Group Microcredit to Foster Sustainable Rural Development in Colombia

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Abstract

This study investigates the accessibility and take-up rate of microcredits among rural households in Colombia, focusing on medium and small agricultural producers. Using data from 2020-2023 and employing both OLS and logistic regression models, the research identifies key factors influencing microcredit accessibility and uptake. The findings highlight significant disparities in financial inclusion, driven by geographic and socio-economic variables. The study highlights the potential of targeted financial tools, such as groupal microcredits, to enhance sustainable economic growth in rural areas. However, the results are limited by post-pandemic biases and the exclusion of certain determinants like individual poverty levels and regional conflicts.

Table of content

Abstract **2**
Chapter 1: Introduction **4**
Chapter 2: Background & Literature Review **7**
Section 2.1. Financial inclusion in rural Colombia. 7
Section 2.2. Microcredit Development in Colombia. 8
Chapter 3: Institutional Framework **13**
Section 3.1: Relevant financial institutions & the structure of the financial market. 13
Section 3.2: Rural, dispersed rural and intermediate municipalities in Colombia. 14
Chapter 4: Methodology. **15**
Section 4.1: Models 15
Section 4.2: Data. 18
Chapter 5: Empirical Results. **20**
Section 5.1. Accessibility of rural households to microcredits. 20
Section 5.2. Microcredit take-up rate by individuals in rural Colombia. 23
Section 5.3. Statistical Analysis. 24
Chapter 6: Discussion. **28**
Chapter 7: Conclusions. **31**

Chapter 1: Introduction

The evidence shows that microcredit has boosted the growth of microentrepreneurs and has contributed to the management of their cash flows, as well as to overcoming poverty. In the last two decades, financial organizations together with the Colombian Government have been generating different financial inclusion proposals. Among the measures to be highlighted are the actions taken by entities such as *Banco Agrario de Colombia* (Agrarian Bank of Colombia, BAC), FEDESARROLLO[1] and *Asomicrofinanzas*[2]; where they created financial products to encourage rural micro-entrepreneurs to acquire or build a credit history and, in addition, the opportunity to have a new line of liquidity. However, historically, rural areas have been under-intervened by the state which has brought ongoing consequences in the degree of accessibility and financial inclusion.

The rural areas of Colombia are among the poorest in the country, with nearly 42% of the population living in extreme poverty and 48% in vulnerable conditions, according to the UNDP. Beyond poverty, these regions also suffer from high unemployment and financial instability, which further impede social development. Poverty remains the most significant factor, creating a cycle of socio-economic stagnation. Therefore, access to credit and financial services is essential for fostering sustainable development in rural households and lifting them out of poverty. However, these populations are often not the preferred clients for financial institutions due to the high-risk profiles typically associated with farmers in rural areas.

According to the economic report prepared by Banco de la República de Colombia (BanRep)[3] and *Asomicrofinanzas*, the challenge lies in striking a balance between providing financial access to these populations while minimizing the risk of high credit costs for entities[4]. While there is a clear imperative to pursue policies geared towards rural development, it's equally crucial to evaluate the factors that predominantly influence the credit dynamics within these areas. This analysis is essential for devising a more targeted tool that incentivizes collaboration between

[1] FEDESARROLLO is an independent (non-governmental) center for economic and social research.
[2] Is the Colombian association of microfinance institutions, it is responsible for ensuring the microfinance market in the country.
[3] BanRep is a government agency of a unique nature, with administrative, financial, and technical autonomy, which performs central banking functions.
[4] Clavijo Ramírez, F., Estrada, D., & Yaruro, A. M. (2022). El microcrédito en municipios rurales y rurales dispersos: determinantes de acceso y morosidad.

public and private entities, ultimately fostering effective support mechanisms that are appealing to small farmers in Colombia.

Although there are several credit mechanisms focused on rural economic life, the vast majority are utilized only by large rural entrepreneurs with strong financial profiles. Small farmers often find themselves ineligible for such loans, thereby excluded from lending opportunities. This disincentive to demand and the low financial accessibility are mainly due to the characteristics of the environment in which these populations operate. Firstly, the economic activities that sustain small farmers, such as agriculture and livestock, are highly susceptible to exogenous factors like weather and animal pests. This volatility makes them have an unstable source of income and therefore have risky credit profiles. Secondly, the significant distances from urban centers further hinder access to financial services, making transportation costs a determining factor in deciding whether to pursue a credit opportunity. For all these reasons, a financial tool like groupal-microcredit could have a positive impact on various dimensions, contributing to the sustainable development of rural households in Colombia. Access to financial services can enable poor people to move forward from hand-to-mouth survival to planning for the future, acquiring physical and financial assets, investing in better nutrition, health, and education (Imran H, 2022).

The main purpose of this study is to identify the key factors that enhance microcredit accessibility and determine the factors influencing its take-up rate. The objective is to devise a more impactful solution, such as targeted group microcredit, tailored specifically for low-income families living in rural areas, whose primary economic activity revolve around agriculture and/or livestock. Additionally, I provide an enhanced economic analysis building upon the findings of the study (Clavijo Ramírez, F. et. al. 2022), utilizing updated data spanning from 2020 to 2023. The recommendation is based on certain characteristics exposed by Banerjee and Duflo on the Indian study. The problem statement of this study is "*What socioeconomic determinants are relevant to boosting financial accessibility and the take-up rate of microcredits, if a targeted group microcredit is offered to rural households in Colombia?*".

The databases I will use will provide information on credit allocation, access, and how frequently Colombian farmers demand microcredits. Likewise, other data bases were also managed to provide information on the reason for credit applications, the number of installments, and in which region of the country they were requested. The data collection was carried out by accessing to public information held by financial or governmental organizations.

I conducted two main analyses: First, an OLS regression was performed to evaluate which factors have a greater impact on rural households' access to microcredit. Secondly, a logistic regression was used to identify which factors affect the take-up rate of microcredits. I found that medium and small producers face greater obstacles due to their size and limited infrastructure. Furthermore, the level of the rurality of the municipality and the line of credit significantly impacts the allocation of microcredit and the take-up rate.

This paper consists of 6 chapters. In chapter 2, I will discuss the context of economic development in rural areas of Colombia, as well as the conditions of financial inclusion. Additionally, I will discuss several literatures that influenced this research. In chapter 3, I will discuss the institutional setting which is important to understand the Colombian financial context. In chapter 4, I will cover the methodology and the data used for this study. In chapter 5, the main results are showed and analyzed. In chapter 6, the discussion based on the findings will take part. Lastly, in chapter 7, I will derive the conclusion.

Chapter 2: Background & Literature Review

Chapter 2 will address the background and the relevant literature for the understanding of this research. **Section 2.1** I will present the state of financial inclusion in the country, while in **Section 2.2** I will show the development of microcredit in Colombia. Finally, **Section 2.3** will discuss literature related to the research.

Section 2.1. Financial inclusion in rural Colombia.

Before characterizing the microcredit market in Colombia, it is pertinent to analyze in depth the financial accessibility of the country's rural areas. For the past few decades, one of the main goals of the government has been to increase the financial opportunities of the Colombian population through policies and programs that allow them to increase their accessibility regardless of their socio-demographic characteristics. Thus, policies such as "The National Strategy for Financial Inclusion (ENIF)" or supported Microcredit programs like "Fondo Nacional de Garantias (FNG)" have been created. Additionally, the work of financial inclusion has involved not only governmental efforts but also significant contributions from private entities and financial organizations such as Asomicrofinanzas, Banca de las Oportunidades, and FINAGRO.

According to the MFI, factors like age, gender, marital status, education, the distance to MFI offices or mobile advisors, local violence levels, and the technology and microcredit methodology of MFIs should be considered to promote sustainable access to microcredit in rural areas. Although accessibility and usage indicators in departments such as Bogota, Huila and Antioquia have been on an upward trend in recent years, the proportion of rural individuals compared to urban individuals that perceives this increase is still notoriously low. "In 2023, an increase in financial product holdings was observed in all categories except rurality. The results are heterogeneous and show that in cities and agglomerations the levels of access and use are higher than the national average. However, despite the progress, access continues to be lower as rurality increases" (Financial Inclusion Report, 2023)[5].

In addition, according to Asobancaria in the *Banking & Economics Report* (2023, edition 1343), factors such as high remoteness, lack of road infrastructure and connectivity, and the

[5] Financial inclusion report carried out jointly by Banco de la República, Asomicrofinanzas and Banca de las Oportunidades.

informality of production factors, continue to be an impediment to greater access to financing and other financial services. Therefore, just as public policy should focus on improving these enabling conditions to improve the supply of financial services in the countryside, the financial sector should continue to make progress in deepening credit and access to financial products for the country's rural population.

On the other hand, if we analyze the credit behavior in Colombia, we find that the indicator of access to credit, which measures the percentage of adults in Colombia with some credit in force, increased in 2023, after a decline since 2019. This result was explained by the dynamics registered in housing credit, credit cards and consumer credit, mainly. However, access to microcredit continues to decrease, especially for rural households. "Access to microcredit has declined steadily since 2019. For the 2023 period, this indicator, which measures the percentage of adults with at least one of these products, was 6.3%. This indicates that only 2.4 million Colombian adults have one of these financing tools, mainly to microentrepreneurs" (Financial Inclusion Report, 2023). These statistics show that the problem of access, especially to credit, for rural areas is notorious. Often the decrease in the demand for these financial products is also due to the barriers of requirements that the entities put in place to be eligible as a client, which is why it is imperative that the financial products offered to this group of clients be tailored to the characteristics of their economy.

Section 2.2. Microcredit Development in Colombia.

This section characterizes the microcredit market and how it has developed over the years. This analysis is made through the economic and governmental reports made by Asomicrofinanzas, Banco de la República, Asobancaria and the Fund for the Financing of the Agricultural Sector (FINAGRO).

According to Asomicrofinanzas, these entities accounted for 58.2% of operations and 43.2% of the amount of the microcredit market in Colombia as of June 2023. Although Banco Agrario de Colombia (BAC) accounts for 41.3% of this portfolio, most of its loans are for loans to big producers and not for microcredit, since the evaluation methodology is associated with the productive project. Therefore, it can be inferred that the strongest financial product is constituted for large producers who may have much larger agricultural projects than producers located in dispersed rural areas, which ultimately generates a financial gentrification in the intermediate

rurality. If we decompose the supply of microcredits in the rural areas, it is evident that some financial institutions prefer rural products but more of them are focused on urban areas and agglomerate cities. Thus, “banks specialized in microfinance have a majority participation in all municipalities and in disbursements of medium or low amounts, while public banks and microfinance NGOs are more important in rural and dispersed rural municipalities” (Financial Inclusion Report, 2023).

Since 2015, the agricultural sector has had the lowest distribution of microcredit, with only 21% of disbursements and 20% of the total amount disbursed across all economic sectors. Even though the industry has been expanding into rural and dispersed rural municipalities, there was an step-back in 2019 and 2020 (mainly because of the Covid-19) leaving only 23% of lending operations as microcredits. This is relevant for the country, given that historically these areas have presented the greatest restrictions in access to credit due to both supply and demand factors. Finally, “the distribution of microcredit, in terms of the amount disbursed, shows that most operations are concentrated in the range between $1m and $2m (25 %), followed by amounts between $2m and $3m (20 %), and between $5m and $10m (16 %). Between 2010 and 2019, there is evidence of a drop in microcredits between $3m and $4m (from 22% to 14%) and between $1m and $2m (from 36% to 33%)” (Asomicrofinanzas, 2023).

Moreover, according to reports from Asomicrofinanzas and Bancoagrario: Of the total number of clients, 50% were in cities and agglomerations, 27% in intermediate municipalities and the remaining 23% in rural and dispersed rural municipalities. In the case of women, there is greater participation in cities and agglomerations; in the case of men, rural and dispersed rural municipalities stand out. This difference by sex could be due to a segmentation of the microfinance industry or characteristics of the productive sectors in both territories.

Section 2.3. Literature review

Section 2.3.1. Microcredit in rural and dispersed rural municipalities: Determinants of access and delinquency.

This report is elaborated by several private and public financial associations in Colombia, including Asomicrofinanzas, Banco de la República and FINAGRO. The study analyzes the impacts of microcredit in rural areas and presents models of the determinants of individuals' access to credit opportunities, considering factors such as delinquency and accessibility. Furthermore, it

also provides an analysis of the risk factors that should be taken into account by governments when implementing a public policy focused on financial inclusion. The authors make a complete analysis not only of the socioeconomic context of rural areas but also of the country's credit markets, using databases obtained from entities and national surveys such as: DANE, TerriData, National Agricultural Census, Bancoldex, among others.

The author divides the study in three parts: First, discusses the importance of microcredit and characterizes rural and dispersed rural municipalities, then mentions the determinants of access and finally the determinants of delinquency. For the section on the determinants of access, the author conducted a probit model where the database is composed of information on loans and borrowers from 14 microfinance institutions. In the section on delinquency, the authors performed a Probit econometric model. The database is the same as the one used for the model in the previous section. However, unlike the unapproved loans variable, the database does have delinquency information for the fifteen institutions analyzed. For both models, the variables are divided into i). socioeconomics of the borrowers, ii). financial situation of the microentrepreneur and iii). characteristics of the loans and the MFIs.

The results obtained by the authors show that variables such as age, gender, marital status, and education of the individuals, as well as the distance between the municipality where they carry out their activity, the levels of violence in the territories and elements related to the technology and microcredit methodology of the MFIs should be considered to promote sustainable access to microcredit in rural areas of the country. In addition, facilitating access to credit is essential for rural inhabitants to develop or expand their productive activities, which can not only generate a livelihood for their families but also provide employment for other people in the community. In this way, microcredit providers can contribute to the development and stabilization of rural and dispersed rural municipalities.

Section 2.3.2. Role of microcredit in Sustainable Rural Development.

Inform conducted by Muhammad Imran, Shamsheer Ul Haq and Orhan Ozcatalbas (2022). Is a paper that gathers information on the context of rural areas, the history and development of microcredit, the functions of microcredit and how microcredit impacts the sustainable development of rural areas.

The authors begin the report by defining sustainable development in rural areas. They reach to the consensus that "to achieve equality on welfare efforts should be made to minimize the differences in living standards of both areas (Urban and rural areas). Rural areas can be described as residential areas where the economy is mainly based on a natural resource such as agriculture & forestry, where face-to-face interaction is more common, rules of daily life are shaped by local customs, and social, economic, and cultural developments are relatively slow and delayed" (Imran, M. et al. 2022). In addition, it discusses how microcredit can be a solution to boost rural development, allow access has a positive impact on three dimensions; social, economic, and environmental.

Furthermore, the authors conclude that "Access to microcredit has a positive impact on three dimensions of sustainable rural development; social, economic, and environmental. Microcredit helps in the alleviation of poverty, employment, entrepreneurship, higher productivity from agriculture, women empowerment, gender equality, reduced rural outmigration, better health and education, green entrepreneurship, and adoption of modern technology/ inputs in agriculture". (Imran, M. et al. 2022)

Section 2.3.3. The miracle of microfinance? Evidence from a randomized evaluation.

Economic study conducted by Banerjee, Duflo, et. Al (2014). This study performs a randomized evaluation of the effect of a group lending microcredit program in Hyderabad, India. They retrieved the data from a collaborative project in 2005 between the Center of Microfinance (CMF) at the Institute for Financial Management Research (IFMR) in Chennai and Spandana. The authors define the sample from the 52 poorest neighborhoods of Hyderabad, which were randomly selected to form part of the branch.

The paper examines "the effect on borrowing from various sources, consumption, new business creation, business income, etc., as well as measures of other human development outcomes such as education, health, and women's empowerment" (Banerjee, Duflo, et. Al. 2014). As for the intervention, the treatment and comparison areas did not differ in their baseline levels of demographic, financial, or entrepreneurship characteristics in the baseline survey. Given the limitation of the possible spillovers and the general equilibrium effects, the authors decided to carry out an Intention-to-Treat (ITT) analysis on a sample of "likely borrowers", additionally, they held

a process of simple comparisons of averages in treatment and comparison areas, averaged over borrowers and non-borrowers.

Regarding the results, the authors found that at the first deadline while households do borrow more from microcredit institutions, the overall take-up rate is reasonably low and some of the loans are substituting for informal loans. Therefore, they conclude that the demand for microcredit is not as bigger as expected. However, they did find significant impact on small business investment and profits of pre-existing businesses increased, but consumption did not significantly increase. Thus, in the context of the study microfinance is influencing some households to make different intertemporal choices of consumption. Lastly, another result is that in contrast to the claims sometimes made by MFIs and others (including our partner), demand for microloans is far from universal.

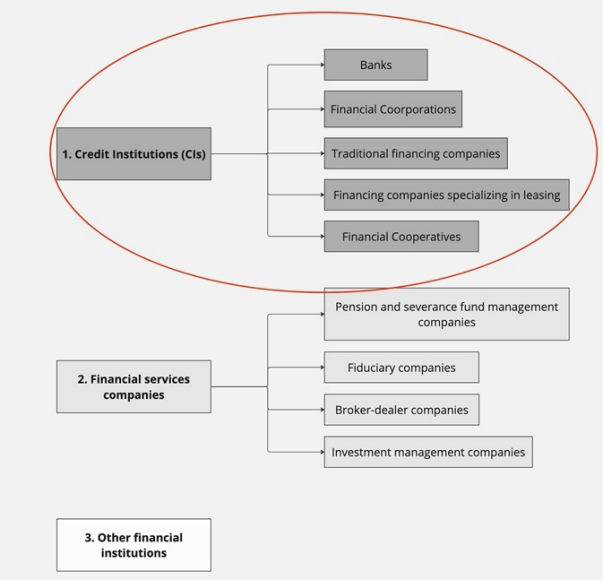
Chapter 3: Institutional Framework

In **section 3.1** I will define the financial institutions and the structure of the financial sector in Colombia. Likewise, in **section 3.2** I will define the three types of municipalities in Colombia.

Section 3.1: Relevant financial institutions & the structure of the financial market.

The Colombian financial system is composed of credit institutions (CIs), financial service entities (FSEs) and other financial entities, called financial conglomerates. The above are regulated by the Super Intendencia Financiera[6]. In Figure 1, the financial sector on which this study will focus and where the data for the models were taken from is illustrated more clearly.

Figure 1.Colombian Financial System



Own elaboration. Source: Organic Statute of the Financial System (EOSF).

Financial cooperatives are supervised by the SFC, while savings and credit cooperatives and multi-asset cooperatives are supervised by the Superintendency of the Solidarity Economy. The data used in this research are mostly taken from the SFC's open databases, so the focus is on the entities under its umbrella.

It is pertinent to clarify the CIs that will be most relevant to this study. In Colombia, a bank is a financial intermediary for lenders and depositors; they are corporations and provide services to the public. A financial cooperative, on the other hand, "is owned and operated by the members of the cooperative entity with a common purpose, which is to provide financial services to its members

[6] The *Super Intendencia Financiera* is a governmental technical body in charge of preserving the security, stability, and confidence of the Colombian financial system.

on a not-for-profit basis" (Coopetraban 2023). Additionally, it is the case that many banks have a financial cooperative attached to them as well, usually for the purpose of generating greater services to different client segments.

Section 3.2: Rural, dispersed rural and intermediate municipalities in Colombia.

According to Castro et al. (2015), rural municipalities are those with headwaters of less than 25,000 inhabitants and population densities between 10 inhabitants/km2 and 100 inhabitants/km2, while for dispersed rural municipalities the headwaters and population density is less than 50 inhabitants/km2. Intermediate municipalities are characterized by having between 25,000 and 100,000 inhabitants in the headwaters or have a relatively high population density (more than 10 inhabitants/km2). Finally, cities and agglomerations concentrate more than 100,000 inhabitants.

In Colombia, "rural and dispersed rural municipalities represent 61% of the country's municipalities and account for 84% of the national area. These territories comprise 56% of the total Agricultural Productive Units (UPAs) of the country and 84% of its area. Around 8.7 million Colombians live in these areas, representing 18% of the total national population" (Clavijo, F, et. al. 2022). Additionally, rural areas are characterized by generating economic activity mostly from agriculture and livestock. Although the added value, according to DANE, is at a level similar to the national aggregate (1.5% rural municipalities and 1.4% dispersed rural municipalities), these areas are at a comparative disadvantage with other economic activities due to the volatility of changes in climate, the fertility of the fields, etc.

Additionally, these municipalities are characterized by their high levels of multidimensional poverty, where they present a poverty level of about 37% and 38%, respectively. The above, highlighting that it is almost 15 percentage points higher than the poverty presented in cities and agglomerations. Likewise, the Unsatisfied Basic Needs Index (UBNI)[7] was located at 23.3 and 31 for rural and dispersed rural municipalities, placing it above the national total (22.7).

[7] National survey, performed by DANE, that seeks to determine from the simplest economic indices whether the basic needs of the population are covered.

Chapter 4: Methodology.

In **section 4.1.** the structure of the models will be discussed. In **section 4.2.** I will explain the construction and characteristics of the dependent and independent variables. For **section 4.3.** the description of the data and some important remarks regarding the dataset will be given.

Section 4.1: Models

Section 4.1.1: Accessibility of rural households to microcredits (Linear approach).

First, I present an OLS regression to evaluate which factors influence in the accessibility to microcredits. Additionally, I consider the case in which the dependent variable had a logarithmic transformation due to the distribution of the data (See Appendix 1). The first regression consists of the following variables:

$$allocation_i = \beta_0 + \beta_1\ Type\ producer_i + \beta_2\ Investment_i + \beta_3\ PCM_i + \beta_4\ Deadline_i + \beta_5\ Credit\ line_i + \beta_6\ Production\ line_i + \beta_7\ FAG_i + \beta_8\ FAG\ value_i + \beta_9\ Gender_i$$

Where:

- $allocation_i$: Amount authorized by the financial institution, based on the amount requested by the applicant.
- $Type\ producer_i$: Categorical variable of producer size applicable to microcredit. It takes the following values: Small low-income producer (SLIP), small producer, medium or large producer.
- $Investment_i$: Tentative amount requested to the bank for the microcredit.
- PCM_i: Post-Conflict Municipality. Categorical variable that evaluates whether the municipality from which the applicant originated belongs to the municipalities affected by violence.
- $Deadline_i$: Number of months authorized for the credit repayment.
- $Credit\ line_i$: Classification of financeable activities, based on the FINAGRO classification. Categories: working capital, investment, and portfolio normalization.
- $Production\ line_i$: Categorical variable indicating the financeable activities for each credit line.

- FAG_i: Percentage of the FAG Guarantee backing the disbursed operation. Not all operations have a guarantee.
- $FAG\ value_i$: Initial amount guaranteed by the FAG (Value of the Placement by the FAG Percentage)

These variables for the regression were chosen because they are expected to be determining factors that influence how much accessibility the financial entity grants to an individual living in rural areas of Colombia. It is expected that the variables that determine the characteristics of the economic activity of the producer, such as $Type\ producer_i$ and $Production\ line_i$, have a negative impact if the producers are small or SLIP, and/or with production lines related to agriculture, as this makes them more likely to be potential clients that default on their loans, hence restricting further the possibilities or flexibilities of the microcredit given the uncertainty. On the other hand, as for the variables that address the financial characteristics of the requested microcredit, such as $Investment_i$, $Deadline_i$, $Credit\ line_i$, FAG_i and $FAG\ value_i$ it could be expected that as the term and amount of the microcredit increases, this will imply greater microcredit accessibility for the individuals who apply. Likewise, for the variables that belong to the FAG scheme, it is expected that there will be a positive impact on accessibility as the amount and interest rate increase. The latter because greater coverage by the agricultural fund is a guarantor for the financial institutions of the low risk of the microcredit applicant.

Section 4.1.2: Accessibility of rural households to microcredits (Logistic approach).

This approach is also used in the study because it allows us to analyze the credit accessibility of individuals as the difference between investment and allocation. Additionally, it is an approach that is used in many studies on the subject, especially in one of the papers guiding this Thesis.

In this case, the logistic regression looks as follows:

$$accesibility_i = \beta_0 + \beta_1\ Type\ producer_i + \beta_2\ Investment_i + \beta_3\ PCM_i + \beta_4\ Deadline_i + \beta_5\ Credit\ line_i + \beta_6\ Production\ line_i + \beta_7\ FAG_i + \beta_8\ FAG\ value_i + \beta_9\ Gender_i$$

As can be seen, the relevant change is in the dependent variable, which, unlike the two previous regressions, is constructed as a dummy. In this context the variable is constructed as follows:

- $accesibility_i = 1$: If the difference between "*investment*" and "*allocation*" is 0.
- $accesibility_i = 0$: If the difference between "*investment*" and "*allocation*" is different than 0.

The purpose of this dummy is to capture the effect of the covariates on the authorization by the financial institutions to grant the microcredit of the amount initially requested by the applicant. This is achieved because by converting the variable into a dummy of the difference between investment and allocation, it is possible to accurately identify whether the full amount is delivered (difference of 0) or if, on the contrary, less is granted due to the credit risk characteristics (different from 0) of the individual. The rest of the variables present the same characteristics and predictions of the past sections. Likewise, although the structure of the dependent variable changes, the interpretation of the coefficients also changes a little, since now we are talking about probabilities of greater accessibility. Because of the aforementioned, by means of this scope it is possible to easily understand how a change in a variable affects the probabilities of obtaining a microcredit.

Section 4.1.3: Microcredit take-up rate by individuals in rural Colombia.

In this regression, the idea is to capture the factors that most influence the take-up rate of credit opportunities (specifically microcredit) by agricultural producers and households in rural areas. It is a logistic regression performed with a database that further analyzes the financial inclusion approach in the country in an individual level. The regression is as follows:

$$TakeUp\ Rate_i = \beta_0 + \beta_1\ Rurality_i + \beta_2\ Entity_i + \beta_3\ Branch\ indicator_i + \beta_4\ Branch\ quantity_i + \beta_5\ PCT_i + \beta_6\ Credit\ history\ index_i$$

Where:

- $TakeUp\ Rate_i$: Dependent variable of categorical modality, which captures whether the individual is more likely to apply for a microcredit given his or her socio-demographic characteristics.
- $Rurality_i$: Variable that categorizes the type of rurality (rural, dispersed rural, intermediate, city and agglomerations) from which the individual comes.
- $Entity_i$: Variable that classifies the type of financial entities to which the individual applied for microcredit.

- $Branch\ indicator_i$: Categorical variable that indicates the type of branches of the financial institution.
- $Branch\ quantity_i$: Number of branches in the municipality, given the type of branch.
- PCT_i: Number of Transactions in Physical Correspondents.
- $Credit\ history\ index_i$: Index that classifies the individual's credit history into: Non, Super Low, Low, Intermediate, High.

With these variables I seek to analyze what factors influence the probability of an individual in rural areas to accept or be more likely to apply for a microcredit given its rural characteristics. The variable that determines the level of rurality is expected to have a negative relationship, implying that the more rural (such as rural and dispersed rural) the less likely it is that individuals acquire to microcredit. This may be due to factors such as the level of delinquency, the demographic characteristics of rural areas and the reach of bank branches. Similarly, it is expected that the variables that have to do with the characteristics of the type of financial entity ($Entity_i$, $Branch\ indicator_i$) will be negatively correlated if the financial presence is weak, since this is subject to the person not acquiring financial products due to the presences of transportation costs or few offered options that meet their financial needs. Finally, variables that represent some aspects of the individual's financial profile, such as PCT_i and $Credit\ history\ index_i$, should have a positive effect on the take-up rate of microcredits as they increase.

Section 4.2: Data.

The database for the financial accessibility analysis was collected from the Colombian government's open data page, however the origin is from the agricultural sector placements provided by FINAGRO. This base covers the years 2020 through 2023, on a quarterly basis. Likewise, it describes the data at the individual level and has an initial number of 2,025,979 observations distributed in the 32 departments and more than 1108 municipalities of the country. After the data cleaning and filtering process, the remaining database is with 1,231,437 observations. The variables include the type of producer, microcredit value and placement, transaction location (department and municipality), post-conflict status of the municipality, production and credit line, microcredit purpose, gender, and Guarantee Fund (FAG) details. I decided to omit the year 2019 from the analysis, as I believe it could be heavily biased by the effects of COVID-19. Likewise, while the 2020 observations may also have lags from the

pandemic, I also believe that they may reflect the financial recovery in the country, and with each passing year the impact of COVID-19 on the data is less and less.

On the other hand, the database for the second analysis, the microcredit take-up rate, was merged between two databases: 1. Financial inclusion database (2020-2023) and 2. Database of bank branches in Colombia (2020-2023). The first one was collected from the open data page of the Colombian government, and the data is from the Financial Superintendence of Colombia. For the second one, the observations were extracted from the entity "*Banca de las Oportunidades*". Both databases were joined at the quarterly level and by municipality. After the cleaning and filtering process, there were a remaining 1,266,748. This base has approximately 79 variables, in which is analyzed the issuing entity, the type of banking, in which municipality and department the credit transaction was carried out, what was the destination that was granted to the credit, collects whether the naturalness of the transaction with what type of correspondent, the amount requested, as well as the balance of the accounts (if any).

Chapter 5: Empirical Results.

In this section I will analyze all the relevant results obtained by the regressions and perform a statistical analysis of relevant financial characteristics of the credit applicators. In **section 5.1.** I will discuss the results of the *Accessibility of rural households to microcredits.* In **section 5.2.** the results of *Microcredit take-up rate by individuals in rural Colombia* will be discussed. In **section 5.3.** the analysis of the statistical measures obtained will be covered.

Section 5.1. Accessibility of rural households to microcredits.

Table 1: Linear model with allocation and logarithmic allocation variable

	Dependent variable:	
	allocation	log(allocation)
type_producerMEDIUM	−44,744,711.000***	−0.171***
	(108,515.900)	(0.010)
type_producerSMALL	−44,903,021.000***	−0.967***
	(115,796.400)	(0.011)
type_producerSMALL PPIB	−45,332,932.000***	−0.883***
	(116,182.000)	(0.011)
investment	0.0001***	0.000***
	(0.00000)	(0.000)
post_conflict_munS	−2,060.542	−0.056***
	(12,951.750)	(0.001)
deadline	−5,378.547***	0.004***
	(331.799)	(0.00003)
credit_lineINVESTMENT	886,941.200***	0.203***
	(54,720.070)	(0.005)
credit_linePORTFOLIO NORMALIZATION	−786,020.200***	−0.308***
	(45,050.260)	(0.004)
production_lineRURAL ACTIVITIES	−847,356.100***	−0.155***
	(221,501.500)	(0.020)
production_lineCOMMERCIALIZATION	153,722.400	0.190***
	(118,050.600)	(0.011)
production_lineANIMAL PURCHASE	−144,458.800	−0.091***
	(91,142.100)	(0.008)
production_lineINFRAEST AND LAND SUITABILITY	−53,011.430	−0.116***
	(93,786.920)	(0.009)
production_lineMACHINERY AND EQUIPMENT	1,261,005.000***	0.375***
	(100,622.800)	(0.009)
production_linePRODUCTION	1,552,271.000***	0.327***
	(76,924.240)	(0.007)
production_lineSEEDING	−1,001,035.000***	−0.308***
	(90,963.460)	(0.008)
FAG	−265,237.200***	−0.002***
	(839.261)	(0.0001)
FAG_value_initial	1.631***	0.00000***
	(0.0003)	(0.000)
genderWOMAN	−140,005.900***	−0.022***
	(11,897.420)	(0.001)
genderLEGAL ENTITY	3,327,750.000***	0.204***
	(81,098.460)	(0.007)
Constant	63,264,707.000***	16.827***
	(141,026.400)	(0.013)
Observations	1,231,417	1,231,417
R^2	0.970	0.585
Adjusted R^2	0.970	0.585
Residual Std. Error (df = 1231388)	6,333,267.000	0.579
F Statistic (df = 28; 1231388)	1,421,467.000***	61,936.840***
Note:		*p<0.1; **p<0.05; ***p<0.01

As we can see in Table 1. Both models have an important percentage of significant variables, however, they differ in the R2. The first regression with the dependent variable without scaling presents a better performance with a value of 0.97, which means that it has an excellent fit to the model. For the second model, although it has a lower R2 (which is not unusual for log transformed data), also has a very good fit performance of 0.58.

The coefficients indicate that the type of producer significantly affects the credit allocation. As the size of the producer decreases, the amount authorized for microcredit also declines. Being medium producers decreases by 44,744,711 COP the allocation compared to high producers. Small and small PPIB producers experience decreases of 44,903,021 and 45,332,932 COP, respectively. Additionally, each extra day in the loan term (deadline) reduces the allocation by 5,379 COP, reflecting the higher risk for longer repayment periods. Microcredit for investment purposes increases the allocation by 886,941 COP. Table 1 shows that agriculture and livestock production lines negatively impact credit allocation, with seeding activities reducing the amount by nearly 1 million COP. Conversely, credits for machinery and infrastructure positively influence the allocation, increasing it by 1,261,005 COP.

In the second model, where the variable is *log(allocation)*, suggests that being a medium producer reduces microcredit allocation by 17.1% compared to the reference group, while being a small PPIB reduces allocation by 88.3%. Each additional day in the credit term is associated with a 0.4% decrease in credit allocation. The investment credit line is associated with a 20.3% increase, while portfolio normalization is associated with a 30.8% decrease. The production line variables also show significant effects in the logarithmic model. Rural activities are associated with a 15.5% decrease in credit allocation, while commercialization is associated with a 19% increase.

Table 2: Logistic Model with accessibility dependent variable

	Dependent variable:
	accesibility
type_producerMEDIUM	−0.809***
	(0.046)
type_producerSMALL	1.104***
	(0.051)
type_producerSMALL PPIB	1.653***
	(0.052)
post_conflict_munS	0.015*
	(0.008)
deadline	0.016***
	(0.0002)
credit_lineINVESTMENT	0.813***
	(0.029)
credit_linePORTFOLIO NORMALIZATION	−4.127***
	(0.019)
production_lineRURAL ACTIVITIES	−3.986***
	(0.098)
production_lineCOMMERCIALIZATION	−3.503***
	(0.071)
production_lineANIMALS PURCHASE	−2.240***
	(0.064)
production_lineINFRAEST AND LAND SUITABILITY	−3.468***
	(0.064)
production_lineMACHINERY AND EQUIPMENT	−3.122***
	(0.066)
production_linePRODUCTION	−0.974***
	(0.059)
production_lineSEEDING	−2.427***
	(0.064)
FAG	0.018***
	(0.0005)
FAG_value_initial	−0.000***
	(0.000)
genderWOMAN	0.034***
	(0.007)
genderLEGAL ENTITY	0.684***
	(0.033)
Constant	0.328***
	(0.079)
Observations	1,231,417
Log Likelihood	−309,580.600
Akaike Inf. Crit.	619,217.300
Note:	*p<0.1; **p<0.05; ***p<0.01

The results in Table 2. indicate that the smaller the producer type, the less possibility of accessibility to a microcredit it will have compared to the reference group. If the municipality is in a post-conflict area, the probability of accessing a microcredit increases by 0.015. This could be explained by the land reintegration and financial aid policies that the government has in its scheme. The different lines of credit also show significant effects. The line of credit for investments is associated with an increase in the probability of access to microcredit of 0.813, while the line of credit for portfolio normalization shows diminishes the probability of access by 4.13. In terms of

the production line variables, rural activities (coefficient = -3.986), marketing (coefficient = -3.503), and animal purchasing (coefficient = -2.240) are associated with a significant decrease in the probability of access to credit. If the individual belongs to the Agricultural Guarantee Fund (FAG), the probability on credit accessibility increases by 0.018. The model shows a log likelihood of -309,580,600 and an Akaike information criterion (AIC) of 619,217,300, indicating a good predictive capacity of the model.

Section 5.2. Microcredit take-up rate by individuals in rural Colombia.

Table 3: Logistic Model Estimations for Take-Up Rate

	Dependent variable:
	take_up_rate
ruralityINTERMEDIATE	-0.155***
	(0.008)
ruralityRURAL	-0.276***
	(0.009)
ruralityDISPERSED RURAL	-0.309***
	(0.011)
entity_typeBANKING ESTABLISHMENT	0.065
	(0.049)
entity_typeFINANCING COMPANY	-0.611***
	(0.054)
entity_typeFINANCIAL CORPORATION	-0.725
	(251,819.900)
entity_typeFINANCIAL COOPERATIVE	0.356*
	(0.190)
entity_typeSEDPES	-23.677
	(14,402.190)
indicatorNRO ACTIVE PHYSICAL CORRESPONDENTS	0.264***
	(0.012)
indicatorNRO ACTIVE OUTSOURCED PHYSICAL CORRESPONDENTS	-0.229***
	(0.013)
indicatorNRO ACTIVE MOBILE CORRESPONDENTS	-0.399***
	(0.054)
indicatorNRO MOBILE OUTSOURCED CORRESPONDENTS	-3.085***
	(0.252)
indicatorNRO TOTAL PHYSICAL OFFICES	0.745***
	(0.030)
NRO TRANSACTIONS PHYSICAL CORRESPONDENTS	-3.920***
	(0.188)
credit_historyNON	23.390
	(61,198.120)
credit_historyOTHER	25.030
	(61,198.120)
credit_historySUPER LOW	-0.930
	(61,207.030)
Constant	-25.656
	(61,198.120)
Observations	1,886,068
Log Likelihood	-363,787.900
Akaike Inf. Crit.	727,647.900

Note: *p<0.1; **p<0.05; ***p<0.01

The model estimated in Table 3 shows statistically significant results for several variables, indicating that both rurality characteristics and the type of accessible financial entity significantly influence individuals' adoption rate of microcredits. The rurality variables indicate that compared to urban areas, intermediate, rural, and dispersed rural areas have significantly lower adoption rates, with coefficients of -0.155, -0.276, and -0.309 respectively. This reflects a decreasing trend in adoption as rurality increases. Regarding the type of entity, individuals with accessibility to financing companies show a significantly lower adoption rate (-0.611), while financial cooperatives present a higher adoption rate (0.356). The above may be due to the fact that financial cooperatives in Colombia tend to have a closer and more direct presence in local communities but also offer better credit conditions.

Furthermore, the model reveals that the number of active physical correspondents and total physical offices are positively associated with the adoption rate (0.264 and 0.745, respectively). On the contrary, a greater number of outsourced mobile correspondents is negatively associated with the adoption rate (-3.085). These results suggest that a greater physical and operational presence of financial institutions promotes adoption. On the other hand, although credit history does not show a clear effect, we can see when the individual's credit history is super low, the probability of taking a microcredit decreases by almost 0.93.

Section 5.3. Statistical Analysis.

Table 4: Percentage of adults with deposit, credit, microcredit, saving account by type of municipality

Type of municipality	% Financial products	% Deposit products	% With saving account	% Credit products	% Microcredit products
Cities and agglomerations	86.57	84.45	80.61	75.49	71.63
Intermediate	73.08	65.32	65.75	57.04	67.38
Rural	57.58	54.99	54.42	43.76	35.49
Dispersed rural	55.61	54.55	54.10	42.79	35.08

Own elaboration. Source: Banca de las oportunidades

As shown in table 4, the percentage of adults with financial products in cities and agglomerations and intermediate municipalities is approximately 86% and 73%, respectively. In rural municipalities, the acquisition of financial products is 58%, and in dispersed rural municipalities, it is 56%. This indicates a significant difference in financial product acquisition, which becomes more pronounced in more rural areas of the country. It is also notable that most of these products are deposit or savings accounts, since only 43% have an active credit and 35% of

adults in rural and dispersed municipalities have a microcredit. It is evident the difference in acquisition of the type of financial product between the type of municipalities, which may be largely due to the accessibility of supply that each has.

Table 5: Percentage of financial correspondent type by municipality

Type of municipality	% Active physical correspondents	% Outsourced active physical correspondents	% Active mobile correspondents	% Offices
Cities and agglomerations	80.3	7.53	1.67	10.5
Intermediate	52.6	24.6	6.8	16.0
Rural	22.4	40.4	12.8	24.4
Dispersed rural	15.4	38.7	29.6	16.3

Own elaboration. Source: Banca de las oportunidades

As shown in Table 5, cities and agglomerations account for 80% of correspondents as physical assets, while rural and dispersed rural municipalities account for only 22% and 15%, respectively. On the other hand, the banking presence in these areas is mostly outsourced correspondents (40% and 39%, respectively). These data represents that the physical presence of banking entities is notoriously smaller as rurality increases, which can present a problem when it comes to accessing microcredit, since many times outsourced branches are not as effective or cannot carry out certain financial products for the client.

Table 6: Percentage allocation of Microcredit by product line

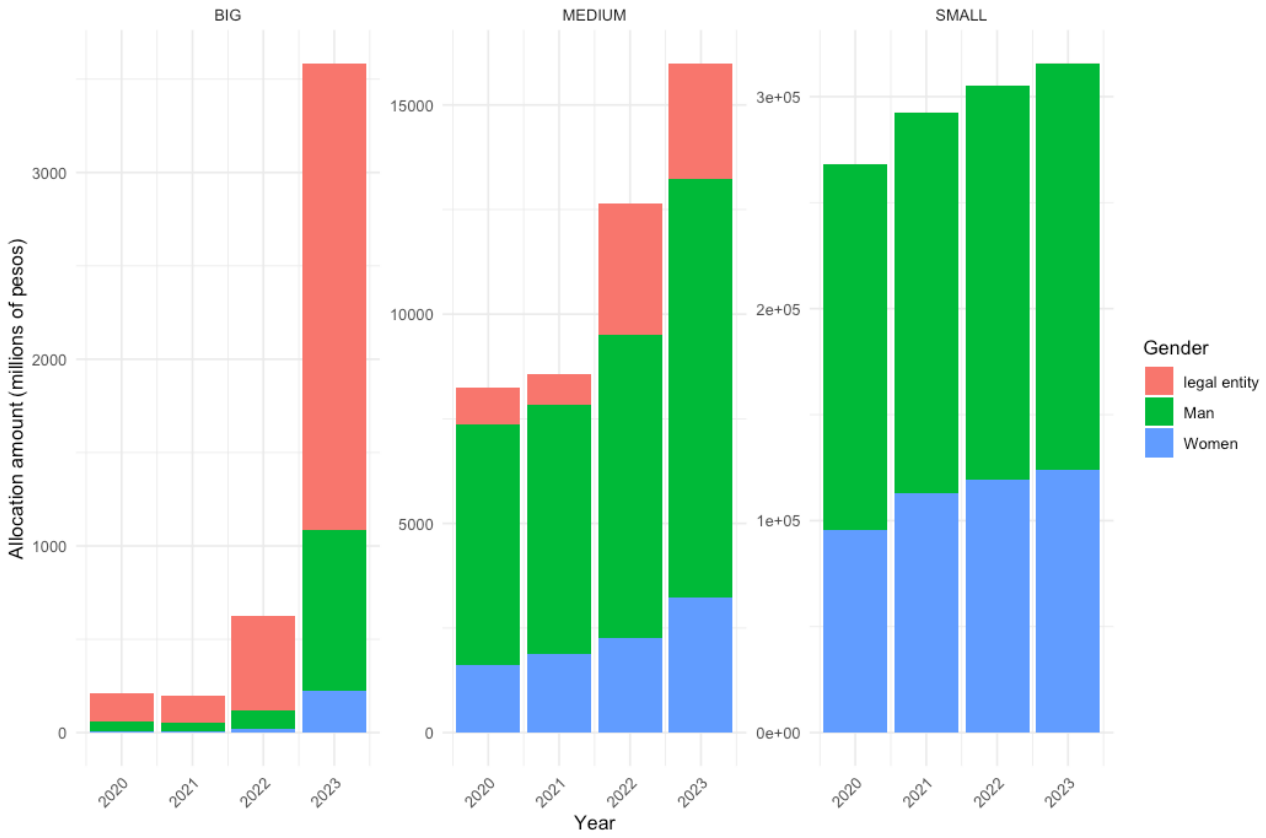
Year	%Rural activities	%Commercia-lization	%Purchase of animals	%Infraest, land suitability	%Machines and equipment	%Other activities	%Production	%Seeding
2020	12.5	15.5	16.8	9.4	11.3	14.6	11.4	8.5
2021	11.5	15.6	17.3	10.4	11.3	15.6	12.3	6.0
2022	11.3	14.6	17.6	10.5	10.3	14.3	14.5	7.5
2023	10.4	13.6	17.8	12.2	9.6	14.3	13.6	8.5

Own elaboration. Source: Finagro

Table 6 shows a decrease in the allocation for rural activities (from 12.5% to 10.4%) and marketing (from 15.5% to 13.6%). The allocation for animal purchases increased significantly (from 16.8% to 17.8%), as well as for infrastructure and land improvement (from 9.4% to 12.2%). Production and other activities remained relatively stable, with a slight increase in production in 2022 (14.5%). This reflects a growing preference for financing for the purchase of animals and infrastructure.

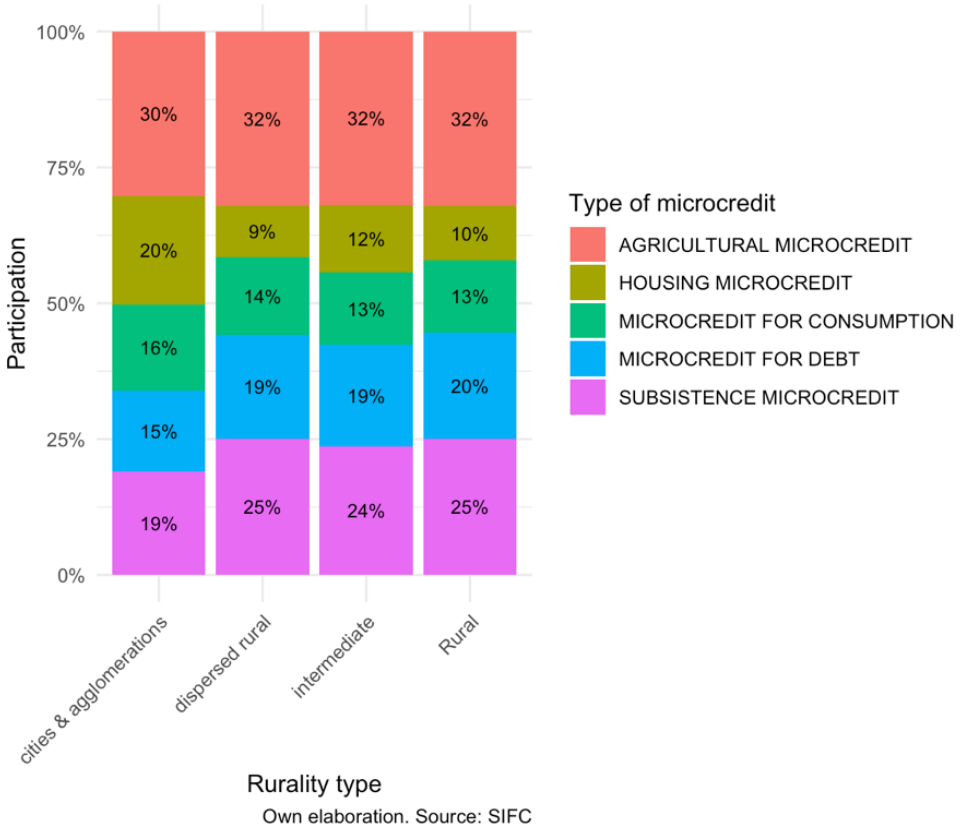
Now, if we analyze the allocation distribution that has been made over the past years and the participation of microcredits in the pool of financial options, we find the following:

Graph 2. Allocation amount given the producer type and the gender



Graph 2, portraits the proportion of the amount of allocations by financial institutions from 2020 to 2023 by type of producer and filtered by gender. One can see that big producers received a larger amount of credit in 2023, with a notable participation of legal entities. Medium producers also saw a significant increase in 2023, and it should be noted that the increase of male medium-sized producers is almost 1000 million pesos more than that of female medium-sized producers. For small producers, men consistently received the largest share of microcredit, followed by women, with no significant presence of legal entities. Trends show a general growth in microcredit allocation over the years. However, it is evident that the most noticeable growth over the years for Colombia's large producers, with an increase of almost 70% more in credit placements compared to the year 2022.

Graph 3. Participation of Type of Microcredit by Rurality type



Own elaboration. Source: SIFC

Graph 3 shows the participation of each type of microcredit offered by the financial entities given the rurality of the municipality. This graph is important because it allows us to see how the aggregate demand for the financial product in question behaves. Additionally, it allows us to identify which types of microcredits are best suited to which municipalities. For cities and agglomerations, microcredit for housing (20%) and agriculture (30%) predominate. Which can be explained by the characteristics of the vast agglomerations that the country has and to the territorial expansion that has taken place in recent years of urbanization towards agglomerations. In rural, intermediate and dispersed rural areas, microcredit for agriculture (32%) it's the most common, but also is remarkable the demand for subsistence microcredit (25% approx.), while microcredits for housing, consumption and debt are not that frequently demand. It makes sense that in rural areas the most requested microcredit is for agriculture due to the high amount of agricultural activity that takes place. This may be explained by the high levels of multidimensional poverty that these areas still suffer from and, therefore, they resort to microcredit as a tool to finance their daily activities.

Chapter 6: Discussion.

From the results of the econometric models and the statistical analysis of the microcredit financial sector, we can filter out the shortcomings of the microcredit market for peasants, especially in rural and dispersed rural areas. However, by understanding these determinants of access and what incentivizes rural individuals to obtain more financial products, we can build a product that is much more targeted to this vulnerable population. In addition, this financial methodology allows to control the risk faced by banks when offering loans to such risky and low-income individuals.

From the first two regressions of *Accessibility of rural households to microcredits*, we can note that the most relevant determinants are the type of producer, the credit line and the size of the FAG. It is clear that the size of the producer is directly correlated to how much credit the financial entity allocates in their favor. Where, the smaller the producer, the less accessibility it gets. In addition, the intention (line of credit) of the microcredit is important. More relevance is given to microcredits that are requested for investment rather than portfolio normalization[8]. Determinants such as the initial amount requested for the microcredit (*investment*) and whether or not the municipality is post-conflict do not seem to have a major impact on financial accessibility. Nevertheless, historically the conflict status of the municipality has been a constraint on the social and economic development of the area as it leads to problems such as insecurity, residual violence and lack of trust in institutions. Therefore, in recent years, governments have promoted policies for the reintegration of these populations into social and economic life. This effect can be evidenced in the logistic regression of accessibility, where, if it is a post-conflict municipality, the probability of getting full accessibility in the microcredit increases.

In the second analysis, the regression with respect to *the take-up rate of microcredits* shows that the applicant's level of rurality is a very important determinant. The more rural the municipality of the applicant, the less incentive he/she has to take or apply for a microcredit. This may be due to the high transportation costs they have to incur and the type of microfinance institutions they have to use. Let’s remember these extremely rural municipalities suffer from significant poverty and lack the necessary technology and infrastructure to access the information needed for informed

[8] Portfolio normalization is to shift the payment of one or two installments of the loan, maximum one due and one to be paid, at the end of the payment plan initially agreed with the client, the payment plan is extended according to the number of installments moved. (Bancamia, 2022)

decision-making. Additionally, the regression shows that banks and financial cooperatives could be the most appropriate institutions to offer microcredits. The above may be given because these entities already have the necessary infrastructure in those areas of the country. This regression also highlights that farmers are more encouraged to take-up a microcredit if they have the possibility of doing so in the company's primary offices.

Now, if we put these findings together and mold them into a microcredit product that is focused on low-income rural producers, we find that groupal microcredit could be an innovative tool. Following a structure similar to the one proposed by Duflo, this groupal microcredit should be focused only on medium, low or low PPB producers. The eligibility characteristics should be built based on the size of the producer, with what line of credit and given the percentage of FAG owned (at the individual level). These characteristics would help financial entities filter the risk levels of each applicant group. Likewise, individuals would be more encouraged to apply for a microcredit since factors such as credit history or production line would no longer be relevant factors because risk would be measured in aggregate terms. Therefore, asymmetry information is reduced and the moral hazard that financial institutions could face is controlled. Additionally, factors such as transportation costs would take on less importance since only one individual from the group of applicants could be requested to be the representative when opening the credit. This is also related if the entities that offer this product are banks or financial cooperatives, since they are the entities that have the most primary infrastructure in these rural areas of the country, so it would not present an additional cost to them either. Finally, the risks that the financial company faces when offering these products are significantly reduced since it is the same applicants who carry out a filtering process between them and generates a selection by indicator phenomena. Also, the Guarantee Fund (FAG) offers the possibility of granting group leverage, then the FAG index at the group level that could be achieved can be much higher than if it had been done individually. The above, generating that applicants have more leverage, and that banks and cooperatives face less uncertainty.

In conclusion, medium and small producers are the agricultural population that has the least credit accessibility and therefore the lowest take-up rate of microcredits. It is evident that a financial tool focused only on these groups could be efficient to help the economic growth of these areas, through the expansion of disposable income that they could have through a microcredit. However, in this study there are variables that are omitted from the analysis and that can also influence the

credit profile of individuals. For example, determinants such as late payment, individual poverty level, current conflict in the areas or current political effects are not considered. Therefore, with my study we cannot conclude that only the exposed factors are the main determinants of whether or not a farmer takes credit. Additionally, my study has a limitation, since the data used is only from the period 2020-2023. Therefore, many results may still be biased due to post-pandemic effects, and it also does not consider the situation before COVID-19.

Chapter 7: Conclusions.

This study explores the accessibility and adoption rate of microcredit among rural producers in Colombia, with a particular focus on small and medium-sized agricultural producers. Through an analysis using OLS and logistic regression models, the key factors influencing the accessibility and adoption of microcredit were identified, using data collected between 2020 and 2023.

The results reveal that small and medium-sized agricultural producers face significant barriers to accessing microcredit. Among the main factors identified, the rurality of the municipality, the size of the farmer, and the line of credit are critical determinants in the accessibility of microcredit. More remote rural areas show considerably lower access rates, underscoring the need to improve financial infrastructure and connectivity in these areas.

The study also highlights that the characteristics of the financial products currently available are not adequately adapted to the needs and economic conditions of small farmers. The volatility of agricultural income, influenced by exogenous factors such as weather and pests, along with long distances to urban centers, reduces the ability of these producers to meet traditional credit requirements. Consequently, financial institutions should consider developing more flexible and accessible financial products, such as groupal microcredit, that could mitigate these barriers and encourage greater adoption of credit in rural communities.

However, it is important to recognize the limitations of the study. The database used could still be influenced by post-pandemic effects, introducing potential biases into the results. Furthermore, certain determinants were not included in the analysis, suggesting that there may be omitted variable bias. To gain a more complete understanding of the dynamics of microcredit accessibility and adoption, additional research is needed that incorporates a broader range of variables and a longer time period.

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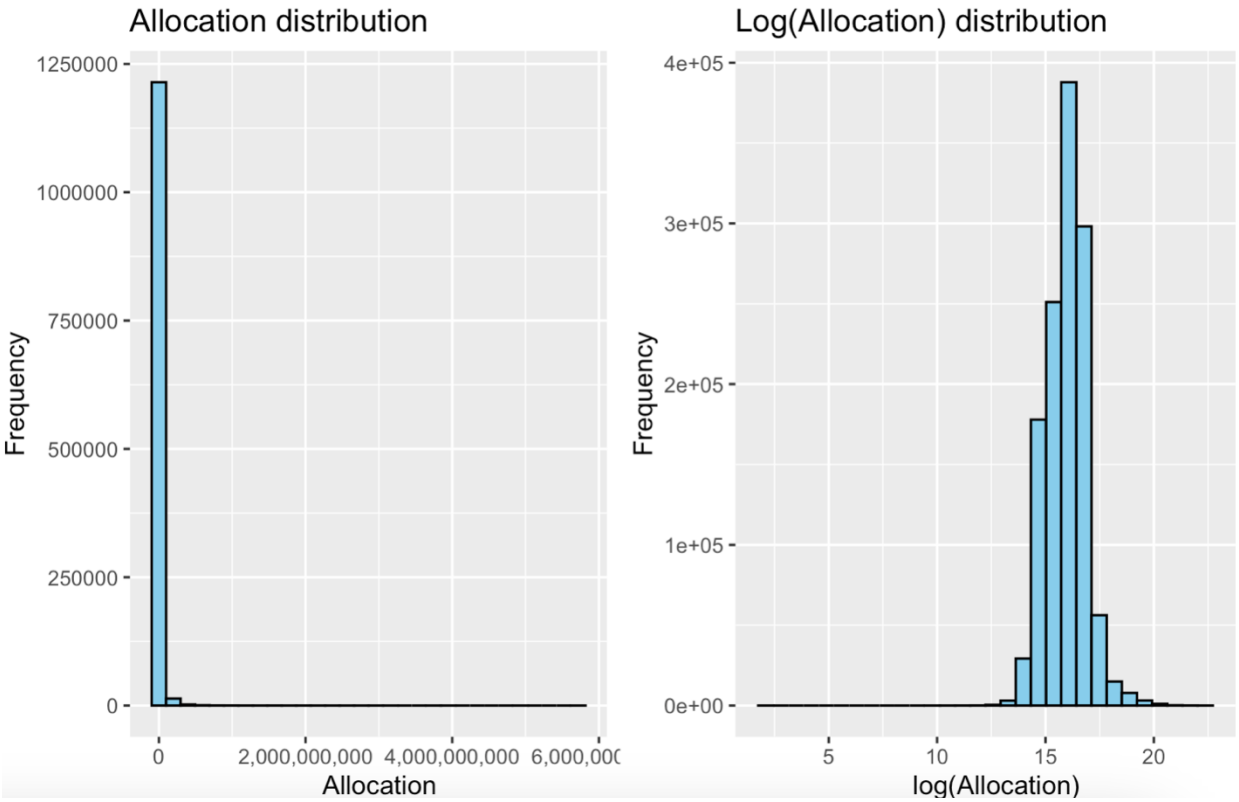
Appendix

- **Appendix 1: Data distribution.**



- **Appendix 2: Robustness check Linear Regression.**
    - Heterogeneity Test:

Table 7: Test de Breusch-Pagan

Model	BP	df	p-value
Allocation	40	12	2.2e-16
Log(allocation)	35	8	2.2e-16

    - Coefficient T-Test:

Table 8: T-test coefficients

Variable	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	6.3265e+07	2.7299e+06	23.1751	< 2.2e-16
type_producerMEDIUM	-4.4745e+07	1.9038e+06	-23.5023	< 2.2e-16
type_producerSMALL	-4.4903e+07	2.7656e+06	-16.2364	< 2.2e-16
type_producerSMALL PPIB	-4.5333e+07	2.7436e+06	-16.5230	< 2.2e-16
investment	5.2645e-05	5.1305e-05	1.0261	0.3048
post_conflict_munS	2.0605e+03	2.2430e+04	0.0919	0.9268
deadline	-5.3785e+03	5.8983e+02	-9.1188	< 2.2e-16
credit_lineINVESTMENT	-8.8694e+05	1.4196e+05	-6.2478	4.165e-10
credit_linePORTFOLIO NORMALIZATION	7.8602e+05	5.5613e+04	14.1337	< 2.2e-16
production_lineRURAL ACTIVITIES	-8.4736e+05	5.6668e+05	-1.4953	0.1348
production_lineCOMERCIALIZATION	-9.5757e+05	1.2770e+05	-7.4986	6.455e-14
production_lineLIFESTOCK	-1.4446e+05	1.3551e+05	-1.0660	0.2864
production_lineINFRAEST AND LAND SUITABILITY	5.3011e+04	1.3298e+05	0.3986	0.6902
production_lineMACHINES AND EQUIPMENT	1.2610e+06	1.7966e+05	7.0187	2.241e-12
production_lineOTHER ACTIVITIES	3.6680e+05	1.5211e+05	2.4114	0.0159
production_linePRODUCTION	-1.5523e+06	1.3957e+05	-11.1219	< 2.2e-16
production_lineSERVICES	-1.0884e+06	2.6599e+06	-0.4092	0.6824
production_lineSEEDING	1.0010e+06	1.7658e+05	5.6690	1.436e-08
FAG	-2.6524e+05	4.0516e+03	-65.4641	< 2.2e-16
FAG_value_initial	1.6311e+00	2.7027e-02	60.3487	< 2.2e-16
genderWOMAN	1.4001e+05	1.3316e+04	10.5141	< 2.2e-16
genderLEGAL ENTITY	3.3278e+06	1.0397e+06	3.2007	0.0014

- **Appendix 3: Robustness check Logistic Regression.**
    - Multicollinearity:

Table 9: Multicollinearity Test Results (GVIF)

Variable	**GVIF**	**Df**	**GVIF**$^{(1/(2*Df))}$
Rurality	1.1593	3	1.0249
Entity type	1.3323	12	1.0120
Indicador	1.2180	15	1.0066
NRO TRANSACTIONS PHYSICAL CORRESPONDENTS	0.9311	1	0.9649
Credit history	1.1036	3	1.0166