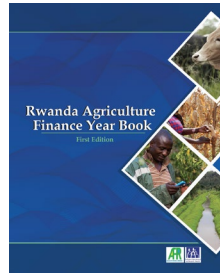


Rwanda Agriculture Finance Year Book

First Edition

Forecasting credit needs





Acknowledgement

The Agriculture Finance Year Book First Edition was compiled by the Institute of Policy Analysis and Research(IPAR-Rwanda) with a grant from Access to Finance Rwanda (AFR).

Disclaimer

The views expressed in this book don't necessarily represent the views of IPAR-Rwanda and AFR about Agriculture Financing in Rwanda.

Published by



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Foreword



*A*griculture is essential for the Rwandan economy as it contributes to a third of the GDP. The sector employs more than two thirds of the workforce and agriculture led growth is expected to play a key role in reducing poverty and eradicating extreme poverty.

The Government of Rwanda is committed to transforming agriculture from subsistence to a productive, high value, market oriented farming sector which has an impact on other sectors. This will be achieved through several programs implemented through the Ministry of Agriculture and Animal Resources (MINAGRI) and its agencies but also with the help of the private sector, development partners and other key stakeholders.

To sustain growth, there is need for farmers to move from subsistence farming to commercial farming, which is possible when they have adequate access to financial services. Finance is needed along the whole production value chain such as purchase of quality seeds and adequate fertilizers, payment of labor, harvesting and transportation of produce as well as post-harvest handling.

However, even though access to finance is important for agriculture sector development in Rwanda, credit to the sector remains outstandingly small at only 6% of total commercial lending. This limits the sector's growth potential.

Recognizing that the agriculture sector faces critical challenges such as access to credit and having in mind efforts by different actors both private and public, led by the Government of Rwanda, Access to Finance Rwanda (AFR) and the Institute of Policy Analysis and Research (IPAR) Rwanda partnered to put together the Agriculture Finance book. The book, the first of its kind in Rwanda, is a great source of information on financing, innovations, challenges and learnings with regard to agriculture financing in Rwanda.

We believe the Agriculture Finance book will add great value to existing initiatives geared towards improving the agriculture sector. It is our sincere hope that the information contained in this book will particularly be useful to farmers, financial institutions and policy-makers.

We thank everyone who contributed their time and effort in one way or another, leading to the successful compilation of the book.

Thank you and enjoy reading!



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Forecasting credit needs



Background

Agriculture is the most important sector of the economy of Rwanda. Eighty-six percent (86%) of the adult population is involved in agriculture whether as its main source of income or employment. Since 2014 agriculture has a growth of six percent (6%) and in the last quarter of 2018, it contributed twenty-seven percent (27%) to Rwandan GDP. The agriculture sector growth is hence essential if Rwanda wants to achieve its target set in NST 1 and national development programs. The development strategy of the country acknowledges that together with the creation of off-farm jobs, agriculture will play a key role in reducing poverty and eradicating extreme poverty. Improved productivity along the value chain in agriculture directly benefit the poor. It is a pathway out of poverty. This is supported by the findings of a survey conducted by the International Food Policy Research Institute (IFPRI),

which states that: "economy wide growth led by the agriculture sector has a greater effect on poverty reduction than does the same level of growth driven by the non-agricultural sector".

One constraint to the agriculture sector growth is the access to financial services. Financing Agricultural limits come from both demand and supply factors. On the supply side, lending to farmers or agri-business shares similarities to lending to other sectors. However, given its nature of agriculture it has some differences and lenders often do not understand these differences. For example, as agriculture is seasonal and deals with nature, loan repayment conditions need to take into account that cash flows are linked to the agriculture production cycle. Lenders must hence structure their products to meet the production cycle of the activity they finance. On the demand side, smallholders may not be aware of the financing possibilities or may not



provide the adequate guarantee. A big number of the farmers work in subsistence Agriculture and they are necessity entrepreneurs. If they want to become sale oriented and to grow, they have to borrow but they also have to save. Lack of information related to environmental risks, business capability of farmers, value chains, price risks, yields risks etc. creates market failures, which result in insufficient credit, low levels of investment and low productivity of agriculture.

The above is illustrated by the low level of loans to the Agriculture which account for only an average of 6.15 %¹ of the total loans in the country (from September 2014 to march 2018) (BNR, 2018). Agriculture finance is a key challenge to enhance productivity in the sector and to reach the Rwanda targets in terms of growth, poverty reduction etc.

¹ From both the banking sector and microfinance sector (MFIs and SACCOs).

While various agriculture initiatives have been implemented by the Rwandan government, financial institutions, international development partners, non-governmental organizations and other associations, there is a need for a deep analysis and documentation of such initiatives. It is against this background that Access to Finance Rwanda (AFR) and the Institute of Policy Analysis Research (IPAR-Rwanda) collected and analysed agriculture financing initiatives in Rwanda which are compiled in the first edition of the Agricultural finance book. The have supported the Ministry of Agriculture and Animal Resources in collecting and sharing agriculture initiatives in Rwanda, through an agriculture finance book. The book has been compiled and produced with collaboration of different agencies that are involved in the financing of different activities across the agricultural value chain. Organizations that have provided valuable inputs in terms of quantitative figures on access to finance and the amount of



agricultural credit that has gone to the different actors in the value chain include the National Bank of Rwanda (BNR), Rwanda Development Bank (BRD), and the National Institute of Statistics of Rwanda (NISR). Other organizations that have provided the case study experiences include Dairy cooperatives such COOIAB and National Agricultural Exports Board (NAEB), Bank of Kigali Techouse in collaboration with the Rwanda Agricultural Board (RAB) have provided useful insights on the functioning of the “Smart Nkuganire platform” which will go a long way in de-risking agriculture in Rwanda and improving efficiencies in the distribution of inputs like seed and fertilizers in Rwanda. Although the information has been collected from different actors in agriculture financing chain, the experiences and lessons provided in this book will go a long way in improving the functioning and performance of the agriculture sector in Rwanda. This is because agriculture is a critical sector where all activities such land preparation, planting,

agronomic practices, harvesting, post-harvest handling, market and export are all interlinked. Improved access to finance and credit drives all the above activities and cuts across all the activities in agricultural value chains. It is for this reason that the Ministry of Agriculture and Natural resources has endorsed the initiative and publication of the Agriculture Finance book.

The book with financial availability is planned to be published every year to ensure robust market engagement, continuous knowledge sharing and learning. This is intended to increase knowledge and good practices implemented in Rwanda in the area of agriculture financing.

The book provides a repertory of the past and expected trends in agriculture financing in Rwanda, and hence shows the actual priorities of the sector. The book also provides experiences and practical examples put in



place by different types of actors in the sector. These experiences are actions taken by farmers, cooperatives, banks, private investors, public sector development partners. They showcase the environment of agriculture financing in Rwanda.

The Agriculture Finance book hence aims at sharing knowledge of existing trends and practices in Agriculture finance through a description of Agriculture financing trends and activities. The book therefore aims at informing all readers with interest in Agriculture Financing including decision makers, farmers, investors, consumers and development partners.

This section aims at providing an indicator of the gap to bridge in order to reach a more efficient market in agriculture finance. Credit needs are forecasted using quantitative methods based on the EICV4 dataset, looking at what would be the agriculture loans needed

in case of an increase in the real economic activity.²

6.1. Determinants of participation in the market for agriculture credit

The aim of this chapter is to provide a projection of agricultural credit based on an assumed path for a real economic activity. Based on the descriptive analysis of Section 1, households were put into four clusters based on their credit status:

- Households that had outstanding loans at the time of the interview;
- Households that had debt within the previous 12 months, but had repaid everything at the time of the interview;
- Households that did not have a loan in the

² This forecasting model was designed and applied with the support of RWI – Leibniz Institute for Economic Research



previous 12 months because they did not request for one;

- Households that did not have a loan in the previous 12 months because their loan application had been rejected;

Cross-sectional sample of the Integrated Household Living Conditions Survey for Rwanda for the years 2013-2014 (EICV4) was also used. Table 1 presents descriptive statistics of farm households' socio-economic characteristics in our sample.³

³ For partially repaid agriculture loans, where the repayment amount exceeds the loan volume plus required interest payment, we set the outstanding loan payment to zero.



Table 3: Descriptive Statistics of households with outstanding loans

	Observations	Households in (000s)	Mean	Standard Deviation	Min	Max
Volume of unrepaid agriculture loans	812	134	32179	109950	300	3000000
Volume of partially paid agriculture loans	624	102	97408	459374	700	1.0*10 ⁷
Interest unrepaid agriculture loans	812	134	2946	20366	0	570000
Interest partially paid on agriculture loans	624	102	142827	3645385	0	1.0*10 ⁸
Repaid loan amount	624	102	311732	5173922	100	1.0*10 ⁸
Dummy had an agriculture loan	12701	2168	0.1042	0.3060	0	1
Consumption	12701	2168	259105	326482	21327	1.3*10 ⁷



HH size	12701	2168	4.6803	2.0642	1	18
Dummy has a savings account	12701	2168	0.4816	0.4997	0	1
Dummy female	12701	2168	0.2583	0.4377	0	1
Dummy rural area	12701	2168	0.9160	0.2775	0	1
Dummy went to school	12701	2168	0.7376	0.4400	0	1
Province						
Kigali City	12701	2168	0.0500	0.2180	0	1
South	12701	2168	0.2621	0.4398	0	1
West	12701	2168	0.2327	0.4226	0	1
North	12701	2168	0.1742	0.3793	0	1
East	12701	2168	0.2810	0.4495	0	1

Source: EICV4, author's calculations.



In the EICV4, households were asked to give information on indebtedness by reporting each loan they had within the previous 12 months. About 134,000 households had outstanding agriculture unpaid loans at the time of the interview. The mean volume was Rwf 32,179 and loan volumes differed considerably, ranging from Rwf 300 to Rwf 3 million. The initial loan volume of partially repaid loans was Rwf 97,408 on average. Differences in loan volumes were even more pronounced. The average agreed interest payment was Rwf 20,366 for un-paid and Rwf 14,2827 for partially repaid loans.

On average, about 10% of farm households had outstanding agriculture loan. Their aggregate consumption expenditures were equal to Rwf 295,105. On average, households consisted of 4.7 members. About 92% of households lived in a rural environment, for about 73% the head of the household went to school and 26% of farm households had a female head.

A multivariate logit model is used to investigate whether these socio-economic characteristics can explain the probability of a household belonging to one of the four credit groups constituted on the basis of socio-economic variables. The explanatory variables are (i) household specific characteristics (aggregate real household consumption expenditures, household size, and whether any member of the household has a savings account), (ii) socio-economic characteristics of the head of the household (whether the head is a male or female, whether the head went to school, and the interaction term between these two variables), and (iii) location specific characteristics (whether the household lives in a rural or urban environment and the province the household lives in).



Table 4: Multinomial Logit

	HH owed money in the previous 12 months – all repaid	No loan – did not request	Requested loan – rejected
Log consumption	1.40*** (0.11)	1.06 (0.05)	1.16 (0.11)
HH size	0.96* (0.02)	0.93*** (0.01)	1.01 (0.03)
Has savings account	0.75*** (0.08)	0.65*** (0.04)	1.86*** (0.26)
Dummy rural area	1.06 (0.28)	0.46*** (0.07)	0.64* (0.15)
Southern province	0.47* (0.21)	0.32*** (0.09)	0.28*** (0.10)
Western province	0.68	0.31***	0.29***



	(0.30)	(0.09)	(0.11)
Northern province	0.81	0.31***	0.25***
	(0.36)	(0.09)	(0.10)
Eastern Province	0.88	0.47***	0.36***
	(0.39)	(0.14)	(0.14)
Dummy female	0.90	1.87***	0.99
	(0.19)	(0.24)	(0.29)
Dummy went to school	0.85	1.05	1.20
	(0.12)	(0.09)	(0.22)
Dummy went to school x Dummy female	0.84	0.62***	0.96
	(0.23)	(0.10)	(0.33)
Observations	12 700	12 700	12 700

Note: Relative risk ratios. *, **, *** respectively represent significance at the 1%, 5%, and 10% level. Clustered standard errors are in parentheses. Comparison to “No loan – did not request”. Base category for province is “Kigali City”.

Source: EICV4, author's calculation.



Estimation results are presented in Table 6. Baseline category represents households that had outstanding debt when the interview took place. Coefficients represent relative risk ratios. By keeping other variables constant, it was possible to measure the amount of risk of the respective credit group changes given a one-unit increase in the respective variable relative to the baseline category which had outstanding agriculture loans at the time of the interview. To give a vivid example, given a 1% increase in consumption, the probability of belonging to the category of not having an outstanding agriculture loan as all loans have been repaid compared to having agriculture outstanding debt is multiplied by 1.4. Therefore, values larger than one indicate that an increase in the respective variable increases the probability of belonging to the group under consideration, relative to the base category. Values lower than 1 point to a decrease in the probability.

Real higher consumption expenditures at the household level seem to be associated with a higher probability of not having outstanding agriculture debt. Household size, living in a rural area as opposed to an urban area as well as living in the Southern, Western, Northern, or Eastern province as opposed to Kigali City are associated with a lower probability of having outstanding agriculture debt.

Having a savings account is ambiguous. It is negatively related to the probability of not having outstanding debt because it has been repaid or because the household did not apply for it. Households with savings accounts might have opened them because they just wanted to save, which is why they did not apply for a loan. On the other hand, a savings account is associated with a higher probability of the loan application being rejected. One explanation might be that households that have a relationship with a bank are more likely to apply for a loan.

If the head of the household is a female, there is a higher probability of not requesting for a loan. However, if a household is headed by a female who attended formal education, this *Ceteris paribus* (c.p.) lowers the probability of not requesting for a loan.

6.2. Explaining loan volumes

Having investigated the extent to what differences in households' socio-economic characteristics correlate with households' credit status, the following analysis aims at explaining outstanding aggregate loan volumes and projecting them, based on an assumed path for a real economic activity⁴.

Here, the focus is on measuring the outstanding agriculture loan volumes; that is the outstanding amounts of loan at the time of the interview.

⁴ We use the natural logarithm of the loan volume to circumvent heteroscedasticity issues.

The initial loan volume is considered for non-repaid loans and the reported repayment is assumed to be the first redemption⁵ for partially repaid loans. The loan volume is reduced if reported repayments exceed total interest payments by the respective amount. Total outstanding agriculture loans are given by the sum of unrepaid and adjusted partially repaid loan volumes.

With respect to consumption expenditures, the effect on loan volumes might be ambiguous. On the one hand, households that borrow higher amounts have c.p. more resources available that they can spend in the current period. Therefore, consumption and agriculture loan volumes might be positively related. On the other hand, consumption expenditures are typically higher for the households that have higher income.

⁵ Reported average repayment amounts are well above 50 percent of the average loan volume, which drove us to make this assumption.



The households that consume a lot might be less in need of borrowing or borrow lower amounts. Therefore, loan volumes might also be negatively correlated with consumption.

The household size has a positive correlation with loan volumes, given that larger households probably need more resources to make a living and, therefore, borrow larger amounts. The presence of a savings account is indicative of a bank-customer relationship, which reduces the extent of asymmetric information; therefore, they should also be positively related to loan volumes. The descriptive statistics in Section 1 showed that the households with female heads are less likely to borrow. Therefore, sex is also a factor that affects loan volumes negatively.

6.3. Loan volumes forecasting

To project aggregate loan volumes given an assumption with respect to real economic activity, three approaches were considered:

- ❖ The first approach is just a simple analysis explaining outstanding loan volumes based on the socio-economic characteristics. However, as we have to condition on households having outstanding loans, the time variable was not taken into account.
- ❖ The second approach is a two-step procedure. We first estimate the probability of a household having a loan. In the second step, we explain outstanding loan volumes as we do for the simple case (the first approach). The probability of a household having a loan is explained by all the variables discussed above plus education and sex of the head of the household, and location specific characteristics



(the province in which the household lives and whether the household is in an urban environment or not).

- ❖ The third approach allow for non-random selection of borrowers by employing the Heckman selection model.⁶ In the market for agriculture credit, participation might also be non-random. Literacy levels might affect individual reservation prices of loans. For example, if the borrower does not understand the terms of the loan contract, she/he might have additional costs to clarify these, which results in an increase in the loan's reservation price.

- ❖ In addition to that, reservation prices in rural areas might be higher, as the distance to lenders might be larger and the chance of choosing between different lenders might be lower. Therefore, to explain participation in the agriculture loan market we included: i) a variable indicating *the head of the households' literacy level* (whether he went to school); ii) variables indicating whether *the household is located in a rural environment* (base category in urban environment) and iii) in *which province the household lives* (base category is Kigali City).

⁶ Its classic application is the estimation of female wage. If reservation wages for non-working females are higher than for working ones, e.g. because they are married or have to look after kids, restricting the sample to females that are working results in a sample selection bias. The Heckman approach corrects for this bias.



Table 5: Estimation results used to project agriculture loan volumes

	OLS	2stage model	Heckman
Log consumption	-4.66** (2.08)	-4.66** (2.08)	-1.54 (2.20)
(Log consumption) ²	0.20** (0.08)	0.20** (0.08)	0.08 (0.09)
HH size	-0.86** (0.40)	-0.86** (0.40)	-0.50 (0.41)
Log consumption x HH size	0.09*** (0.03)	0.09*** (0.03)	0.06* (0.03)
Dummy has a savings account	0.40*** (0.07)	0.40*** (0.07)	0.55*** (0.08)
Dummy female	-0.35*** (0.08)	-0.35*** (0.08)	-0.45*** (0.08)
Constant	35.07*** (13.15)	35.07*** (13.15)	13.76 (14.12)
Observations	1369	1369	



	OLS	2stage model	Heckman
Log consumption		3.09*** (0.81)	3.09*** (0.80)
(Log consumption) ²		-0.12*** (0.03)	-0.12*** (0.03)
HH size		0.38** (0.15)	0.37** (0.15)
Log consumption x HH size		-0.03** (0.01)	-0.03** (0.01)
Dummy has savings account		0.20*** (0.03)	0.21*** (0.03)
Dummy rural area		0.30*** (0.07)	0.29*** (0.07)
Southern province		0.52*** (0.13)	0.55*** (0.12)
Western province		0.54*** (0.13)	0.58*** (0.12)



Northern province	0.52*** (0.13)	0.52*** (0.12)
Eastern Province	0.32** (0.13)	0.35*** (0.12)
Dummy female	-0.28*** (0.06)	-0.27*** (0.06)
Dummy went to school	-0.02 (0.04)	-0.06 (0.04)
Dummy female x Dummy went to school	0.23*** (0.08)	0.20** (0.08)
Constant	-21.08*** (5.13)	-21.76*** 5.10
Observations	12 701	12 701
ρ		0.63*** (0.13)
σ		1.49*** (0.15)

Note: Base category province: "Kigali City". *, **, *** respectively represent significance at the 1%, 5%, and 10% level. Clustered standard errors in parentheses.

The forecast is based on the assumption that a 1% change in real economic activity translates into a 1% change in real consumption expenditures for each household. This allows computation of the probabilities that individual households have outstanding agriculture

loans according to the two-step and the Heckman approach and on the assumption that the composition of households that have loans is independent of real economic activity for the simple OLS approach.

Table 6: Projected changes in agriculture loan volumes

	OLS	2stage model	Heckman
Change in average probability		-0.04%	-0.03%
Change in loan volumes	10%	7%	7%

Note: Changes after a 10% increase in real consumption

Assuming a c.p. 10% increase in real consumption, aggregate loan volumes of agriculture loans might increase by a factor about one. Note that this effect is non-linear due to the specification of our models (see Table 3).



We also have to stress that these projections are highly uncertain⁷.

So, these projections actually tell us that we should expect a loan volumes increase by about 7% to 10% after an increase in aggregate consumption by ten percent. However, it is important to stress that these numbers should by no means be understood as normative or even prescriptive statements. They should be understood as purely descriptive. These calculations based on EICV4 tell what historic loan volumes would be if consumption were different.

Establishing whether loan volumes were sufficient at the time the households were interviewed or whether households suffered from credit constraints by then is beyond the scope of this project.

⁷ We will briefly explain just two of potentially substantial draw backs of our projected loan volumes.

- First, the loan measure has been computed as described in this chapter due to the fact that data was not available. We state all the assumptions we employed and deemed them plausible. Of course, some other assumptions are possible and probably affect aggregate loan volumes as well as projected changes.
- Second, due to the lack of an intertemporal elasticity, we had to make the assumption that the cross-sectional elasticity of consumption expenditures on individual loan volumes that we observe in the EICV4 will also be valid if aggregate consumption expenditures increase.





