

RISK-CONTINGENT CREDIT (RCC) ASSESSING SMALLHOLDERS' AGRICULTURAL CREDIT NEEDS AND THE FEASIBILITY OF IMPLEMENTING RCC IN ETHIOPIA

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Agricultural credit is an important instrument for improving the welfare of farm households and their resilience to weather-related shocks. Farm households with access to credit can overcome liquidity constraints and undertake investment in new production technologies such as improved seeds and machinery. This investment can boost farm production, food security, incomes, employment opportunities, and overall household welfare. However, in many low- and middle-income countries (LMICs), credit market imperfections pose a challenge to both the supply of agricultural credit and farmers' use of credit (Marjit and Mishra 2020). Even when the credit infrastructure is relatively well-developed, smallholder farmers in LMICs remain largely underserved (Karlan and Morduch 2010; McIntosh et al. 2013).

Information asymmetry is a key cause of low credit supply to farmers in LMICs. Information asymmetry makes it difficult for lenders to ascertain the creditworthiness of borrowers *ex ante*, and to enforce contracts *ex post*, making it risky and expensive to serve smallholder farmers (Giné and Yang 2009). As a result, lenders ration the quantity of credit offered, or raise interest rates and impose exorbitant collateral requirements. On the demand side, only a small proportion of smallholder farmers can meet the lenders' stringent requirements, which often include having a bank account, collateral requirements, and long and

bureaucratic borrowing processes. Moreover, formal credit lenders are located in major towns and urban centers, which locks out many smallholders who face transportation and time constraints. As a result, many farm households in LMICs rely on informal credit. Although informal credit sources have proved relatively successful in reducing information asymmetries and in meeting the credit needs of smallholders, the limited resources of informal lenders restrict the extent to which they can effectively and sustainably satisfy the credit needs for high-return agricultural investments. Moreover, the interest rates can exceed those in the formal sector, and some farmers do not have access even to the informal sector (Demont 2020)

This study examined the feasibility of implementing a risk-contingent credit (RCC) program as an alternative lending approach in LMICs, specifically in Ethiopia. RCC is a credit product that is bundled with an insurance component. Under the RCC model, qualifying smallholders can apply for agricultural production loans from formal institutions, such as banks, with minimal or no collateral. To reduce the risks to the lender and the potential for default, an insurance company underwrites the climate risks. Because the borrowers' ability to repay a loan depends on the productivity of their primary crop, which in turn depends on the weather outcomes, when the underlying risk (either drought or flood) passes a certain threshold,



part or all of the borrower's liability is transferred to the insurer, who then repays the lender (Shee et al. 2019). Although RCC can potentially widen the credit access gap due to its complexity and the added costs of the insurance premium, emerging studies indicate that the lower collateral requirements plus the insurance protection provided by RCC products offer smallholders increased access to agricultural credit (Ndegwa et al. 2020).

Our study reports findings on farmers' agricultural production, credit demand, constraints to credit access, and their demand for RCC in Ethiopia. We employ both quantitative and qualitative data collected from households across three *woredas* (districts) between April 2022 and February 2023. These findings contribute to better understanding of the demand for RCC products in LMICs and how to appropriately design and target the products for smallholders.

METHODS

To evaluate the potential uptake and thus the likely impacts of RCC, we conducted a clustered randomized controlled trial (RCT) in selected households in Ethiopia. Two zones – West Shewa and East Shewa – were purposively selected based on their agroecological characteristics, the importance of agriculture to the community, and the availability of

commodity and financial markets. Using the same criteria, three *woredas* – Woliso and Dawo (West Shewa zone) and Adama (East Shewa zone) – were selected for the study. In each *woreda*, between 10 and 22 *kebeles* (small administrative districts) were randomly selected, making a total of 50 *kebeles*. In each *kebele*, a sampling frame was developed with the help of the local administrators, and a total of 1,050 households were randomly selected for the study. Clustering was done at the *kebele* level, assigning 535 households from 25 *kebeles* to the treatment group with access to RCC products. The remaining 515 households from the other 25 *kebeles* are in the control group.

In April 2022, pre-intervention baseline data were collected from all 1,050 households within the three *woredas*. The survey included detailed questions about household and individual socioeconomic characteristics, household livelihood activities, agricultural land ownership, farm input usage and expenditure on inputs, livestock holdings, experience with agricultural shocks, credit uptake decisions, and supply- and demand-side challenges to credit access, among other questions. In February 2023, detailed focus group discussions (FGDs) were held with pre-selected households from the baseline group; a total of 229 smallholder farmers – 36 percent women and 64 percent men – were invited and participated in the FGDs. The FGDs included an open-ended discussion about local production conditions, the importance of different crops to the farmers, key agricultural

TABLE 1. Crop production and input use, household averages

Variable	Total	Teff	Wheat	Maize	Beans
Area under crop production (ha)	2.901 (5.598)	5.649 (7.918)	2.386 (5.874)	1.218 (1.201)	2.50 (2.125)
Share of land under production (%)	0.786 (0.192)	0.620 (0.211)	0.266 (0.184)	0.198 (0.162)	0.168 (0.146)
Use improved seed varieties (%)	0.314 (0.464)	0.232 (0.422)	0.332 (0.471)	0.529 (0.499)	0.159 (0.366)
Quantity of seeds planted (kg/ha)	21.511 (31.056)	14.620 (22.704)	33.939 (37.497)	9.796 (7.835)	29.440 (50.636)
Fertilizer use (%)					
NPS	0.798 (0.400)	0.968 (0.173)	0.932 (0.250)	0.696 (0.460)	0.606 (0.490)
Urea	0.614 (0.486)	0.852 (0.354)	0.758 (0.428)	0.523 (0.499)	0.251 (0.366)
DAP	0.019 (0.136)	0.021 (0.021)	0.031 (0.175)	0.011 (0.108)	0.011 (0.106)
Labor (in days)					
Land preparation	99.736 (71.189)	165.619 (164.028)	139.933 (110.96)	40.127 (35.698)	60.463 (51.382)
Planting	30.764 (59.445)	50.930 (83.488)	22.005 (45.437)	16.995 (19.511)	13.987 (26.515)
Fertilizing	8.336 (16.091)	11.420 (16.515)	6.175 (11.107)	6.681 (9.142)	4.237 (6.805)
Weeding	63.645 (34.929)	98.303 (97.377)	29.026 (59.434)	63.053 (62.866)	30.642 (34.606)
Harvesting	129.383 (115.24)	204.864 (122.086)	96.520 (66.71)	47.209 (49.043)	43.857 (46.947)
Quantity of harvest (kg)	324.189 (1,873.2)	377.110 (1,904.65)	335.080 (1,999.939)	205.425 (1,297.227)	206.132 (529.573)
Number of observations	1,050	1,027	597	672	573

Note: Standard errors in parentheses.

production challenges (mainly focused on weather-related risks), farm investment, demand for and sources of agricultural credit, and challenges to credit access. In addition, the farmers in the FGDs received training about the RCC product and its potential for reducing production risks.

FINDINGS

Crop production and input use

Table 1 summarizes findings on crop production from the baseline survey. The average area under crop

production is 2.9 ha, which represents 78 percent of the total land owned. The four most important crops (based on the share of land under production) are teff (62 percent), wheat (27 percent), maize (20 percent), and beans (17 percent).¹ Farmers also produce other crops, including barley, sorghum, chickpeas, lentils, and potatoes, but to a smaller extent. Qualitative findings from the FGDs highlight the importance of crop production, especially teff, wheat, and maize, as the main source of livelihood in the study area (a few farmers also mentioned animal production, mainly cattle and small ruminants). The FGDs also highlighted some spatial variations in production practices; for instance, teff and maize are

¹ The total shares add to more than 100 percent due to intercropping.

FIGURE 1. Sources of seeds reported by farmers



the main crops in the Adama woreda while farmers in the Dawo and Woliso woredas mainly produce teff and wheat.

Only about 31 percent of the farmers use improved seed varieties. The highest use of improved seed varieties is in maize production (53 percent) and lowest use is in beans (16 percent). Most of these seeds are obtained from extension workers and government-controlled cooperatives (Figure 1). Other sources include grain traders and input dealers, previous harvests, and borrowing from neighbors. These findings were confirmed by the FGD participants, who noted the important role of the public sector in supplying improved seed varieties.

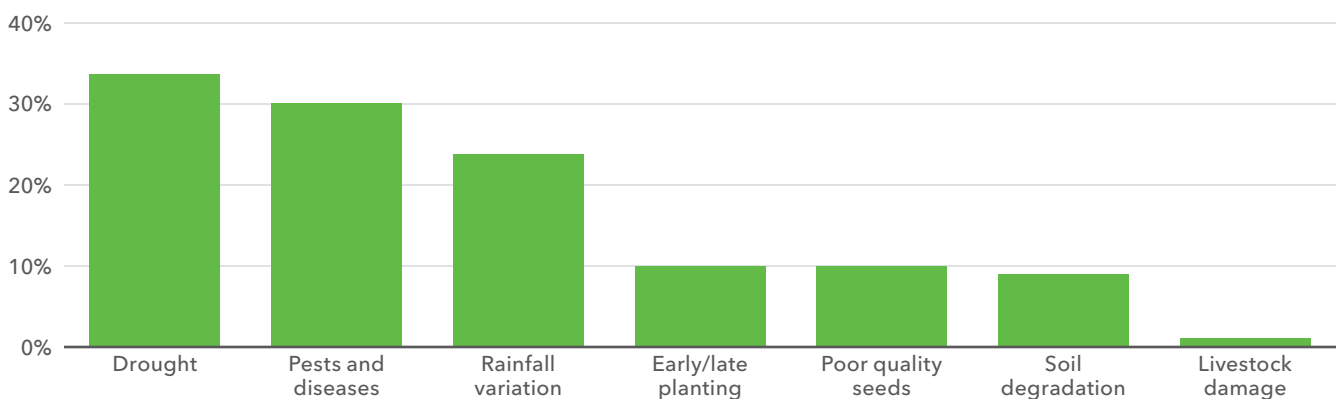
The average quantity of seeds planted per hectare is 14.6 kg for teff, 33.9 kg for wheat, 9.8 kg for maize, and 29.4 kg for beans. These quantities are on average 30 percent below the recommended standard of

practice for optimal production (Balemi et al. 2019; Lakew and Berhanu 2019). In terms of fertilizer use, we find high rates of nitrogen, phosphorus, and sulfur (NPS; 80 percent) and urea (61 percent) use. Only 1.9 percent of the farmers use diammonium phosphate (DAP) fertilizer. The highest fertilizer allocation is to teff and wheat production. At the same time, teff and wheat are more labor-intensive than other crops produced in the study area.

Agricultural production risks

Figure 2 indicates the main production challenges and causes of crop failure in the study area. The main production risks reported by the farmers were drought and rainfall variability, aggravated by the high dependency on rainfed agricultural production practices (except for a few kebeles that have access to irrigation water from the Awash River). Drought

FIGURE 2. Main agricultural production challenges reported by farmers



and inconsistent rainfall accounted for more than 60 percent of crop losses in 2022. Other production risks include pests and diseases, soil degradation, poor timing of sowing, and poor-quality seeds. The farmers also noted that the shortage of inputs – especially improved seeds and fertilizer – coupled with high input costs due to global inflation is quickly becoming a challenge in their production practices.

Agricultural credit demand and constraints to access

Table 2 presents the demand for and constraints to credit access among farmers in the study area during the 2021/22 cropping season. Twenty-one percent of households applied for credit from a banking institution or cooperative. The average amount of credit requested was about US\$163, but the average amount obtained was just \$86. In the FGDs, farmers indicated that in addition to borrowing from formal lending institutions, friends and relatives are major sources of informal credit. They also indicated that they sometimes borrow in groups – through solidarity loans – from microfinance institutions, such as rural savings and credit cooperatives (Ru-SACCOs) and the Oromia Credit and Saving Share Company (OCSICO).

Farmers in the FGDs reported that, on average, 81 percent of the borrowed money was invested in agricultural production, primarily for the purchase of fertilizer for teff and wheat production as well as for improved seed varieties. Women farmers indicated that part of the money is also used to cover some household expenses, such as food purchases. Farmers who did not apply for credit indicated that they work with their own liquidity and sometimes sell their productive assets, such as livestock, to finance their input purchases.

Both supply- and demand-side constraints affect credit access. The farmers reported that the main supply-side constraints include lenders limiting the amount of credit offered to farmers and making application costs punitively high, which discourages potential applicants. Other supply-side constraints include high interest rates; inflexible lending terms, such as short repayment periods; geographic distance of the banking institution from the farmers; and tedious and complicated paperwork, which is likely to exclude farmers with low literacy levels. The

TABLE 2. Credit constraints reported by the farmers

Variable	Mean	SD
Applied for a loan in 2022	0.211	0.408
Amount requested (US\$)	163.240	866.500
Amount offered (US\$)	86.210	961.190
Proportion spent in agricultural production	0.810	0.331
Supply-side constraints		
Amount offered was too little	0.847	0.360
High cost of application	0.730	0.444
Interest rates are high	0.584	0.493
Inflexible lending terms	0.561	0.497
Bank is far away	0.543	0.498
Tedious paperwork	0.528	0.499
Demand-side constraints		
Fear of losing collateral	0.585	0.493
Not creditworthy	0.728	0.445
No guarantor	0.732	0.443
Borrow from other sources	0.546	0.498
Number of observations	1,050	

demand-side constraints stem from farmers' risk aversion, such as the fear of losing their collateral if they cannot repay the loan; farmers' poor perception of their creditworthiness; lack of guarantors; and the availability of credit from informal sources.

TRAINING AND FARMER PERCEPTIONS OF RCC

During the FGDs, farmers received training about farm investment, credit use, and subsequent pay-offs from borrowing and farm investment. They also saw a demonstration of how RCC works and its ability to protect against drought and loan default risks. The training was offered in the form of a game in which seven groups of farmers (for each training session) chose between different production scenarios: One was a low-potential, traditional agricultural practice with minimal farm investment and no credit. The payoff under this practice is 10,000 Ethiopian birr in a normal crop season and zero in a bad season. The other scenarios were high-potential production with credit, either (1) traditional credit (TC) that requires a loan of 3,000 birr for farm investment, but with a payoff of 20,000 birr in a normal season and zero in a bad season, or (2) the RCC option, which requires a loan of 3,000 birr plus with a risk premium of 200 birr, with a

TABLE 3. Farmer role-play outcomes

	Round 1 (no credit vs. TC)			Round 2 (TC vs. RCC)		
	Decision	Net payoffs		Decision	Net payoffs	
		Normal season	Bad season		Normal season	Bad season
Group 1	H/TC	17,000	-3,000	H/RCC	16,800	0
Group 2	H/TC	17,000	-3,000	H/RCC	16,800	0
Group 3	H/TC	17,000	-3,000	H/RCC	16,800	0
Group 4	H/TC	17,000	-3,000	H/RCC	16,800	0
Group 5	H/TC	17,000	-3,000	H/RCC	16,800	0
Group 6	H/TC	17,000	-3,000	H/RCC	16,800	0
Group 7	L/N	10,000	0	H/TC	17,000	-3,000

Note: H = high-potential practices; L = low-potential practices; TC = traditional credit; N = no credit; RCC = risk-contingent credit.

payoff of 20,000 birr in a normal season and zero in a bad season. The game consisted of two rounds of play with two options in each round: In round 1 the farmers chose between low potential-no credit production and high-potential production with TC. In round 2, the farmers chose between the TC and RCC options, both with high-potential production practices.

For ease of understanding and to foster participation, the game materials were translated into two local languages (Amharic and Afaan Oromo). In each game group, the members held a discussion and picked their preferred production practice in both rounds 1 and 2. A realized weather (risk) condition was determined through a random draw from a bag of markers containing 1 red (representing a bad season, $P=0.33$) and 2 green (representing a normal season, $P=0.67$). The end-of-season earnings were then calculated as total earnings from production, less the loan repayment obligation (including the premium payment for RCC). Thus, under normal weather conditions, the low potential-no credit farmers earn 10,000 birr; TC farmers earn 17,000 birr; and RCC farmers earn 16,800 birr. However, in a bad weather season, low potential farmers earn nothing. TC farmers end the season with a debt of 3,000 birr (that is, earnings are negative), while farmers who opted for RCC do not have a debt (that is, no negative earnings) because the insurance component is triggered by the bad weather and protects against this risk faced by farmers.²

Table 3 shows the outcomes of the game: six out of seven groups chose production under TC for round 1 and RCC for round 2. When farmers were asked to explain their choices in round 1, they stated that taking all seasons together (good and bad), the expected payoffs were higher under TC production. Regarding round 2, the farmers considered the additional insurance premium under RCC insignificant, given the level of insurance protection it provides under bad weather outcomes. These explanations show that the farmers recognized the potential of RCC and suggest that they would be interested in using this option if it were available.

CONCLUSIONS

Agricultural credit allows farm households to invest in inputs and practices to increase productivity and income and to increase their resilience to shocks. However, the combination of weather risks and imperfections in credit markets poses a challenge to the provision and use of credit by smallholder farmers in most LMICs. Although RCC products are more expensive than traditional credit, they have the potential to unlock credit markets for smallholders by reducing some of the supply- and demand-side constraints to credit access. This study from Ethiopia reported on the demand for credit and constraints to credit access and explored the potential for implementing

² See Shee et al. (2015) for an extensive discussion of the RCC game.

RCC as an alternative lending approach to improve the supply of and demand for agricultural credit for farm households.

Although many households in the study area depend on crop production as their main source of livelihood, they face major production challenges, including weather-related risks, pests and diseases, input scarcity, and the high costs of inputs. Farmers also face substantial supply- and demand-side credit constraints that limit their access to credit and their farm investment choices. Collectively, these factors limit

the farmers to suboptimal levels of farm investment and production. We implemented a game to train farmers on the potential and limitations of RCC as an alternative lending mechanism (Shee et al. 2015). The findings from the game highlighted the farmers' understanding of farm investment and how insurance can be leveraged to manage agricultural production risks. Overall, the findings from this study contribute to the process of appropriately designing and delivering RCC and other financial products to smallholders in the developing world.

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