarily cultivated in the Akposso and Dayes plateaus. However, coffee production is less geographically concentrated than cocoa production because coffee is more tolerant of soil and climate variation. Scattered coffee plantings exist throughout the eastern Plateaux Region and the northeastern Maritime Region. Coffee acreage is estimated at 50,000 ha, but it is estimated that some 12,000 hectares are abandoned due to the advanced age of the trees.

Since the analysis of coffee is similar to cocoa, this paper will be on those production characteristics that differentiate coffee from cocoa, and hence have different implications for price policy.

Various reports indicate the following historical trends in coffee production. Coffee plantings were high between 1940-55. In the 1960's prices were low and plantings declined. Unsanitary harvest practices caused the spread of disease.

Smuggling should not affect coffee production to any great degree since there are only 10,000 ha of coffee in the Volta Region of Ghana.

Rainfall should be a more important factor in coffee production than cocoa production for two reasons. First, coffee yields are more susceptible to low rainfall combined with lack of maintenance. Second, coffee in Togo is planted in some areas that have marginal rainfall for tree crops. Average rainfall in the coffee producing areas is lower than average rainfall in cocoa areas.

No satisfactory results were obtained for a historical supply function due to lack of information about acreage planted and age of trees. However, rainfall explained 26% of the variation in coffee production from 1959 to 1976. If damage from drought causes a permanent downward shift in the supply curve, this could explain the decline in production since 1971.

An analysis of the economic and financial profitability of coffee was made. There are several factors that make coffee more profitable than cocoa. First, the lag between planting and production is much shorter: 3-4 years instead of 7-8. Second, old coffee areas that could potentially be replanted have been abandoned and no longer produce. There will be no opportunity cost of foregone production to either the producer or the economy. Finally, the projected world prices for coffee are much higher than those for cocoa.

Economic profitability was calculated, valuing labor at 300 CFAF/manday and materials at market prices. An estimate of extension costs per hectare was made using information in the first cocoa/coffee project appraisal. Two different assumptions regarding world price were made: (1) world price equals 213.2 CFAF/kg, an average of the 1974 and 1975 farmgate economic price; (2) world price equals Bank projections in real terms.

The results are presented in Table 1. Since the stream of returns for the first assumption changes sign more than once, a consistent IRR is obtainable. Instead present values at various discount rates are presented. Coffee production has a very good return, especially for Bank projected prices.

Coffee is a more labor-intensive crop than cocoa. During the years when the tree is bearing, cocoa requires an average of 125 mandays/ha of labor while coffee requires 193 mandays/ha. As a result, the returns per manday for coffee are lower than for cocoa (590 CFAF vs. 844 CFAF) at 1977/78 producer prices. For maintenance activities alone, the difference is even more striking. Cocoa requires 48 mandays/ha, while coffee requires 103 mandays/ha. This is due to higher requirements for weeding and pruning.

The coffee budgets used in this analysis assume regular pruning which periodically decreases yields but increases lifetime productivity. However, these periodic decreases in yields combined with a low producer price mean that the private producer will have negative returns in some years. Table 2 shows costs, returns and net benefits for the farmer who replants at the 1977/78 producer price. There is some question as to whether farmers will follow recommended pruning practices when they result in periodic losses.

Table 3 shows present values of the coffee replanting investment for various producer prices. Costs to the private producer are materials and labor inputs, priced at 300 CFAF/manday. To the extent that some labor may be provided by family labor, the calculations may overestimate labor costs. Replanting appears to be quite profitable for the 1977/78 producer price, 145 CFAF/kg, and a hypothetical producer price of 175 CFAF/kg. At 115 CFAF/kg, the 1975/76 producer price, replanting is only just profitable at 20%.

Institutional constraints are not as serious for coffee as for cocoa. In the Dayes area, only 47% of the farms employ sharecroppers as opposed to 85% in the Litime area. Of these sharecroppers, 90% in the Dayes area are also responsible for foodcrops where only 60% are in the Litime area. Similar figures are not available for the Akposso area, but the following figures on use of family labor are:

Coffee areas:	Akposso	65%
	Dayes	80%
Cocoa areas:	Litime	55%
	Kloto	75%

These figures outline a broad pattern. In cocoa areas, labor is hired for harvest activities only. Constraints on available land mean that sharecroppers cannot settle and cultivate foodcrops. Cocoa requires less maintenance in non-harvest periods. In coffee areas owners are more often farmers and operators too. Coffee sharecroppers are not hired just for the harvest but maintain the plantation year-round and also cultivate foodcrops. This leads to conjecture that institutions have developed in response to production characteristics of the two crops and land availability.

Several factors outlined above lead to the conclusion that economic incentives will be more effective in promoting coffee production than they would be for cocoa production. Private producers do not face as long a lag between planting and production. There is no opportunity cost of income foregone from cutting down old coffee trees. Problems of labor availability are not as acute for coffee. Maintenance of coffee, especially when rainfall is deficient, will affect production. Higher prices will raise not only incentives to plant but incentives to maintain existing trees, which will be more important for coffee production than for cocoa.

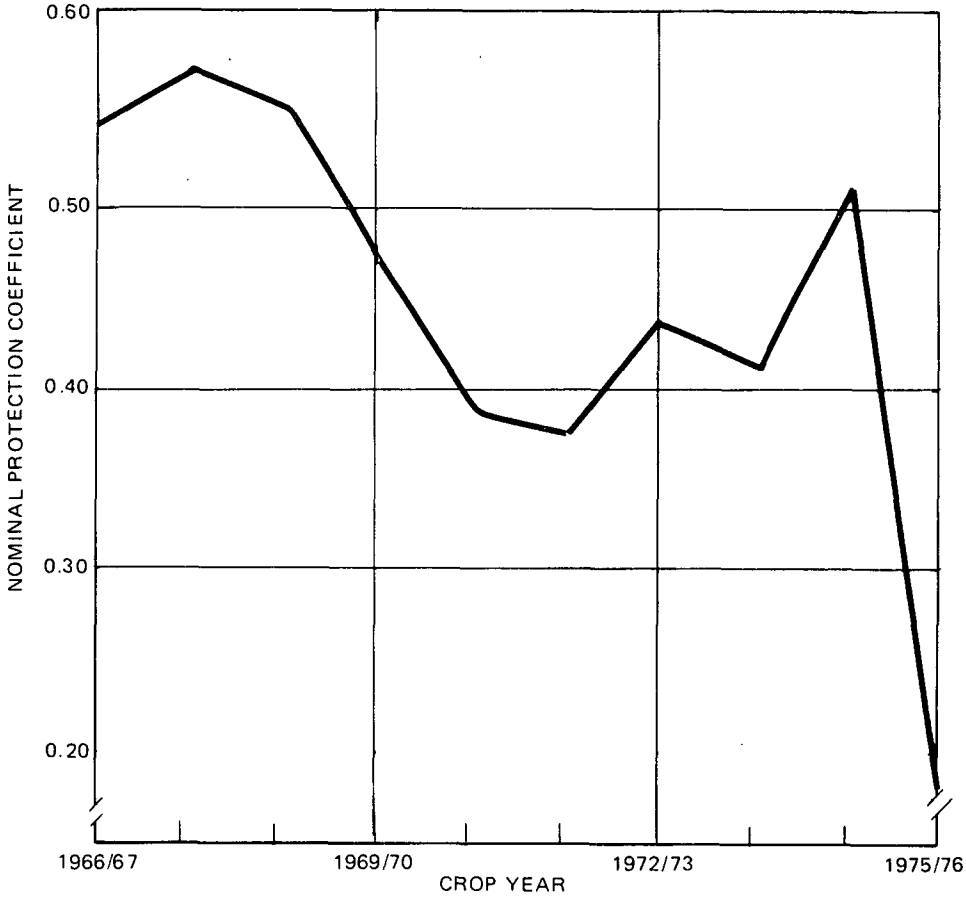
The average nominal protection coefficient for coffee for the 1967-76 period was .45. This is slightly lower than the average NPC for cocoa, .47. Graph A shows coffee NPC's over time. Since the NPC is the ratio of producer price to world price, the lower the NPC, the greater the disincentive to production. Incentives to production have tended to decline over this period. The implicit export tax on coffee has increased from .46 to .81.

If Bank price projections are correct, the real price of coffee will not fall below 497 CFAF/kg in the next 10 years. Despite the fact that Togo receives only about 80% of average world coffee prices, there should still be considerable latitude for raising producer prices.

The above arguments about producer ability to respond to price and the high level of projected future prices argue for an increase in coffee producer prices.

ANNEX B

FIGURE B–1: NOMINAL PROTECTION COEFFICIENTS FOR COFFEE



World Bank – 20186

Annex B

Table 1: ECONOMIC PROFITABILITY OF COFFEE REPLANTING (CFAF)

Discount Rate	Price = 213.2 CFA/KG	Price = World Bank Projections
8	935,514	3,228,083
10	748,732	2,611,811
12	605,127	2,142,255
14	493,057	1,778,712
16	404,381	1,492,982
18	333,317	1,265,237
20	275,700	1,081,333
22	228,484	931,037
24	189,416	806,845
26	156,803	703,183

Table 2: COST & BENEFIT STREAMS FOR COFFEE REPLANTING AT PRODUCER PRICE = 145 (CFAF)

YEAR	TOTAL COST	TOTAL BENEFIT	NET BENEFIT
1	23,100.00	0.00	-23,100.00
2	64,150.00	0.00	-64,150.00
3	34,950.00	0.00	-34,950.00
4	41,500.00	36,250.00	- 5,250.00
5	59,100.00	72,500.00	13,400.00
6	93,100.00	261,000.00	167,900.00
7	76,100.00	145,000.00	68,900.00
8	75,600.00	145,000.00	69,400.00
9	41,900.00	29,000.00	-12,900.00
10	73,500.00	108,750.00	35,250.00
11	86,600.00	217,500.00	130,900.00
12	82,700.00	174,000.00	91,300.00
13	76,100.00	145,000.00	68,900.00
14	41,400.00	29,000.00	-12,400.00
15	75,000.00	108,750.00	33,750.00
16	92,100.00	217,500.00	125,400.00
17	82,700.00	174,000.00	91,300.00
18	76,600.00	145,000.00	68,400.00
19	40,800.00	26,100.00	-14,700.00
20	71,100.00	97,875.00	26,775.00
21	88,500.00	195,750.00	107,250.00
22	78,300.00	156,600.00	78,300.00
23	72,800.00	130,500.00	57,700.00
24	40,700.00	23,200.00	-17,500.00
25	69,200.00	87,000.00	17,800.00
26	82,200.00	174,000.00	91,800.00

Annex B

Table 3: PRESENT VALUE OF COFFEE REPLANTING UNDER VARIOUS ASSUMPTIONS OF PRODUCER PRICE (CFAF)

Discount Rate	Price = 115	Price = 145	Price = 175
8	182,055	385,750	700,089
10	131,469	299,404	549,852
12	92,605	233,133	436,161
14	62,367	181,516	348,698
16	38,571	140,769	280,374
18	19,652	108,204	226,243
20	4,470	81,884	182,799
22	-7,811	60,395	147,519
24	-17,818	42,691	118,564
26	-26,021	27,984	94,570

T O G O

COTTON

In terms of government revenue or foreign exchange earnings, cotton is not as important as the perennial crops. However, cotton could be produced in all regions of Togo, and so the potential for significant expansion of cotton production is much greater. Cotton could provide cash income to a large segment of the agricultural population.

Until 1965, only the low-yielding mono variety of cotton was produced in Togo. This variety is intercropped with yams. Starting in 1965, single-stand production of allen variety cotton was promoted and mono production was discouraged. Lower prices were offered for mono cotton and marketing arrangements were less favorable. Fertilizer and insecticide inputs for allen cotton production were subsidized. Production of mono declined rapidly while allen production increased slowly. Then rising foodcrop prices starting in 1975 and drought in 1976/77 caused allen cotton production to decline.

Supply functions were estimated for allen cotton production in order to test the responsiveness of production to producer prices and prices of competing foodcrops. Then, to evaluate the effects of price distortions on both inputs and outputs, effective protection coefficients were calculated for various techniques of cotton production in various regions.

Supply Response

Data was available on allen cotton production by region for 1968/69 to 1977/78. Since production systems differ between regions, supply functions were estimated separately for the Plateaux and Centrale Regions. These two regions account for more than 95% of all cotton production during this period.

Each function was estimated using rainfall and foodcrop price data specific to the region. A time trend was used to capture the upward trend in production due to promotion and adoption of new varieties.

Equations were estimated with the cotton price and foodcrop prices specified separately. The results were significant and the coefficients had the correct signs. However, there is a high degree of collinearity between cotton prices and foodcrop prices. The correlation coefficient between the two variables was .99 for the Plateaux Region and .93 for the Centrale Region. This makes it difficult to distinguish the separate effects of each price variable. The reported equations use foodcrop prices only or relative prices in order to avoid collinearity problems.

Despite the limited number of observations, significant coefficients were obtained for relative prices in both regions and for rainfall in the Centrale Region.

Plateaux Region

Double cropping is possible in the Plateaux Region and cotton is usually planted in the second season. Production (crop season 68/69-77/78) is a function of time, cotton price (67/68-76/77), and a weighted average of indices of maize, yam, and manioc price movements (Atakpame, August to July 68/69-77/78)*. 1/ A log-linear functional form produces the best results, and gives the elasticities directly.

Equation No. 1: Foodcrop Prices

$$Q = 6.26 + 1.60\ T - 1.47\ F$$

significance levels * 99% 99%

Adjusted

$R^2 = .88$

Equation No. 2: Cotton Price Deflated by Foodcrop Prices

$$Q = 1.29 + 1.58\ T + 2.17\frac{C}{F}$$

significance levels * 99% 99%

Adjusted

$R^2 = .89$

Q = log of quantity (expected) F = log of food prices

T = log of time $\frac{C}{F}$ = log of $\frac{\text{cotton}}{\text{food}}$ price

Centrale Region

There is a single crop season in the Centrale Region. Cotton is planted in rotation with cereal crops. Production is a function of time, cotton price (67/68-76/77), a weighted average of indices of sorghum and yam price movements (Sokode 1968-1977) and rainfall (Sokode 1968-1977). A linear functional form produced the best results.

Equation No. 1: Foodcrop prices

$$Q = 2400.9 + 361.2T - 722.2F + 1.8R$$

Significance levels 95% 99% 97.5% 99%

adjusted $R^2 = .81$

---

* Not significant.

1/ Rainfall (Atakpame) was not found to be a significant variable.

Equation No. 2: Cotton price deflated by foodcrop prices

$$Q = 8119.9 + 508.0T + 110.0 \frac{C}{F} + 2.1R$$

Significance levels 95% 99% 99% 99%

adjusted $R^2 = .88$

Q = quantity (expected)

T = time

F = foodcrop prices

R = rainfall

$\frac{C}{F}$ = cotton prices deflated by foodcrop prices

Elasticity computed at mean:

$$E_{\frac{C}{F}} = 3.4$$

$$E_F = -1.1$$

The estimated price elasticities are high and may overestimate price responsiveness. Since the equations are estimated using production rather than acreage data, the foodcrop price variable captures some of the effects of rainfall on cotton yields. As longer time series on acreage planted becomes available, it will be possible to separate acreage response to price from variations in yields due to rainfall.

While the estimated elasticities may be high, it seems safe to conclude that supply response of cotton production in Togo is elastic with respect to relative cotton/foodcrop prices. 1/ Producer price response is very sensitive to the price of competing activities.

1/ Estimates of cotton supply elasticities mentioned in "Price Prospects for Major Primary Commodities" are as follows: United States, 1.97; Greece, 1.00; aggregate for Mexico, Guatemala, El Salvador, Nicaragua, and Colombia, 1.55; Pakistan, 1.65; Turkey, 0.21; and Ivory Coast, 3.69.

Price responsiveness to competing crops is further illustrated by an analysis of farm budget data. Differences between the two regions in returns per manday may explain differences in the rate of adoption. Less labor is required in the Plateaux Region than in the Centrale Region due to the different cropping patterns.

Average Returns per Manday 1968-72 1/

	Cotton (Stage 1)	Maize	Sorghum
Plateaux	210	275	-
Centrale	162	285	264

Returns to cotton production in the Plateaux Region were more competitive with returns from cereal production than those in the Centrale Region. Graph 1 shows that adoption of Allen cotton was slower in the Centrale Region than in the Plateaux Region. Cotton production in the Centrale Region began to increase significantly only after cotton price increases began in 1973.

A priori, differences in supply response between farmers producing at different levels of technology would be expected since they face different cost curves. When food price increases occurred in 1975-1978 the farmers who abandoned cotton production were primarily those in Stage I, the least remunerative production technique.

Financial Returns per Manday, Plateaux Region

Price = 60

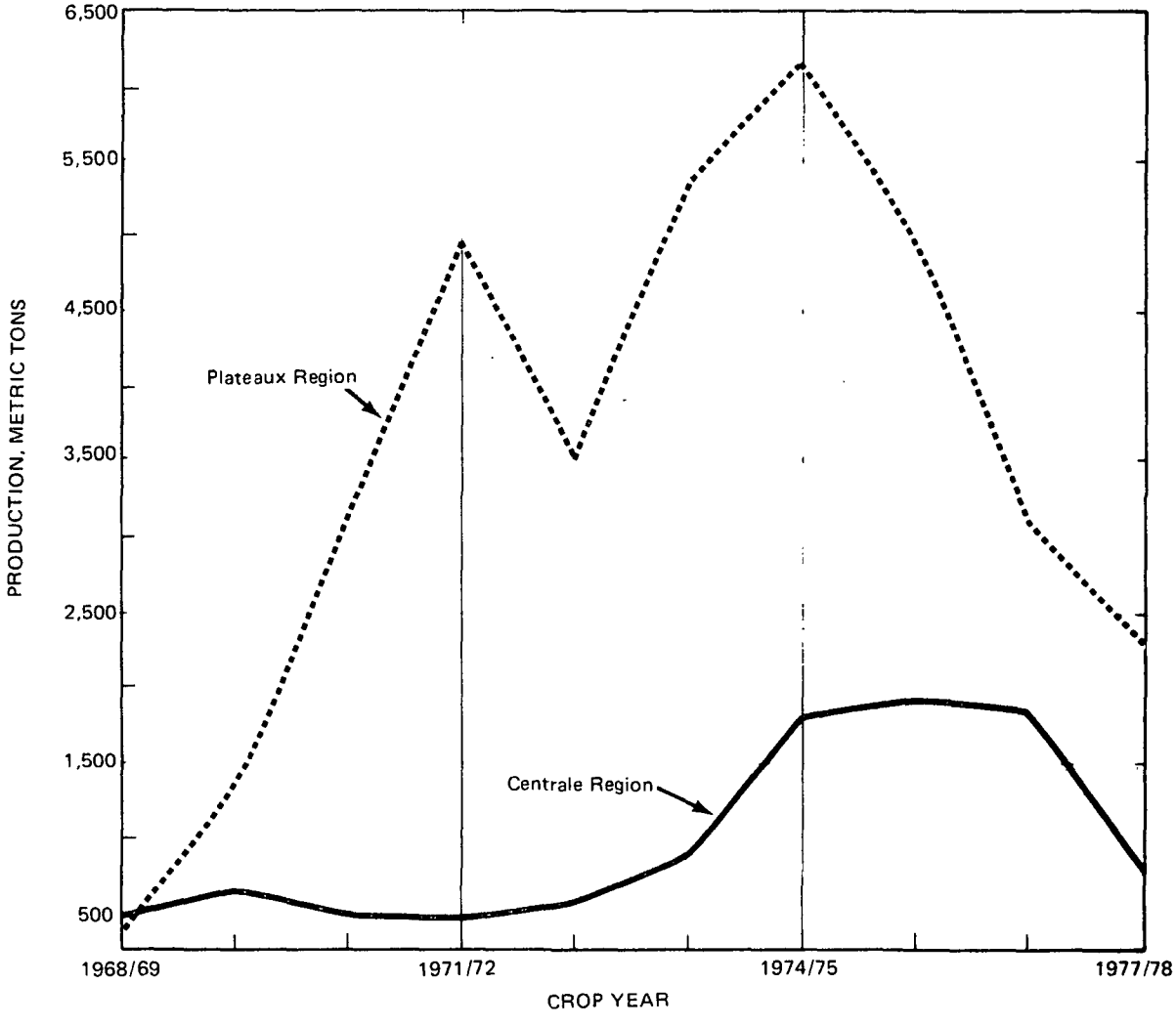
Stage I	280
Stage II	398
Stage III	458

Returns per manday for Stage III are competitive with the high returns to foodcrop production in recent years.

1/ Returns have been calculated assuming constant yields. In reality, as prices go up due to drought, yields may fall. Therefore an average was taken over this period to approximate long-run expected returns.

ANNEX C

FIGURE C–1: COTTON PRODUCTION BY REGION



World Bank – 20187

Structure of Incentives

Cotton is marketed by OPAT. In evaluating the price distortions for cotton production, it is necessary to find economic values for both lint and seed. F.O.B. Lome prices for cotton lint and cotton seed were used to calculate an economic farmgate price for seed cotton. Nominal protection coefficients were then calculated for 1972-77. The results are below, and a sample calculation of the economic farmgate price is in Table 1.

	F.O.B. Lome Lint Prices	F.O.B. Lome Seed Prices	Farmgate Value	Producer Prices	NPC 1/
72	127	16	43.9	35	.80
73	203	16	74.3	35	.47
74	307	19	117.5	37	.31
75	181	24	69.9	46	.66
76	322	33	131.2	48	.37
77	310	24	112.9	50	.44
				Average:	.51

The NPC is always less than one, indicating that incentives to produce have been less than if free trade prices had prevailed. The world price of cotton and hence the rate of disincentive to production have varied greatly over this period.

1/ $NPC = \frac{\text{Producer Price}}{\text{Farmgate Price}}$

TABLE 1

COTTON ECONOMIC PRICE CALCULATION SAMPLE -- 1977

	Lint	Seed
F.O.B. Lome	310	24
Transport	6.6	6.6
Value at Factory	303.4	17.4
Ginning Costs	23.7	
	279.7 x .40 = 111.8	17.4 x .55 = 9.6

Lint Value	111.8
Seed Value	9.6
Seed Cotton Value Pre-ginning	121.4
Transport	8.5
Economic Farmgate Value	112.9

Transportation and ginning cost estimates taken from 1977/78 Bareme.

For cotton production in Togo, there are price distortions for both outputs and inputs. Fertilizer and insecticides are sold to farmers at prices below cost. It is argued that these subsidies are needed to overcome farmer resistance to modern techniques of production. Since the subsidized inputs do require less cash outlay, the risk to the farmer of adopting the new techniques may be lessened. The question arises of whether subsidized inputs offset the producer price distortion. To evaluate the net effect of price distortions on incentives, effective rates of protection were calculated for each technique in the Plateaux and Centrale Regions. 1/

The EPC's vary across regions and techniques because yields vary and therefore the cost of inputs per unit of output varies. The results of the calculations, based on 1977 producer price and economic price, are presented below.

Effective Protection Coefficients

Technique	Plateaux Region	Centrale Region
I	.41	.41
II	.45	.45
III	.46	.46

The net effect of the price distortions is to discourage cotton production relative to the situation that would obtain with no price distortions.

1/ The effective rate of protection is the ratio of the difference between producer price and cost of subsidized inputs over the difference between economic farmgate value and economic costs of inputs. It measures the degree of protection on value added.

It is of interest to compare EPC's for the hypothetical cases of no subsidies and/or increases in producer price.

	Plateaux Region				Centrale Region			
	Price = 50		Price = 80		Price = 50		Price = 80	
Technique	W/Subsidies	W/o sub.	W/sub.	W/o sub.	W/sub.	W/o sub.	W/sub.	W/sub.
I	.41	.29	.75	.63	.41	.29	.75	.63
II	.45	.28	.79	.62	.45	.21	.83	.59
III	.46	.29	.79	.63	.46	.26	.81	.61

These figures indicate that subsidies affect not only overall profitability of production but the relative profitability of different techniques. With subsidization, the relative disincentive is less with increasing sophistication of production technique. Without subsidization, relative disincentive is about the same for all techniques in the Plateaux Region. In the Centrale Region, relative disincentives increase with increasing sophistication. These figures support the current government rationale for input subsidies, which is to encourage adoption of more modern techniques.

The question remains of whether the techniques being promoted are socially profitable. Domestic resource coefficients were calculated for all techniques in both regions. 1/ It is assumed that there are no capital inputs, the shadow price of land is zero, and the shadow price of labor is 300 CFA/manday. The results are below.

1977 Price	Domestic Resource Coefficients	
	Plateaux Region	Centrale Region
	Economic Value = 113 CFAF/kg	
I	.57	.74
II	.41	.68
III	.37	.50

The smaller the DRC, the greater the foreign exchange earned per unit of domestic resource. Cotton production is economically profitable overall. The more sophisticated techniques are relatively more profitable. This is to be expected since the more advanced techniques use less labor per unit of output. Production in the Plateaux Region is relatively more profitable than in the Centrale Region. This is because of the greater rainfall in the Plateaux Region, which allows double-cropping and hence fewer labor inputs. However, cotton production is economically profitable in both regions.

1/ DRC is the ratio of the costs of domestic inputs at shadow prices to value added in world prices, converted at the official exchange rate. If the DRC $\leq$ 1, the activity is socially profitable.

Since cotton prices have fluctuated so widely, it is of interest to test the sensitivity of economic profitability to a 20% decline in economic value.

Domestic Resource Coefficients

	Plateaux Region	Centrale Region
	Economic Value = 90 CFAF/kg	
I	.77	1.00
II	.67	.95
III	.50	.68

Bank projections for both cotton seed and cotton lint show fairly stable prices at about 1977 levels. It seems that cotton production should remain profitable through the medium term. Sensitivity tests to á 20% increase in labor costs showed that cotton production remains profitable.

Policy Implications

It is useful to draw implications for policy from the above analysis in terms of the objectives of maximizing government revenue and maximizing foreign exchange earned. There will be some trade-off between these two objectives to the extent that a producer price below world price will reduce production. For further elaboration of this argument, see Annex A.

The supply analysis above indicated that cotton supply response is elastic. This result coupled with a producer price that is on average only half of the world price will mean a substantial loss of earned foreign exchange. For example, taking only production in the Plateaux Region, and the estimated elasticity of 2.17, the loss of foreign exchange due to the price distortion can be calculated:

Plateaux Region: 1977

World Price-Producer Price (CFAF/kg)	Production at World Price -Actual Production (tons)	Loss of Foreign Exchange (thousand CFAF)	Gov't. Revenues (thousand CFAF)
62.9	5413	170,239	196,814

The loss of society is nearly as great as government revenues. This loss may be exaggerated if the estimated elasticity, 2.17, is higher than actual response would have been. However, this calculation demonstrates that when the supply curve is elastic, a large price distortion will cause large losses of foreign exchange.

In terms of the objective of maximizing government revenues, the existing producer price may be too low. The revenue maximizing producer price, Pt, will depend on the world price, Pw, and the elasticity of supply with respect to producer price, Ept.

$$Pt = \frac{P_w Ept}{1-Ept}$$

The higher the supply elasticity the greater the optimal producer price from a revenue maximization viewpoint. (For a mathematical derivation of the above formula, see Annex A.)

In order to simulate optimal prices for the 1972-77 period, Pw is taken to be the economic farmgate value minus the cost of subsidies per unit of output for technique I.

	Revenue Maximizing Producer Price	Actual Producer Price
72	23	35
73	43	35
74	73	37
75	40	46
76	82	48
77	70	50
78	-	60

Actual prices have tended to be too low to maximize government revenue, if we take the Plateaux Region as representative. Estimated price responsiveness in the Centrale Region has been even higher than in the Plateaux Region, which should raise the aggregate elasticity for the country as a whole. The higher price responsiveness is, the higher the optimal price from point of view of government revenue.

World prices for lint and seed as forecast by the Bank should be steady at about the 1977 level in real terms. This should leave enough latitude for producer price increases.

If cotton prices are increased, providing higher incentives relative to foodcrop prices, then cotton production should increase more than proportionally to the price increase, up to the revenue maximizing price. However, the occurrence of drought will qualify this rule. In years of disastrous drought, the perceived risk of obtaining food may be too high that no cotton price will maintain production levels. In such situations, foodcrop production may be the best earner of foreign exchange by reducing the need for food imports. This implies that in setting competitive cotton prices, OPAT must try to distinguish between longer-term trends in foodcrop prices and those which reflect drought conditions in a single year.

Cotton prices are set below world prices while foodcrop prices are determined by market forces. Thus it would seem that cotton production is discouraged relative to foodcrop production. However, this is partially offset by the provision of extension services and subsidized inputs to cotton producers.

If incentives to cotton producers are increased, resources may be pulled away from foodcrop production. This might not be desirable from a social point of view if cotton producers are better off than foodcrop producers. However if the welfare of foodcrop producers and growth of food supplies is to increase, it will be necessary to provide foodcrop producers with better techniques of production.

The existence of different production systems in the different regions of the country means that costs and returns will differ by region even though production is economically profitable in all regions. If the promotion of regional equality is one of the government's goals, then prices should be high enough to be competitive with foodcrop production in all regions. Otherwise only the most productive area, Plateaux Region, will benefit from cash crop production.

Along with promotion of the new cotton variety, modern techniques of production are also being promoted. Subsidies are provided for fertilizer and insecticide. The above analysis of incentives showed that this did increase the relative profitability of the more advanced techniques. It has been argued in another Bank analysis that these subsidies reduce the risk to the farmer of adopting new techniques. The policy of providing subsidies seems reasonable at the present time, but should be reviewed periodically as the use of modern inputs becomes more common or extends to foodcrops.

In terms of either economic efficiency, government revenue or promotion of the new cotton variety, higher prices than post historical levels seem to be called for. World price prospects should allow the government enough latitude to make increases in the producer price.

TABLE 1-A

SUPPLY FUNCTION DATA

COCOA

Crop Year	Acreage 1/	Median Age 2/	$\frac{P_T}{P_G}$ 3/	$\frac{P_T}{P_{FT}}$ 4/	$\frac{P_G}{P_{FG}}$ 5/	Q_T 6/	Q_V 7/
59/60	34,119	18.56	2.11	100	202	8,889	23,000
60/61	34,881	19.59	2.11	95	202	12,616	31,000
61/62	35,234	20.42	1.58	65	202	11,460	29,000
62/63	35,587	21.25	1.59	62.5	202	10,903	21,000
63/64	35,940	22.07	2.00	70	202	13,834	28,000
64/65	36,293	22.90	2.55	90.9	202	17,587	27,000
65/66	36,646	23.73	2.11	30.5	149	14,807	20,000
66/67	36,999	24.56	2.68	63.2	179	16,317	19,000
67/68	37,352	25.38	2.30	95.9	243	18,337	24,000
68/69	37,705	26.21	2.58	68.4	229	19,979	14,000
69/70	38,058	27.04	2.41	73.3	311	23,188	21,000
70/71	38,411	27.87	2.54	92.1	305	27,878	15,000
71/72	38,511	28.82	2.84	58.1	210	29,361	10,000
72/73	38,611	29.77	2.23	71.5	236	18,604	22,000

1/ Source: SRCC data

2/ Source: SRCC data

3/ P_T = Togo Producer Price, Source: OPAT; P_G = Ghana Producer Price, Source: Gill & Duffus

4/ P_T as above; P_{FT} = index of food crop prices in Palimé, Source: Togo Statistics

5/ P_G as above; P_{FG} = index of food crop prices in Hohoe, Source: Ghana Statistics

6/ Q_T = cocoa production in Togo, Source: OPAT

7/ Q_V = cocoa production in Volta Region, Source: Ghana Agricultural Sector Review

TABLE 1-B

SUPPLY FUNCTION DATA

COCOA: SUPPLEMENTARY DATA

Crop Year	Ghana CPI 1/	Togo CPI 2/	P_{FT} 3/	P_{FG} 4/
59/60	1.04	1.00	1.00	1.00
60/61	1.10	1.00	1.00	1.00
61/62	1.20	1.00	1.00	1.00
62/63	1.26	1.00	1.00	1.00
63/64	1.41	1.00	1.00	1.00
64/65	1.81	1.00	.77	1.00
65/66	1.90	1.00	1.31	1.00
66/67	1.78	1.035	.87	.84
67/68	1.96	1.011	.73	1.00
68/69	2.07	1.014	1.17	1.14
69/70	2.14	1.075	1.20	.96
70/71	2.25	1.125	1.01	.98
71/72	2.70	1.196	1.60	1.43
72/73	2.82	1.289	1.30	1.59

1/ Source: IMF Statistics, 1958 = 1.00

2/ Source: Togo Statistics, African CPI Lomé, 1958 = 1.00 (Prices assumed constant 1958 to 1965.)

3/ Source: Togo Statistics, Palimé food crop prices: maize, manioc, and yams. (Prices assumed constant 1959/60 to 1963/64.)

4/ Source: Ghana Statistics, Hohoe food crop prices: maize and yams. (Prices assumed constant 1959/60 to 1965/66.)

TABLE 2-A

SUPPLY FUNCTION DATA

COTTON: CENTRALE REGION

Crop Year	Production (tons) 1/	Cotton Price (CFA/kg) 2/	Food Crop Price Index 3/	Rainfall (mm/yr) 4/
68/69	498	32	.70	1,559.8
69/70	685	35	1.01	1,874.2
70/71	492	35	.99	1,439.6
71/72	488	35	.97	1,169.5
72/73	583	35	1.15	1,262.4
73/74	840	35	1.21	1,333.6
74/75	1,788	37	1.33	1,457.4
75/76	1,907	46	1.66	1,389.8
76/77	1,797	48	2.23	1,302.7
77/78	808	50	3.11	1,122.4

1/ Source: Supervision Report for Cotton Project

2/ Source: OPAT

3/ Source: Togo Statistics; food crop prices in Sokodé: millet/sorghum and yams

4/ Source: ASECNA,Sokodé annual rainfall

TABLE 2-B

SUPPLY FUNCTION DATA

COTTON: PLATEAUX REGION

Crop Year	Production (tons) 1/	Cotton Price (CFA/kg) 2/	Food Crop Price Index 3/
68/69	408	32	1.00
69/70	1,353	35	1.22
70/71	3,125	35	1.05
71/72	4,967	35	1.35
72/73	3,580	35	1.37
73/74	5,400	35	1.24
74/75	6,150	37	1.43
75/76	5,000	46	2.74
76/77	3,129	48	3.06
77/78	2,291	50	3.73

1/ Source: Supervision Report for Cotton Project

2/ Source: OPAT

3/ Source: Togo Statistics; food crop prices in Atakpamé: maize, yams and manioc.

TABLE 3-A

NOMINAL PROTECTION COEFFICIENTS (NPC)

COFFEE (CFA/kg)

Year	Producer Price	Marketing and Distribution Costs	F.O.B. Lomé Price	NPC 1/
1967	70	20.1	148.7	.54
1968	75	20.4	151.1	.57
1969	75	19.7	156.7	.55
1970	75	19.8	178.6	.47
1971	75	20.2	211.0	.39
1972	75	20.2	216.9	.38
1973	80	20.5	203.5	.44
1974	90	22.7	241.2	.41
1975	105	23.9	231.8	.51
1976	115	25.0	616.2	.19
			Average:	.45

Source: OPAT

1/ Nominal Protection Coefficient = $\frac{\text{Producer Price}}{\text{F.O.B. Lomé Price} - \text{Marketing and Distribution Costs}}$

TABLE 3-B

NOMINAL PROTECTION COEFFICIENTS (NPC)

COCOA (CFA/kg)

2ND Year	Producer Price	Marketing and Distribution Costs	F.O.B. Lomé Price	NPC 1/
1967	55	13.6	123.94	.50
1968	70	14.5	147.11	.53
1969	80	14.6	202.78	.43
1970	88	15.1	225.40	.42
1971	93	15.6	167.16	.61
1972	93	15.6	151.06	.69
1973	93	15.2	202.73	.50
1974	95	16.4	357.78	.28
1975	115	17.1	299.28	.41
1976	120	17.7	403.32	.31
			Average:	.47

Source: OPAT

1/ Nominal Protection Coefficient = $\frac{\text{Producer Price}}{\text{F.O.B. Lomé Price} - \text{Marketing and Distribution Costs}}$

TABLE 4-A

EFFECTIVE PROTECTION COEFFICIENTS AND DOMESTIC RESOURCE COSTS 1/

Cotton: Plateaux Region

	Technique I	Technique II	Technique III
Inputs/ha. 2/			
Producer Costs	8,000	10,250	11,000
Actual Costs	14,500	23,500	26,500
Yields	600	900	1,100
Inputs/kg.			
Producer Costs	13.33	11.39	10.00
Actual Costs	24.17	26.11	24.09
Producer Price	50	50	50
Economic Farmgate Price	112.9	112.9	112.9
EPC 3/	.41	.44	.45
Labor/ha.	100	110	120
Labor/kg.	.17	.12	.11
Labor Costs (300 CFAF/manday)	51	36	33
Economic Price -- Actual Input Costs	88.7	86.8	88.8
DRC 4/	.57	.41	.37

All prices in CFAF.

1/ Above data based on farm budgets in Appraisal of Rural Development Project in Cotton Areas, Togo.

2/ Technique I = 20 liter insecticides. Technique II = as Technique I + 150 kg. fertilizer. Technique III = as Technique II + 50 kg. urea. Input prices: insecticide = 725 CFAF/liter or 400 CFAF/liter with subsidy; fertilizer and urea = 60 CFAF/kg. or 15 CFAF/kg. with subsidy.

3/ $$\text{EPC} = \frac{\text{Producer Price - Producer Costs}}{\text{Economic Price - Actual Input Costs}}$$

4/ $$\text{DRC} = \frac{\text{Labor Costs}}{\text{Economic Price - Actual Input Costs}}$$

TABLE 4-B

EFFECTIVE PROTECTION COEFFICIENTS AND DOMESTIC RESOURCE COSTS 1/

Cotton: Centrale Region

	Technique I	Technique II	Technique III
Inputs/ha. 2/			
Producer Costs	8,000	11,000	11,750
Actual Costs	14,500	26,500	29,500
Yields	600	800	1,050
Inputs/kg.			
Producer Costs	13.33	13.75	11.19
Actual Costs	24.17	33.13	28.10
Producer Price	50	50	50
Economic Farmgate Price	112.9	112.9	112.9
EPC 3/	.41	.45	.46
Labor/ha.	130	140	150
Labor/kg.	.22	.18	.14
Labor Costs (300 CFAF/manday)	66	54	42
Economic Price -- Actual Input Costs	88.7	79.8	84.8
DRC 4/	.74	.68	.50

All prices in CFAF.

1/ Above data based on farm budgets in Appraisal of Rural Development Project in Cotton Areas, Togo.

2/ Technique I = 20 liter insecticides. Technique II = as Technique I + 200 kg. fertilizer. Technique III = as Technique II + 50 kg. urea. Inputs prices same as for Plateaux Region.

3/ $$EPC = \frac{\text{Producer Price} - \text{Producer Costs}}{\text{Economic Price} - \text{Actual Input Costs}}$$

4/ $$DRC = \frac{\text{Labor Costs}}{\text{Economic Price} - \text{Actual Input Costs}}$$

TABLE 5-A

ECONOMIC PROFITABILITY OF COCOA REPLANTING 1/ (CFAF)

Year	Extension Costs 2/	Material Costs	Labor Costs (300 CFA/manday)	Opportunity Cost of Land 3/ No. 1	No. 2
0	9,448	26,000	45,000	45,100	89,950
1	5,178	1,250	56,400	45,100	80.950
2	5,178	2,250	44,400	45,100	72,700
3	5,178	750	36,900	45,100	68,350
4	5,178	1,000	21,600	45,100	63,550
5	5,178	250	14,400	45,100	58,600
6	5,178	2,000	22,500	45,100	53,800
7	5,178	500	27,900	45,100	50,800
8	5,178	1,250	38,700	45,100	47,950
9	5,178	1,000	46,800	45,100	44,950
10	5,178	1,500	46,800	45,100	42,100
11	5,178	1,500	46,800	45,100	39,100
12	5,178	1,500	46,800	45,100	39,100
13	5,178	1,500	46,800	45,100	39,100
14	5,178	1,500	46,800	45,100	39,100
15	5,178	1,500	46,800	45,100	39,100
16	5,178	1,500	46,800	45,100	39,100
17	5,178	1,500	46,800	45,100	39,100
18	5,178	1,500	46,800	45,100	39,100
19	5,178	1,500	46,800	45,100	39,100
20	5,178	1,500	46,800	45,100	39,100
21-25	5,178	1,500	34,800	0	0
26-30	5,178	1,500	32,100	0	0
31-35	5,178	1,500	27,900	0	0

1/ Information taken from SRCC budgets for second cocoa/coffee project.

2/ Planting costs, costs of capsid control and extension worker estimated on a per hectare basis from information in the Appraisal of a Cocoa-Coffee Development Project, Togo.

3/ Opportunity cost of land equal to value of 150 kg. of cocoa minus 5,000 CFAF harvest costs. Value of cocoa is alternatively No. 1: World price = 334 CFA/kg or No. 2: World price = World Bank commodity price projections.

TABLE 5-A (cont.)

Year	Value of New Cocoa 4/ No. 1	No. 2	Banana Plantains (15 CFA/kg)
0	0	0	0
1	0	0	45,000
2	0	0	90,000
3	0	0	45,000
4	0	0	0
5	0	0	0
6	66,800	78,400	0
7	167,000	186,000	0
8	233,800	247,100	0
9	283,900	283,050	0
10	300,600	282,600	0
11	300,600	264,600	0
12	300,600	264,600	0
13	300,600	264,600	0
14	300,600	264,600	0
15	300,600	264,600	0
16	283,900	249,900	0
17	283,900	249,900	0
18	283,900	249,900	0
19	283,900	249,900	0
20	283,900	249,900	0
21-25	250,500	220,500	0
26-30	217,100	191,100	0
31-35	167,000	147,000	0

4/ Value of cocoa under two different assumtions of world prices as above.

TABLE 5-B

ECONOMIC PROFITABILITY OF COFFEE REPLANTING 1/

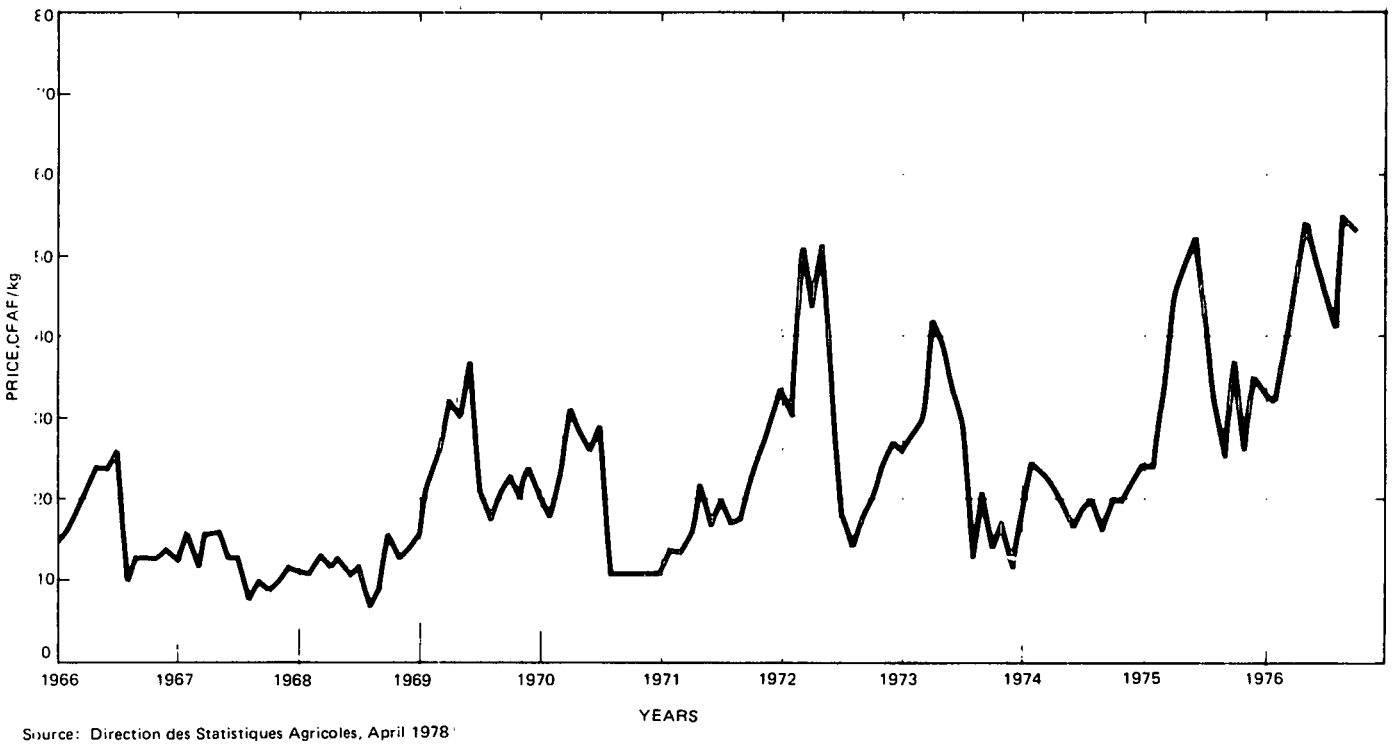
Year	Extension Costs 2/	Material Costs	Labor Costs (300 CFA/day)	Value of Coffee 3/ No. 1	No. 2
0	5,998	12,600	10,500	0	0
1	1,700	3,850	60,300	0	0
2	1,700	4,050	30,900	0	0
3	1,700	3,700	37,800	53,300	114,835
4	1,700	13,500	45,600	106,600	238,995
5	1,700	14,500	78,600	383,760	894,042
6	1,700	14,000	62,100	213,200	515,340
7	1,700	13,500	62,100	213,200	524,660
8	1,700	3,800	38,100	42,640	106,798
9	1,700	13,500	60,000	159,900	407,445
10	1,700	14,000	72,600	383,760	414,435
11	1,700	14,000	68,700	255,840	674,292
12	1,700	14,000	62,100	213,200	561,910
13	1,700	3,300	38,100	42,640	112,382
14	1,700	15,000	60,000	159,900	421,433
15	1,700	13,500	78,600	383,760	1,011,438
16	1,700	14,000	68,700	255,840	674,292
17	1,700	14,500	62,100	213,200	561,910
18	1,700	3,300	37,500	38,376	101,144
19	1,700	13,500	57,600	143,910	379,289
20	1,700	15,000	73,500	287,820	758,579
21	1,700	13,500	64,800	230,256	606,863
22	1,700	14,000	58,800	191,880	505,719
23	1,700	3,800	36,900	34,112	89,906
24	1,700	14,000	55,200	127,920	337,146
25	1,700	13,500	68,700	255,840	674,292

1/ Information taken from SRCC budgets for second cocoa/coffee project.

2/ Planting costs and costs of extension worker estimated on a per hectare basis from information in the Appraisal of a Cocoa-Coffee Development Project, Togo.

3/ Value of coffee calculated under different assumptions of world price: No. 1 World price = 213.2 CFA/kg; No. 2 World price = World Bank commodity price projections.

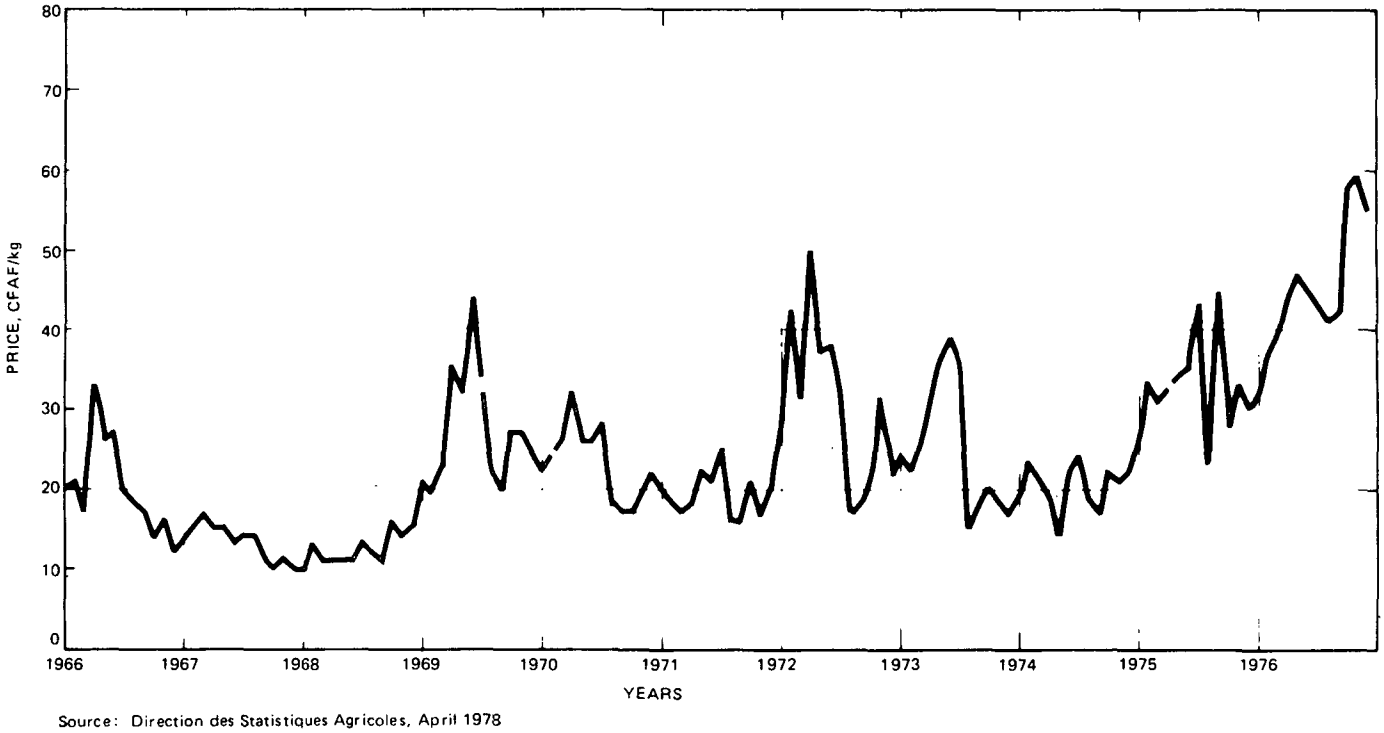
FIGURE SA–1: MAIZE RETAIL MARKET PRICES IN TSEVIE



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20188

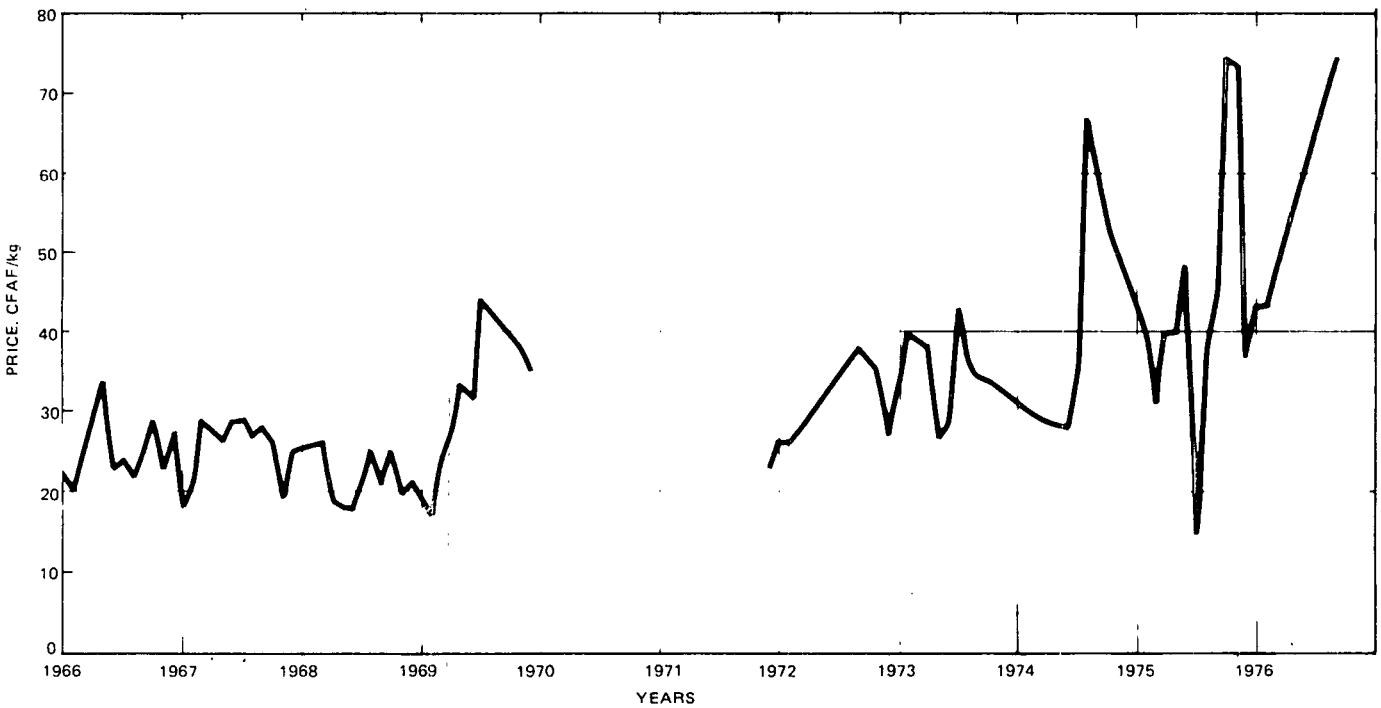
FIGURE SA–2: MAIZE MONTHLY RETAIL MARKET PRICES IN ATAKPAME



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20189

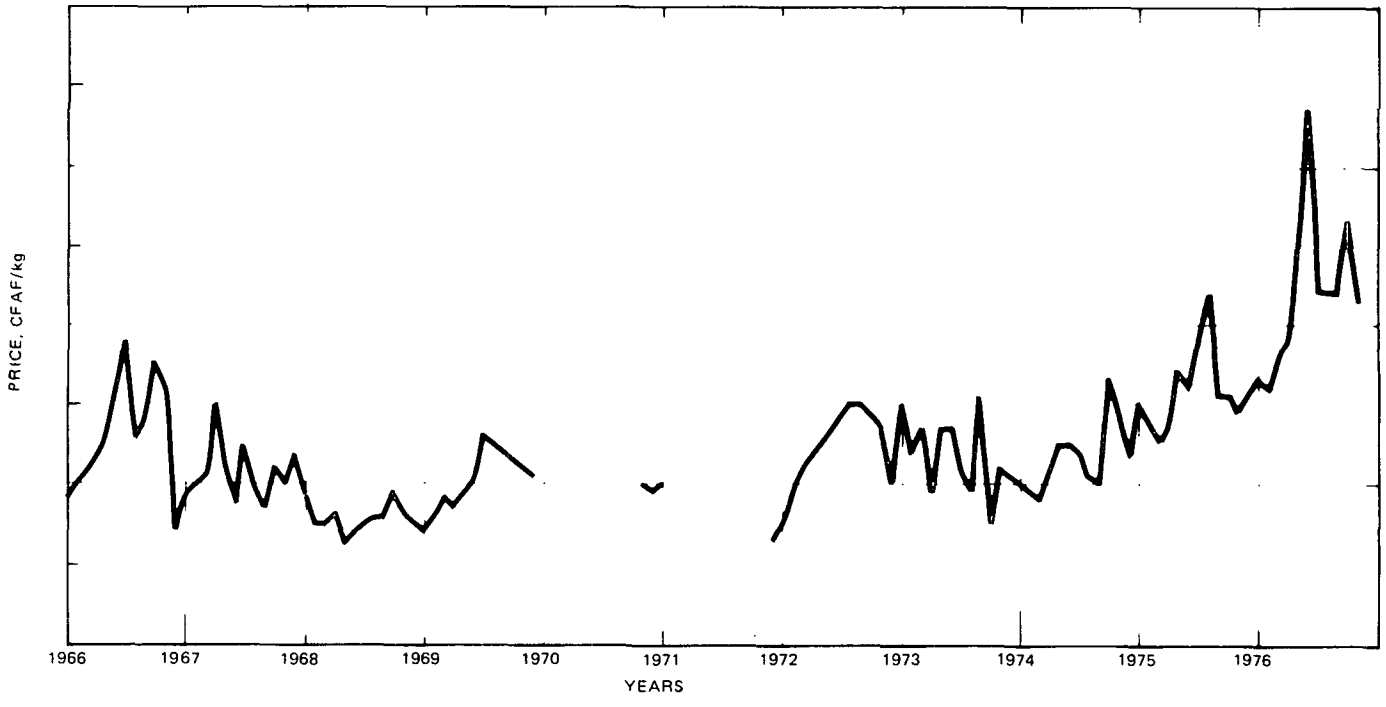
FIGURE SA–3: MILLET–SORGHUM RETAIL MARKET PRICES IN LAMA–KARA



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20190

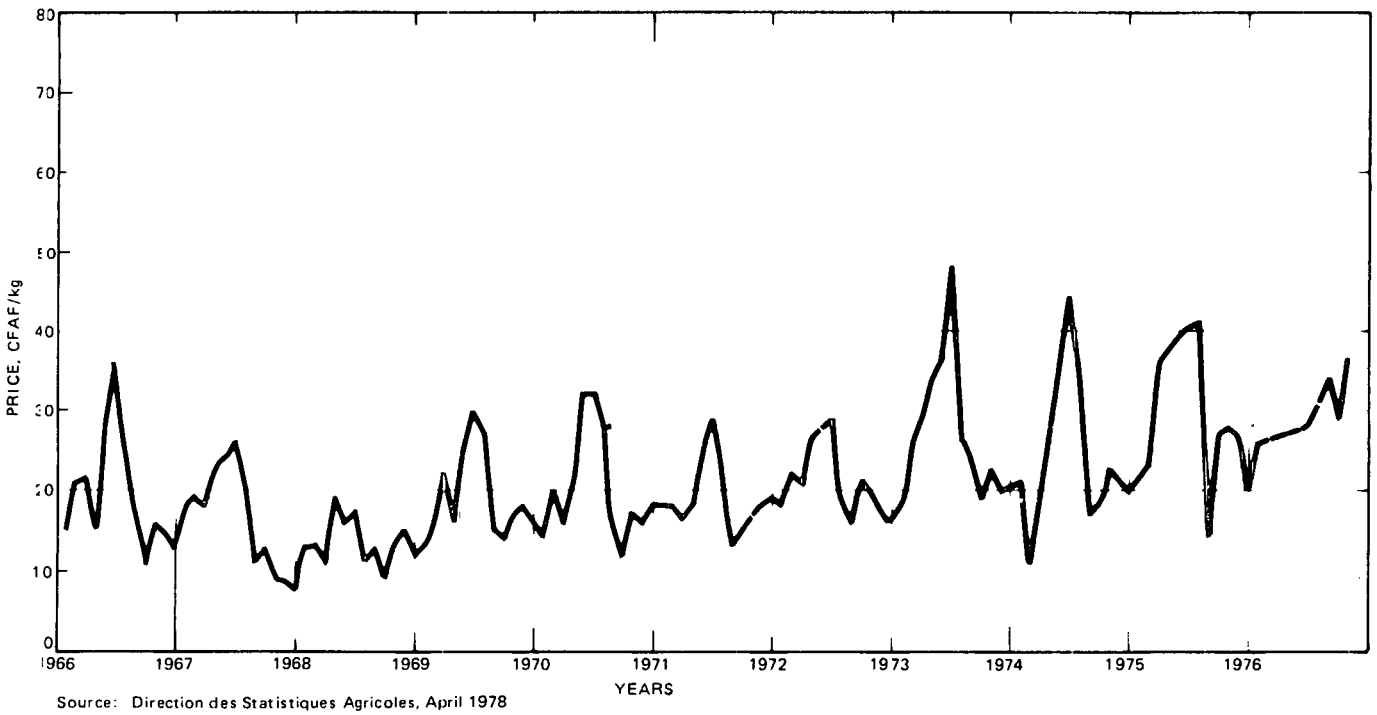
FIGURE SA–4: MILLET–SORGHUM MONTHLY RETAIL MARKET PRICES IN DAPANGO



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20191

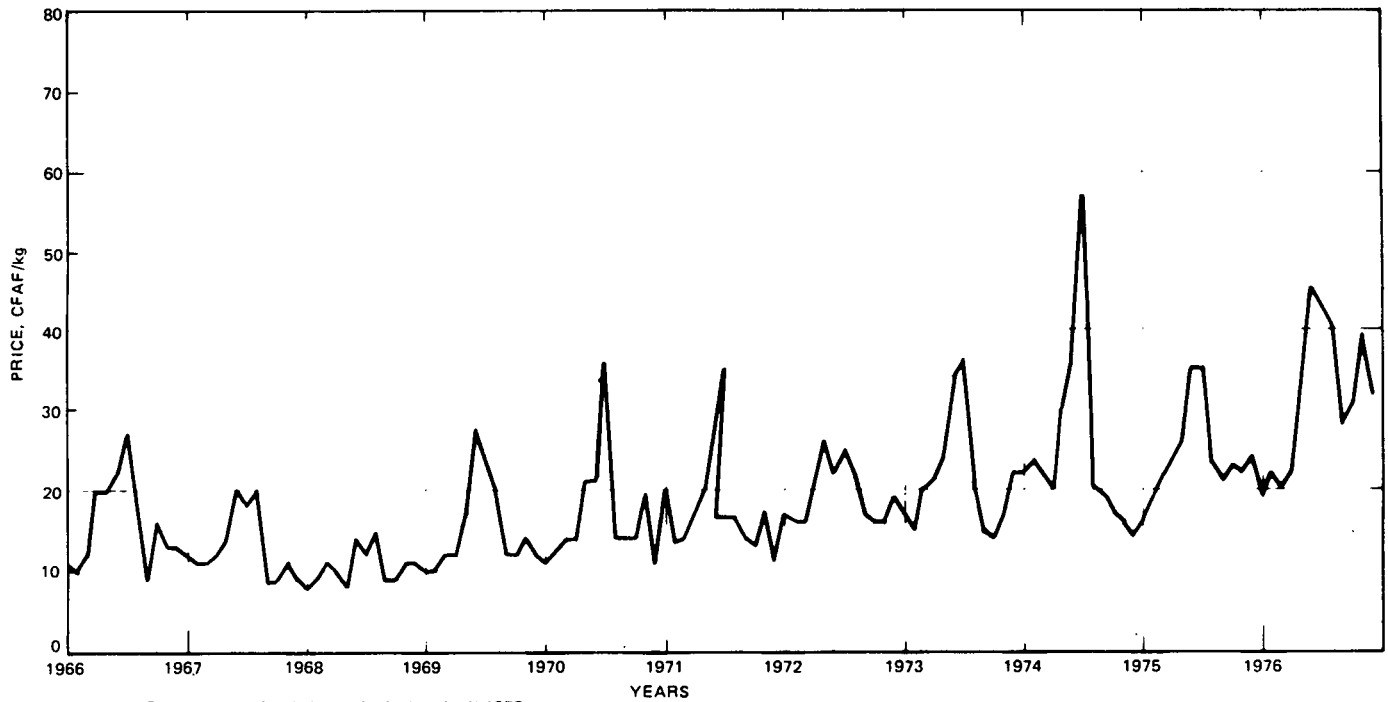
FIGURE SA–5: YAMS RETAIL MARKET PRICES IN TSEVIE



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20192

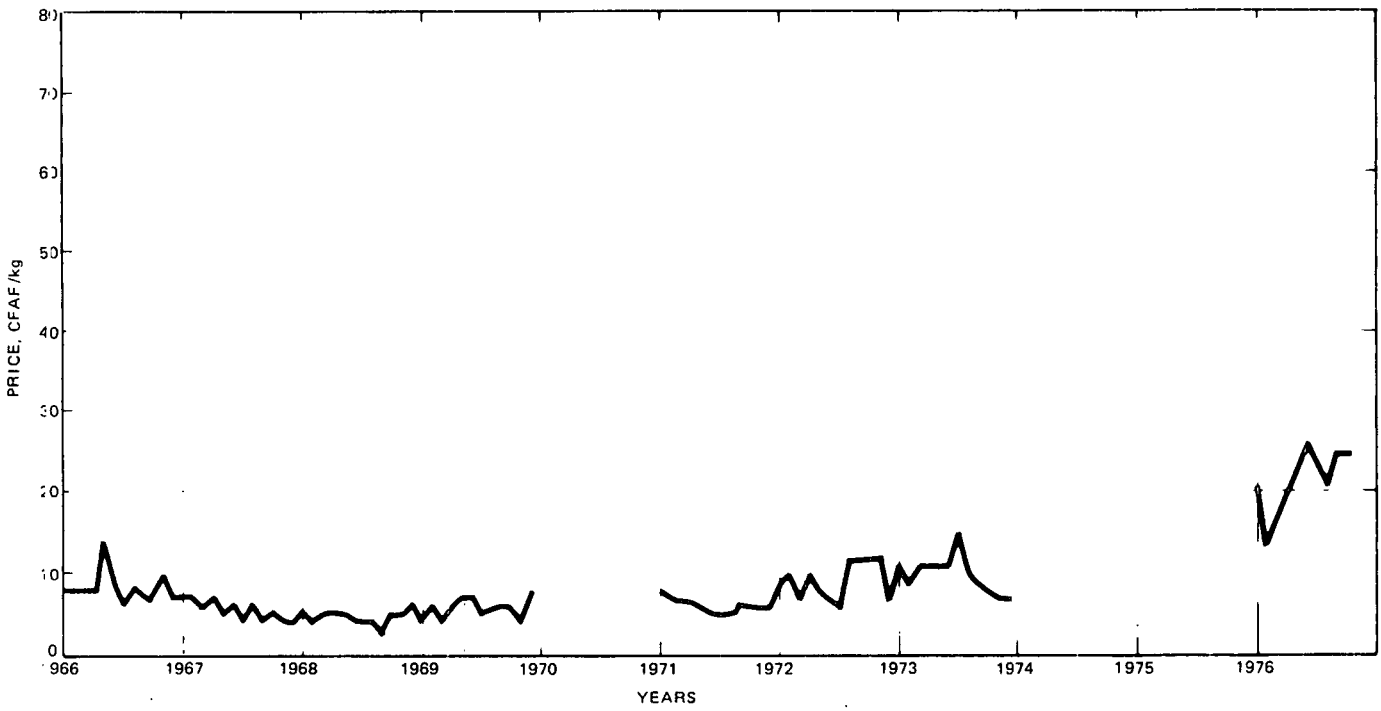
FIGURE SA–6: YAMS RETAIL PRICES IN ATAKPAME



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20193

FIGURE SA–7: MANIOC RETAIL PRICES IN TSEVIE



Source: Direction des Statistiques Agricoles, April 1978

World Bank – 20194

BIBLIOGRAPHY

General:

Bateman, Merrill. "Aggregate and Regional Supply functions for Ghanaian Cocoa, 1946-1962". Journal of Farm Economics, May 1965, Volume 47, No. 2.

Purseglove J.W. Tropical Crops: Dicotyledons. Wiley & Sons, N.Y., 1968.

Askari, Hossein and J.T. Cummings, Agricultural Supply Response: A Survey of the Econometric Evidence. Praeger Publishers, 1976.

Pearson, S.R. and J. Cownie. Commodity Exports and African Economic Development. Lexington Books, 1974.

Theil, Henri. Principles of Econometrics. Wiley & Sons, N.Y.

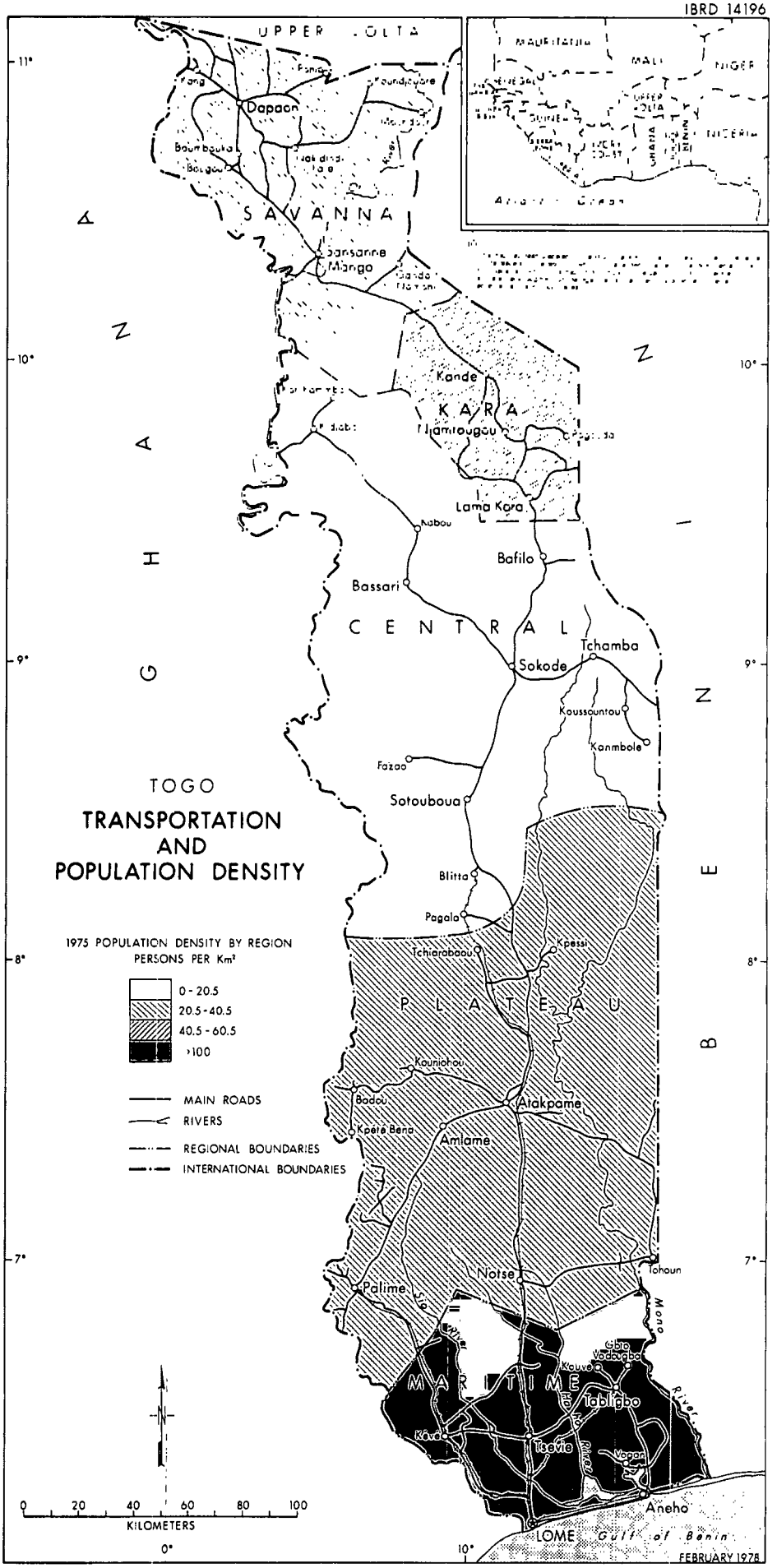
Country Sources:

Interim Report on Intensive Cocoa Survey, Republic of Ghana Ministry of Cocoa Affairs.

Twentieth Annual Report and Accounts, Ghana Cocoa Marketing Board.

Togo:
- Prices
- Enquete Agricole
- Annuaire Statistique

IBRD 14196


TOGO
TRANSPORTATION AND POPULATION DENSITY
1975 POPULATION DENSITY BY REGION
PERSONS PER Km²
0 - 20.5
20.5 - 40.5
40.5 - 60.5
>100
MAIN ROADS
RIVERS
REGIONAL BOUNDARIES
INTERNATIONAL BOUNDARIES
0 20 40 60 80 100
KILOMETERS
UPPER VOLTA
SAVANNA
KARA
CENTRAL
PLATEAU
MARITIME
Dapaon
Mango
Kande
Lama Kara
Bafilo
Bassari
Tchamba
Sokode
Koussountou
Kanmbole
Fazao
Sotouboua
Blitta
Pagala
Kpessi
Tchiaraboau
Kouniohou
Badou
Atakpame
Kpele Bena
Amlame
Notse
Palime
Tohoun
Vogan
Tsevie
Kovè
Tabligbo
Aneho
LOME
Gulf of Benin
FEBRUARY 1978

RECENT PAPERS IN THIS SERIES

No.	TITLE OF PAPER	AUTHOR
450	Education and Basic Human Needs	A. Noor
451	Economics of Supplemental Feeding of Malnourished Children: Leakages, Costs and Benefits	O. Knudsen
452	Land Tenure Systems and Social Implications of Forestry Development Programs	M. Cernea
453	Industrial Prospects and Policies in the Developed Countries	B. Balassa
454	Labor Migration from Bangladesh to the Middle East	S. Ali, A. Arif A.K. Habibullah, R. Islam A. Hossain, W. Mahmud S. Osmani, Q. Rahman A. Siddiqui (consultants)
455	Managerial Structures and Practices in Manufacturing Enterprises: A Yugoslav Case Study	M. Schrenk
456	Nutritional Consequences of Agricultural Projects: Conceptual Relationships and Assessment Approaches	Per Pinstrup-Andersen (consultant)
457	Industrial Strategy for Late Starters: The Experience of Kenya, Tanzania and Zambia	R. Gulhati U. Sekhar (consultant)
458	Comparative Study of the Management and Organization of Irrigation Projects	A. Bottrall (consultant)
459	Size of Land Holding, Living Standards and Employment in Rural Western India, 1972-73	P. Visaria
460	Some Aspects of Relative Poverty in Sri Lanka, 1969-70	P. Visaria
461	Incidence of Poverty and the Characteristics of the Poor in Peninsular Malaysia, 1973	P. Visaria
462	Regional Aspects of Family Planning and Fertility Behaviour in Indonesia	O. Meesook D. Chernichovsky
463	What is a SAM? A Layman's Guide to Social Accounting Matrices	B.B. King
464	Structural Adjustment Policies in Developing Countries	B. Balassa
465	Cost-Benefit Evaluation of LDC Industrial Sectors which have Foreign Ownership	G. Pursell
466	Energy Prices, Substitution, and Optimal Borrowing in the Short Run: An Analysis of Adjustment in Oil Importing Developing Countries	R. Martin M. Selowsky