FACTORS AFFECTING THE LOAN STATUS OF SUGAR-CANE FARMERS USING A GRADUATED MORTGAGE LOAN REPAYMENT SCHEME IN KWAZULU-NATAL

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Abstract

Factors affecting whether or not 83 medium-scale sugarcane farmers using a graduated mortgage loan repayment scheme in KwaZulu-Natal were current or in arrears on loan repayments as at 31 March 2001 were analysed using a logit model. Results show that the estimated probability of a farmer in the scheme being current on loan repayments was higher for clients with higher levels of average annual farm gross turnover relative to loan size, and for clients with access to substantive off-farm income. This suggests that farm size (proxied by annual gross turnover) does matter when policymakers in South Africa consider future similar schemes designed to improve access to commercial farmland by people that previously could not buy farmland. Access to off-farm income could also be considered as a criterion in selecting potential farmers for such schemes, as it helps to provide additional liquidity to fund future operations and debt repayments.

1. INTRODUCTION

Land reform has been accorded a high priority in South Africa (SA) as a means of promoting political stability (Lyne & Darroch, 1997; Nieuwoudt & Vink, 1995; Van Zyl, 1994). The challenge for policymakers, commercial farmers, agribusinesses and researchers is to find appropriate ways of *implementing* land reform. One innovative financing scheme for this purpose was introduced in 1996 to help redistribute commercial sugarcane farmland owned by sugar millers to previously disadvantaged, aspirant black farmers in KwaZulu-Natal. These "medium-scale farmers" (hereafter referred to as

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MSFs) had limited capital to buy sugarcane farms ranging from 55 to 216 hectares in area offered by the sugar millers, and so had to borrow most (up to 95%) of the funds needed to acquire the land. This was likely to cause liquidity problems for these highly leveraged farmers due to differences in the compensation required by lenders and the form of returns to land that the MSFs purchased (Barry *et al*, 1995). Lenders require loan repayments (principal plus interest) in cash, of which part is a real return and part is an inflation premium to compensate them for the expected loss in purchasing power of their debt claim. The MSFs, however, would experience part of their return as a current cash return, and part as capital gain on land. The result would be a financing gap, as there is insufficient cash from land earnings in the early years to meet the debt payments. This gap is expected to close over time as nominal returns to land rise in line with anticipated inflation and as the new owners adjust to operating their farms.

To help manage the financing gap, the sugar millers invested 18% of the capital from land sold to the MSFs at market-related prices with Ithala Bank to fund a finite interest-rate subsidy on mortgage loans that Ithala made to the MSFs to buy the land. The MSFs, therefore, pay a sliding scale of interest, starting low but gradually rising to the market interest rate after seven years as farm earnings are expected to improve and subsidy funds are used up (Simms, 1997). The gradual rise in annual loan repayments is hence intended to improve the viability of the MSFs in the early years after land purchase. Van den Heever (2002) attributes the absence of defaulters in the scheme, to date, in part to this interest rate subsidy. Ithala Bank also has a cession on MSF cane deliveries to sugar mills and so can recover loan repayments directly from a sugar miller before the farmer is paid for cane deliveries. The cession helps Ithala Bank to remove some of the risk of possible non-repayment of loans. At the start of each cane-cutting season, the cession per ton of sugarcane delivered to the mill is fixed by dividing the grower's required annual loan repayment by the grower's estimate of the seasonal volume of sugarcane that will be delivered. The cession per ton cannot be adjusted by the miller, and hence for Ithala Bank, during the season without the grower's consent. The borrower, therefore, falls into arrears if his/her actual cane deliveries are less than the estimated volume that was used to set the cession. Successful loan repayment performance by these emerging growers is critical to the viability of the current, and any future, graduated loan repayment scheme. The aim of this study, therefore, is to estimate financial, economic and/or institutional factors that may determine whether the MSF growers were current or in arrears on their loan repayments by the end of March 2001. This will help to identify what grower characteristics to target in later such land transfers, thereby increasing the likelihood that the MSFs will be

commercially viable over the long-term. Policymakers, farmers and agribusinesses can use this information to help them develop mechanisms that could be used to facilitate meaningful land redistribution in South Africa.

The next section reviews some past studies of loan repayment performance to show how the study relates to past local and international research on loan repayment performance, and to identify factors that may affect loan repayment performance. Section 3 presents the data sources and research methodology, and outlines a conceptual model of the determinants of loan repayment by the MSFs. Section 4 reports the results of a logit model used to estimate the probability that any MSF in the scheme would be current on their graduated loan repayments. A concluding section considers the management and policy implications of the results.

2. PAST STUDIES OF THE DETERMINANTS OF LOAN REPAYMENT PERFORMANCE

Several African studies of loan repayment performance have estimated the determinants of loan performance with a binary loan outcome – defining borrowers as either current on their loan repayments or in default. Loan repayment was positively related to factors such as timeliness of loan disbursement, enterprise profitability, the number of supervisory visits by credit officers, having additional sources of income, established previous loan history, and lower client debt-asset ratios (Kamajou & Baker, 1980; Vogel, 1981; Okorie, 1986; Njoku & Odii, 1991; Vigano, 1993; Lugemwa & Darroch, 1995). Lyne & Ortmann (1992) report that small-scale farmers in the former KwaZulu homeland who had higher levels of off-farm income and who rented in more farmland from other households were more likely to repay seasonal (working capital) loans. Kuhn & Darroch (1999) studied rural medium-term loan repayment performance in KwaZulu-Natal using multiple loan repayment categories (current, in arrears, and default) and found that first-time borrowers, and clients that have modest loans, smaller own direct equity contributions, and who manage contract ploughing and broiler ventures, tended to default on loan repayments.

In the financial literature, Ohlson (cited by Miller & LaDue, 1989) reported that larger companies are less likely to fail. Mortensen *et al* (1988) identified the debt-to-asset ratio and the operating ratio (annual production expenses as a proportion of annual gross cash farm income) as indicators of potential loan default by commercial farmers in North Dakota in the United States (US). Miller & LaDue's (1989) comprehensive review of past US studies of agricultural credit assessment shows that business solvency, repayment

ability and liquidity are important factors in assessing the quality of commercial farmers as borrowers. Miller & LaDue then identify higher-quality dairy farm borrowers in the state of New York as being more liquid, more profitable and having higher operating efficiency. Aguilera-Alfred & Gonzalez-Vega (1993) used a multinomial logit model to analyse the repayment performance of loans disbursed by a typical developing-country specialized lender in the Dominican Republic. They concluded that borrower characteristics (land tenure status and credit rating by the bank), loan characteristics (restriction on use of borrowed funds) and regulatory instruments (bank's own funds and international targeted funds) most affect client loan repayment.

None of the above studies considered factors affecting the long-term mortgage loan repayment performance of highly-leveraged, emerging commercial farmers with land title (well-defined property rights). This study, therefore, tries to partly fill this gap in research and thereby provide information that could help SA policymakers, commercial farmers and agribusinesses to identify ways of promoting sustained access to commercial farmland by people that were previously denied the opportunity to operate such land. Section 3 describes the data sources and conceptual model of loan repayment that were used for this purpose.

3. DATA SOURCES AND CONCEPTUAL MODEL OF LOAN REPAYMENT

3.1 Data sources

By March 2001, the graduated mortgage loan repayment scheme in KwaZulu-Natal had financed 107 MSF clients. The first group of 11 clients was settled in the 1995/96 sugar-cane season, followed by a group of 27 farmers in the 1996/97 season, another 51 clients in the 1997/98 season, and 18 more farmers in the 1999/00 season. Eight of the 107 growers had fully repaid loans as of March 2001 and so were excluded from the analysis. Of these eight growers, one client had settled his mortgage bond by using off-farm income, while the other seven were associated with deceased estates in which the principal borrower had passed away and the mortgage bond had been fully paid from the proceeds of loan insurance policies. Reliable financial and economic data for 83 of the remaining 99 clients were available from Ithala Bank and the South African Canegrowers' Association for the analysis of repayment performance. This sample is very representative of the MSF scheme growers, with 11 growers from the Midlands region, 45 from the North Coast area, and 27

from the South Coast region. All but one of the sugar miller estates participating in the MSF scheme had more than 85% of their growers in this sample.

Repayment performance by the MSFs was monitored *over time* to avoid distortions in delinquency measurement. The annual instalment for each client is raised at the end of each financial year, in this case 31 March for Ithala Bank. Clients fall into arrears if they fail to pay/raise the required mortgage bond repayment amount within 30-90 days of the cut-off date. As explained in the Introduction, this occurs if the borrower's actual sugarcane deliveries are less than his/her estimated seasonal deliveries, because a fixed (cession) repayment amount is set per ton of sugarcane. For example, if Ithala Bank requires a borrower to make an annual repayment (capital redemption plus interest charges) of R100,000 and the borrower's sugarcane delivery estimate is 4,000 tonnes for the season, Ithala Bank's cession equates to R25 per ton of sugarcane. The borrower will, therefore, be in arrears if his/her actual deliveries are less than 4,000 tonnes of sugar-cane by the end of the season, unless he/she increases the cession per ton charged on the reduced delivery amount in order to cover the required annual repayment of R100,000 in full. The remainder of the income per ton from the reduced cane deliveries would still be available to the grower to fund farm expenses and family drawings. The reason is that the miller cannot automatically increase the cession per ton of sugarcane actually delivered to compensate for the repayment shortfall without the grower's consent. Ithala Bank's internal credit risk division is notified of any grower accounts that are in arrears for lengthy periods, and this division then institutes legal proceedings to reclaim funds owed.

The repayment status over time of the 83 loans with reliable financial and economic data as at 31 March 2001 was classified as being either current (most instalments over time were paid within 30 days of the cut-off date) or paid in arrears (most instalments over time were paid within 31 to 90 days of the cut-off date). Thirty-six per cent (or 30) of the 83 loans were current, while 64% (53) were deemed to be in arrears. A total of R73,473,288 was disbursed to the sample borrowers, with an average loan size at disbursal of R914,317 and R868,750 for current and in arrears loans, respectively. The next section specifies and discusses a conceptual model of factors that could determine such loan status.

3.2 Conceptual model of loan repayment

Discriminant analysis and logistic regression are commonly used to estimate the determinants of dependent variables that have binary outcomes, such as loan repayment status that is current or in arrears. Discriminant analysis was not used in this study because some of the potential determinants of loan

repayment status that were considered were dichotomous (see below). Discriminant analysis requires that, within the groups, variables follow a multivariate normal distribution, with equal covariance matrices (Press & Wilson, 1978; Manly, 1986). Although the violation of this assumption will not necessarily lead to poor results, Press & Wilson (1978) recommend the logistic regression model because of its robustness in respect of the underlying distribution of the independent variables, which need not be multivariate normal. Given that P_i is the probability that the ith farmer will be current on loan repayments, the logit model of loan repayment status for the MSFs can be expressed in equation (1) as follows (see Demaris (1992) and Gujarati (1995), for a summary of the model's statistical properties):

$$\ln (P_i/(1-P_i)) = \beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki} + \mu_i \quad (1)$$

where $1-P_i$ is the probability of the ith farmer being in arrears, and $\ln(P_i/(1-P_i))$ is the logit or log odds in favour of the ith farmer being current on loan repayments. The X_k are hypothesized determinants of loan repayment status, while the β_k are the parameters to be estimated. Using equation (1), the loan repayment status of the ith MSF was estimated as a function of the following k variables:

TURNOVER-TO-LOAN SIZE RATIO (TLSRATIO) = average annual farm gross turnover in Rands (proxy for farm size) relative to loan size;

OFFINC = 1 if the MSF has material sources of off-farm income, and 0 otherwise;

EXP^2 = number of years, squared, that the MSF had been farming sugarcane at the time of the study;

AGE^2 = age in years of the MSF, squared, at the time of the study; and

EDU = 1 if the MSF had obtained a Matric or higher level of education, and 0 otherwise.

The rationale for selecting these variables as potential determinants of MSF client loan status is given in the following paragraphs. Note that the ratio of own equity contribution to loan size was not included as an explanatory variable as there was little variability in this ratio between the growers (their equity contribution was 5% of the loan disbursed if in the North Coast area, and 8% if in the South Coast and Midlands regions). The ratio of annual drawings to annual turnover could also not be used as a potential liquidity indicator due to unreliable information about the growers' levels of drawings over time (records were incomplete and inaccurate as some growers

introduced earlier drawings into the business to pay for operating expenses). Data on asset values and other debt obligations were also not available, so the effect of asset collateral relative to loan size, and debt obligations relative to turnover, on loan repayment performance could not be evaluated. Women constituted only 6% (five farmers) of the sample, and so gender was not considered as a determinant of loan status.

Sanderatne (1986) argues that when a grower owns a large farm, he is usually predisposed to settle his obligations, which, if the capital were borrowed, would include loan repayment. This may be due to the ability to benefit from economies of size and/or scale. Large farms can reduce the average cost per unit of output sold by spreading fixed annual machinery, labour, interest and management costs, and information and transaction costs in the formal credit market, over more output. This is implied in Welch's (1978) assertion that larger-size farms have more to gain from lower average cost. Larger-size farms (relatively larger annual gross turnover) may also be those managed by farmers that have the specialist skills (relatively greater ability) required to produce on a larger scale (Pasour, 1981). Management, interest, information and transaction costs are likely to be the most relevant fixed costs for the MSF sample growers as most of these growers contract out their sugarcane harvesting operations. Mbowa & Nieuwoudt (1998) reported that smaller sugarcane farms in KwaZulu-Natal (under eight hectares, or farms with a gross annual income of less than R40,000 in 1998 rands) require significantly more resources to produce a rand's worth of output than do larger farms. The above arguments suggest that there is a positive relationship between the TLSRATIO and loan repayment, and that those MSF clients with larger average annual turnover relative to loan size are more likely to be current on their loan repayments. Farm size for the MSF sample, measured by average annual gross turnover, ranged from R271,993 to R942,336, while the TLSRATIO ranged from 0.26 to 1.01, with an average of 0.56.

Off-farm earnings could help to alleviate on-farm liquidity constraints (Barry *et al*, 1995). Growers with material sources of off-farm income may be able to rely less on drawings from the farm to finance family expenditure, and/or to supplement their limited farm income in low-income (e.g. drought) years in order to repay their loans. Consequently, having a substantive amount of off-farm income (OFFINC = 1) is expected to increase the probability that the MSF is current on loan repayments.

The number of years that a borrower has been involved in sugarcane farming can increase the likelihood that he/she can more readily adapt to the challenge of managing a commercial sugarcane farm. Growers with relatively

more experience, therefore, could manage their farm operations better than those with less or no farming experience. The conceptual model uses the MSF client's farming experience in years, squared, EXP^2, as a proxy for experience because the positive influence of farming experience on loan repayment is expected to peak at some critical level of years of experience, beyond which additional years of experience are unlikely to markedly increase this effect. This implies a quadratic relationship between years of experience in sugarcane farming and being current on loan repayments. The MSF sample growers had from two to 36 years experience in sugarcane farming, with an average of 13 years of experience.

There is no *a priori* economic expectation that applies readily to the age of the grower in relation to loan repayment performance. Baker & Dia (1993), however, report that older borrowers are more likely to be current on loan repayments rather than to have paid with arrears or be in default. The model of MSF client loan status proxies the MSF's age in years as age, squared, AGE^2, to show that the influence of age on loan status is likely to peak at a certain age level (perhaps once the client-lender relationship has been well-established). If the borrower's age is a good proxy for the extent of the lender-customer relationship, this indicates that older borrowers have been able to establish a better relationship with the lender (quadratic relationship between age and loan status). This reasoning may be less applicable in this graduated mortgage loan repayment scheme as the credit relationship between the MSFs and Ithala Bank personnel has operated only since 1996. The age of the 83 MSFs ranged from 30 to 70 years, with an average age of 47 years.

If education is an allocative input that facilitates the adoption of new technologies, then farm scale offers a benchmark for measuring returns to these allocative skills (Welch, 1978). Growers with relatively higher levels of education are expected to use better, or more readily adopt, technology such as ripeners and heat-treated seed-cane, and to employ consultants for advice in areas in which they feel their own management skills are deficient. As long as the expected benefits from the use of consultants and better technology are higher than the expected costs, the growers may continue to use the technology. If the use of technology and consultants can either reduce operating costs or improve productivity, more educated growers (adopters) will be more likely to repay their loans. Loan repayment and EDU are, therefore, likely to be positively related.

4. RESULTS

The signs of the logit model coefficients estimated by the maximum-likelihood method shown in Table 1 agree with a *priori* reasoning, and only the estimated parameters for the TLSRATIO and OFFINC are statistically significant at accepted levels. The probability of the ith MSF being current on graduated mortgage loan repayments, therefore, increases as average annual farm gross turnover increases relative to loan size, and if the client has material sources of off-farm income (additional liquidity). The Pearson correlation coefficient between TLSRATIO and OFFINC is 0.152, and this coefficient was not statistically significant at the 10% significance level or below. The estimated logit model thus captures the separate effects of each of these variables on loan repayment performance. None of the other explanatory variables were correlated, except for EXP^2 and EDU (0.257) at the 5% level of significance. These results support the past studies reported in section 2 above that identified business size and liquidity as being key determinants of loan repayment status.

Table 1: Coefficient estimates for the logit model of graduated mortgage loan repayment status for medium-scale sugarcane farmers in KwaZulu-Natal, 2001 (n=83)

Variable	Coefficient estimates
Constant	5.6069**
TLSRATIO	5.4707**
OFFINC	1.4895***
EXP^2	0.0015
AGE^2	0.0004
EDU	0.6812

Note: *** and ** indicate statistical significance at the 1% and 5% levels of probability, respectively.

The MSFs in the study sample who manage larger farms may benefit from returns to "lumpy" management, information and transaction costs being scale dependent, and from spreading these and fixed annual interest costs over a larger output. In addition, smaller-size farms able to generate relatively more turnover compared to loan size are more likely to be current on loan repayments. The ability to use off-farm income for family expenditure or to introduce off-farm income into the farm business when there are liquidity problems also can assist in staying current on loan repayments. An overall correct classification rate of 70% was achieved, with 53% of current loans and 79% of loans in arrears being correctly predicted. These classification results are biased upwards, as the same (83 MSFs) cases were used to both estimate the logit model and to assess the model's classification accuracy. These correct

classification rates compare quite well with rates of 62-85% reported in the loan repayment studies described in section 2 above.

Under the null hypothesis that the estimated model of determinants of MSF client loan status fits the data perfectly, -2 LL (where LL is the log of the likelihood) has a chi-square distribution with N-k degrees of freedom, where N is the number of cases and k is the number of parameters estimated. Given that there are 83 cases and six estimated parameters, the degrees of freedom are 77. The estimated model chi-square value is 88.78, which is the value of –2 LL for the current model. The observed significance level (probability between 0.25 and 0.20) for this chi-square statistic indicates that the estimated model does not differ significantly from the "perfect" model. Further logistic regression diagnostics, which included statistics to assess the influence of individual observations on the overall and individual parameter estimates (Hosmer & Lomeshow, 1989), showed no apparent lack of fit.

Years of farming experience was expected to be positively related to being current on loan repayments, but the estimated coefficient is not statistically significant. This may be due to a number of the MSF sample borrowers having gained their previous experience on small-scale sugarcane farms or relatively smaller sections of sugarcane estates, and so possibly lacking the "commercial experience" immediately required to operate the relatively larger farms under the MSF scheme.

5. CONCLUSION

The estimated logit model of MSF loan status identifies higher levels of average annual farm gross turnover relative to loan size, and access to substantive off-farm income, as key determinants of successful loan repayment by the MSFs using a graduated mortgage loan repayment scheme in KwaZulu-Natal as at 31 March 2001. The viability of future commercial farmland transfer schemes financed by graduated mortgage loan repayments may, therefore, be promoted if farms with relatively large expected annual gross incomes compared to the size of the disbursed loans are permitted, especially if the potential clients are going to be as highly leveraged as those in the KwaZulu-Natal MSF scheme. Growers that are highly leveraged and managing smaller-sized farms are probably less able to benefit from spreading fixed or "lumpy" annual management, information, interest and transaction costs over their units of farm output. Hence, it seems that farm size does matter for policymakers considering future similar land redistribution schemes. Smaller-sized farms with loan sizes that are relatively low compared to the expected average annual gross income may, however, also be viable.

Access to off-farm income could also be used as a criterion when assessing the expected total liquidity of potential farmers in future schemes – their access to sugarcane, or other commodity, farming need not necessarily be determined solely by their expected levels of on-farm income. Access to substantive off-farm income helps to provide additional liquidity to fund future operations and debt repayments. Further research is needed to establish whether or not there are regional differences in the loan repayment status of the sample of MSFs that was analyzed in this study.

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