

REFORMS IN THE AGRICULTURAL LENDING PROGRAMS OF IVORY COAST'S BNDA

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1. Introduction

Capital is a major constraint on the economic and social progress of the small farmer in Ivory Coast. The informal sector's provision of loanable funds to producers has been perceived as inadequate in terms of loan size as well as cost to borrowers. Consequently, the public sector's intervention in small farm loans via the *Banque Nationale Pour le Développement Agricole (BNDA)*, now the only institution specializing in granting loans at subsidized interest rates, has increased sharply in recent years.

Yabile [10] has shown that the BNDA's net returns from agricultural lending are negative mainly because of the low interest rates and high default rates on agricultural loans. The objective of this study is to identify reforms to reduce the BNDA's net lending costs and to estimate the effects of the reforms on the performance of small farm borrowers.

2. The Problem

It is widely contended that the small farmer's limited access to credit and his aversion to debt limit his capacity to acquire off-farm inputs and thus increase his output, his productivity and his income [6]. In the Ivory Coast the BNDA makes small farm loans in two programs. In one, the *prêts de soudure*, loans are made to small farmers in groups. Proceeds are disbursed without requirement as to use. Repayment incentives consist of sanctions applied against all members of the group that includes a defaulter. In the other program, loans are made to small farmers as individuals, the proceeds limited to use for production purposes [3]. The loans are to increase the farmer's output and enlarge his marketable surplus, to improve his living standard and free him from the moneylender's « exploitive » practices. Loans generally are made at low interest rates and disbursed mostly in kind or in coupons that can be exchanged for specific production inputs.

As a consequence of a general shortage of public funds, the BNDA's loans have been limited in amount. Limited funds and the increasing demand for loans have caused the bank to slow down the making of the so-called « unproductive » loans such as in the *prêts de soudure* program in favor of loans more directive in terms of production and marketing, such as the individual credit program. However a recent study [10] has found the *prêts de soudure* to be the less costly program because of its low default

rate record. The BNDA's other credit program has been very costly because of increasing delinquency and default rate among borrowers.

Credit is defined as the farm firm's borrowing capacity, a source of cash [1]. Credit reserves can be viewed as sources of liquidity because undrawn balance can substitute for cash reserves. Hence credit has a liquidity value [4]. A permanent, reliable, flexible and accessible source of loans is an important source of liquidity. Unused credit can represent a contingency source of cash and allows the farmer to commit cash to productive activities. Consequently, such credit will be valued and preserved by farmers.

Except for the *prets de soudure* program, the BNDA's loan programs constrain the use of loan proceeds to specific purposes such as production, marketing and even further, to the purchase of « improved inputs ». In addition, loan procedures are complex and slow. Delays in loan decisions are not unusual and have serious consequences for timeliness of crop practices. Therefore, the credit produced by the BNDA in its individual borrower program has limited liquidity value.

The viability of the bank, as with any lender, is essential to the supply of credit to the borrower. In any event net high lending cost generated mainly by the low interest rate policy and the increasing default rates limit BNDA's success in meeting the government's objective, namely, a substantial increase in small farmers' aggregate output and income.

3. The Model

To determine the effect of the break-even interest rate on the farmer's economic welfare and to identify the reforms to offset his financial losses caused by such an interest rate policy, linear programming [2, 8] was used to model the individual farmer borrower in the Abidjan district, the district reporting the highest default rate in the individual borrower program [9].

Data from a sample of farmer borrowers were used to specify parameter values in the linear programming model [9]. Data from secondary sources were obtained to supplement the survey data. A sample of 50 farmers was drawn randomly from a total population of 160, which constitutes the total population of individual borrowers in the Southern region, with headquarters in Abidjan. Thus, the sampling rate was 31.3%. The

interviews were conducted by the senior author using a written questionnaire. In the district of Abidjan, 92% of the borrowers interviewed had had formal education. The interviews were therefore conducted mainly in French.

3.1. *The objective function*

The individual borrower is specified to maximize the end-of-period net cash flow generated from production, marketing, financing (including unpaid debt not yet due) and liquidity values (value of credit and cash held in reserve) after meeting farm and household obligations.

3.2. *The constraints*

The financial environment of the producer is central to this study. It is reflected in the constraints listed in Table 1. Normally, family food requirements are met by subsistence food crops produced within the farm. But cash is needed to buy additional food and to pay for other living expenses, mainly clothing, schooling and health care.

A sum of \$ 1,400,000 CFAF¹ is assumed available at the beginning of season 1. Seasonal cash supplies are increased by interseason transfer. Any cash surplus is transferred to the next season or, in the case of the last season, to the objective function. All cash supplies are allocated between the cash account and the cash reserve. Cash is available from the cash account for consumption, production and debt payment. Cash in reserve is valued to reflect its liquidity attributes. Reserved quantities are specified in percentage classes, the classes arrayed to approximate nonlinear value functions [2, 8].

BNDA credit is also specified by season. The limits on BNDA's loans are based on the results from the survey. The BNDA credit is allocated between the BNDA credit account and the BNDA credit reserve. The BNDA credit account is available for loans to finance production, marketing and living expenses and debt repayment.

The amounts not borrowed are held in reserve. As defined earlier, credit is the producer's capacity to borrow. If loans are disbursed in cash, then the producer may utilize

¹ Central French African Franc. When the research for this article was completed, one CFAF = \$ US 0.0031. Now one CFAF equals \$ U.S. 0.0024.

BNDA's credit to borrow or hold in reserve, with the assumption that the proportion held in reserve could be converted into cash by borrowing a given period.

Table 1
MODEL CONSTRAINTS

Row description	Constraint ^d	
	Relation	Level ^a
Cash supply (by season)	E ^a	(1) ^a
Cash requirements	E ^a	(2) ^a
Cash accounting equality (by season)	E ^a	0
Cash reserve: 20,40,60,80,100(%) (by season)	E ^a	0
BNDA credit limit (by season)	LE ^b	(3) ^a
BNDA credit account (by season)	E ^a	0
BNDA credit reserve: 20,40,60,80,100(%) (by season)	E ^a	0
Commercial bank credit limit (by season)	LE ^b	(4) ^a
Commercial bank credit account (by season)	E ^a	0
Commercial bank credit reserve: 20,40,60,80,100(%) (by season)	E ^a	0
Moneylender credit limit (by season)	LE ^b	(5) ^a
Moneylender credit account (by season)	E ^a	0
Moneylender credit reserve: 20,40,60,80,100(%) (by season)	E ^a	0
Liquidity reserve requirement (by season)	GE ^c	(6) ^a
Debt: BNDA Loan (by season)	E ^a	0
Debt: Commercial bank loan (by season)	E ^a	0
Debt: Moneylender loan (by season)	E ^a	0

^a Equal to.

^b Less than or equal to.

^c Greater than or equal to.

^d All constraint levels stated in terms of CFAF. At the time the research for this article was completed one CFAF = US \$ 0.0031. Now one CFAF = US \$ 0.0024.

	(1)000	(2)000	(3)000	(4)000	(5)000	(6)000
^a Season 1	1.4	240	255	287	12	211
2	0	243	367	372	10	213
3	0	193	733	231	25	169
4	0	479	467	290	25	420

Similar to the BNDA credit constraints, the moneylender and the commercial bank credits are specified by season. The commercial bank credit is allocated between commercial bank credit account and commercial bank credit reserve. Borrowing from the commercial bank draws upon the commercial bank credit account. The commercial bank credit reserve constitutes a source of liquidity. The procedure for allocating com-

mercial bank credit between credit account and credit reserve components is equally applied to the allocation of moneylender credit.

Liquidity requirements are estimated from results of the survey. The liquidity level is differentiated by season. (See item [6] in the constraint set.) A different minimum amount is specified in reserve each season (last column, footnote e) to reflect the various risk factors unique to the season (epidemy, drought, price fluctuations, etc...). Thus, liquidity requirements reflect needs to meet unexpected cash expenses.

Borrowing generates debt balances which must be repaid or carried over as liabilities at the end of the trading year. Debt balances are shown in constraints differentiated by source and time of borrowing.

3.3. Model Activities

Activities are compared in terms of their contributions to the value of the objective function and are subject to resource constraints and to requirements to which the activities contribute. The activities most relevant to the producer's financial environment are described in Table 2.

Table 2

MODEL ACTIVITIES

Column description	Unit
Hire labor (by season)	Man days
Buy protein items (by season)	Kilograms
Buy fats items (by season)	Kilograms
Buy iron items (by season)	Milligrams
Buy vitamin B ₁ items (by season)	000 International Units
Meet other family living expenses (by season)	CFAF
Borrow from BNDA (by season)	CFAF
Repay BNDA (by season)	CFAF
Borrow from commercial bank (by season)	CFAF
Repay commercial bank (by season)	CFAF
Borrow from moneylender (by season)	CFAF
Repay moneylender (by season)	CFAF
Allocate cash to cash account (by season) subject to reserve: 20, 40, 60, 80, 100 (%)	CFAF
Allocate BNDA credit to BNDA credit account (by season) subject to reserve: 20, 40, 60, 80, 100 (%)	CFAF
Allocate commercial bank credit to commercial bank credit account (by season) subject to reserve: 20, 40, 60, 80, 100 (%)	CFAF
Allocate moneylender credit to moneylender credit account (by season) subject to reserve: 20, 40, 60, 80, 100 (%)	CFAF
Value reserved cash (by season): 20, 40, 60, 80, 100 (%)	CFAF
Value BNDA reserved credit (by season): 20, 40, 60, 80, 100 (%)	CFAF
Value commercial bank credit (by season): 20, 40, 60, 80, 100 (%)	CFAF
Value moneylender credit (by season): 20, 40, 60, 80, 100 (%)	CFAF
Transfer cash: between seasons and to objective function	CFAF

Crop expenses are specified to be paid with cash. Labor and tractor hiring activities are differentiated by season. It is assumed that hired labor (unskilled labor) differs in quality from family labor (skilled labor).

Food needs for the typical household are defined in terms of dietary requirements: protein, fat, iron and vitamin B₁. Vitamin B₁ has been included because of the limited supply of this nutrient in menus of interviewed farm units.

Various FAO reviews have been relied upon to establish the required levels of nutrients and energy intakes. Cash outlays are allowed for to supplement food produced within the unit. Subtracting home-produced supplies from the (FAO) safe levels determines the balance to be met by purchasing. This balance is converted into actual weight of food and then stated in terms of cash requirements.

Borrowing activities are differentiated by source and season to allow borrowing from more than one source and in each season. Borrowing is for short-term purposes, generating debt payable within one year. Repayment coefficients are calculated as one plus the interest due on one CFAF in the specified alternative repayment period.

The household is assumed to have access to the commercial bank, the BNDA and the village moneylender. In addition, the model assumes that the commercial bank, the moneylender and the BNDA's credit programs interact. The commercial bank is assumed to reduce its credit supply to the farmer by 0.01 CFAF and 0.001, when the latter borrows respectively, one CFAF from the moneylender and BNDA. The moneylender is assumed to reduce his credit supply to the farmer by 0.0005 when the latter borrows one CFAF from either the BNDA or the commercial bank. It is also assumed that the BNDA reduces its credit supply to the farmer by 0.01 CFAF when the latter borrows one CFAF from either the commercial bank or the moneylender.

Cash generated by the various cash-producing activities is used for cash-requiring activities or held in reserve. The proportion of cash used and reserved must always add to one. Activities are specified that value reserved cash. The value of one CFAF kept in reserve is reflected as a contribution to the value of the objective function. Table 3, indicates the values of these cash reserves. The value of cash in reserve increases as the percentage held in reserve decreases. One unit of cash in reserve is valued at more than one to reflect the incremental value of the liquidity attribute, as size of reserve varies.

Table 3**CASH RESERVATION PRICES**

Percentage of cash in reserve	Value of one CFAF in season			
	1	2	3	4
20	1.95	1.85	2.00	2.00
40	1.60	1.40	1.65	1.65
60	1.30	1.25	1.35	1.35
80	1.20	1.15	1.25	1.25
100	1.15	1.10	1.20	1.20

Credit is an asset that the farmer can allocate between credit account and credit reserve. The amount committed to credit account is used for borrowing while the remainder is held (and valued) in reserve. The specification of these activities is similar to those for cash. Credit allocation activities are specified for the BNDA, the commercial bank and the moneylender credit.

Credit valuation activities are specified seasonally, by percentage of credit kept in reserve and by the credit source. The procedures are the same as those for the valuation of cash reserves. Credit reservation prices, shown in Table 4, differ from those of cash reserves because of the difference between cash and credit reservation values for the different financial sources. The differences in magnitudes between cash and credit reservation prices reflects the farmer's assumed valuation of cash reserves relative to credit reserves. The difference in the reservation prices among the three financial sources is to reeleft, in particular, the lengthy procedure needed to secure a loan from the BNDA credit programs, as revealed in survey findings.

4. Results

Table 5 displays the several simulations made with variations of the validated model, M_0 , the simulations specified to accomplish the objective of this study. In M_0 , the BNDA charges an interest rate of 11% in the individual loan program, and disburses the loan in kind. M_0 assumes that the BNDA credit has no value in reserve due to

restrictions on use of the loan proceeds. In this model, the typical farmer relies on the commercial bank and the moneylender as sources of credit liquidity.

Table 4
CREDIT RESERVATION PRICES

Credit in reserve (%)	Value of one CFAP in season											
	1			2			3			4		
	Commer- cial banks		Money- lenders	Commer- cial banks		Money- lenders	Commer- cial banks		Money- lenders	Commer- cial banks		Money- lenders
	BNDA			BNDA			BNDA			BNDA		
20	1.60	1.75	1.65	1.50	1.80	1.70	1.70	1.85	1.75	1.70	1.85	1.75
40	1.30	1.35	1.35	1.25	1.40	1.40	1.45	1.55	1.45	1.45	1.55	1.45
60	1.10	1.10	1.00	1.05	1.20	1.15	1.15	1.25	1.20	1.15	1.25	1.20
80	.80	.80	.70	.75	.85	.75	.85	.90	.85	.85	.90	.85
100	.60	.70	.55	.55	.75	.65	.65	.85	.70	.65	.85	.70

Table 5
SIMULATIONS

Interest rate (%) and form of loan disbursement	BNDA credit limits: increments to M_0 , M_1 specifications (%) ^a					
	0	10	20	30	40	50
(11) Kind	M_0					
(40) Kind	M_1	M_2	M_3	M_4	M_5	M_6
cash ^b	M_7	M_8	M_9	M_{10}	M_{11}	M_{12}

^a See Table 6.

^b Reservation values assigned to BNDA credit. See Table 3.

Model M_1 differs from model M_0 only by change in specification of the BNDA's interest rate. For M_1 an interest rate is introduced that would reduce the BNDA's net lending costs to zero [5, 9]. Models $M_2 - M_6$ are simulations made with Model M_1 , simulations in which the BNDA credit is increased. In Model 7, BNDA loans are disbursed in cash. Otherwise, M_7 is the same as M_1 . The availability of cash from loans and the perception of the BNDA credit program as permanent is assumed to lead the borrower to value BNDA credit in reserve. Thus, in $M_7 - M_{12}$ credit reserves are valued for BNDA as well as commercial bank and moneylender. In $M_8 - M_{12}$, BNDA credit limits are varied in the same increments as in $M_2 - M_6$.

Results from M_0 are summarized in the first column of Table 6. They indicate outcomes to be expected if the BNDA pursues its present lending policies and operates at high financial losses. The value of the objective function is 67,348,306 CFAF. This value includes liquidity values and accrues to all resources identified in the right-hand-side of the model after deductions are made for debt repayments at the different credit sources through the objective function. The reserving vectors are not to be interpreted as actual cash flows. Therefore, the value of the objective function generated by the model must be reduced by the liquidity values in order to obtain the net cash flow available to the modeled household. Thus, the net cash flow is 24,151,411 CFAF.

Cash held in reserve is 41,438,164 CFAF. The amount of reserved cash depends on the cash reservation prices in relation to rates earned from cash committed to farm organization. The amount of cash available (net cash flow + reserved cash) is 65,589,575 CFAF. The amount of reserved credit is 358,730 CFAF. The optimizing farmer borrows 1,547,465 CFAF, 886,540 CFAF and 17,518 CFAF, respectively from the BNDA, the commercial bank and the moneylender.

In the optimum of Model M_0 the farmer produces 14.45 ha of bananas, 7.92 ha of pineapple, 7,740 chickens and 87,661 eggs, hiring in 10,600 man days of labor, and hiring out 522 man days of family labor.

Yabile found the BNDA breakeven interest rate to be 40%, the rate reflected in specifications of M_1 . Results from M_1 are summarized in the second column of Table 6. The value of the objective function is reduced to 66,109,613 CFAF and the net cash flow to 21,964,145 CFAF. The reserved cash is increased, as is credit at both sources where credit has a reservation value: by 2% at the commercial bank and 35% at the moneylender. The amount of cash available to the producer from the year's operation, plus what he could withdraw and use at the end of the year is reduced to 64,338,299 CFAF.

Table 6

OPTIMAL ACTIVITY LEVELS FOR M_0 AND M_1

Activities	M_0 ($i = 11\%$)	M_1 ($i = 40\%$)
Value of objective function ^a	67,348	66,110
Reserved cash ^a	41,438	42,374
Reserved credit ^a	359	371
Commercial bank ^a	343	347
Moneylender ^a	16	25
Net cash flow ^a	24,151	21,964
Cash available ^a	65,590	64,338
Borrowed from ^a		
BNDA	1,548	1,558
Commercial bank	887	707
Moneylender	17	22
Repaid to ^a		
BNDA	1,548	1,558
Commercial bank	887	707
Moneylender	17	22
Produce: bananas (ha)	14.45	15.40
pineapples (ha)	7.92	7.92
chickens (head)	7,740	4,754
eggs (number)	87,661	0
Hire labor in (man days)	10,900	10,822
Hire labor out (man days)	522	571

^a 000 CFAF.

Despite the higher interest rate of M_1 , the farmer borrows 1,558,272 CFAF from the BNDA, an increase of 0.7% over M_0 . He borrows 20% less from the commercial bank (707,277 CFAF) and 28% more from the moneylender (22,032 CFAF). The simultaneous increase in funds borrowed from and credit reserved at the moneylender arises from the fact that more funds are available at this credit source in model M_1 .

With an interest rate of 40%, less borrowing might be expected from the BNDA and more borrowing from commercial bank. However, such behavior did not occur. The paradoxical borrowing responses to the increased BNDA interest rate can be explained by the need to offset financial losses due to the shortage of cash supply at the end of each season as seen in M_1 ; chicken and egg production are reduced. Since the BNDA credit has no reservation value and other credit sources do, it is more attractive to borrow from BNDA despite the higher rate charged.

Among the following four activities, bananas, pineapple, eggs and chickens the latter is the least attractive. However, from M_0 ($i = 11\%$) to M_1 ($i = 40\%$), chicken production is reduced from 7,740 to 4,754 head while egg production decreases from 87,661 to zero. This production response to the increased BNDA interest rate can be explained in the following manner: Bananas, pineapple and eggs are sold during the same period (i.e. seasons 3 and 4) while chickens are marketed at the end of seasons 1, 3, and 4. Obviously chicken production generates more cash inflow during season 1 when there is a shortage of cash supply. Thus the high interest rate (40%) constrains the producer to select cash flow activities such as chicken production in season 1 and to cancel the less attractive activities during seasons 3 and 4 (i.e., chicken and egg production).

Models M_2 — M_6 are designed to determine the extent to which increased credit limits might provide for recovery from the loss generated by increasing the BNDA interest rate. The five models modify model M_1 by increasing the BNDA credit limit by 10 to 50% in 5 equal increments. Results from these models are reported in Table 7. The value of the objective function increases in response to increases in the BNDA credit limit. With an increment of 40% in the credit limit the farmer's loss from the higher interest rate is offset in terms of the objective function value, though not in terms of net cash flow. The increase of BNDA credit increases the amount of cash held in reserve while the amount of credit held in reserve decreases. In terms of the amount of cash available (reserved cash plus net cash flow) the financial loss from the increased rate of interest is offset by a credit increment of between 30 and 40%.

The vital importance of credit limits to the farmer was revealed in survey results as well as model output. In the survey respondents clearly favored higher credit limits even at higher interest rates. Equally clearly, BNDA must reduce net lending costs if it is to respond with higher credit limits.

In model M_7 , the BNDA loan is disbursed in cash, the proceeds unrestricted as to use. In response, the borrower is assumed to assign values to BNDA credit reserves. The only difference between models M_1 and M_7 is the cash disbursement and consequent reserve valuation of BNDA credit specified in model M_7 . Comparisons between M_1 and M_7 are exhibited in Table 8.

The value of the objective function is increased to 66,402,480 CFAF. The amount of cash held in reserve decreases while the total credit reserved increases. Most of the increase is in BNDA credit reserve. In fact, the producer borrows only 765,216 CFAF from the BNDA in M_7 , about half the amount he borrows in M_1 . The valuation of BNDA

Table 7

OPTIMAL ACTIVITY LEVELS FOR $M_2 - M_6$:
LOANS IN KIND WITH INCREMENTS TO BNDA CREDIT LIMITS

Activity	Optimal activity levels				
	$M_2 (+ 10\%)^b$	$M_3 (+ 20\%)^b$	$M_4 (+ 30\%)^b$	$M_5 (+ 40\%)^b$	$M_6 (+ 50\%)^b$
Value of objective function ^a	66,437	66,765	67,092	67,419	67,745
Reserved cash ^a	41,800	42,198	42,596	42,994	43,255
Reserved credit ^a	368	365	363	360	357
Commercial bank	344	341	338	335	332
Moneylender	25	25	25	25	25
Net cash flow ^a	22,869	22,801	22,733	22,666	22,734
Cash available	64,669	64,999	65,329	65,660	65,989
Borrowed from					
BNDA	1,715	1,871	2,028	2,185	2,342
Commercial bank	711	714	715	721	724
Moneylender	22	22	22	22	22
Repaid to ^a					
BNDA	1,715	1,872	2,028	2,185	2,342
Commercial bank	711	714	718	721	724
Moneylender	22	22	22	22	22
Produce: bananas (ha)	15.57	15.74	15.91	16.08	16.26
pineapples (ha)	7.92	7.92	7.92	7.92	7.92
chickens (head)	3,857	2,960	2,062	1,165	887
eggs (number)	0	0	0	0	0
Hire labor in (man days)	10,777	10,733	10,689	10,544	10,684
Hire labor out (man days)	582	592	603	613	616

^a 000 CFAF.

^b Numbers in parentheses are increments to the M_0 specification.

credit induces the producer to commit more cash to production, since he can substitute credit reserves for cash reserves. Committing more cash to production increases net cash flow and cash available, a result made possible by added credit held in reserve to meet the risks reflected in the liquidity requirements. Committing more assets to production further reduces the BNDA burden to generate more loanable funds.

Table 8OPTIMAL ACTIVITY LEVELS FOR M_1 AND M_7 : LOANS IN KIND VERSUS LOANS IN CASH, INTEREST AT 11% PER ANNUM

Activities	Model M_1 (loan in kind)	Model M_7 (loan in cash)
Value of objective function ^a	66,110	66,403
Reserved cash ^a	42,374	40,520
Reserved credit ^a	371	1,084
BND A	0	739
Commercial bank	347	324
Moneylender	25	25
Net Cash flow ^a	21,964	23,398
Cash available ^a	64,338	63,918
Borrowed from ^a		
BND A	1,558	765
Commercial bank	707	734
Moneylender	22	22
Repaid to ^a		
BND A	1,558	765
Commercial bank	707	734
Moneylender	22	22
Produce: bananas (ha)	15.40	15.06
pineapple (ha)	7.92	7.92
chickens (head)	4,754	6,549
eggs (number)	0	0
Hire labor in (man days)	10,822	10,910
Hire labor out (man days)	571	550

^a 000 CFAF.

As in models M_2 — M_6 , the BND A credit limits are varied in models M_8 — M_{12} from 10 to 50% in 5 equal increments. The results are summarized in Table 9.

The value of the objective function increases in response to increased BND A credit limit. Interest-induced loss in the value of the objective function is offset, in the case of cash disbursed loans, by an increase in credit limit of between 20% and 30%, instead of between 30% and 40%, the increase required when the BND A loan is disbursed in kind. The amount of cash held in reserve increases progressively as does the total of reserved credit. Most of the increase in credit reserve is generated at the BND A.

Table 9

OPTIMAL ACTIVITY LEVELS FOR $M_8 - M_{12}$: LOANS IN CASH WITH INCREMENTS TO BNDA CREDIT LIMITS

Activity	$M_8 (+10\%)^b$	$M_9 (+20\%)^b$	$M_{10} (+30\%)^b$	$M_{11} (+40\%)^b$	$M_{12} (+50\%)^b$
Value of objective function ^a	66,758	67,113	67,468	67,883	68,178
Reserve cash ^a	40,831	41,141	41,452	41,768	42,073
Reserve credit ^a	1,153	1,221	1,290	1,357	1,419
BNDA	807	875	943	1,011	1,073
Commercial bank	324	324	324	324	324
Moneylender	22	22	22	22	22
Net cash flow ^a	23,374	23,351	23,327	23,358	23,286
Cash available ^a	64,205	64,492	64,779	65,126	65,359
Borrowed from ^a					
BNDA	843	920	997	1,075	1,152
Commercial bank	734	734	734	734	734
Moneylender	22	22	22	22	22
Repaid to ^a					
BNDA	843	920	997	1,075	1,152
Commercial bank	734	734	734	734	734
Moneylender	22	22	22	22	22
Produce: bananas (ha)	15.20	15.34	15.47	15.61	15.75
pineapples (ha)	7.92	7.92	7.92	7.92	7.92
chicken (head)	5,831	5,113	4,395	3,677	2,959
eggs (number)	0	0	0	0	0
Hire labor in (man days)	10,876	10,842	10,804	10,770	10,737
Hire labor out (man days)	559	567	575	584	592

^a 000 CFAF.^b Numbers in parentheses are increments to the M_1 specification.

While the net cash flow is higher for disbursement in cash than for disbursement in kind at each of the credit limits, the model M_0 level of net cash flow is not reached with disbursement in either kind or cash, when the interest rate is increased to the break-even level. However, the loss is narrowed to only a slight difference (3.6%) in the case of cash disbursement, and a credit increment of 40%. A progression in the amount of funds borrowed from the BNDA is observed for models, $M_8 - M_{12}$. However, at each of the credit limits, the amount of funds borrowed at BNDA is about half the size borrowed when the credit is disbursed in kind. The value of the objective function is higher in $M_8 - M_{12}$ than in $M_2 - M_6$, respectively. Increasing credit limits increases the objective function more for cash disbursements than for loans in kind.

The net cash flows in $M_8 - M_{12}$ are higher than are generated in $M_2 - M_6$. Cash reserves are reduced significantly and total credit reserves are increased. The farmer commits more cash and borrows only half as much when the loan is disbursed in cash since he substitutes BNDA credit reserve for cash reserves. Such are the gains from making the loan program more flexible and thus more valuable to the farmer. Owing to a considerably greater reserve in credit, the farmer not only increases his net cash flow, but he is also more secure under specification of models $M_8 - M_{12}$ than he is under those of models $M_2 - M_6$.

5. Summary and Conclusion

Comparing the results of the various models reveals that credit limits are far more important to the farmer's welfare than are rates of interest. For example, a nearly fourfold increase of the interest rate (from 11% to 40%) reduces the objective function by only about 1.4%. Such a reduction is recovered with a credit increase of between 30% and 40% when the BNDA loan is disbursed in kind and of between 20% and 30% when the loan is disbursed in cash. This finding reinforces the point that limited capital constrains the farmer more than does the cost of capital, over substantial ranges of these costs.

The last simulations reveal that relaxing restrictions on the use of BNDA loan proceeds, by disbursing loans in cash, significantly increases the farmer's output and income. In addition, by simply changing the disbursement from kind to cash, the BNDA might reduce by half the demand for its loans, owing to producer substitution of credit for cash in his liquidity reserves.

Liquidity management is assumed to be the producer's principal risk response. As demonstrated in the various simulations, the logical consequence of this assumption is that the producer holds a large amount of cash and credit in reserve to meet adverse contingencies. To pay out loans solely in kind is to disregard the farmer's need for liquid reserves and reduces the value of the credit programs to the small farmer. A reliable and valuable source of credit to provide for liquidity requirements would allow the farmer to commit more of his cash to production, substituting credit for the committed cash. But it must be stressed that the results depend on borrower perceptions of the individual credit program as reliable, flexible and permanent.

While not demonstrated in the simulations results, there are persuasive reasons to argue that reforms such as cash disbursement of loans, along with larger and more certain credit supply, may generate an incentive to repay BNDA loans, and thus reduce default rates: the credit is made more valuable and worthwhile to protect.

In many developing countries, financing the rural sector has greatly expanded during the past three decades. The share of the institutional private sector in the financing is still negligible. Thus the financial burden is carried largely by the public sector. The Ivory Coast is no exception. External financing of Ivorian farmers has proved to be extremely costly to the BNDA. Criteria for evaluating credit policies are diverse: (1) the cost of operating the credit programs, (2) the degree to which the producer's financial needs are met, (3) the number of farmers served, (4) the level of delinquency and/or default rate, reflected in part in (1) above, (5) the increase in the farmer's output, income and welfare, and (6) the impact on income equalization or distribution between various socio-economic rural groups.

The BNDA has met criterion (5) by significantly increasing the participating farmers' output and income. The extent to which criterion (6) is met depends largely on government officials, since the allocation of BNDA funds is subject to political decisions. The BNDA has largely failed to meet the other criteria.

Two major factors account for the excessive lending cost observed in the BNDA programs: (1) the BNDA does not charge its clients for the full cost of services rendered and (2) the level of delinquency and default is high. Disbursing the loans in kind makes the problem worse.

Despite the government's attempts to justify the low interest rates, it remains that they contribute to a misallocation of resources, the weakening and the distortion of capital markets, reduced incentives to save, and costly, non-productive forms of liquidity management such as cash, jewelry and other forms of balance sheet liquidity (6, 7).

Important gains can be won by reorienting credit institutions to reduce cost, to create incentives to save in rural areas and, obviously, to allow the mobilization of these savings, facilitating an expansion of credit programs at lower public sector cost.

This study has demonstrated that a higher interest rate policy *e.g.* to break even rates is not necessarily a threat to the farmer's profit-making if larger loan size, reliable credit supply and cash disbursement of loans are included within the programs.

Such a policy will allow credit institutions to be self-supporting and thus capable of program expansion. In the specific case of the BNDA, an increase in the interest rate

is a policy decision from the member countries of the West African Monetary Union and can be implemented through BCEAO (Central Bank). Remedies for loan default are suggested by reforms such as larger and more reliable credit supply along with cash disbursement.

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LES REFORMES DU PROGRAMME DE PRETS AGRICOLES DE LA B.N.D.A. DE LA COTE D'IVOIRE

RESUME

La Banque Nationale pour le Développement Agricole (B.N.D.A.) de la Côte d'Ivoire accorde des prêts individuels à des exploitations agricoles de petite dimension dans le contexte d'un de ses programmes d'activité de crédit. Comme dans les programmes de crédit en faveur des petites exploitations dans beaucoup de pays en voie de développement, l'activité de la B.N.D.A. se caractérise par des prêts à coûts élevés qui limitent la clientèle et réduisent le montant des prêts accordés.

Les données analysées dans cet article montrent que le taux d'intérêt ne nuit pas au revenu des exploitations de petite dimension qui ont obtenu des prêts de la B.N.D.A. à condition que parallèlement aux taux d'intérêt plus élevés réformes soient envisagées par le programme de prêt.

A cet égard des montants de prêts plus élevés, une plus grande sécurité de l'offre de crédit et une flexibilité accrue en ce qui concerne l'utilisation permise des fonds obtenus sont particulièrement prometteurs.