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Microfinance for agricultural firms - What can we learn from bank data?

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**Selected Paper prepared for presentation at the International Association of
Agricultural Economists (IAAE) Triennial Conference, Foz do Iguacu, Brazil, 18-24
August, 2012.**

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The authors are grateful to Access Microfinance Holding AG and LFS Financial Systems GmbH in Berlin, Germany for the provision of data, in particular to Patrick Schoeneborn as well as Juergen Rausch and his colleagues from the LFS IT department. Furthermore we would like to thank Christoph Diehl from LFS Financial Systems GmbH and Eva Terberger, Marlis Sieburger and Jan Schrader from the Independent Evaluation Department of KfW for contributing their expertise and helpful comments.

Abstract

Using a unique dataset of a commercial microfinance institution (MFI) in Tanzania this paper investigates first whether agricultural firms have a different probability to get a loan and whether their loans are differently volume rationed than loans to non-agricultural firms. Second, we analyze whether agricultural firms repay their loans with different delinquencies than non-agricultural firms.

Our results reveal that agricultural firms face higher obstacles to get credit but as soon as they have access to credit, their loans are not differently volume rationed than those of non-agricultural firms. Furthermore, agricultural firms are less often delinquent when paying back their loans than non-agricultural firms.

Our findings suggest that a higher risk exposition typically attributed to agricultural production must not necessarily lead to higher credit risk. They also show that the investigated MFI overestimates the credit risk of agricultural clients and, hence, should reconsider its risk assessment practice to be able to increase lending to the agricultural sector. In addition, our results might indicate that farmers qualify less often for a loan as they do not fit into the standard microcredit product.

Keywords Agricultural Finance, Access to Credit, Loan Repayment, Microfinance Institutions

JEL codes G21, G32, Q14

Introduction

Agricultural income is generally considered to be volatile due to its dependencies on production (weather, pests and diseases) and market (commodity prices) risks (Binswanger & Rosenzweig, 1986; Paxon, 1992; Heimfarth & Musshoff, 2011). Income volatility can even be more severe in the absence of suitable agricultural insurance products (Rosenzweig & Binswanger, 1993), which is especially the case for small-scale farmers in developing countries (Roth et al., 2007; SwissRe, 2011). This also affects the share of income available for loan repayment of agricultural borrowers, which in consequence can lead to higher loan defaults (Barry, 2001). This seems especially plausible for small scale-farming households which only have limited potential to compensate income fluctuations. Therefore, financial institutions in developing countries are still cautious to lend to small farmers (Zeller et al., 1997), a behavior which might also be attributed to the characteristics of financial sectors and to the history of agricultural finance in developing countries (Adams & Graham, 1981; Maurer, 2011).

Financial sectors in developing countries are often characterized by low financial intermediation (i.e. bank credit to the private sector in relation to the Gross Domestic Product), low diversification but high profitability (IBRD, 2012). Consequently, large shares of financial assets are held by few highly profitable regular banks which mainly focus on urban situated large enterprises (IFC, 2010). As long as profits are high and competition is low, regular banks will continue to focus only on highly collateralized investments with low credit risks, which are rarely found in the micro, small and medium enterprise (MSME) sector and especially not amongst small-scale agricultural producers. Also, most regular banks are not adapted to serve MSMEs of which most operate informally and, hence, are neither registered nor have a proper book keeping, which could serve as a basis for client assessment. As a result, many MSMEs do not have access to credit and other financial services (CGAP, 2010; Reyes & Lensink, 2011).

This situation is even worse in the lesser populated rural areas where reaching and monitoring clients is relatively expensive for lenders compared to the densely populated urban areas. Despite that most of the agricultural production takes place in rural areas, lending to the agricultural sector remains low. From a macroeconomic point of view, this is surprising as the agricultural sector in developing countries usually contributes large shares to the Gross Domestic Product and should, therefore, be more in the focus of lenders. Beside its economic importance, the agricultural sector also employs the major part of the rural labor force of which a large share is considered to be poor and, thus, the development of the agricultural sector could help to increase the income of farmers.

Frequently, it is reported that farmers in developing countries are credit rationed (Simtowe et al., 2008). Nevertheless most of the investigations on access to credit for farmers have two major shortcomings: First, they generally do not consider comparisons with other sectors. Therefore, it is difficult to judge whether credit rationing is a general problem in the investigated economy or a phenomenon that only appears in the agricultural sector. Second, they only focus on access to credit but cannot account for the credit risk even if some of these investigations, such as Petrick (2004) and Foltz (2004), link rationing effects to firm characteristics. Therefore, it is not possible to draw conclusions on whether credit rationing is rationale from a financial institution perspective.

The contribution of this paper is, therefore, twofold. Based on a unique dataset from a commercial microfinance institution (MFI) in Tanzania, we first investigate whether farmers have a different probability to access credit and also whether the loan amounts they receive

differ from those of non-agricultural loan applicants. Second, we compare the delinquency ratio of agricultural clients with those of non-agricultural clients of the MFI in order to investigate whether the loan repayment behavior of farmers differs from non-agricultural clients of the bank.

To our knowledge, this is the first paper which simultaneously investigates access to credit and the repayment behavior of agricultural borrowers. Thus, our investigations will provide a valuable contribution to the agricultural credit rationing literature.

The remainder of the paper is organized as follows: In the second part, we will provide a brief overview of the microfinance development and present an approach of credit rationing which MFIs apply to manage their credit risk. This leads to our research hypotheses. In the third part, the data are presented, and the analytical methods which are applied to investigate the hypotheses will be discussed. After the discussion of the results in the fourth part, the paper ends with conclusions and suggestions for future research.

Literature Review and Hypotheses

Access to Finance for Agricultural MSMEs

Driven by negative experiences of the supply-led development finance period in the 1960s and 1970s and the failure of state owned development banks in the 1980s (Adams & Graham, 1981; Maurer, 2011), governments and central banks in many developing countries have started to constantly improve the regulatory and operating environment in the financial sector (IBRD, 2010; CGAP, 2010). These improvements were important preconditions for the successful development of the commercial microfinance industry, which is driven by various attempts such as developing regular banks to better serve MSMEs and professionalizing existing and creating new MFIs (Krahnert & Schmidt, 1994; Maurer, 2011). Thereby informal MSMEs represent the target clients of MFIs as informal MSMEs are normally neglected by regular banks. Rather than applying the conventional, collateral based lending approach followed by regular banks or the joint liability principle of group lending mostly applied by non-commercial MFIs, commercial MFIs typically use individual cash flow and income-based lending techniques instead. Thereby the family and the business income, i.e., the total household income, determines the repayment capacity of a loan applicant and is the basis for the decision of the MFI whether a loan is granted and how much credit will be disbursed. As reliable income statements or balance sheet data are hardly available in the informal MSME sector, MFIs themselves carry out detailed assessments of loan applicants to evaluate their repayment capacities¹.

As the microfinance approach has proven its success of sustainable-inclusion of formerly financially excluded MSMEs, successfully operating commercial MFIs can currently be found in many developing countries. Most of these MFIs, however, still operate in urban areas. Similar to regular banks, the biggest challenges for commercial MFIs to access rural MSMEs are high transaction costs and dealing with agricultural specific credit risks. The latter might also explain why empirical research on access to finance frequently suggests that agricultural firms are credit rationed (Beck et al., 2003; Bell et al., 1997; Diagne et al., 2000; Foltz, 2004; Petrick, 2004; Simtowe et al., 2008). This would especially be the case if agricultural firms were also relatively credit rationed, i.e., in comparison to other sectors. However, this aspect was not yet investigated by the existing literature on access to finance for agricultural firms.

¹ For further information on the principles of microfinance the reader is referred to Armendáriz & Morduch (2010) and Turvey & Kong (2007).

As most of the risks inherent to agricultural MSMEs are similar to non-agricultural MSMEs (Maurer, 2010), the commercial microfinance approach seems appropriate to also address the financial needs of small farmers in developing countries. Hence, it is not surprising that a recent approach to enhance access to finance for agricultural MSMEs is driven by the commercial microfinance industry. Christen & Pearce (2005) have presented the principles of this new “Agricultural Microfinance Model” which adapts the general microfinance approach for agricultural MSMEs. By taking into account the production specifics of the agricultural sector, the core approach of this model is the adaptation of standard microloans so that repayment schedules can reflect the cyclical cash flows of agricultural borrowers².

Given the risk exposition of agricultural firms and the inadequacy of standard microloans to finance agricultural producers, our first hypothesis (H) is the following:

H₁ “different probability”: The probability to have access to credit is significantly different for farmers compared to non-agricultural entrepreneurs.

Credit Rationing

Whilst risk adjustments of interest rates are one option to account for different credit risks (Jaffee & Stiglitz, 1990), most MFIs are bound by unique interest rates. Risk heterogeneity is typically addressed by loan volume rationing, based on the assumption that smaller loan sizes reduce potential credit losses (Barry, 2001; Hodgeman, 1960; Jaffee & Modigliani, 1969; Jaffee & Stiglitz, 1990). The higher the risk of a loan applicant the lower are the loan amounts he will receive. Of course, the loan volume is not the only determinant of credit risk which can also depend on the applicant’s repayment capacity and his sector affiliation (Barry, 2001). Pederson & Zech (2009) even see sector-related risks as the most important part of credit risk.

Therefore, our second hypothesis is the following:

H₂ “different volume”: The magnitude of volume rationing is significantly different for farmers compared to non-agricultural entrepreneurs.

Loan Repayment

Surprisingly, most of the investigations on agricultural credit rationing, e.g., Simtowe et al. (2008), do not measure the extent of credit rationing directly from bank information which, by definition, should be the most straight forward way of measuring. Jaffee & Modigliani (1969) already stated that the reason for not using direct measures might be the limited data

² For further reading on the development of rural microfinance also see Hatarska & Holtmann (2006), Kono & Takahashi (2010) and Meyer & Nagarajan (2006).

availability. Using bank information would, furthermore, have the advantage that it allows for the investigation of the loan repayment performance of borrowers, which might also explain the loan granting behavior of financial institutions.

Literature which addressing loan repayment aspects with a focus on agricultural MSMEs is scarce and includes Fidrmuc & Hainz (2010), who state higher loan default rates for farmers in Slovakia. Furthermore, there are Baele et al. (2010), who find in their duration analysis focused on loan defaults in Pakistan ambivalent effects for the agricultural sector depending on the underlying distribution of the applied hazard function. In contrast, Raghunathan et al. (2011) find that a higher share of agricultural loans increases the average repayment efficiency of MFI borrowing groups in India. A similar finding reveals Vogel (1981), who investigates the loan repayment behavior of bank clients in Costa Rica and finds (under the condition of subsidized interest rates) lower loan default rates for farmers compared to non-agricultural borrowers. Vogel (1981) attributes these effects mainly to the incentive for agricultural clients to have continuing access to credit if repayment is prompt and the decentralized and extensive client assessment procedures of the loan granting financial institution. These aspects also play an important role in commercial microfinance practice (Turvey & Kong, 2007).

As the findings for loan repayment are ambivalent our third hypothesis is as follows:

H₃ “different delinquencies”: Loan delinquencies of agricultural loans are significantly different from those for loans to other sectors.

Data and Methods

Data

The data we use for our empirical analysis was provided by AccessBank Tanzania Ltd (ABT), a commercial MFI with a special focus on MSMEs. The bank operates in Tanzania as a fully-fledged commercial bank and is owned by the five founders, the Access Microfinance Holding, the Belgian Investment Company for Developing Countries, KfW (the German Development Bank), the International Finance Corporation and the African Development Bank. During the first four years of operation from 2007 to 2011, the bank grew steadily and currently runs six branch offices in greater Dar es Salaam. ABT disburses all loans in the local currency, Tanzania Shilling (TZS), and procedures of the bank are specially designed and only allow for disbursing individual loans. At the moment, the bank offers one loan product in the micro segment, and loans to agricultural entrepreneurs are granted under the same

procedures like any other microloan. Hence, they are not yet adapted to the agricultural production cycles and have fixed repayment schedules and maturities without grace periods. In addition ABT offers deposits, automatic teller machine (ATM) services, money transfers (domestic and international) and mobile phone banking services.

The loan granting process of ABT is typical for commercial MFIs involved in individual lending: First, through a rapid appraisal of a loan applicant (for simplicity reasons subsequently referred to as client) a specially trained loan officer decides whether the client is eligible, i.e., the client can provide a proof of identification, is minimum of 18 years old, and the cash flow of his business seems sufficiently high to repay a loan. The loan request which leads to the rapid appraisal can either come directly from the client through a loan application form or can be stimulated by the loan officer who directly contacts the entrepreneur (direct marketing). Through the rapid appraisals about 30 % of all loan requests are rejected. Provided that the minimum criteria are given, the loan officer will then continue with an in-depth client assessment. During the in-depth client assessment, detailed information about the client's private and business income as well as expenses are collected in order to calculate the loan repayment capacity. In a third step, this information is cross-checked through the loan officer by asking family members and referees of the applicant whether the information provided is reliable. Also, the client has to provide some collateral. As the liquidation of collateral for small loan amounts is costly and often legally difficult in contrast to conventional banking, the role of collateral in microfinance is mainly to serve as incentive for the borrower to repay. Furthermore, it avoids client over-indebtedness as the client would not be able to pledge the same collateral item for a loan application with another bank.

After the in-depth client assessment, the loan officer decides whether the loan application can proceed to the fourth and final step in the loan granting process (credit committee). If the likelihood for a loan rejection in the credit committee is high, the loan officer will reject the application. In the credit committee meeting the loan officer presents the results of his in-depth client assessment and suggests the loan maturity and the amount he would grant based on his assessment. Credit committee meetings are held daily in the ABT decentralized on branch office level. Besides the loan officers presenting the client assessment results, these committees consist of at least one experienced senior loan officer or the branch office manager and other loan officers working in the area. Based on the joint opinion of the credit committee, the requested loan amount and loan maturity will be fully approved or it will be

fully or partly rejected. The loan decision is based on the client's repayment capacity and the reliability of the information he provided.

The dataset we use comprises all microloans ABT has disbursed since the first month of operation in November 2007 until the end of April 2011. Our data were extracted from the Management Information System (MIS) of the bank and include loan and respective client data. The loan data (e.g. number of installments, interest rate) are generated automatically by the MIS as soon as a loan is disbursed. The client data which are generated through the in-depth client assessments by the loan officers are entered manually into the MIS. Consequently, it was necessary to clean the client data for obvious data entering errors and outliers, which was jointly conducted with the management of ABT. Furthermore, we excluded those loan applications that were withdrawn by the client before the bank had made a loan decision, loans that were still in the decision process and loans with incomplete client or loan data. After the data cleaning process for initially 22,978 requested microloans, the remaining population consists of 21,334 requested working capital and investment loans including 538 loans to agricultural entrepreneurs.

Whether a client is classified as an agricultural entrepreneur is decided by the bank along the following two criteria: First, more than 50 % of the *household income* of the client must be generated through agricultural production, i.e. crop, fruit and vegetable or livestock production. Second, the client must use the loan for agricultural production purposes. This strict classification covers only primary agricultural producers. Clients with businesses only related to agricultural production (input supply for farmers, processing of agricultural produce) are not considered as agricultural clients.

Methods

In order to investigate H_1 "different probability," we estimate a Probit-Model for the probability of a loan application to be approved. For the investigation of H_2 "different volume," the magnitude of volume rationing, we estimate a Heckman-Model proposed by Heckman (1979) to allow for conditional dependency between the credit access and the volume rationing decision³. The probability of receiving a loan and the magnitude of volume rationing for all 21,334 loan applications ABT has received are estimated as follows:

$$A_{i,t}^* = \alpha + \beta \cdot a_i + \gamma \cdot c_{i,t} + \delta_t + \varepsilon \cdot s_i + u_{i,t} \quad (1)$$

³ For the case of independency between the credit access and the volume rationing decision, the magnitude of volume rationing could be estimated separately for the sample of approved loans (Cragg, 1971).

$$K_{i,t} = \alpha + \beta \cdot a_i + \boldsymbol{\gamma} \cdot \mathbf{c}_{i,t} + \delta_t + \boldsymbol{\varepsilon} \cdot \mathbf{s}_i + v_{i,t} \quad (2)$$

In equation (1), the dependent variable $A_{i,t}^*$ denotes a dichotomous (1, 0) latent variable indicating whether the bank disburses a loan amount greater than zero to a client i who applied for the loan in year t . In equation (2), the dependent variable $K_{i,t}$ denotes the loan amount disbursed by the bank to a client i who applied for the loan in year t . Furthermore α is a constant, a_i is a (dummy) variable accounting for the *agricultural sector affiliation*⁴ of the client, $\mathbf{c}_{i,t}$ is the vector of client characteristics (e.g. *age*), δ_t is a time constant for the year t of loan application, \mathbf{s}_i is a vector of dummy variables accounting for the branch offices of ABT where the loan decision was made⁵, $\boldsymbol{\gamma}$ and $\boldsymbol{\varepsilon}$ are parameter vectors and $u_{i,t}$ and $v_{i,t}$ denote the over i and t independently and identically distributed error terms with a mean of zero and a variance of σ_u^2 and σ_v^2 , respectively.

We measure the extent of volume rationing through equation (2) indirectly by including the *requested loan amount* in the vector $\mathbf{c}_{i,t}$ of client characteristics. Therefore, *ceteris paribus* lower disbursed loan amounts indicate a higher magnitude of credit rationing. This approach, also applied by Agier & Szafarz (2011), allows us to investigate the influence of the requested loan amount on the magnitude of volume rationing. As higher loan volumes increase the credit risk (Barry, 2001; Jaffee & Stiglitz, 1990), we see the requested loan amount as one of the key determinants for volume rationing.

In order to examine H_3 “different delinquencies,” we estimate an OLS-Model for all loans disbursed by ABT and apply a similar approach to Raghunathan et al. (2011) by using the ratio between delinquent loan installments and total loan installments due (delinquency ratio) as the dependent variable. Compared to the 18,101 uncensored observations used for the estimation of equation (2), we had to exclude 548 loans which were not disbursed or for which the first loan installment was not due at the time of data extraction. The repayment performance is estimated as follows:

$$D_{i,t} = \alpha + \beta \cdot a_i + \boldsymbol{\gamma} \cdot \mathbf{c}_{i,t} + \varepsilon_t + \boldsymbol{\epsilon} \cdot \mathbf{s}_i + e_{i,t} \quad (3)$$

Herein the dependent variable $D_{i,t}$ denotes the delinquency ratio of a loan, which was disbursed in year t . Furthermore, ε_t is a time constant for the year t of loan disbursement, $\boldsymbol{\epsilon}$ is a parameter vector and $e_{i,t}$ is the over i and t independently and identically distributed error

⁴ The investigation of interaction effects between the agricultural sector affiliation and other independent variables is beyond the scope of this paper.

⁵ For the selection equation of the Heckman-Model we exclude \mathbf{s}_i , the vector of branch offices to avoid collinearity among the regressors (Wooldridge, 2002, pp. 565-566).

term with a mean of zero and a variance of σ_e^2 . All other vectors and variables are similar to equation (1) and (2).

Our approach measures credit risk by the frequency of late payments during the loan repayment period. Rosenberg (1999) states that the frequency of delinquencies is an important indicator for credit risk as frequent delinquencies increase the risk for loan defaults. We also argue that the delinquency ratio provides a good indication whether borrowers are in serious loan repayment troubles. In this context, Schicks (2012) states that microfinance clients in Ghana make hard sacrifices only to be able to pay their loan installments on time. In addition, MFIs will usually not wait until the client has not paid a subsequent loan installment and rather visit the client soon after the missed due date to prevent a loan default (Raghunathan et al., 2011).

Table 1 shows the descriptive statistics of the dependent and independent variables and the expected direction of the influence of the independent on the dependent variables for our three estimations. The descriptive statistics are provided separately for the group of agricultural and the non-agricultural clients.⁶

[Insert Table 1 about here]

The vector $\mathbf{c}_{i,t}$ of client characteristics includes *household income*, *requested loan amount*, *disbursed loan amount*, *age*, *gender*, *number of family members*, whether the client has a *higher education* (university level, medium technical college, diploma, advanced diploma), whether the client is a *repeat client* or has a *deposit* with ABT. For the independent variables *household income*, *requested / disbursed loan amount*, *age* and *family members*, we also included them in a squared form in order to check for other influences besides linear on the dependent variables. For each of the (squared) variables, the expected influence is explained in Table 1.

In order to be able to investigate the influence of time (*Year of Loan Application*, *Year of Loan Disbursement*) and branch office (*Branch Office Number*) effects, we excluded the year 2011 and branch office number five to avoid perfect multicollinearity. Furthermore, this allows us to use the current year and the lastly opened branch office, number five, as benchmarks in the analysis. Consequently, the estimated influences for time and branch office

⁶ Despite the low share of agricultural loans in our population, the absolute number of agricultural loans is sufficiently high to calculate robust test statistics for the dummy variable *agricultural sector affiliation* in the Probit-, Heckman-, and OLS-Model.

on the dependent variables have to be interpreted in relation to year 2011 and branch office number five, respectively.

The test for homoscedasticity was rejected for the access to credit as well as the repayment performance estimation.

The mean comparison in Table 1 reveals that whilst there are no significant differences for *household income* and *requested loan amount*, agricultural firms have significantly lower loan approval rates and receive significantly lower loan amounts than non-agricultural firms. Also there is no significant difference for loan delinquencies. Furthermore, farmers are on average five years older, have a slightly larger family size, are mostly female and are better educated than non-agricultural loan applicants.

The descriptive statistics also indicate that ABT has started its operation late in 2007 as the loan applications and loan disbursement increase strongly after 2007. Second, the different shares of the total loan applications for each branch office show that ABT has started operation with only one branch office in 2007. Hence, branch offices which started to operate earlier in time show the largest shares of loan applications. It is also obvious that in 2007 no loans to agricultural firms were issued.

Results

The results for the estimation of the Probit-Model (probability of receiving loan) and the Heckman-Model (magnitude of volume rationing) are shown in Table 2. The first column indicates the name of the independent variables with “Square” indicating the quadratic term. The explanatory power of both models is considered as high because 89.30 % of the observations are correctly predicted using the Probit-Model and the R^2 equals to 0.87 for the Heckman-Model. The insignificant inverse mills ratio in the Heckman-Model reveals that the magnitude of volume rationing is independent from the probability of receiving a loan.

[Insert Table 2 about here]

Our results for the *agricultural sector affiliation* reveal that there are significant differences between agricultural and non-agricultural clients for the probability of receiving a loan. In fact, agricultural clients of ABT have on average a 3 % lower probability of receiving a loan. Thus, we can accept H_1 “different access.” For those agricultural clients who have access to credit, the magnitude of volume rationing is not significantly different than for other clients of ABT. Therefore, we have to reject H_2 “different volume.”

Our finding that agricultural clients have a lower probability of receiving a loan is in line with the findings of most of the empirical literature on agricultural credit rationing, which frequently reports that agricultural clients are credit rationed (Diagne et al., 2000; Petrick, 2004; Simtowe et al., 2008). We now can show that these findings still hold in comparisons to other sectors indicating that agricultural clients also face relatively higher obstacles to have access to credit. However, we will later discuss why this effect is only significant for the probability of receiving a loan but not for the magnitude of volume rationing.

We further find a significantly positive influence of the *household income* on the probability of receiving a loan and the disbursed loan amounts⁷ indicating that higher household incomes increase the probability of receiving a loan but also reduce the extent of volume rationing. For the probability of receiving a loan, this effect is decreasing with increasing income as the significant quadratic term reveals. Taking into account the underlying principles of the cash flow based microfinance approach and the in-depth loan assessment procedures of ABT, this is not surprising.

When looking at the influence of the *requested loan amount* we further find that the *requested loan amount* does negatively influence the probability of receiving a loan as the significant quadratic term reveals. The coefficient is hence smaller than zero, indicating that on average only 58 % of the requested loan amount is disbursed. The magnitude of volume rationing is significantly lower for larger requested loan amounts. This effect even is significantly increasing as the positive and significant quadratic for the magnitude of volume rationing reveals. These findings are ambivalent as they reveal that applicants who request larger loan amounts have a lower probability to receive a loan but as soon credit access is given larger loans are significantly less volume rationed. Whilst the first seems plausible the latter is surprising as larger loan sizes bear higher default risks. As Baele et al. (2010) assume that larger firms receive larger loan sizes this result also indicates that smaller firms have better credit access but are more likely to be volume rationed than bigger firms.

The client's *age* neither influences the probability to get a loan nor the magnitude of credit rationing. Hence, the age seems to play no important role for the loan decision of ABT, and is not surprising for two reasons: First, as we have included the educational level of the loan applicants, all formal education which is generated during the life cycle is accounted by this variable. Second, as the mean of the maturity of all loans disbursed by ABT is about nine

⁷ We would like to remind the reader that we use an indirect approach to measure the magnitude of volume rationing. Thus a positive influence on the loan amount disbursed indicates a lower magnitude of volume rationing.

month, the risk that the client runs into serious health problems (which is more likely for older clients) that could endanger loan repayment is limited.

With regard to *gender affiliation*, the probability of receiving a loan is highly independent from gender being contradictory to Reed (2011) and Armendáriz & Morduch (2010, p. 219) who find that women have better credit access than men. However, as soon as women receive a loan, they are significantly stronger volume rationed than men, a finding which is in line with Agier & Szafarz (2010).

The *family size* plays a significant role for the probability of receiving a loan and for the magnitude of volume rationing. The larger the family size, the higher the probability of receiving a loan and the lower the magnitude of volume rationing. This influence of the family size is decreasing for the probability of receiving a loan as the significant quadratic term reveals. This finding suggests that an increasing family size not only affect household expenses but might also increase the number of income-generating household members.

The *educational level* of the client influences the probability of receiving a loan significantly negative and the magnitude of volume rationing significantly positive. The first is surprising and in contrast to Briggeman et al. (2007) who find that a higher educational level leads to a higher likeliness of having credit access. The latter seems plausible as a higher educational level might increase the business abilities of a loan applicant and hence the credit risk might decrease.

The borrower-lender-relationship indicated by the variables *repeat client* and *deposit* have a significant positive influence on the probability of receiving a loan and reduce the magnitude of volume rationing. Hence, we confirm the findings of the borrower-lender-relationship research by attributing a high relevance to bank client relations for credit access (e.g. Berger & Udell, 2002; Petersen & Rajan, 1994).

Time (*Year of Loan Application*) effects indicate that the probability of receiving a loan and the magnitude of volume rationing differs with only few exceptions significantly between years. These differences are not surprising as Tanzania's economy is prospering and therefore the economic activity especially in and around urban areas increases which, in turn, increases bank lending (CGAP, 2010). This argument is supported by increasing probabilities of receiving a loan over the period 2008-2010 (compared to benchmark year 2011). Furthermore, the time effects for the probability of receiving a loan could indicate an increasing business experience for ABT. This process typically goes along with adjustments

of the (risk) management procedures which might explain the fluctuations of the magnitude of volume rationing over the years.

Also, the branch office (*Branch Office Number*) effects indicate that the probability of receiving a loan and the magnitude of volume rationing differ significantly between branch offices. In fact, we find that in comparison to benchmark branch office number five, the probability of receiving a loan and the magnitude of volume rationing is lower for all other branch offices. As all our investigated microloans in ABT are approved on branch office level, branch office effects can account for differences in the economic activity and sector concentrations within the business range of the branch offices. They could, furthermore, indicate that the management and, thus, the loan granting process of ABT differ amongst branch offices.

The results for the estimation of the OLS-Model for the loan repayment are given in Table 3.

[Insert Table 3 about here]

Our findings indicate that loan delinquencies differ significantly between agricultural and non-agricultural clients. Consequently, we can confirm H_3 "different delinquencies." Agricultural clients report an average of 14 % significantly lower delinquency ratio compared to non-agricultural clients. This is surprising as due to production and market risks attributed to agricultural production literature often assumes the opposite (Zeller et al., 1997). Also, there seems no reason to assume a self-selection problem as the results of our first estimation (probability of receiving a loan) reveals a higher rejection rate for agricultural clients. Our findings are in line with Vogel (1981) and Raghunathan et al. (2011), and we can confirm these results in the African context under the condition of unsubsidized interest rates and for a commercial MFI.

We further find no significant influence for *household income* on loan delinquencies which seems plausible as the extent of volume rationing mainly depends on the household income of the client, and the loan amounts disbursed are adjusted accordingly. This result also confirms the irrelevance of income for loan repayment as stated by Kropp et al. (2009).

When looking at the influence of the *disbursed loan amount* we further find significantly higher loan delinquencies for larger disbursed loan amounts (with decreasing effects) which is in line with Barry (2001), Hodgeman (1960) and Jaffee & Stiglitz (1990) who attribute a higher credit risk to larger loans. As larger firms seem to receive larger loans, this result could indicate lower delinquencies for smaller firms.

The significant positive influence of the client's *age* on loan delinquencies indicates higher and as the significant quadratic term reveals also diminishes loan delinquencies for older clients. This is in contrast to the literature which often attributes more business experience to older clients (e.g. Briggemann et al., 2007), leading to lower loan delinquencies. The reason might be that there are more unforeseen household expenses with increasing age, e.g., expenses for depending relatives that endanger loan repayment.

With regard to *gender affiliation*, we find significantly higher loan delinquencies for women than for men. This is in contrast to Armendáriz & Morduch (2010, p. 219) and Agier & Szafarz (2011) stating that women are the more reliable borrowers. However, our findings might be related to the urban focus or the legal form of ABT. In this regard d'Espallier et al. (2011) find in their global analysis of MFIs that gender effects depend significantly on the geographical focus and the legal form of the financial institutions. Also Godquin (2004) cannot prove better repayment rates for women. In terms of gender discrimination, defined by Agier & Szafarz (2011) as a situation where women face stronger credit rationing despite a better loan repayment, we cannot find evidence for ABT.

The *family size* has a significantly negative influence on loan delinquencies. This effect is increasing as the significant quadratic term reveals. This result supports our argument that an increasing family size not only increases household expenses but might also increase the repayment capacity.

The *educational level* of the client has no significant influence on loan delinquencies. On the one hand, this is surprising as we would have expected that a higher level of education leads to a higher repayment reliability. On the other hand, this finding is in line with the adequacy of the microfinance approach to address informal MSMEs, which can mainly be found amongst the poorer and, hence, also lower educated population.

The influence of the borrower-lender relationship on loan delinquencies indicates that being a *repeat client* does not influence the delinquency ratio whilst having a *deposit* with the bank reduces loan delinquencies significantly. These findings indicate that the information gained by the bank through established business relationships seems to be only of relevance for loan repayment if the clients are depositors. The finding on deposits might also highlight the importance of deposits as cash collateral which the bank can debit in the case of delinquencies.

Time (*Year of Loan Disbursement*) effects indicate that the loan repayment differs significantly between years. In fact, loan delinquencies fluctuate over years but were always higher in the past compared to benchmark year 2011.

With regard to branch office (*Branch Office Number*) effects, our results indicate that loan repayment differs significantly between branch offices. As the management of each branch office is expected to adjust the credit risk management according to the prevailing economic activity within its business range, loan delinquencies should not differ amongst branch offices. Consequently, our results support the argument that branch differences can be attributed to the management practice of the branch offices rather than to the economic activity within the range of the branch offices.

Conclusion and Outlook

Although it is frequently reported that agricultural firms are credit rationed, most investigations in this context focus on the borrower perspective to investigate the access to credit for farmers but neglect the point of view of financial institution. As the loan repayment is an important determinant for the loan granting decision of financial institutions, our analysis focuses on the financial institution perspective. Thereby, we investigated for ABT a MFI in Tanzania, first, whether agricultural firms have a different probability of receiving a loan and whether they are differently volume rationed than non-agricultural firms. Second, we analyzed whether agricultural firms repay their loans with different delinquencies than non-agricultural firms. In order to do so, we estimated a Probit-Model for the probability of receiving a loan, a Heckman-Model to investigate the magnitude of volume rationing and an OLS-Model to investigate the loan delinquencies of all microloans disbursed by ABT. Our results reveal that agricultural firms have a 3 % lower probability to get credit but as soon as they have access to credit, their loans are not differently volume rationed than the loans of non-agricultural borrowers. Furthermore, our results show that compared to non-agricultural borrowers, agricultural borrowers have a delinquency ratio that is on average 14 % lower when paying back their loans.

Our findings suggest that lending to agricultural firms must not necessarily lead to higher credit risk if the risk exposure of agricultural firms is addressed adequately by the lender. For the case of ABT this leads to an overestimation of the credit risk of agricultural clients as the lower loan delinquencies account for those agricultural firms that have received a loan. ABT should, thus, reconsider its risk assessment practice for agricultural firms. This might also lead to a better inclusion of women entrepreneurs as about 70 % of ABT's agricultural clients

are women. However, even if the bank overestimates the credit risk of agricultural clients, our results might also indicate that farmers qualify less often for a loan as they do not fit into the standard microcredit product. This is suggested by the lower probability of receiving a loan for agricultural firms, whilst they face no different magnitudes of volume rationing. This argument is further supported by the fact that most of ABT's agricultural clients are livestock producers where cash flows are *ceteris paribus* less volatile than in, e.g., crop production. However, the fact that agricultural firms are more often completely denied access to credit than non-agricultural firms seems to be in conflict with the idea of a broader provision of financial access for agricultural firms. Loan products for agricultural firms should therefore at least allow for flexible repayment schedules to avoid that agricultural firms are denied credit because their cash flows do not allow for a continuous loan repayment. In this regard, we also argue that as long as offered loan products cannot account for agricultural production specifics, the exploitation of the microfinance potential for agricultural firms will be limited. This will necessarily affect a successful outreach of MFIs into rural areas where agricultural production plays an important role.

Even though we can show that access to credit and loan repayment is different for agricultural firms, the current regional focus of ABT only allows for lending to agricultural firms in the greater Dar es Salaam area. Hence, our results might change in a rural setting. Besides general differences of the rural economic environment, the production type of agricultural firms might also differ in rural areas. Our results might also change in different country contexts. We, therefore, see a high relevance for future research to verify our findings for rural areas, different production types and for different countries. A further field of research might be the application of an approach similar to that in the present study for MFIs which have already introduced agricultural microcredit products. This will allow for investigations whether the Agricultural Microfinance Model of Christen & Pearce (2005) really is the key to overcome the obstacles of agricultural finance in developing countries.

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Table 1: Descriptive Statistics and Expected Directions of Effects

Variable ¹	Unit ²	Descriptive Statistics ³				Expected Direction of Effects ⁴			Explanation
		Agricultural		Non-Agricultural		Access		Delinquencies	
		Mean	SD	Mean	SD	Probit	Heckman	OLS	
Agricultural Sector Affiliation	1/0	-	-	-	-	?	?	?	credit access and loan delinquencies are different for farmers compared to non-farmers
Household Income	ThsTZS	986	1,084	1,040	1,232	↑	↑	0	a higher income increases access to credit but does not affect delinquencies
Household Income Square	-	-	-	-	-	↓	↓	0	effect is decreasing for access to credit, no effect on delinquencies
Requested Loan Amount	ThsTZS	960	1,073	882	1,216	↓	↓	-	larger loan sizes are more likely to be denied and to be volume rationed
Requested Loan Amount Square	-	-	-	-	-	↑	↑	-	effect is increasing with increasing loan size
Credit Approval	1/0	0.80	-	0.85	-	***	-	-	-
Disbursed Loan Amount	ThsTZS	2,155	2,181	2,435	2,462	**	-	↑	larger loans show higher delinquencies
Disbursed Loan Amount Square	-	-	-	-	-	-	-	↓	effect is decreasing with increasing loan size
Age	years	44	9.42	39	8.32	***	↑	↑	older experienced clients have better access to credit and show lower delinquencies
Age Square	-	-	-	-	-	-	↓	↓	effect is decreasing for access to credit and loan delinquencies
Female	1/0	0.71	-	0.40	-	***	↑	↑	women have better access to credit and show lower delinquencies
Family Members	number	5.29	2.08	5.00	2.00	***	↑	↑	a larger family size increases credit access and reduces delinquencies
Family Members Square	-	-	-	-	-	-	↓	↓	effect is decreasing for access to credit and delinquencies
Higher Education	1/0	0.30	-	0.24	-	***	↑	↑	a higher level of education increases access to credit and reduces delinquencies
Repeat Client	1/0	0.39	-	0.37	-	-	↑	↑	customer-lender relationships increase access to credit and reduces delinquencies
Deposit	1/0	0.72	-	0.74	-	-	↑	↑	customer-lender relationships increase access to credit and reduces delinquencies
Delinquency Ratio		0.13	0.20	0.15	0.23	-	-	-	-
Year of Loan Application	2007 1/0	0.00	-	0.02	-	?	?	-	
	2008 1/0	0.19	-	0.21	-	?	?	-	
	2009 1/0	0.31	-	0.29	-	?	?	-	year of loan application affects access to credit differently
	2010 1/0	0.30	-	0.31	-	?	?	-	
Year of Loan Disbursement	2007 1/0	0.00	-	0.01	-	-	-	?	
	2008 1/0	0.12	-	0.16	-	-	-	?	
	2009 1/0	0.31	-	0.30	-	-	-	?	year of loan disbursement affects loan delinquencies differently
	2010 1/0	0.34	-	0.34	-	-	-	?	
Branch Office Number	1 1/0	0.53	-	0.29	-	***	?	?	
	2 1/0	0.21	-	0.31	-	***	?	?	
	3 1/0	0.09	-	0.16	-	***	?	?	branch offices affect access to credit and delinquencies differently
	4 1/0	0.13	-	0.16	-	**	?	?	

¹ Bold variables are also dependent variables for credit access and loan delinquency estimations.

² ThsTZS, thousand Tanzania Shilling; As ABT records the monthly household income in ten ranges, we use the mean of each range to calculate the household income for each client.

³ ***, **, * indicate a significant mean difference between agricultural and non-agricultural firms on a 1%, 5% and 10% level respectively.

⁴ ↑, positive influence on dependent variable; ↓, negative influence on the dependent variable; ?, no a priori hypothesis on the influence on the dependent variable; -, not relevant for the respective estimation.

Table 2: Estimation Results for Credit Access¹

Variable		Probability of Receiving a Loan - Probit						Disbursed Loan Amount - Heckman					
Name	Unit ²	Coefficient	Slope	SE (robust)	z-value	p-value		Coefficient	SE (robust)	z-value	p-value		
Intercept		0.27		0.23	1.16	0.25		-379.48	128.67	-2.95	0.00	***	
Agricultural Sector Affiliation ³	1/0	-0.17	-0.03	0.08	-2.33	0.02	**	-13.65	38.33	-0.36	0.72		
Household Income	ThsTZS	1.10E-03	1.73E-04	4.77E-05	26.57	0.00	***	0.12	0.04	2.84	0.00	***	
Household Income Square		-1.99E-07	-3.13E-08	9.26E-09	-23.41	0.00	***	-7.38E-06	8.94E-06	-0.83	0.41		
Requested Loan Amount	ThsTZS	-1.70E-05	-2.68E-06	1.48E-05	-1.16	0.25		0.58	0.04	13.65	0.00	***	
Requested Loan Amount Square		-3.25E-09	-5.12E-10	1.28E-09	-2.55	0.01	**	1.89E-05	4.07E-06	4.64	0.00	***	
Age	years	0.01	1.20E-03	0.01	0.74	0.48		-3.59	5.36	-0.67	0.50		
Age Square		-1.84E-04	-2.89E-05	1.27E-04	-1.51	0.15		0.07	0.06	1.05	0.29		
Female	1/0	4.90E-03	7.82E-04	0.03	0.19	0.85		-46.91	13.15	-3.57	0.00	***	
Family Members	number	0.10	0.02	0.02	5.17	0.00	***	-15.96	12.06	-1.32	0.19		
Family Members Square		-8.44E-03	-1.30E-03	1.51E-03	-5.31	0.00	***	3.03	1.07	2.84	0.00	***	
Higher Education	1/0	-0.26	-0.44	0.03	-8.97	0.00	***	46.42	17.83	2.60	0.00		
Repeat Client	1/0	0.53	0.08	0.03	16.96	0.00	***	313.61	18.98	16.53	0.00	***	
Deposit	1/0	0.93	0.20	0.03	34.98	0.00	***	94.18	40.98	2.30	0.02	**	
Year of Loan Application	2007	1/0	-0.61	-0.14	0.09	-6.58	0.00	***	279.82	57.01	4.91	0.00	***
	2008	1/0	-0.71	-0.14	0.05	-14.20	0.00	***	18.64	34.04	0.55	0.58	
	2009	1/0	-0.19	-0.03	0.05	-3.95	0.00	***	233.55	20.88	11.19	0.00	***
	2010	1/0	-0.02	-2.87E-03	0.04	-0.38	0.68		71.57	18.54	3.86	0.00	***
Branch Office Number	1	1/0	-0.44	-0.08	0.06	-5.99	0.00	***	330.46	24.70	13.38	0.00	***
	2	1/0	-0.11	-0.02	0.07	-1.45	0.09	*	195.96	22.86	8.57	0.00	***
	3	1/0	-0.21	-0.04	0.07	-2.75	0.00	***	57.35	31.20	1.84	0.07	*
	4	1/0	-0.28	-0.05	0.07	-3.73	0.00	***	58.33	23.88	2.44	0.02	*
Inverse Mills Ratio (λ)								-40.33	116.25	-0.35	0.73		
Number of Observations				21,334				21,334 (3,233 censored)					
Model Significance (pseudo) R-square				Likelihood-Ratio-Test (21): 5,510 [p-value < 0.01]				Wald χ^2 (38): 130,232 [p-value < 0.01]					
Percent Correctly Predicted				89.30 %				0.87					
								n.a.					

¹ ***, **, * indicate a significance on 1%, 5% and 10% level respectively.

² ThsTZS, thousand Tanzania Shilling; as ABT records the monthly household income in ten ranges, we use the mean of each range to calculate the household income for each client.

³ Comprises only primary agricultural producers, i.e., livestock, crop as well as fruit and vegetable producers.

Table 3: Estimation Results for Credit Repayment¹

Variable		Delinquencies - OLS				
Name	Unit ²	Coefficient	SE (robust)	t-value	p-value	
Intercept		0.26	0.04	6.57	0.00	***
Agricultural Sector Affiliation ³	1/0	-0.02	9.71E-03	-2.45	0.01	***
Household Income	ThsTZS	3.44E-06	5.09E-06	0.68	0.50	
Household Income Square		-2.19E-10	1.07E-09	-0.20	0.84	
Disbursed Loan Amount	ThsTZS	1.38E-05	2.06E-06	6.67	0.01	***
Disbursed Loan Amount Square		-1.41E-09	1.80E-10	-7.86	0.00	***
Age	years	2.81E-03	1.34E-03	2.10	0.04	**
Age Square		-3.18E-05	1.53E-05	-2.08	0.04	**
Female	1/0	0.02	3.32E-03	4.62	0.00	***
Family Members	number	-7.41E-03	2.91E-03	-2.54	0.01	**
Family Members Square		5.79E-04	2.50E-04	2.32	0.02	**
Higher Education	1/0	4.84E-03	3.75E-03	1.29	0.20	
Repeat Client	1/0	-4.10E-03	3.47E-03	-1.18	0.24	
Deposit	1/0	-0.19	5.41E-03	-36.84	0.00	***
Year of Loan Disbursement	2007 1/0	0.06	0.02	2.91	0.00	***
	2008 1/0	0.06	5.88E-03	10.00	0.00	***
	2009 1/0	0.09	4.45E-03	19.14	0.00	***
	2010 1/0	0.06	3.57E-03	16.19	0.00	***
Branch Office Number	1 1/0	0.05	5.07E-03	10.32	0.00	***
	2 1/0	0.04	5.09E-03	7.08	0.00	***
	3 1/0	0.05	5.52E-03	9.09	0.00	***
	4 1/0	0.04	5.07E-03	7.73	0.00	***
Number of observations ⁴				17,553		
Model Significance			F-Test (21; 17,531): 155 [p-value < 0.01]			
R-square				0.17		

¹ ***, **, * indicate a significance on 1%, 5% and 10% level respectively

² ThsTZS, thousand Tanzania Shilling; As ABT records the monthly household income in ten ranges, we use the mean of each range to calculate the household income for each client.

³ Comprises only primary agricultural producers, i.e., livestock, crop as well as fruit and vegetable producers.

⁴ Compared to the 18,101 uncensored observations for the second estimation, we had to exclude 548 loans which were not disbursed or for which the first loan installment was not due at the time of data extraction.