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Supply and Demand for Livestock Credit in Sub-Saharan Africa: Lessons for Designing New Credit Schemes

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Summary. — Based on analysis of credit supply in Ethiopia, Kenya, Uganda and Nigeria, it is shown that public credit institutions do not have sufficient funds to meet the demand for livestock credit and cannot mobilize savings from their clients or other commercial sources for one reason or another. In addition, available credit does not reach those who need it the most and with whom it could have the greatest impact due to the application of inappropriate screening procedures and criteria to determine creditworthiness. The analysis of demand based on borrowing and nonborrowing sample households using improved dairy technology, it is shown that not all borrowers borrowed due to liquidity constraint while some borrowers and some nonborrowers had liquidity constraint but did not have access to adequate credit. Logistic regression analysis show that sex and education of the household head, training in dairy, prevalence of outstanding loan and the number of improved cattle on the farm had significant influence on both borrowing and liquidity status of a household, though the degree and direction of influence were not always the same in each study country. Based on the findings it is suggested that combining public and commercial finance could solve the problem of inadequate credit supply while inventory finance to community level input suppliers and service providers might help in getting credit to worthy and needy smallholders at lower cost than providing credit to smallholders directly. © 2002 Published by Elsevier Science Ltd.

Key words — Africa, Nigeria, Ethiopia, Uganda, Kenya, credit, livestock

1. OBJECTIVES AND BACKGROUND

This paper reports the results of a study conducted in four countries in sub-Saharan Africa to: (a) assess the extent to which formal agricultural credit institutions target smallholder livestock producers, the mechanisms they use for selecting borrowers and delivering credit, and the volume, type, purpose and conditions of their livestock loans, and the nature of benefits for the borrowers; (b) determine the factors that influence the demand for livestock credit, particularly for dairy production, and to assess the role of credit relative to the liquidity status of the borrower; and (c) discuss the implications of the findings for designing new credit schemes to overcome the major deficiencies of the existing systems.

Smallholders are typically trapped in poverty because they do not have the money required to invest in income-enhancing innovations. This constraint has been addressed by a variety of smallholder credit schemes and a number of studies have found positive correlations between supplies of credit from formal credit institutions [1] and expenditure on modern inputs such as improved seeds, irrigation and fertilizer

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that resulted in increased agricultural output (Braverman & Guasch, 1986; Desai & Mellor, 1993; Malik, Mushtaq, & Gill, 1991). In this way formal credit played a major role in the wide scale adoption of improved technologies that led to the Green Revolution. It has been shown that formal credit increases in importance relative to informal credit as economies develop and new technologies are adopted (Desai & Mellor, 1993; Heidhues, 1995).

There is less empirical evidence on the role of credit in the smallholder livestock sector. For example, contrary to expectations, the Grameen Bank in Bangladesh extends as much as 40–50% of its loans to landless and poor farmers to acquire and raise livestock. The incentive for this is livestock's potential for generating regular incomes and realizable assets that are essential to enabling the beneficiaries to stay out of poverty in times of adversity. Processing and marketing of livestock products are also especially attractive to women borrowers. But these farmers rarely adopt improved livestock technologies leaving untapped much of the potential of the animals they purchase. A recent study in East Africa has shown that credit has a higher potential for impact through higher input use and milk yield if targeted to liquidity-constrained farms than otherwise (Freeman, Ehui, & Jabbar, 1998). A better understanding of the role of credit in the adoption of livestock technology in sub-Saharan Africa is urgently required to make it more effective in improving the livelihoods of resource-poor livestock owners and low-income consumers of livestock products.

During the 1970s and early 1980s, growth in the demand for meat and milk in sub-Saharan Africa outstripped supply partly because of subsidized imports, particularly that of milk. Thereafter, as productivity continued to decline, the deficit could not be made up by imports because of falling foreign exchange reserves and consumers had less meat and milk on their tables. Projections to 2020 indicate continued rising demand for animal products with corresponding deficits, unless productivity can be improved significantly (Delgado, Rosegrant, Steinfeld, Ehui, & Courbois, 1999). This deficit is an important issue because, apart from providing high-value food, the livestock sector contributes substantially to the economies of sub-Saharan countries by providing income, employment and foreign exchange. They contribute to sustainable agricultural production with inputs and services such as draught power, manure and transportation for crop production. Livestock products—meat, milk, eggs, wool, hides and skins—on average account for 28% of agricultural GDP of sub-Saharan African countries. This share increases to about 35% when the value of animal traction, transport and manure are included. In addition, the share increases as agriculture intensifies. In summary, the livestock sector is a vital component of national development with multiplier effects in processing and marketing which is falling far short of its potential (Winrock, 1992).

Since the early 1990s, the introduction of structural adjustment programs led to a reduction of real expenditure on agriculture. This included falling supplies of agricultural credit, which reduced uptake of innovations by the majority of resource-poor smallholders. Livestock technology adoption has probably suffered proportionately more in this process (De Haan, 1995) because livestock enterprises such as those involving high-yielding crossbred dairy cows require high initial outlays to acquire the animals and construct housing and install other infrastructure. They also require substantial working capital. Furthermore, in contrast to annual crops, it takes several years to raise income from investment in livestock production; meanwhile substantial expenses are incurred in, for example, maintaining maturing animals.

In this paper, the supply and demand side issues related to livestock credit are analysed based on field surveys in four countries. In Section 2, sampling and data sources are described. In Section 3, the issues related to credit supply are discussed. In Section 4, the current extent of borrowing and liquidity constraint, and the determinants of being borrowers and being liquidity constraints are discussed. In Section 5, the findings are summarized and their implications for designing new credit schemes are discussed with an illustration.

2. SOURCES OF DATA

In order to assess the issues related to the supply of credit to smallholder livestock producers, information was collected from the principal agricultural credit institutions in Uganda, Ethiopia and Nigeria in 1992. These were the Uganda Commercial Bank (UCB), the Agricultural and Industrial Development Bank (AIDB) in Ethiopia, and the Nigerian Agricultural and Cooperative Bank (NACB). In

each country, structured questionnaires were mailed to the selected branches in predominantly livestock producing areas. A senior bank official provided the required information from individual borrower records and other relevant bank documents. The responses included information on the borrowers' assets such as herd size, crop and grazing lands, how they got credit, the prerequisites for loan approval, what they used it for, the loan characteristics such as the amount, interest rate, length of grace periods, the repayment period, and collateral.

In order to determine the demand for credit among smallholder dairy producers, data were collected through crosssectional surveys among farmers in Ethiopia, Kenya and Uganda. Particular attention was given to dairy farmers because dairying is an important agricultural subsector in the selected countries and improved dairy technologies (crossbred cows, improved feeds and management etc.) are already in use. Further expansion of these technologies is being promoted through development projects in which credit could be an important component. Credit is expected to raise dairy productivity through enabling smallholders to invest in productivity increasing inputs. The results of the surveys were expected to contribute to designing better development projects that target borrowers more objectively, and assisting governments in formulating enabling policies for livestock development.

A two-stage sampling procedure was followed for the farm surveys in Selale and Debre Libanos Awrajas (districts) in Ethiopia, Githunguri and Limuru divisions in Kiambu district in Kenya, and Mukono and Mpigi districts in the central region of Uganda. The sites were purposively selected in locations with histories of improved smallholder dairying and the use of credit. A one-page questionnaire on herd inventory was administered to all the households in the selected study locations. This generated information from 2,630 households in Ethiopia, 1,225 in Kenya and 500 in Uganda. Farms having at least one dairy cow were identified, out of which random samples were drawn for detailed survey. Data were collected from 75 households in Ethiopia, 94 in Kenya and 73 in Uganda during November 1992–April 1994 by structured questionnaires (for details see, Freeman, Jabbar, & Ehui, 1998).

3. SUPPLY OF INSTITUTIONAL LIVESTOCK CREDIT FOR SMALLHOLDERS

(a) *Credit delivery mechanisms*

In Uganda, the most important source of formal credit for smallholder livestock farmers was the government-owned UCB, a multipurpose bank providing loans to industry, transportation, commerce and agriculture. The Rural Farmers Scheme (RFS), a specialized scheme for integrated rural development, was the primary channel in the UCB for lending to smallholders. Although RFS incorporated aspects of small-scale agro-industry, rural transport and rural housing, most of the lending was for agricultural production. RFS's funds were provided by the African Development Fund at a nominal service charge of 0.75% per annum. The remaining funds were grants from the government to cover administrative costs.

In 1992, UCB had 10 regional offices and 185 local branches, and RFS engaged 22% of the bank's branches and 5% of its current staff. Potential borrowers were not required to provide collateral but the local council was required to certify their credit worthiness. In addition, loan applicants had to provide evidence of prior experience with livestock husbandry and ownership of some livestock-related infrastructures such as barns.

To avoid diversion of loan funds to nonapproved activities, the RFS disbursed most loans in kind and very little in cash. For example, over 90% of the livestock-related loans disbursed in 1991–92 were in the form of live animals or materials for fencing. The few cash loans given were mainly intended for payment of hired labor. The nominal interest rates charged to borrowers under the RFS were 37% and 32% per annum for unsecured and secured loans, respectively. These translated into real interest rates of, respectively, −10.1% and −13.4%. [2]

In Ethiopia, the government-owned AIDB was the principal source of agricultural credit including loans for livestock. The bank offered short-term (one year), medium-term (2–5 years) and long-term (over five years) credit to private and public investors in the agricultural and industrial sectors. Its lending portfolio as of June 1992 was 77% to agriculture, 17% to industry and 6% to other sectors. It received its funds directly from the state treasury and indirectly through specific lines of credit from

external donors. It was not allowed to mobilize savings from the public. In 1992, AIDB accounted for 99% of the total volume of rural credit from the formal sector; the Commercial Bank of Ethiopia disbursed the remaining 1%.

In 1992, AIDB had a network of 11 branches and 19 subbranches. Its lending policies were directed by the central bank, the National Bank of Ethiopia (NBE) whose Board of Directors was also the governing board of AIDB. Lending policies were not always dictated by commercial considerations. For example, as of June 1992, the bank had extended about 90% of its agricultural loan portfolio in unsecured loans to state farms and cooperatives, which owed 97% of all delinquent loans.

During 1982–92, agricultural loans constituted 62% of all approved loans by AIDB, and the smallholder sector accounted for only 9% of total rural loans (Tilahun, 1994). Of the agricultural loan portfolio, 94% was allocated to the crop sector and 6% to livestock. About 76% of livestock loans were allocated to government farms, 22% to service cooperatives and 1% each to producer cooperatives and private individuals.

AIDB had a two-tier system in which credit funds were advanced to Service Cooperatives for lending to farmers through their Peasant Associations (PAs). As the primary borrowers, Service Cooperatives were responsible for determining their members' creditworthiness and ability to repay. Service Cooperatives were provided two types of incentives by AIDB to encourage vigorous loan collection. A service cooperative was allowed to generate revenue by adding up to 2% to the bank's basic 5% interest rate. It would receive fresh loans only when outstanding loans were fully repaid by its borrowing members. The service cooperatives were expected to extend this requirement to the individual PAs as well. In recent years, government policy reforms have led to restructuring of the cooperative system. Almost all producer cooperatives have been dissolved while large number of service cooperatives are either nonfunctional or were expected to be liquidated.

NGOs such as the Finnish Development Aid Agency FINNIDA and the Canadian Physicians for Aid and Relief have also been providing smallholder livestock credit. In most cases these loans were provided in kind except for a few loans for cattle fattening that were given in cash. AIDB branches usually administered these loans on behalf of the NGOs. At the time of the survey in 1992, AIDB did not have any regular credit program for livestock farmers.

Interest charged on loans was fixed by the central bank. Prior to 1992, the nominal interest rate on lending ranged between 5% and 7% per annum with preferential rates for state-owned enterprises and cooperatives. In 1992, as part of financial sector reforms, interest rates were increased to between 11% and 11.5% per annum and preferential rates were abolished. Lending rates have changed periodically since 1992. The real interest rate in 1992 was 0.9%. [3] In September 1994, the lending rate on all types of loans was between 14% and 15% per annum.

In Nigeria, the primary supplier of livestock credit was the NACB, which was established by the Federal Government in 1973 to provide agricultural loans to individual farmers, cooperatives, limited liability companies, state and federal government agencies. The NACB relied entirely on the government or donors for its funds. It did not mobilize any savings from its clients. As of January 1993, NACB had nine departments, five zonal offices, over 50 branches and about 300 representatives throughout the country.

The NACB had two operational schemes for lending to smallholders. One was the smallholder direct loan scheme under which loans were mostly disbursed for crop production. Potential borrowers were not required to provide collateral security but they had to provide evidence that they were full-time farmers, were resident in the village in which they had their farm, and two guarantors who should be persons of good standing in the community. The second scheme, specifically intended for livestock development, was the smallholder cattle-fattening and work-oxen loan scheme. Loans could be used either to fatten mature cattle over a six-month period, or to purchase pairs of work-oxen, complementary equipment and other related inputs over a period of three years. Borrowers were required to procure all inputs, which were usually given in kind, from the National Livestock Projects Division, a government agency. As with other NACB loans intended for smallholder producers, borrowers were not required to provide collateral security, rather they had to provide two guarantors who had to be persons of good standing and proven character in the community. NACB charged 15% and 17% nominal interest rates on its beef-fattening and work-oxen loans, respectively. [4] These rates were below the 25% lending rate charged by commercial banks for similar ac-

tivities. In real terms interest on NACB loans for beef fattening and work-oxen were −20.5% and −19.1%, respectively (Gefu, 1992).

A common feature of the credit programs was an elaborate process for screening applicants involving third parties to do the screening or to vouch for the applicant. Attending to these processes involved high transaction costs for applicants for small amounts of credit. The smaller credits had proportionately higher transaction costs.

(b) *Purpose of livestock loans*

Analyses of the purposes for which loans were given were based on data on UCB loans disbursed in 1992, AIDB loans disbursed during 1985–89 and NACB loans disbursed in 1988/89. Of all the livestock loans given by UCB in Uganda, 48% were given to purchase animals (15% for purchasing purebred exotic breeds and 33% for purchasing crossbreeds), 22% for development of infrastructure, e.g., fencing and water development, 14% for animal health inputs, and 16% for purchase of feeds and other inputs. The use of loan funds usually depended on the type of animals farmers kept, herd size and the size of grazing area. For example, farmers keeping up to 10 crossbred cows spent 11% of loan funds on animal health; those with the same number of purebred exotic cows spent almost double that amount on animal health. This suggests that the adoption of purebred exotic cows with higher milk productivity potential was more dependent on credit than more robust crossbred herd operations.

In Ethiopia, 46% of livestock loans disbursed by AIDB were given for dairy enterprises including milk-processing activities by state farms, 22% for beef fattening, 21% for animal traction, 10% for feed processing and 1% for dairy goats. The aggregate nature of the data did not permit clear distinction of smallholders from other categories of borrowers. AIDB staff suggested however, that smallholders were given loans mainly to finance animal traction and beef fattening while state farms were given loans primarily for dairy operations. About 78% of loans disbursed by NGOs were for the purchase of oxen, 22% for beef-fattening enterprises, and less than 0.5% for dairy enterprises.

In Nigeria, of the livestock loans disbursed by NACB 82% were given for beef fattening (purchase of cattle, supplementary feeds, veterinary drugs, and construction of barns), 8% for sheep fattening, 9% for poultry rearing, and 1% for animal traction.

(c) *Beneficiaries of livestock loans*

In Uganda, only 13% of the total number of livestock loans disbursed went to smallholders with less than five hectares of cultivable land, 17% to owners of 5–10 hectares, 23% to owners of 10–20 hectares, 34% to owners of 20–50 hectares and 13% to owners of over 50 hectares. Average loan size was US$290 per borrower. [5] There were, however, large variation in loan size depending on the location of the borrower and the purpose of the loan. At branches near major urban centers such as Kampala, loans tended to be larger, averaging between US$359 and US$431 while average loan size for rural bank branches ranged between US$232 and US$314. A major reason for this disparity in loan size was that borrowers close to urban areas, such as Kampala, tended to purchase more purebred exotic animals than rural borrowers. These were more expensive than crossbred cows and they required larger outlays for veterinary care and feed.

In Ethiopia, farms are generally small due to the egalitarian distribution of land by the previous government, and the small number of livestock loan recipients other than the state farms could be classified as smallholder livestock producers. Detailed data collected from three sample areas where AIDB operated showed that average farm size of borrowers ranged between 2.6 and 4.7 hectares while average herd size was between five and six cattle. Average loan size ranged between US$290 and US$580 for dairy loans, US$242 and US$611 for oxen loans, and US$169 for beef-fattening loans.

In Nigeria, three sample areas in the north of the country where NACB operated, the mean farm sizes of loan beneficiaries ranged between two and eight hectares while average herd size ranged between three and 16 cattle. The cattle-fattening loan was US$289 for first time borrowers with the amount rising to US$867 for borrowers with a proven credit worthiness rating. The maximum loan for work bulls or equipment was US$867.

(d) *Duration and repayment of livestock loans*

The banks in Uganda and Nigeria tended to provide short-term loans to individuals and

organized groups while the bank in Ethiopia mostly provided long-term loans. The majority of loans given by UCB in Uganda were for a fixed 18-month term regardless of the purpose of the loan. Repayment started after six months and the borrower was expected to pay the loan in full within the fixed term. In Ethiopia, loans for beef fattening were given for five years with the borrowers required to make one repayment per year. Dairy loans were given for five years. Repayment started after one year with equal annual repayments for the next four years. Oxen loans were given for four years with one repayment required in each year. In Nigeria, NACB loans for beef-fattening operations were given for a period of six months, to be repaid in one lump sum at the end of the period.

In Uganda, the average recovery rate of livestock loans was 66%. In Ethiopia, AIDB could not provide up-to-date records on livestock loan recovery rates. But, aggregate loan recovery performance of the bank was poor. For example, as of June 1993, 89% of total outstanding loans were in arrears (Tilahun, 1994). Moreover, rates of defaults appeared to be increasing due, in part, to the dissolution of the service and producer cooperatives. In the absence of enforcement mechanisms, most cooperatives were dissolved without repaying their loans. In Nigeria, NACB reported steadily increasing loan recovery rates since the inception of the smallholder direct loan scheme. When the scheme started in 1988, loan recovery rate was at a dismal 2%. By 1992, average loan recovery rate had increased to 87% although there were wide variations in recovery rates by state and branches. This steady improvement in NACB's loan recovery was partially due to its rigid loan collection policies, which denied further loans to defaulters. In cases of noncompliance the guarantors were compelled to repay the loans. Borrowers with prompt repayment record were encouraged to re-apply for larger loans.

4. DAIRY TECHNOLOGY ADOPTION AND DEMAND FOR CREDIT

(a) *Technology adoption*

The farm surveys in Ethiopia, Kenya and Uganda revealed that the sample farmers in all three countries used one or more components of four broad categories of improved dairy technology, i.e., genetics, health, nutrition, and management. The genetics component included the purchase of crossbred or purebred exotic animals and use of artificial insemination. The health component included the use of veterinary drugs and services. The nutritional component included the use of improved fodder and concentrate feeds. The management component included improved husbandry practices such as barn construction or training related to improved technologies.

In Ethiopia, all the sample farmers had crossbred cows while in Kenya and Uganda some farmers had only crossbred cows and some others had both crossbred and purebred exotic cows. In all three countries, nearly all farmers also kept indigenous cows for milk production as well as traction. In Ethiopia, all the sample farmers used grass hay as the principal forage supplement followed by green oats (92%) and, oats and vetch hay (28%). In Kenya, Napier grass was the principal forage for all the farmers while in Uganda Napier grass (89%), banana peelings (84%) and potato vines (77%) were the principal forage supplements. In Ethiopia Noug cake and oat seed were the most common concentrates used by 44% and 59% of the sample; in Kenya dairy meal (98%) and in some case maize bran and brewers grain and in Uganda dairy meal (82%), maize bran (40%) and cottonseed cake or sunflower cake (8%) were the principal concentrates. Two-thirds of the Kenya sample but none in Ethiopia practised zero grazing. There was no information on this for Uganda (Freeman *et al.*, 1998).

(b) *Incidence of borrowing and liquidity constraint*

Forty-nine percent of the sample farmers in Ethiopia borrowed varying amounts for dairy activities compared to 40% in Kenya and 79% in Uganda. The survey revealed that some nonborrowers already had sufficient realizable capital while some borrowers and some nonborrowers had liquidity problem but did not have access to credit at all or could not get enough for the intended purposes. This suggested that it was not adequate to classify farmers as merely borrowers or nonborrowers. A more subtle classification system was needed to determine why some smallholder dairy producers used credit and others did not and they were further classified as liquidity-constrained, i.e., in need of more funds or liquidity-nonconstrained, i.e., having access to sufficient

funds to meet their immediate investment aspirations.

A farmer was classified liquidity-constrained if (i) he/she already had a loan but expressed a wish to borrow more at the current interest rate; or (ii) he/she was unable to obtain a loan because the request for a loan was turned down, or there was no access to formal or informal lenders, or no dairy animals were available for purchase within their means. [5] In Ethiopia, 35% of the sample farmers—31% of borrowers and 38% of nonborrowers—were liquidity-constrained; in Kenya 29% of the sample—58% of borrowers and 9% of nonborrowers—were liquidity-constrained, and in Uganda 55% of the sample—61% of borrowers and 35% of nonborrowers were liquidity-constrained.

The credits were primarily used to purchase crossbred or purebred exotic cows. Some farmers used a small portion of the credit to purchase improved feeds, veterinary inputs or to construct barns and water supply systems for their dairy animals. Nonborrowers, when purchased these items, used their own funds. Generally the level of input use was marginally higher for borrowers and liquidity-nonconstrained farmers compared to nonborrowers and liquidity-constrained farmers, though only in a few cases such differences were statistically significant (Table 1). Therefore, generally all farms lost opportunities to benefit from the milk yield potential of the improved cows due to shortage of cash to buy inputs (Freeman *et al*., 1998).

Table 1. *Input use per animal by borrowing and liquidity status of farms in Ethiopia, Kenya and Uganda*[a]

Country and input	Borrowing status		Liquidity status	
	Nonborrower	Borrower	Constrained	Nonconstrained
Ethiopia				
Concentrate	0.52	070	0.68	0.54
Forage	6.15	5.90	5.14	6.91
Vet expenses	0.53	0.91*	0.80	0.65
Kenya				
Concentrate	0.81	1.14	0.70	1.25*
Forage	14.15	17.14	14.18	16.40
Vet expenses	9.87	28.46*	31.75*	6.55
Uganda				
Concentrate	2.47	2.82	2.38	2.91
Forage	6.54	6.75	6.09	7.21
Vet expenses	12.56	18.78	13.19	18.15

[a] Forage and concentrate: kg/animal/day; vet expenses: US$/animal/year.

* Indicates means are significantly different at 0.05 level.

(c) *The determinants of being a borrower and being liquidity constraint*

Since some borrowers borrowed though they did not have liquidity constraint while some borrowers and some nonborrowers did not have access to adequate credit, an attempt was made to determine the factors influencing borrowing vs nonborrowing and liquidity-constrained vs liquidity-nonconstrained status of farms. Logistic regression was applied using borrowing status and liquidity status as binary dependent variables: borrower = 1, nonborrower = 0; liquidity-nonconstrained = 1, liquidity-constrained = 0. The coefficients of the equations were estimated using SPSS Logistic Regression procedure (Norusis, 1993). The variables included in the best-fit models and related hypotheses are defined below.

Site: a dummy variable for sample sites in each country: out of two sites one takes the value 1, the other 0. There are some differences between sites within a country with respect to, e.g., breeds of dairy animals used, availability of feeds, so it was hypothesized that such differences might influence borrowing and liquidity status of the sample farms.

Gender: a dummy variable for gender of household head where male = 1, female = 0. In Ethiopia, only 4% of the sample household heads were female compared to 27% in Kenya and 32% in Uganda. It was hypothesized that female-headed households had less access to formal credit than male-headed households.

Education: a dummy variable for the education status of the household head where no formal education = 0, primary or above = 1. In Ethiopia, 34% of the household heads had primary or higher-level education compared to 86% in Kenya and 94% in Uganda. Agricultural technology adoption is often found to be influenced by education and credit (Feder & Umali, 1993), so it was hypothesized that better educated households had more access to credit and had less liquidity problem.

Training: a dummy variable for attendance at special training or workshop on dairy cattle or livestock management by a household member, where no attendance = 0, attendance = 1. In Ethiopia, 28% of the sample farmers had attended special training compared to 34% in Kenya and 77% in Uganda. In Ethiopia and Uganda, NGOs involved in dairy development projects and in Kenya the Ministry of Agriculture provided such training. Following earlier findings of Thirtle and Ruttan (1987) and Feder and

Table 2. *Estimated coefficients of logistic regression on farmers' borrowing status in Ethiopia, Kenya and Uganda*

Variable	$\beta(e(\beta))$		
	Ethiopia	Kenya	Uganda
Site	0.622 (1.86)[a]	−3.363 (0.04)[a]	0.935 (2.55)[a]
Gender	na	2.323 (10.20)[a]	1.478 (4.38)[a]
Education	0.345 (1.41)[a]	6.14 (96.48)[a]	−5.308 (0.01)[a]
Training	1.747 (5.74)[a]	4.301 (73.79)[a]	0.704 (2.20)[a]
Outstanding loan	na	7.059 (116.14)[a]	0.976 (2.66)[a]
Age	0.062 (1.06)	0.076 (1.08)	−0.002 (0.99)
Farm size	na	0.166 (1.18)	0.029 (1.03)
Herd size	0.011 (1.01)	−0.092 (0.91)	−0.028 (0.97)
CBCE	−0.404 (0.67)[a]	−1.329 (0.27)[a]	0.214 (1.23)[a]
Constant	−1.342	−3.931	2.668
−2 log likelihood	83.934	26.653	46.021
% correct prediction	70	95	85

[a] Marked factors had significant influence on borrowing status.

Umali (1993), it was hypothesized that special training may influence demand for credit through adoption of improved technologies requiring higher investment.

Outstanding loan: a dummy variable for outstanding loan where no outstanding loan = 0 and having outstanding loan = 1. Having outstanding loan may preclude having another loan but in some cases, a higher amount may be given to repay existing loan. In Ethiopia, none of the sample farmers reported having any outstanding loan except the current one (this could be an underreporting given that the supply side analysis indicated that there were many defaulter cooperatives, hence individual farmers); in Kenya 87% of borrowers and 5% of nonborrowers had at least one outstanding loan at the time of the survey, and in Uganda all the borrowers and 54% of nonborrowers had at least one outstanding loan at the time of the survey. The outstanding loans were not necessarily obtained for dairy. It was hypothesized that outstanding loan had a negative influence on borrowing and liquidity status.

Age: age of household head in years. It was hypothesized that age could serve as a proxy for experience, and more experienced farmers would be more likely to borrow to adopt new technology.

Farm size: farm size in acres. In Ethiopia, the previous government distributed cropland to households according to the size of the household, so farm size was excluded from the Ethiopia model.

Herd size: herd size in tropical livestock units (TLU). The following conversion rates were used to arrive at TLU: adult females, bulls, oxen = 1, steers 1–2 years = 0.80, heifers 1–2 years = 0.75, calves 6 months–1 year = 0.40, calves under 6 months = 0.20, sheep, goats = 0.10 (ILCA, 1993). Average herd size in Ethiopia, Kenya and Uganda was, respectively, 35.1, 6.0 and 5.1 TLUs.

Crossbred cow equivalents (CBCE): the sample farms held crossbred and/or purebred exotic and/or local Zebu cows. Therefore it was not possible to specify number of each breed of cows as independent variables nor could they be simply added into one variable by assuming all cows as equivalent to one TLU, because cows of different breeds had different feed requirements and milk yield potentials. In the absence of information on actual body weight and/or feed intake, all cows on a farm were converted into crossbred cow equivalents by using the sample average milk yield ratios as weights. For example, if average lactation yields of purebred exotic, crossbred and local cows in a country sample were in the ratio of 1:0.7:0.3, these ratios were used to convert all cows in that country sample into CBCEs. In Ethiopia, Kenya and Uganda, average number CBCE was, respectively, 2.43, 2.86 and 1.94.

The regression results for borrowing status are shown in Table 2. In Ethiopia, the odds of a farmer being a borrower was significantly higher if he/she was located in Selale, had primary or higher-level education, attended special livestock training course/workshop, but significantly lower if he/she had larger number of CBCEs. In Kenya, the odds of a farmer being a borrower was significantly higher if the farmer was male, had primary or higher-level education, had attended special dairy training course/workshop, had at least one outstanding loan (implying re-lending to existing loanees as a predominant phenomenon), and significantly lower if the farm was located in Githunguri district and had larger number of CBCEs. In Uganda, the odds of a farmer being a borrower was significantly higher if it was located in the district near Kampala and was male-headed, the farmer had attended special dairy training course/workshop, had at least one outstanding loan, and marginally higher with larger number of CBCEs, and significantly lower if the farmer

Table 3. *Estimated coefficients of logistic regression on farmers' liquidity status in Ethiopia, Kenya and Uganda*

Variable	$\beta(e(\beta))$		
	Ethiopia	Kenya	Uganda
Site	0.333 (1.40)[a]	1.068 (2.91)[a]	0.059 (1.06)
Gender	na	−3.733 (0.02)[a]	−0.163 (0.85)
Education	0.036 (1.04)	1.434 (4.20)[a]	3.348 (28.46)[a]
Training	−0.257 (0.77)[a]	−3.483 (0.03)[a]	−1.162 (0.31)[a]
Outstanding loan	na	−1.510 (0.22)[a]	2.462 (11.73)[a]
Age	0.021 (1.02)	0.060 (0.06)[a]	−0.028 (0.97)
Farm size	na	0.036 (0.97)	0.029 (1.03)
Herd size	0.085 (1.09)	0.211 (1.23)[a]	0.010 (1.01)
CBCE	1.452 (4.27)[a]	−0.012 (0.99)	0.115 (1.12)
Constant	−6.149	−4.632	−1.44
−2 log likelihood	58.985	55.304	54.609
% correct prediction	80	85	72

[a] Marked factors had significant influence on liquidity status.

had higher education. The negative effect of a larger number of CBCEs on the probability of borrowing in Ethiopia and Kenya might be explained by the fact that these loans were provided mainly to acquire improved cattle stock, so those who already had good number of such cows would not qualify for new loans but those having none or few might qualify.

The regression results for liquidity status are shown in Table 3. In Ethiopia, the odds of a farmer being liquidity-nonconstrained was significantly higher if the farmer was located in Selale area, had larger number of CBCEs (implying that larger number of improved cows might generate adequate cash income to reduce the need for borrowing to meet cash needs), and significantly lower if the farmer had attended special dairy training. In Kenya, the odds of a farmer being liquidity-nonconstrained was significantly higher if located in Limaru district, had higher education, marginally higher with larger herd size and significantly lower if the farmer was female, attended special dairy training/workshop and had outstanding loans (i.e., having more loans implies more outflows in repayments, so less possibility of being liquidity-nonconstrained). In Uganda, the odds of a farmer being liquidity-nonconstrained was marginally lower for female-headed households, significantly lower if the farmer had attended dairy training, significantly higher if the farmer had higher education and outstanding loan (this was an opposite situation compared to Kenya).

5. SUMMARY OF FINDINGS AND IMPLICATIONS FOR DESIGNING NEW CREDIT SCHEMES

(a) *Summary of findings*

All the banks in the three countries had a common official objective of increasing the flow of institutional credit to large numbers of smallholder livestock producers. To meet this objective, they had established specialized subsidized credit schemes and had opened branches in rural areas. Despite these mechanisms, this study revealed that few smallholder livestock producers actually got credit from formal sources. Often, smallholder producers were screened out by the criteria for loan eligibility. For example, UCB in Uganda required potential borrowers to show evidence that the applicant owned livestock infrastructures, which was partly what they wanted the loan for. In Ethiopia, credit was allocated on political, rather than financial considerations, and it was given on concessionary terms to state farms and cooperatives despite their poor performance and high levels of loan delinquency. Since this took up most of the funds there was little left for the many smallholder producers who were, therefore, denied credit. In Nigeria and Uganda, the banks did not insist on collateral security. They usually based creditworthiness on the personal characteristics of potential borrowers. In cases where bank officials did not have sufficient information on a potential borrower they tended to allocate credit on observable characteristics such as wealth or

influence in the community. These factors screened out many potential smallholder borrowers who did not appear creditworthy or about whom they did not have complete information.

Because the credit was subsidized, demand tended to exceed supply and the available funds had to be rationed. The rationing rules often favored influential community members who, for the most part, got larger loans. Since the amount of the subsidy increased in proportion to the amount of the loan these policies aggravated the income inequalities between small and large borrowers.

In Uganda and Nigeria, most of the loans were short-term with fixed repayment periods. AIDB in Ethiopia was the only institution to have the majority of its portfolio in long-term loans with more flexible repayment periods. The other banks may have opted for short-term loans because of the need to collect loans quickly, especially under conditions of high inflation and controlled interest rates, which rapidly erode the real value of loan repayments. Another reason for short-term loans might have been that borrowers did not have assets to offer as collateral.

There is, a priori, no ideal loan term. It is important to maintain the flexibility to relate loan terms to factors such as the uses to which it will be put, the cash flow generated by the funded activity, and the attendant risks. When these factors are not taken into account the consequences are likely to be inefficiencies in the use of loan funds and increased incentives to default. This occurred in Uganda where under UCB's conditions on short-term loans borrowers were not able to generate sufficient revenues to repay their loans, within the stipulated periods, from the proceeds of the funded investments. In Nigeria, the short-term loans given by NACB for beef fattening were much shorter than the average fattening period of between 12 and 18 months. This limited borrowing to customers who had alternative means of financing repayments and effectively excluded those who had most need for credit.

On the other hand, in Ethiopia, where most livestock loans ranged from 4 to 5 years, bank officials' lax attitude toward recovery and low level of supervision contributed to poor loan recovery even though revenues were generated by funded activities sooner than the permitted repayment period. In an attempt to encourage repayments the Service Cooperatives were given financial incentives, in addition to threats of denial of fresh loans in case of default by some of their members. Apparently these measures were also not effective because the option of denying the service cooperatives fresh loans because of outstanding repayments was not actually exercised. The records show that fresh loans were never denied for this reason and political motives, which promoted cooperatives irrespective of their performance, also contributed to low levels of loan recovery (Tilahun, 1994). The poor rate of loan recovery led to failure of the credit programs.

In Nigeria, NACB's 85% recovery rate suggested that its mandatory collection policy, which denied future loans to defaulters, was effective. But, the bias toward relatively large borrowers contributed to high rates of loan recovery because these producers have the financial means and appreciated the high value of NACB's subsidized credit line (Aku, 1986).

The UCB in Uganda reported recovery rates of 66% on livestock loans in 1990. This was partly attributed to the fact that loan repayments were consistent with the regular cash flow of dairy activities. The farmers were paid weekly or bi-weekly by the dairy corporations, which are the major buyers and distributors of fresh milk in Uganda.

An important aspect of improving the supply of credit to rural clients is the development of true financial intermediaries that facilitate savings mobilizations and credit distribution (Desai & Mellor, 1993). But, the credit institutions examined in this study did not mobilize savings. They all relied completely on the government and foreign donors for loanable funds. In Ethiopia and Nigeria this was a result of deliberate government policy, which prohibited mobilizing savings from the public. In addition, these institutions only distributed credit and did not provide any banking services to their clients. Thus, they could not be regarded as true financial intermediaries. They did not recognize the links between demand for and supply of funds nor did they exploit the complementarities between investment in new technologies and increased liquidity.

These findings are consistent with the findings of related studies in the crop sector. With few exceptions, formal credit programs in sub-Saharan Africa have performed rather poorly. Despite substantial outlays, credit subsidies have led to misallocation of resources, have typically not led to significant increases in adoption of new technologies, and have not succeeded in replacing traditional money lend-

ers (Adams, 1995; Braverman & Guasch, 1986; Krause *et al.*, 1990; Olomola, 1994; Von Pischke, Adams & Donald; World Bank, 1994).

The surveys of the demand for credit for dairy activities revealed that smallholder farmers in Ethiopia, Kenya and Uganda were prepared to borrow from formal credit institutions as well as use their own funds to purchase crossbred and/or purebred exotic dairy cows. Some farmers used small amounts of their loans to build barns, water supply systems or purchase feeds and veterinary care. In all three countries, there were farms among both borrowers and nonborrowers who did not have sufficient funds to expand or improve their dairy enterprises. This made it necessary, in addition to classifying farms as borrowers and nonborrowers, to also classify them according to their liquidity status in which credit could be a component. Regression analysis showed significant differences between the profiles of borrowers vs nonborrowers and between liquidity-constrained and liquidity-nonconstrained farms in all three countries. Sex of household head, education, dairy training, prevalence of outstanding loan and the number of improved cattle on the farm had significant influence on both borrowing and liquidity status, though the degree and direction of influence were not always the same in each country. Contrary to the findings of the supply side analysis, farm size and herd size had neutral effects on borrowing in all three countries, which probably could be explained by the fact that this was based on a sample focusing only dairy farmers.

Borrowers used their loans mainly to acquire improved cows, so the primary impact of credit was to increase milk production through increased dairy herd size. Borrowers and nonborrowers alike spent very little on better feed and management. This is not a tenable long-term solution because smallholders cannot readily expand their crop and grazing land areas. Thus greater emphasis must be given to increasing milk production through better feeding and management. Assuming that cash constraints were the primary reason for inadequate spending on inputs there is great potential for increasing milk production by reinforcing loans for acquiring cows with working capital loans to ensure proper feeding and management.

These findings from supply and demand side analysis suggest that, public credit institutions do not have sufficient funds to meet the demand for credit and cannot mobilize savings from their clients or other commercial sources for one reason or another, and available credit does not reach those who need it the most and with whom it could have the greatest impact. To become more effective and sustainable, credit institutions that intend to serve smallholders need to rationalize their screening procedures and the criteria they use to determine creditworthiness. To reach poor and liquidity-constrained smallholders the credit must also be provided at a cost they can afford while the system remains viable. That includes interest charges and transaction costs and for small amounts of money the latter becomes most critical. Lower interest rates would encourage innovation but they must be consistent with the cost of capital, the risk of default and servicing costs. To be effective and encourage repayments, the amount of the loans and their repayment terms must be matched to the income generating and cash flow patterns of the investments for which the loan are given. That means they must square any subsidy on interest rates with the potential contribution of the credit to overall output growth and economic development. To be sustainable, credit systems need to be able to attract savings to provide capital for future lending.

(b) *Implications for designing new credit schemes*

Recognizing the need to involve commercial banks to increase credit supply, governments in some countries have tried to use legislation to force them to increase the proportion of agricultural lending in their portfolios. But this was not successful because it is contrary to banking norms, so some other way must be found. Nominal interest rates have been found to be less important than intuitively assumed in determining demand for credit (Henk Moll, personal communication). In order to engage the poorest farmers however, the interest that they are charged should at least not be more than that charged to their commercial large-scale competitors. This conundrum can be resolved by leveraging high-interest commercial money with low-interest government funds. To illustrate this assume that government (G) wants smallholders to have access to inputs at say 16.5% per annum despite the fact that commercial banks (B) are charging 20% per annum. This could be achieved through an appropriate

mix of government (either from own sources or from foreign loan or aid) and commercial finance as illustrated below:

—If (B) commits its own $3 million at 20% interest, it would expect to earn $600,000 per annum. The interest rate comprised of say 10% cost of capital, 5% cost of servicing (transactions cost) and 5% coverage for default (risk).

—If (G) lends $3 million to (B) at 3% per annum, (B) would owe (G) $90,000 per annum but would still be responsible for recovering servicing cost and risk, for which the bank would need to charge an additional 10% to earn an additional $300,000.

—Then (B) would need to recover $990,000 by investing $6 million, and could do so by charging 16.5%. This would make more funds available to more people at lower cost.

As noted above however, the interest rate on capital is not always the main component of the cost of credit to the borrower. On small loans the transaction costs are usually more serious than the interest charges because the time and paperwork does not decrease proportionately. They are much higher per unit of credit than for large borrowers, especially those who deal directly with their suppliers or bank managers. This is the reason why even large-scale farmers prefer supplier credit and overdrafts to loans with lower interest charges. Feed mills and other farm input suppliers in developed countries and in agriculturally developed sectors in developing countries have their own source of inventory finance that enables them to provide goods on credit. A classic illustration of this was the interdependence between European farmers and Indian shopkeepers in pre-independent Kenya. The Central Bank of Uganda and Barclays also initiated a similar scheme in the early 1970s but political disruption did not permit its full implementation.

To provide smallholders with the same possibility of being able to take goods on credit village suppliers including livestock breeders, farmers' supply stores and veterinarians may be provided with inventory finance tied to the inputs required by the smallholders. Without such support they will necessarily continue to focus their businesses on more profitable fast turnover goods such a beer and cigarettes. But, with tied inventory finance they would become very efficient credit providers because, through their long-term relationships with their customers, they can assess creditworthiness instantly on the spot. They also become motivated extension agents because the only way they can make a profit is to move the goods off their shelves.

Enabling smallholders to purchase goods in the form, amounts and locations of their choice would encourage them to innovate and get optimum production from their smallholdings and livestock. But these are not the characteristics of the prevailing credit schemes. For example, in Kenya smallholder dairy producers can only get credit if they sell milk through a cooperative even if it does not offer the best price. To make matters worse, they get credit only when they have milk to deliver and have good records of delivery, which means that they cannot buy feed for steaming up cows prior to parturition and, therefore, can never hope to reach the full production potential of their cows (Steve Staal, personal communication).

By providing larger inventory finance loans to relatively few easily reached creditworthy village suppliers, rather than small loans to thousands of small producers, the commercial banks would be able to spared the unusually high servicing costs associated with rural credit. The finance would only be available for agreed inputs in noncommercial quantities that are not otherwise readily available in rural areas. To ensure that the funds reach the intended beneficiaries, the amount provided by the government would be proportional reimbursement of the amounts advanced by the commercial bank.

If the provision of inventory finance for rural suppliers of goods and services is effective in encouraging smallholders to take up innovations, a second phase could be developed to encourage savings. If the scheme is successful, it would provide a solution to the long running difficulty of engaging commercial banks in rural finance. It would also provide governments and development agencies such as the World Bank and IFAD with an exceptional instrument for influencing the cost of credit to smallholders without meddling in the commercial decisions of participating banks.

6. UNCITED REFERENCE

Von Pischke (1995).

NOTES

1. Formal credit is defined as credit given by financial institutions that have been legally established to engage in credit delivery and savings mobilization, including commercial and development banks and nongovernmental organizations. Other important source of credit is the informal credit market including traditional moneylenders, traders, relatives, friends and mutual help associations.

2. Real interest rate was calculated as $\{(1+r)/(1+i)-1\}$, where r is the nominal interest rate and i is the inflation rate for 1992. Inflation was calculated as the change in consumer price index. At the time of the survey the official exchange rate was US$ 1 = Ush 1134.

3. At the time of the survey, the official exchange rate was US$ 1 = EB 6.20.

4. At the time of the survey, the official exchange rate was US$ 1 = N 17.30.

5. Feder, Lau, Lin, and Luo (1990) used a fairly similar classification scheme but called them credit-constrained and credit-nonconstrained, which is misleading because when a farmer obtained credit but had unsatisfied credit need, he/she had a liquidity constraint rather than a credit constraint. Similarly nonborrowers needing money had a liquidity constraint, not a credit constraint.

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