Factors Affecting Credit Risk of Commercial Farmers in South Africa: A Case of the Midlands Area of KwaZulu-Natal

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Abstract: The burden of contributing towards the South African economy rests upon a diminishing number of commercial farming units. It is, therefore, important that these farming units remain commercially viable and an examination of commercial farmers' creditworthiness in terms of their ability to service and repay debt is particularly relevant. The aim of this research is to analyse the determinants of credit risk of commercial farmers in a diverse farming area of KwaZulu-Natal (KZN). To achieve this aim, a survey questionnaire was administered to a sample of 50 commercial farmers, and data was analysed using descriptive and regression analyses. The participants were grouped into three credit risk categories: high-, medium- and low-risk, and the results revealed that most of these farmers fall under the low- and medium-risk categories. The key determinants of credit risk were found to be the farmer's commitment to farming activities (part-time vs full-time), the proximity of the farm to the nearest urban centre, reliance on non-farm income to maintain the participant's standard of living, and the funding institution utilised.

Keywords: credit risk; commercial farming; agricultural lending; debt repayment capacity

JEL Classification: E51; G32; Q13; Q14

1. Introduction

South Africa's agricultural sector is described as having a highly dualistic agrarian structure, comprising a large-scale commercial farming sector, dominating production for both the domestic and international markets on one hand and a struggling small-scale subsistence sector on the other hand (Cousins & Scoones, 2010). While large-scale commercial farms remain the normative model for viability in southern Africa, there are more definitions of small-scale farmers than large-scale farmers. Agri News Net, (2019) describes small-scale farmers as those that exist either at the subsistence level

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or can sell only small surpluses on their local markets. For the purposes of this study, a commercial farming operation refers to a tax-paying entity primarily engaging in full-time large-scale farming activities for commercial gain.

Commercial agricultural land utilisation in South Africa has declined dramatically over time, from 82.76 million hectares (ha) in 1993 to 46.5 million ha in 2017 (DALRRD, 2020). In KZN, the decrease over the same period was from 4.064 million ha to 1.8 million ha (Stats SA, 2017). The number of commercial farming units in South Africa (SA) has also declined significantly, from 57,980 units in 1993 to 40,122 units recorded in 2017 (Stats SA, 2017). In KZN, the number of commercial farming units decreased from 6,080 in 1993 to 3,103 units in 2017 (Stats SA 2013; 2017), which is an even more significant decline than nationally. According to du Plessis (2016), it is declining margins at the farm-gate level and water shortages that have left SA with close to a third fewer farms today than it had in the early 1990s. In many instances, farms have been converted to other land uses. During the first decade of the current century, land was taken out of agricultural production to make way for non-agricultural land uses such as game farms, golf courses and housing estates (Hall, 2012). Kirsten and Meyer (2019, p. 96) reported that since 1994, over 4 million ha of agricultural land has been lost to "urban sprawl," mining, and the expansion of parks and forests. Other reasons for the declining number of commercial farms are the increasing popularity of lifestyle farming, consolidation into larger farming units to achieve economies of scale, increased crime levels on farms, land claims diminishing the value of farmland, government policies and support focusing on emerging (previously disadvantaged) commercial farmers, the importation of lower-priced agricultural products (van Zyl, 2000), vegetation degradation (desertification), environmental hazard (climate change, water availability and droughts), increases in the minimum farm wage level, and land reform initiatives (Hlophe-Ginindza & Mpandeli, 2020). These factors not only contributed towards the declining trend in commercial farming units but also negatively affected farmers' creditworthiness and their ability to raise finance and to repay their debts.

Despite the abovementioned trends and challenges, SA experienced a positive and increasing trend in its agricultural trade balance over the period 1990-2018, and in 2018 the agricultural sector contributed around 10 percent to SA's total export earnings (DAFF, 2019). In a year plagued by the impact of COVID-19, the agriculture, forestry and fishing industry was the only positive contributor to GDP growth, at 0.3 percent in quarter 2 of 2020 (Stats SA, 2020). Furthermore, agriculture remains one of the sectors with the largest indirect contribution to GDP (Finance Week, 2009). In the Department of Agriculture's 2008 economic survey, it was shown that around 68 percent of gross agricultural production is used as intermediary products in several other industries, and up to a fifth of the country's population is directly or indirectly dependent on agriculture for income (Stats SA, 2019).

Gross farming income (GFI) in KZN has grown significantly (Stats SA, 2002; 2017) and the midlands area of KZN is an important hub of diverse farming activities, making it well suited to this study. Access to finance is essential for sustainability and growth in any business, and commercial farmers rely on credit to finance their farming activities. Their access to credit is determined by the credit risk they pose to the lender, and their ability to service and repay such debt is therefore also particularly relevant. With fewer farm units producing an incrementally higher total GFI over time, and presumably borrowing more, understanding the credit risk exposure facing commercial farming in KZN is crucial.

Generally, the agriculture sector, particularly the commercial farming industry, faces various risks, including production, market, personal, and financial risks (Savescu & Plotz, 2008). All these risks are

considered and evaluated before investors or banks decide to credit commercial farmers. In South Africa, production risk which refers to all factors that affect the quality and quantity (e.g. disease, pests and weather) of production and financial risk which refers to the farmers ability to secure finance and pay back their loans appear to be the most dominant. Consequently, assessing farmers credit risk is an important factor for agricultural finance in South Africa. Additionally, it is imperative to determine the main factors affecting commercial farmers' ability to repay the loan. Some of the factors that may hinder access to credit for South African commercial farmers are distance between lender and borrower, attitude towards risk, difficulties in lending procedures, total value of farmers' assets and perception on loan repayment (Chauke et al., 2013).

Although many international studies have been undertaken on this particular topic (e.g. Jouault & Featherstone, 2011; El-Osta, 2016; Bai et al., 2019), the SA studies (e.g. Mashatola & Darroch, 2003; Floyd, 2009) have been confined mainly to the KZN sugar industry. There is therefore a need to examine the determinants of credit risk amongst commercial farmers engaging in diverse farming activities. Thus, this study's objectives are to identify the key characteristics of established commercial farmers in the KZN midlands; determine the level of credit risk amongst established commercial farmers in the KZN midlands; and identify the key factors affecting the credit risk of established commercial farmers in the KZN midlands.

The remainder of this article is structured as follows. Section 2 presents a literature review of the credit scoring methods and risk models adopted in agricultural lending, the financial institutions funding agriculture, theories underpinning lending to agriculture, the risks, costs, and other factors involved in lending to agriculture, and the determinants of credit risk. Section 3 illustrates the adopted methodology, including the sample, research instrument, and statistical models used to analyse the data. Section 4 reports the results and discusses the findings, while section 5 provides concluding remarks and recommendations.

2. Literature Review

2.1. Credit Scoring Methods and Risk Models Adopted in Agricultural Lending

The suitability of various lending criteria to commercial agriculture were reviewed. Although credit scores are commonly used in making consumer and business loan decisions, agricultural lenders are divided about them (Jackson, 2005). Proponents, including in Bronstein (1996), say they shorten decision time (an individualised credit analysis can take up to three hours), free lenders to make more loans, and help set pricing. Bob Finney, CEO of Muleshoe State Bank in Texas in 2005, said he was against credit scoring for farmers, as a farmer's income is volatile and dependent upon uncertain variables such as input prices and the weather, which are beyond the farmer's control (Jackson, 2005). In addition to credit-scoring, several other credit risk assessment methods are adopted in practice. One of the major South African commercial banks categorises their agricultural clients into three sub-segments, by key characteristics and qualifying criteria, and then manages the sub-segments accordingly (Douglas, 2010). Within each segment, they assign a Risk Grade to their commercial farming customers, which ranges from 0–9. Low-risk agricultural borrowers are assigned risk grades 7–9, medium-risk borrowers risk grades 4–6, and high-risk borrowers are assigned a grade from 0–3. The assignment of risk grade is based upon three main variables: the account conduct (a behavioural rating), the financial position of the farmer (involves an analysis of key gearing, liquidity, performance and profitability ratios), and an industry and control risk assessment (in terms of product, price,

production, people, cash flow and capital risk of the industry, and any risk management controls in place to minimise these industry risks). Risk grading influences both the lending decision and the pricing (interest rate) of each facility (Douglas, 2010).

2.2. Financial Institutions Funding Agriculture

The financing environment in South Africa's agricultural industry has changed significantly over the past few decades: whilst the Land and Agricultural Bank (Land Bank) was consistently the leading provider of funds to the industry since its formation in 1912, commercial banks started to dominate from the late 1970's (Janovsky, 2007). According to the 2019 Abstract of Agricultural Statistics, the Land Bank's share of total farming debt at the end of 2018 was 28.98 percent, whilst that of commercial banks was 60.22 percent (DAFF, 2019). According to Janovsky (2007, p. 23), management and other problems at the Land Bank contributed to this decline as well as the lien that the Land Bank has on farms as per the "outdated Land Bank Act of 1944." Another factor must have been the shift in agricultural policy post-1994, with the government placing more emphasis on those farmers historically constrained from entering mainstream agriculture and the Land Bank being tasked by the government to focus more on financing development agriculture (Coetzee, 2003).

Other types of farming debt include debt provided by input companies, such as fertiliser, seed or pesticide providers (e.g. Senwes Finance). Such financing has enjoyed increasing popularity amongst farmers in recent years. Gunderson et al. (2003) found that farm borrowers in the North-Eastern USA rely on several agricultural lenders, and this could be true of the South African market. A typical commercial farmer might have borrowed from the Land Bank originally to purchase the land and also conduct a production loan account with their Co-op or fertiliser company, and an overdraft with a commercial bank for general cash flow purposes.

A study of interest rates charged by selected debt providers over time shows that the interest rate differential between both commercial banks and agricultural co-operatives, as well as the land bank and other institutions, has increasingly diminished over time (DALRRD, 2020). The historical attraction of subsidised (lower) interest rates charged by the Land Bank no longer applies, providing yet another possible reason why farmers have moved away from borrowing from the Land Bank.

2.3. Theories Underpinning Lending to Agriculture

Although several theories elucidate credit risk or the relationship between lenders and borrowers, this study is built on four adequate theories. These theories include Credit Risk Theory, Agency theory, Moral hazard, and Adverse selection theory. Credit risk, under the credit risk theory, refers to the uncertainty of suffering a financial loss owing to the reduction in solvency of the counterparty in a financial transaction (Liu et al., 2014). Regarding farming, credit risk theory may refer to the uncertainty of lenders as to whether farmers can accomplish their contractual obligations. On the other hand, agency theory refers to the agency relationship between a principal, who is, in this case, financial institutions or investors, and an agent (Jensen & Meckling, 1979). This relationship can become problematic if the principal and agent have divergent goals or information. Agency costs may arise due to these information asymmetries between lender and borrower. These costs, such as defaults on loan repayments, lead to increased credit risk on the part of the borrower. Agency costs can also be incurred through attempts to reduce the problems of moral hazard and adverse selection (Floyd, 2009).

Moral hazard theory is described as "hidden action" and refers to the situation where a borrower deliberately takes an action that negatively affects the lender (Green, 2003). In this regard, commercial agricultural borrowers are no different from any other group of borrowers. Taking a farmer at his/her word that the borrowed funds will be utilised for the intended purpose and repaid according to the agreed terms, poses the same risk that would apply to any other type of borrower, and must be managed through an integrity assessment of the borrower, as well as putting monitoring and enforcement measures in place. Maintaining close contact with the customer through regular farm visits, and scrutiny of financial records are essential to ensure the existence of a viable operation. Having to allocate resources to prevent moral hazard increases costs on the part of the lender which may be passed on to the borrower.

Adverse selection theory describes the situation when borrowers are trying to obtain credit from a bank, and the criteria which make them either suitable or unsuitable to obtain credit are "diametrically opposite" (Park, 2008). For example, when a bank finds it difficult to distinguish a creditworthy farming customer with low credit risk from a less creditworthy farming customer posing a high credit risk. The implications of such information asymmetries might be poor credit decisions and resultant losses by financial institutions, leading to credit rationing and incorrect loan pricing. It is therefore important that lenders reduce information asymmetries which in turn will assist in overcoming the problems of adverse selection and moral hazard. Clear and precise communication, ongoing credit risk assessment and loan contract monitoring by lenders are other means of achieving this.

2.4. Risks, Costs and other Factors Involved in Lending to Agriculture

Agriculture is distinct from other sectors due to seasonality, geographic limitations, price volatility and dependence on natural conditions (Savescu & Plotz, 2008). These characteristics affect the success of financial institutions operating in the agricultural sector, which is dependent upon the credit risk posed by their customers.

Savescu and Plotz (2008) outline the following nine risks, costs and other considerations: *(I)Production and Yield risk* due to natural hazards such as the weather, pests and diseases, as well as soil quality and geographic location, and the seasonality of production. *(II) Price and Market Risk:* due to the relatively long period of time between planting a crop or starting livestock activities and the realisation of farm output, market prices can change considerably from initial projections. Price uncertainty and market fluctuations are particularly significant when market information is lacking or where markets are imperfect: this risk can be mitigated by price hedging and forward contracts (van Heerden, 2003). *(III) Lack of Diversification:* Farmers involved in a single or small number of similar farm activities are exposed to increased price and market risk, as well as production and yield risk. *(IV) Lack of suitable collateral* which refers to the asset or property offered to a lender as security for a loan (Corporate Finance Institute 2021). *(V) Political risk* refers to government interventions and regulations in support of agricultural activities (Hall, 2012). *(VI) The costs of rural lending* in terms of how lending in rural areas is generally more expensive than lending in urban areas due to a lack of infrastructure and facilities. *(VII) Limited documentation to base credit assessment on,* as particularly small farmers show a low level of formal education and lack record-keeping skills, rendering it difficult to assess credit risk (van Zyl, 1998). *(VIII) Complexity of Economic Activities of Rural Households*: The diversity of farm and non-farm activities practiced by KZN midlands commercial farming entities means that agricultural loan officers need to be equipped with the requisite knowledge

to be able to understand the complexities of each of these operations, thereby reducing the risk of making poor lending decisions which would lead to increased credit risk. *(IX) Demand for variations in lenders' institutional capacity* caused by the fact that seasonal agricultural activities are time-sensitive, and the credit appraisal process needs to be streamlined to ensure timely credit decisions and loan disbursements (Savescu & Plotz, 2008).

2.5. Determinants of Credit Risk

There are many existing international studies on agricultural credit risk determinants. Amongst the international studies reviewed, Purdy et al. (1997) used multiple regression analysis and found that risk, age of operator, financial efficiency and farm size had the largest impact on the financial performance of Kansas farmers. Another study by Zech and Pederson (2003) identified the debt-to-asset ratio as a major predictor of repayment ability, and the rate of asset turnover and family living expenses to be strong predictors of farm performance in the US. El-Osta (2016) studied farmland ownership and its impact on the debt servicing capacity among married-couple farm households across 48 states in the USA. The researcher found that full-farm ownership, age (>35 years), education (College) having insurance, and internet-use had a strong and statistically significant positive impact on the ability of these farm households to repay their debt. Similarly, Quaye et al. (2017) examined the factors that affect the ability of southeast farmers in the US to meet their loan repayments timeously. They found that farmer age, farm size, net income, insurance, debt-to-asset ratio, number of loans and source of the loan were factors that determine loan repayment capacity. They concluded that older farmers with larger farms, with insurance, higher net farm income, smaller debt-to-asset ratios, and single loans from sources other than commercial banks are less likely to default on their debts.

Rahji and Adeoti (2010) found that factors affecting the farmer's access to bank credit in south-western Nigeria include farm size, previous year's income, enterprise type, co-op membership, household net worth, and level of household commercialisation. Other factors such as farmer age, gender and education were not found to affect the credit-granting decision. Bai et al. (2019) used a joint Fuzzy rough set and Fuzzy C-means methodology to predict the creditworthiness of 2044 farmers within China and found that age, education, the proportion of non-agricultural income, and skills-related characteristics are amongst the primary determinants of creditworthiness.

Local research on the determinants of agricultural credit risk is relatively scarce. Lugemwa and Darroch (1995) used linear discriminant and logit regression models to identify loan and borrower characteristics associated with successful and defaulted seasonal agricultural loans made to small-scale farmers by the Agricultural Bank of Transkei in 1991. Their results showed that farmers with a proven credit history, higher repayment ability and collateral were less likely to default on their loans. Floyd (2009) showed that successful new freehold cane growers were characterised by more cane farming experience, larger farm size, greater solvency and liquidity, larger replant area, more emphasis on computerised record-keeping systems, greater use of a financial record-keeping system and utilisation of risk management strategies. Henning and Jordaan (2016) investigated the indicators used in the agricultural credit decision from the perspective of a South African credit provider and found that financial performance, collateral and sustainability are important factors of creditworthiness.

Overall, the most common factors found to have a positive effect on farmer creditworthiness are solvency and, to a lesser extent, farm size and the existence of off-farm income. The reality is that the results of such research are country-/region-/industry-specific. Local studies have focused on emerging

commercial farmers in the SA sugar industry. It proved difficult to find more recent studies, international or local, involving commercial agriculture. A unique feature of this study is that the sample consists of commercial farmers in the KZN midlands who are involved in diverse farming operations.

3. Methodology

3.1. Sample and Research Instrument

A quantitative research approach was followed by collecting and analysing primary data through a survey questionnaire. The questionnaire was designed around factors affecting loan repayment ability (creditworthiness) from past studies and was presented to a sample of commercial farmers in the KZN midlands for completion. The collected data was analysed using descriptive statistics and linear regression analysis. A descriptive analysis was utilised to profile the characteristics of farm, farmer and farming activities in the KZN midlands under the categories of Demographics, Farm Operations, Management, Risk Management, Annual turnover and Funding institution, and a cross-tabulation was employed to explain the relationship between the farmers' credit risk and various key determinants identified. In addition, a multiple linear regression model was applied to determine how some key identified factors affect farmers' credit risk.

The first section of the questionnaire contains questions relating to farmer and farm characteristics, which feed into the descriptive analysis. The second section consisted of questions to gather Financial Data and included five questions used to capture the credit risk score. This credit scoring is used worldwide to process many loan types (Caire et al., 2006). South African commercial banks have a local credit risk model used to assign scores to their agricultural clients. The model addresses three areas: the account conduct (a behavioural rating), the financial position of the farmer (involves an analysis of key gearing, liquidity, performance and profitability ratios), and an industry and control risk assessment (in terms of product, price, production, people, cash flow and capital risk of the industry, and any risk management controls in place to minimise these industry risks) (Douglas, 2010). Within each model segment, banks assign a Risk Grade to their commercial farming customers, ranging from 0 to 9. Low-risk agricultural borrowers are assigned risk grades 7–9, medium-risk borrowers risk grades 4–6, and high-risk borrowers are given a grade from 0 to 3 (Douglas, 2010). This credit score was used to score sampled farmers and to categorize them into low-, medium- or high-risk from a credit point of view.

The questionnaire was administered to a sample of 50 commercial farmers in the KZN midlands, using two non-probability sampling methods, namely convenience and snowball sampling. An effort was made to ensure that sampled farmers were classified as commercial farmers, have diverse farming operations and are geographically spread across the KZN midlands. The sample of 50 commercial farmers met these criteria, and all completed the questionnaire. The sample size is relatively small, however according to Delice (2010), a sample size of more than 30 observations or participants is deemed sufficient for a quantitative analysis. To minimise incomplete responses, researchers collected data during a face-to-face meeting with participants. The Cronbach's Alpha (α) was estimated to measure the reliability of the research instrument.

3.2. Statistical Analysis

The coded data was analysed using the Statistical Package for the Social Sciences (SPSS 26.0). A descriptive analysis was performed using frequency distributions and cross-tabulation. Cross tabulations were used to establish the relationship (if any) between the variables under each of the designated categories (for example age, gender, size of farm under the category of demographics), and each of the three categories of credit risk. A chi-squared test was employed to ascertain whether there is a statistical difference in the distribution of a specific variable across the three categories of credit risk, and the final level of analysis was completed using linear regression.

Since the majority of the farmer participants fell under the low- and medium-risk categories, leaving the high credit risk category non-viable, it was deemed necessary to use total credit risk scores, which are continuous, instead of risk categories. Thus, a linear regression model was adopted as being most appropriate for a continuous score in the dependent variable. Initially, descriptive statistics and cross-tabulations were run, and it was decided to take a few key variables through to a multiple linear regression analysis, based on the model that best fits the data. Two of the main disadvantages of linear regression models is that they do not imply a cause–and–effect relationship between the variables, and they are only as good as the data on which they are based (Montgomery et al., 2012).

After identifying the variables that best fit the model, the following specific regression model was derived:

$$CR_i = \beta_0 + \beta_1 Ed_i + \beta_2 Train_i + \beta_3 WorExP_i + \beta_4 FSize_i + \beta_5 Price_i + \beta_6 RMS_i + \beta_7 FinAdv_i + \beta_8 Turn_i + \beta_9 Type_i + \beta_{10} Prox_i + \beta_{11} IncomRel_i + \beta_{12} Fund_i + e_i$$
(1)

The variables in this regression model are described in Appendix 1. Using this regression model, the following hypotheses were tested:

- H_0: Selected factors (farmer's demographics, risk management, farming revenue, funding method, farm location and size…) do not have a significant effect on credit risk.

- H_1: Selected factors (farmer's demographics, risk management, farming revenue, funding method, farm location and size…) have a significant effect on credit risk.

If the p-value for the factor coefficient β_1 to β_{12} is less than 5%, the H_0 was rejected in favour of the H_1 to indicate a significant effect of such a factor on credit risk.

4. Results and Discussion

4.1. Characteristics of Commercial Farmers in the KZN Midlands

The first objective of this study was to identify the key characteristics of established commercial farmers in the KZN midlands, as these characteristics would form the independent variables needed to achieve the third objective. This first objective was achieved through the use of descriptive statistics. When it came to the demographics' category of variables, a participant profile emerged of a mature, educated, experienced male farmer who owns 100 percent of his relatively large farm, which is situated relatively close to the nearest urban centre. This would indicate a measure of stability and available collateral, which would be important and positive factors when applying for funding.

Under the category of Farm Operations, most participants are well-diversified (beef and timber are the most common farm enterprises), experience evenly-spaced cash flows throughout each year and have a low labour-force turnover, which are all positive factors when it comes to credit risk. Negative factors are that they are largely price-takers, which can lead to uncertainty regarding the size of their cash flows, and the fact that most perceive land claims, crime, and uncertainty (with respect to demand, price and costs) as the top three threats they face.

Under the Management category, most participants frequently use the internet for their farming activities, identify as full-time farmers, self-manage their operation, seek both financial and technical advice from outside their operation, use a computerised system for their financial and production record-keeping, and fully utilise cash flow budgets as a financial planning tool. All of these attributes can have a positive effect on creditworthiness as they suggest informed, committed, hands-on management and the use of progressive and efficient farming practices.

When it comes to Risk Management, most farming operations rely on farm income alone to maintain their standard of living, derive 100 percent of their annual revenue from farming activities, use various types of insurance as a risk management strategy, and adopt more than one risk management strategy (predominantly insurance and enterprise diversification). This indicates that most participants attempt to mitigate the risks they can control, which should lower their credit risk in the eyes of a credit provider.

Annual Turnover ranges between R100,000 and R200 million, averaging R24,625,800. This is a wide range and a high average, indicating a high average size of the farming operations surveyed, which can have a positive effect on creditworthiness, as established by Nannyonga (2000), and Mashatola and Darroch (2003). Regarding choice of Funding Institution, a large majority of participants use a commercial bank to fund their farming operation. The fact that so many participants borrow from a commercial bank (versus a family loan, bridging finance institution, or having no debt), provides a useful platform from which to assign a credit risk category to each participant.

4.2. Level of Credit Risk amongst Commercial Farmers in the KZN Midlands

In order to achieve the second objective of determining the level of credit risk of the commercial farmer participants in this study, farmers were questioned about the interest rate they pay on their bank overdraft, the security held by their bank, their debt-servicing ability, cash flow difficulties and their historical ability to raise finance in need. The resultant analysis indicated that the majority of these KZN midlands farmers displayed characteristics of low- and medium-credit risk: they pay interest at a rate of prime +2 percent and below on their overdraft facility; they borrow on an unsecured basis or secured by personal guarantees, or against bonds over immovable property; and they are up to date with all or most of their loan commitments. Cash flow difficulties are either not experienced or only experienced occasionally. The participant farmers had either not borrowed or received all the finance they had applied for over the past 3 years. Few Midlands farmers fell into the high-risk category. The Cronbach's α was estimated to test for the reliability of each of the five measures used to generate the credit risk scores: the Cronbach's α was between 0.73 and 0.86, indicating the reliability of the scale. The sample of participants scored between 2 (min) and 12 (max), depicting the lowest and highest credit risk, respectively. The average credit score (mean) amongst participants was 6.28, with a standard deviation of 2.485.

The aggregated scores are summarised in Table 1 below, showing the sample statistics for credit risk as a continuous variable among the 50 participants included in the study. This table indicates that 14 (28 percent) participants displayed low credit risk, 32 (64 percent) participants showed medium credit risk, and 4 participants (8 percent) scored high for credit risk. More than 90 percent (92 percent) of the participants have a low or medium credit risk (fall into a high or medium creditworthiness bracket). This result suggests that the majority of these farmers are creditworthy, with a high likelihood of being able to secure credit for their farming activities.

Table 1. Credit Risk categorisation sample statistics

Variable	Category	Frequency	Percent	Cumulative percent
Credit Risk	Low	14	28	28
	Medium	32	64	92
	High	4	8	100
Total		**50**	**100**	

Source: Own estimation (2020)

4.3. Cross-tabulation Analysis of Credit Risk Determinants

The final objective of this study was to determine the key factors affecting the credit risk of established commercial farmers in the KZN Midlands. This involved a cross-tabulation followed by a regression analysis of the data received from the participant farmers. Cross-tabulations were used to analyse the distribution of the three risk categories (low, medium and high) across the different independent variables identified in the descriptive analysis, such as gender, age and level of education, in order to establish how the risk categories vary across these variables. Chi-square statistics were used to check for the significance of the observed distributions. Turnover was captured as a continuous variable and was not cross-tabulated with credit risk.

The cross-tabulation exercise revealed that five independent variables had a significant effect on credit risk. Table 2 below presents the cross-tabulations of the distribution of the three credit risk categories across these five variables. An explanation of the results pertaining to each of the five significant variables is as follows.

Formal agricultural-related training: a large proportion of the participants with no additional agricultural-related training fell into the low credit risk category. Whilst none of the previous studies researched broke the education factor down to the level of agricultural education, this result goes against the expectation that the more agriculturally-trained a farmer, the lower his/her credit risk would be.

Whether the farmer is full- or part-time: a sizeable proportion of the participants who identified as full-time farmers fall into the medium credit risk category. This differs from those participants who identified as part-time farmers, who are predominantly characterised by low credit risk. An explanation for this result could be that part-time farmers are likely to have other (main) sources of income to assist with farm expenses and are less reliant on their part-time farming activities for their livelihood, therefore less likely to require external funding for their farming operation.

The percentage of total income derived from farming activities: half of the participants who derive 0-50 percent of their income from farming fall into the low credit risk category. This ties in with the finding immediately above, where part-time farmers are likely to have other (main) sources of income

and are therefore less reliant on or in a better position to repay external funding raised for their farming operation. The distribution of participants who derive 51-99 percent of their income from farming, and those who derive all (100%) of their income from farming, are characterised by medium credit risk.

The type of risk management strategy employed: a large proportion of the participants who use insurance and enterprise diversification as risk management strategies fall into the medium credit risk category. This differs from those who keep cash reserves and use non-farm activities as risk management strategies, who are predominantly characterised by low credit risk. This finding is partially supported by both Quaye et al. (2011) and El-Osta (2016), who established that having insurance increased a farmer's ability to service their debt, and Purdy et al. (1997), who supported the idea that enterprise diversification led to less variability in farm performance, which could lead to increased creditworthiness. The fact that this study revealed that holding cash reserves and having non-farm income were predictors of low credit risk is not surprising due to the fact that these would be farmers with less reliance on farming income and the inherent risks associated with farming.

Table 2. Cross-tabulation distributions results

	Low credit risk		Medium credit risk		High credit risk		Chi-square (p-value)
	Frequency	%	Frequency	%	Frequency	%	
Formal agricultural-related training							
No additional training	6	12	4	8	1	2	11.081
Various agricultural short courses	1	2	7	14	2	4	**(.086)****
Agricultural diploma	5	10	8	16	1	2	
Agricultural degree	2	4	13	26	0	0	
Total	**14**	**28**	**32**	**64**	**4**	**8**	
Type of Farmer							
Full-time	10	20	31	62	3	6	6.668
Part-time	4	8	1	2	1	2	**(.036)***
Total	**14**	**28**	**32**	**64**	**4**	**8**	
Percentage of income derived from farming/non-farming activities							
0-50	4	8	2	4	2	4	12.941
51-99	1	2	15	30	0	0	**(.012)***
100	9	18	15	30	2	4	
Total	**14**	**28**	**32**	**64**	**4**	**8**	
Risk management strategies used							
Insurance	7	14	27	54	2	4	12.643
Enterprise diversification	2	4	4	8	1	2	**(.049)***
Keeping cash reserves	3	6	1	2	0	0	
Non-farm activities	2	4	0	0	1	2	
Total	**14**	**28**	**32**	**64**	**4**	**8**	
Funding institutions utilised by participants							
Commercial bank	10	20	31	62	4	8	**8.175**
Other institution	2	4	0	0	0	0	**(.085)****
No debt-funding	2	4	1	2	0	0	
Total	**14**	**28**	**32**	**64**	**4**	**8**	

*Significant at 5% level of significance, **significant at 10% level of significance

Source: Own estimation (2020)

The funding institutions utilised by the farming operation: a large proportion of the participants who use a commercial bank fall into the medium credit risk category. By contrast, the two participants who use other funding institutions (bridging finance and a family loan) and two of the three participants with no debt-funding, are characterised by low credit risk. In one respect this result is expected as half of the participants in the low credit risk group do not have any debt, however as only 10 percent of participants do not borrow from a commercial bank (including those who do not borrow at all), a meaningful result was not expected.

4.4. Regression Analysis of the Effect of Key Factors on Credit Risk

To supplement the cross-tabulation analysis in 4.3 above, a linear regression was used to test the influence of certain independent variables on the credit risk score. Several combinations of independent variables were combined in the model to establish best fit. The combination with the highest adjusted R-square, was then selected. The regression results in Table 3 indicate that the selected model is a good fit as shown by an R-square of 0.426, which is significant at the 5 percent level of significance (the p-value of the F-statistic is 0.027 < 0.05). This means that the independent variables selected jointly explain 42.6 percent of the variance in credit risk scores, holding other factors constant. Considering that there are many and varied factors used by financial institutions to evaluate the credit risk of farmers in general, the 42.6 percent captured by the estimated model should be sufficient to explain the participants' credit risk.

The results presented in Table 3 show that a number of coefficients are not statistically significant, even at the 10 percent level of significance, while there are specific variables that have a statistically significant effect on participants' credit risk scores. The variables found to have a non-significant effect on credit risk include formal education, agricultural training, agricultural work experience, farm size, product price influence, aggregated risk management strategies adopted, outside advice sought, and turnover. The variables found to have a significant effect on credit risk include type of farmer, proximity to nearest urban centre, reliance on non-farming income and funding institution used. Each of these significant variables are discussed hereunder.

Table 3. Regression results

	B	S.E.	t	Sig
Constant	13.914	6.964	1.998	.053
Formal education	-.565	.380	-1.486	.146
Agricultural training	.546	.406	1.347	.186
Agriculture work experience	-.336	.372	-.904	.372
Farm size	0.000047	.000	.235	.815
Product price influence	.584	.589	.990	.329
Risk management strategies (summed)	-.025	.436	-.056	.955
Financial advice	-.004	.799	-.005	.996
Turnover/annum (logged)	.154	.295	.520	.606
Full/part time farmer	-2.572	1.487	-1.730	**.092****
The proximity of the farm to the nearest urban centre	-.030	.015	-2.006	**.052****
Reliance on non-farm income	-1.818	.897	-2.026	**.049***
Funding institution	-2.081	1.133	-1.837	**.074****
R square 0.426	**F- stat. 2.291**	**p-value 0.027**		

*Significant at 5 percent level of significance, **significant at 10 percent level of significance

Source: Own estimation (2020)

The type of farmer (full- or part-time) is significant at the 10% level of significance. Part-time farmers pose a lower credit risk than full-time farmers, which corresponds with the findings of the cross-tabulation analysis presented in Table 2, as well as the literature (Rahji & Adeoti, 2010; Quaye et al., 2017; Bai et al., 2019), which indicated that the existence of off-farm income was a common factor affecting farmer creditworthiness. A possible explanation for the finding in this study could be that part-time farmers have other occupations or are engaged in other businesses that generate additional income, which could ultimately improve their ability to secure and service loans or lead to them not having to externally fund their farming operation at all.

Proximity to the nearest urban centre is significant at the 10% level of significance: The results suggest that participants with farming operations further away from urban centres, tend to be more creditworthy (lower credit risk). This goes against logic that would suggest that being closer to town would equate to being closer to markets and suppliers of inputs and services, which in turn would imply lower transport costs, which should translate into a lower credit risk. The study by El-Osta (2016) supports the fact that proximity to markets has a positive effect on debt repayment capacity. A possible reason for the conflicting result in this study is that the KZN midlands is a relatively concentrated geographical area (versus the mid-west of the USA or Karoo region of SA, for example), with no single farming operation being significantly far from the nearest urban centre.

Reliance on non-farm income to maintain the participant's standard of living (significant at the 5% level of significance): the more reliant on farm income alone as opposed to non-farm income, the lower the credit risk score of the participant. In contrast, none of the studies researched support the finding of this regression analysis, with Lugemwa and Darroch (1995), Mashatola and Darroch (2003), Rahji et al. (2009, 2010) and Bai et al. (2019) all finding that access to non-farm income has a positive and significant effect on debt repayment capacity or creditworthiness. Perhaps for the group of participants in this study, being solely focused on their farming operation for their livelihood, yields greater debt repayment capacity.

The funding institution utilised for the farming operation is significant at the 10% level of significance, implying that participants not funded by commercial banks tend to be more credit-worthy (lower credit risk) than those who are funded by a commercial bank. This finding corresponds with the cross-tabulation exercise above which showed that most of the participants who use a commercial bank fall into the medium credit risk category, and those who used another financial institution or do not borrow are characterised by low credit risk. Quaye et al. (2017) also found that farmers with loans from sources other than commercial banks are less likely to default on their debts. Despite this support for the regression result, it must be seen in the context that 90 percent of the farming participants obtain funding from a commercial bank, with the other 10 percent either utilising a family loan or bridging finance (4 percent) or not requiring finance from an institution (6 percent).

5. Concluding Remarks and Recommendations

Globally, the commercial agricultural sector plays a vital role in food security, contribution to GDP, balance of trade, employment and education. However, the prosperity of this sector depends on the farmers' ability to secure sufficient finance. The existing literature shows that debt financing is critical to sustainable commercial agriculture. Hence, it is essential to determine factors affecting farmers' ability to secure debt finance to invest in their agricultural operations. This study used a quantitative

approach to analyse factors affecting the credit risk level of established commercial farmers in South Africa using a case of farmers in the midlands area of KZN. Descriptive analysis revealed that the majority of participants can be categorised as low- and medium-risk, suggesting that most of the farmers in the surveyed group are in a favourable position to borrow funds for sustaining and expanding their farming operations.

The results of the cross-tabulation exercise showed that formal agricultural-related training, commitment to farming activities, the proportion of total income derived from farming activities, the type of risk management strategy employed and the funding institutions used for farming operations have a significant effect on credit risk. Specifically, a large proportion of the participants with no additional agricultural-related training fall into the low credit risk category, which is contrary to what logic would suggest. Additionally, part-time farmers are largely characterised by low credit risk. A further finding is that farmers who manage their risk by keeping cash reserves and diversifying with non-farming activities are predominantly characterised by low credit risk, versus those who use mainly insurance and enterprise diversification as risk management strategies. We also found that participants who do not source funding from a commercial bank are predominantly characterised as having low credit risk, compared to those who borrow from a commercial bank. This is to be expected as the majority of the farmers in the former category do not borrow at all. This reflects global phenomenon that sustainable commercial farming is highly achieved through own capital investments and less reliance on debt finance.

The regression results revealed different predictors of farmers credit risk. Part-time farmers were found to have lower credit risk than their full-time counterparts. The next significant factor is proximity to the nearest urban centre. The further away the farm operation is from the nearest urban centre, the lower the credit risk. This was unexpected as the reverse should be true. The third significant predictor was found to be reliance on non-farm income to maintain the participant's standard of living. Here, the more reliant on farm income to maintain a standard of living, the lower the credit risk. This is in contrast to the empirical evidence researched but could perhaps be explained by the fact that when a farmer only has one livelihood they have to be more focused on it and successful at it, to make a living. The funding institution utilised for the farming operation proved to be the fourth and final significant predictor of credit risk, where participants not funded by commercial banks tend to be more credit-worthy (lower credit risk) than those who are funded by a commercial bank.

In addition to some of the unexpected results already highlighted above, it was somewhat surprising that the demographic variable of experience and management variables such as internet-use, record-keeping systems and the use of cash-flow budgets did not emerge as significant determinants of credit risk. This can possibly be attributed to the fact that the majority of the participants are highly experienced and advanced in terms of their management practices. The least-expected result, however, was that so few of the participants fell into the high-risk category. The agricultural sector as a whole is known for the mixed and volatile fortunes of its farmers, and the fact that many farmers operate under financial constraints. Either the majority of commercial farmers in the midlands area of KZN really are more creditworthy than their counterparts elsewhere, or the convenience and snowball sampling techniques used in this study brought about a somewhat biased or non-representative sample, as is possible, according to Lindquist (2000). Nevertheless, these findings are comparable to the other findings, which state that the location of the farm is essential in securing agricultural finance.

Perhaps the most meaningful outcome is that being a part-time farmer was found to have a positive effect on creditworthiness. This might imply that diversification with non-farm activities is one way for a farming operation to hedge against the uncertainty and volatility of farming earnings and survive in the long-term. This is an important finding that can be generalised at national and global levels, where farmers would be encouraged to diversify their operations to minimise the effect of any financial shocks and increase creditworthiness.

It was confirmed that the much-publicised issues of land security and farm crime are perceived to be the major threats facing this group of farmers. These are both equally important considerations from the perspective of a lender, as the former affects the value of collateral and solvency, and the latter affects cash flow and continuity of the operation and, therefore debt repayment capacity. The bigger picture issue is that should government not do more to address these fears and threats, SA might continue to lose farmers to other industries or countries, which leaves the country with compromised food security, reduced export earnings, a declining GDP, worsening unemployment and the demise of some farm schools.

The trend in agricultural lending is none so apparent as in this study where the majority of the participants who borrow do so from a commercial bank. There is no doubt heightened competition between the commercial banks to be the institution of choice for groups of farmers such as this one, who are largely successful. These farmers in turn are predominately educated and use the internet extensively, hence would be continuously in the market for a banking relationship that can add the most value to their operation. The focus of government agencies such as the Land Bank on emerging farmers is important, but should not be at the expense of providing services and support to the important commercial farming sector.

The COVID-19 pandemic lockdown cut the data collection period short, which resulted in gathering only 50 participants for the study, which affected the depth of the outcomes of the research. Widening the scope of this study could yield a more realistic balance of farmers across the three credit risk categories, thereby leading to a better understanding of the key determinants of credit risk. Additionally, some measures of credit risk, such as solvency and liquidity ratios, could not be considered in this study, mainly because they require sensitive information from participants. These ratios are significant determinants of credit risk according to some of the literature reviewed (e.g. Jouault & Featherstone, 2011; Bai et al., 2019; amongst others), and more up-to-date regional and national data could assist in this regard for further studies.

Whilst this study is positioned within the South African commercial farming environment, it has relevance for similar international studies as it proved that essential determinants of farmers' creditworthiness include factors such as the farm's location, farmer's reliance on farm income, ability to diversify farming activities, and access to financial institutions.

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Appendices

Appendix 1. A description of the variables in the regression model

Independent Variable	Description	Coding
ED	Highest level of formal education	0 = Grade 11 or lower 1 = Matric 2 = Diploma 3 = Undergraduate degree 4 = Postgraduate degree Note: no participant selected 'Grade 11 or lower'
TRAIN	Formal agricultural training received	0 = None 1 = various agric. short courses 2 = agricultural diploma 3 = agricultural degree Note: If more than one selected, then highest training applied.
FSIZE	Total size of farming operation (ha)	0 = <100 ha 1 = 100-199 2 = 200-500 3 = 501-1000 4 = 1001-2000 5 = 2001-3000 6 = >3000
PROX	Proximity of farming operation to nearest urban centre (km)	0 = <10 km 1 = 10-20 2 = 21-30 3 = 31-50 4 = >50
PRICE	Farmer influence on prices received	1 = substantial influence 2 = some influence 3 = no influence ('price taker')
TYPE	Full-time or part-time farmer	1 = full-time 2 = part-time
MGNT	Who manages farm operation (for most part)	1 = yourself 2 = family member 3 = manager 4 = staff
FINADV	External financial advice utilised	0 = none 1 = financial advice from bank or other 2 = technical advice 3 = both financial and technical advice
INCOMEREL	Reliance on non-farm income to maintain standard of living	1 = yes 2 = no
RMS	Sum of commonly used risk management strategy per participant	1 = one strategy used 2 = two strategies used 3 = three strategies used 4 = four strategies used
TURN	Annual farming turnover (R)	'Turnover logged value' variable created to use as % in analysis. Left as continuous variable and analysed in SPSS.
FUND	Financial institution used to fund farming operation	1 = commercial bank 2 = other institution 3 = no debt
Credit risk components	**Description**	**Coding**

INTRATE	Interest rate paid on overdraft facility	0 = not applicable (no overdraft) 1 = prime or below 2 = between prime and Prime + 2% 3 = higher than prime + 2%
SECURITY	Security held by bank for overdraft	0 = not applicable (no overdraft) 1 = unsecured or secured by personal guarantee 2 = Secured by bond over immovable property, or bond over immovable property and personal guarantee 3 = secured by lien over movables, or lien over movables and bond over immovables and personal guarantee
DEBTSERV	Ability to service debt commitments	1 = current with all loan repayments 2 = current with most but not all loan repayments 3 = currently in default with most or all loan repayments Note: No participant selected option 3
CFDIFF	Frequency of experiencing cash flow difficulties	1 = never 2 = occasionally 3 = frequently
LOANAPP	Outcome of loan applications in last 3 years	0 = not applicable (did not apply for loans) 1 = received all finance applied for 2 = received some of finance applied for 3 = received none of finance applied for Note: No participant selected option 3
CRISK SUM (dependent variable)	Credit risk as a sum of scores from the above 5 items.)	1 = score of 2-5 = low credit risk 2 = score of 6-10 = medium credit risk 3 = score of 11-15 = high credit risk

Source: Self-compiled (2020)