Microfinance and climate change: threats and opportunities, the case of Brazil’s largest rural MFIs, Agroamigo and Cresol

Rafael Moser, Davide Forcella and Lauro Emilio Gonzales Farias

This paper reports a cross-case study of the interface between rural microfinance and climate change in Brazil. We use a simple theoretical framework to analyse climate change opportunities and threats of Brazil’s largest rural microfinance institutions, Agroamigo and Cresol, along three main metadimensions: economic, financial and additional services. Our analysis focuses on vulnerability and adaptation to climate change and, to a lesser extent, mitigation. As proxy for climate change effects on clients and institutions, we use the recent droughts and floods affecting some of the areas of operation of these MFIs. We argue that the absence of a combination of climate change strategies in MFIs operating in weather hazard prone regions may result in greater and additional credit risks for their portfolios and a missing opportunity for these players to support their clients better respond to climate change impacts. The case studies under scrutiny corroborate our hypothesis.

Keywords: Climate Change Adaptation, Climate Change Vulnerability, Agricultural Microfinance, Rural Microfinance, Green Microfinance, Climatic Risk, Credit Risk, Brazil, Agroamigo, Cresol

JEL Classifications: O13, Q14, Q54, G21

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AUTHORS:
Moser, Rafael; Centre for Microfinance Studies, FGV¹;
Forcella, Davide; CERMi, ULB²;
Gonzalez Farias, Lauro Emilio; Centre for Microfinance Studies, FGV³.

ABSTRACT:
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¹ rafaelmoser@hotmail.com
² davide.forcella@yahoo.it
³ lauro.gonzalez@fgv.br
INTRODUCTION

Over the last three decades, implications of climate change (CC) on human and natural systems have gained momentum in the local, national and international arenas. As a matter of fact, latest scientific data indicate that during the second half of the 20th century and beginning of the 21st, mean land and ocean temperatures have risen about 0.64ºC and 0.78ºC, respectively, relative to 1850-1900 timeframe (IPCC, 2013). CC, however, goes well beyond this average increase in temperatures, coming to encompass broader and more complex phenomena such as higher rainfall variability, retreating glaciers and sea level rise, destructive storms and floods, prolonged droughts, more frequent and intense cyclones and hurricanes, as well heat waves, among other.

Paradoxically, poorer nations and households who contributed least to global warming happen to be most vulnerable to a changing climate (STERN, 2007; AHMED et al, 2009). Indeed, either because of their geographical location or livelihood strategies, the poor have the lowest adaptive ability to cope with the effects of climate change. As a result, the poor, particularly in the global south, will bear the worst consequences of climate change (BRETSCHGER and VALENTE, 2011; SCHELLNHUBER et al, 2013).

Various proposals have been raised to cope with CC at the global, national and/or international level (see, for example, STERN, 2007; HARRIS and GOODWIN, 2009; IPCC, 2014). However, very little has been done in terms of concrete and ambitious actions at the micro, household level (RIPPEY, 2012). Climate change will affect every level of society and as such tailored actions will be needed to each of these levels. Because the credits provided by microfinance institutions (MFIs) are usually grounded on detailed knowledge of households’ activities and partially influences their livelihood choices, MF emerges as an appealing and yet overlooked instrument to deliver adaptation, and to a lesser extent mitigation, strategies to some of the potentially most affected populations.

The combination of microfinance with climate change realms finds solid ground in Brazil. The country is indeed a major victim of, and key actor against, climate change and its associated disturbances. Through 1991 and 2010 more than 96 million Brazilians were affected by climate-related disasters, in particular throughout Brazil’s Northeast (CEPED-UFSC, 2012). As the 21st century evolves, forecasted temperature increase varying between 2.5 and 6ºC [according to different macro development pathways and compared to the second half of the 20th century (PBMC, 2013a)], may exacerbate environmental disturbances, potentially affecting Brazil’s major socioeconomic pillars such as agriculture, public health, and energy generation (MARENGO et al. 2011; PBMC, 2013a; 2013b).
Increasing CO₂ emissions, as result of ongoing deforestation practices in the Amazon region, are likely to exacerbate even further site-specific climate change effects (PBMC, 2013a). In fact, the Amazon rainforest plays central role in the maintenance and conservation of natural ecosystems in the South American continent since it absorbs and recycles nearly half the total rainfalls of the whole region (CHOU et al., 2011:11). Any alteration in that system [e.g. land use change, decreased precipitation] would impact weather patterns all over South America. This process could also be intensified by Brazil’s recent economic growth. Consequently, Brazil is positioned as central player in terms of climate change mitigation and adaptation actions.

On the other hand, microfinance in Brazil has experienced a boom over the last couple of decades. The sector saw its lending capacity, measured in terms of total outstanding loan portfolio, increase from some US$27 million in 2001 to around US$2.5 billion in 2012, and number of borrowers jump from nearly 100,000 in 2001 to around 2.6 million in 2012 (MIXMARKET, 2014). Such a pike was the result of massive governmental incentives during the 2000s to pour funding into the sector, in particular into public banks such as Bank of the Northeast of Brazil (BNB), the Caixa Econômica Federal, the Bank of Brazil (BB), and the National Bank for Economic and Social Development (BNDES). Microfinance could then be an interesting vehicle to deliver adaptation and mitigation initiatives (AGRAWALA and MAELIS, 2010) to the poorest segments of Brazil’s society.

By combining a priori uncorrelated realms, this study aims to contribute to the discussion concerning the role of MF in bolstering micro/household level CC strategies and to shed further light on an underdeveloped field of research. Applying an instrumental case-study to the two largest rural MF programmes in Brazil: Agroamigo and Cresol, we explore the exposure of MF activities to CC impacts and address the needs and opportunities of microfinance programmes to support adaptation strategies to CC.

It is worth noting that, due to its public character as opposed to most MFI’s private-led models worldwide, the Brazilian case is somewhat peculiar and generalisations of our analysis to other regions is not straightforward. At the same time, it is also important to underline that CC measures should be shaped and constructed according to local specificities and therefore no blueprint shall be reliable.

Section 1 provides a literature review on the relation between microfinance and climate change, as well agriculture with climate change, whereas section 2 presents the methodology and theoretical framework used for the purpose of this paper. In section 3, we present the programmes and data analysis, and finally, in the last section, we state the main results and draw some conclusions.
1. LITERATURE REVIEW

Microfinance and Climate Change

The literature discussing CC and MF is rather scarce and mainly based on theoretical papers and case studies. HAMMIL et. al (2008) and HELTBERG et al (2008), for instance, provide a theoretical discussion on the role of MF in fostering CC adaptation and risk reduction; DOWLA (2009) discusses the possible entry points of MF to cope with CC based on the case of Bangladesh; in (AGRAWALA and MAELIS, 2010), synergies and trade-offs between MFIs’ operations in Nepal and Bangladesh and CC adaptation are analysed and discussed; while (STEINMANN, 2012) discusses the role of micro-insurances to support MF adaptation strategies. In (CASTELLANI and CINCINELLI, 2014) the effects of droughts on MFIs’ portfolios in African countries is analysed, while ongoing work on the present and historical role of MF to support CC adaptation in Bangladesh is pursued in (FENTON, 2014). Previous discussion on the relation between MF and CC actions in Brazil can be found in (MOSER and GONZALEZ, 2014; GONZALEZ and MOSER, 2014).

To our knowledge only few MF programmes are especially dedicated to CC adaptation. For example (FORCELLA, 2013a; 2013b) discuss and assesses a MF pilot programme in Cambodia aimed to increase the resilience of poor rural households against extreme weather events and CC thanks to a mix of savings, credits for diversification of income generating activities, insurance in kind (rice) and technical assistance. Likewise, “Eco Micro” (EcoMicro) supports MF projects that aim to sustain climate change adaptation in Central and South America, while in the Andean region of Colombia and Peru, the Microfinance for Ecosystem-based Adaptation (MEbA) project supports the design of MF services towards more eco-friendly activities and the improvement of resiliencies to climate change effects (UNEP, 2014).

In spite of the low interest of the MF community in the climate change realm, there exist various reasons to believe that MFIs should take a firm grip on the issue. Firstly, as previously highlighted, the countries in which MFIs operate and the population they provide services to are among the most vulnerable to CC. Secondly, such vulnerability combined with greater incidence of climate hazards will increase the credit risk of various MF activities. In fact, climate change is likely to affect both directly and indirectly MFIs and their clients. CC could indeed result in asset and life losses for MFI's clients and, ultimately, cause poverty traps in the short and long runs (see, for example, HAMMILL et al., 2008; AGRAWALA and MAELIS, 2010; HELTBERG et al. 2008; DOWLA, 2009). Climate change could also increase the income variability of the poor, decrease
agriculture productivity and affect negatively investments in livestock. In addition, CC could destroy partially or entirely properties and equipments owned by MFIs worldwide (DOWLA, 2009).

Moreover, as past evidences showed [think of flood periods in Bangladesh (see, DOWLA, 2009)], CC events can reduce the possibility for clients to repay their debts; increase tides of savings withdrawals and claims on insurance policies; and, ultimately soar pressures on MFIs to forgive maturing debts. More indirectly MFIs and their clients will be affected by health problems, educational challenges, and increase of vulnerability of households’ social capital induced by CC. In short, CC will likely introduce new important sources of risk for MFIs and their clients at large.

There are two central strategies dealing with climate change and its associated disturbances: mitigation and adaptation. The former refers to actions aimed at reducing sources of emission and/or increasing sinks [for instance, forests, oceans, and plants absorbing CO2] (UNFCCC, 2009; VIJAYAVENKATARAMANA et al. 2012), and could be implemented by MFIs thanks to the promotion of renewable energies, energy efficiency and environmentally friendly activities such as agroforestry or silvopastoral systems (AGRAWALA and MAËLIS, 2010; FORCELLA, 2012; MUNOZ and CHRISTEN, 2004; GREENMICROFINANCE, 2007; VAN ELTEREN, 2007; HALL et al., 2008; SCHUITE and PATER, 2008; ALLET, 2012, 2013; ALLET and HUDON, 2013; FORCELLA, 2013c; MF RATING, 2013; FORCELLA and HUDON, 2014).

Adaptation is instead the set of actions aimed to adjust natural and/or human systems to actual or expected climatic stimuli or their effects, with a view of moderating harms or exploiting benefits and opportunities associated with climate change (IPCC, 2007; BROOKE, 2008). Along such categories, a third element needs duly consideration, i.e. the notion of risk. According to the IPCC (2014), risk levels are the result of the intersection between site-specific climate change hazards, exposure and idiosyncratic vulnerability (e.g. of communities, individuals, regions, and/or countries) to these impacts, and, consequently, shall be assessed on an individual basis.

While mitigation strategies could still be a choice for MFIs and their clients, fostering adaptation strategies will be a necessity (DOWLA 2009). MFIs and their clients will be indeed among the first and the hardest affected by CC events. For this reason, MFIs should evaluate the possibilities to support CC adaptation actions for both their benefit and their clients’. Adaptation strategies can be divided into ex-ante risk management, i.e. actions that support coping mechanisms to forecasted weather impacts, and ex-post risk management, or actions aimed to reduce the short and long term damages generated once a particular weather event has already affected MFI clients (HAMMILL et. al., 2008).
The position of some MFIs as bridges between international investors and donors, and poor people and clients, could provide advantages for MFIs to support the institutionalisation of local adaptation strategies that poor people and MFIs' clients have developed, with the help of the international experiences and understandings (HAMMILL et al., 2008; HELTBERG et al. 2008; DOWLA, 2009). Moreover the proximity of some MFIs to their clients provides arguments to believe that MFIs are interesting delivery channels for CC adaptation policies.

The overall incertitude of CC effects at the local scale, could induce MFIs to look for a no-regret strategy (HELTBERG et al., 2008): a set of actions that would not depend too heavily on specific forecasted CC events, but would instead provide overall benefits based on a broad range of climatic events: such as asset accumulation and diversification of income sources; greater repayment flexibility; emergency loans; voluntary savings; index based micro-insurances; information sharing, awareness raising, and training on more adapted cultivations; non-productive loans for climate-proof investments; and, more weather-tolerant productions are salutary examples (HAMMILL et al., 2008; HELTBERG et al. 2008; DOWLA, 2009).

Some important potential trade-offs between MF activities and CC adaptation exists (HAMMILL et al., 2008; HELTBERG et al. 2008; DOWLA, 2009): for example between short term livelihood needs (such as food, energy, income, etc.) for poor households and short term credit conditions typical of MFIs, and the intrinsic long-term commitments needed to foster CC actions; moreover certain short term development strategies could increase the medium-long term vulnerability of some households. Some MF operations could also indirectly generate local environmental degradation (HALL, et al. 2008) and, as consequence, leave people greater exposed to climate change related risks (households living in degraded environments are on average more vulnerable to weather hazards). In addition, CC would probably require lending activity to expand during environmental shocks, while instead microcredit provision would naturally decrease in time of crisis.

Also, CC will strongly affect rural population and agriculture, a sector to which MFIs have still hard time to provide adequate services and products. While MF seems to have an important role to play in CC strategies, it is clearly not a panacea, and therefore, these actions should be included in broader set of national and international adaptation and mitigation policies (MCKEE, 2008). Lastly, green MF programmes dealing with aimed environmental outcomes inevitably interact with a complex human-environmental system in which access to resources, environmental preservation, value chain structure, poverty, inequalities and power relationships are interacting structures shaped by local culture and value and embedded in local livelihood strategies and regional development pathways: strong feedbacks and indirect or side effects could then redirect the
hoped environmental outcomes and a more local, integrated and territorial approach should then be supported (FORCELLA, 2012, 2013a, 2013b; HUYBRECHS et. al., 2015).

**Agriculture and Climate Change**

Agriculture is one of the most vulnerable sectors to climate change, and, historically MF has always had problems to finance agriculture. Smallholder farmers face a myriad of constraints in the pursuit of their agricultural activities, which contribute to lower their adaptive ability. The sector is characterised by high price volatility, crops are extremely exposed and vulnerable to climate extremes and abnormal seasonal weather trends, and traditional financial institutions are quite reticent in lending to this segment. The result is that peasants, especially in the global south, struggle to survive and earn a decent living (MORVANT-ROUX, 2011), and eventually, are caught in poverty trap. Indeed, the World Bank (2007) estimates that 75% of the world’s poor live in rural areas and depend on agricultural yield for their livelihoods, making rural poverty a primary concern for development.

Recently microfinance has attracted attention for being an interesting financial tool that could be close to the needs of the poor rural communities in southern countries (DOWLA, 2009). In fact, the Mix Market data indicates an increase of the volume and number of credits of credit unions an rural banks that passed from about US$1.2 billion and nearly 2 million clients in 2003 to US$6 billion and about 4.2 million clients in 2009. In six years these rural MFIs combined have financed approximately US$22 billion to about 21 million clients worldwide (MIX MARKET, 2014). In Brazil, three of the biggest five MFIs [which accounts for 94% of the market share in the country], are rural microfinance providers. In 2013, Agroamigo, Central Cresol Baser, and Cresol Central, combined, had US$1.6 billion in outstanding loans and about 1 million clients (MIXMARKET, 2014).

Though, as extreme events such as drought, heavy rains, floods, occur with more frequency, intensity and in wider geographic scale in the future, crop productivity is expected to decrease sharply, adversely affecting millions of rural MF borrowers in particular throughout the Global South, that will find increasingly harder reimburse their micro loans. This could cause significant solvency and liquidity problems to numerous rural MFIs. The consequence increase and volatility of staple crops market prices, and the devaluation of livestocks (used as a means of savings or buffer against losses in bad times) market price during climate extremes, will increase even more the vulnerability of MF clients (DOWLA, 2009). Being livestock an important income source for most rural MF clients or a valuable debt repayment tool, such wealth depreciation would
compromise their ability to repay loans and would then indirectly affect the portfolios of several rural MFIs.

**Rural Green Microfinance in Brazil**

As an attempt to replicate a study conducted by (AGRAWALA and MAELIS, 2010) in Bangladesh and Nepal to the Brazilian context, (MOSER and GONZALEZ, 2014) analysed potential linkages between products offered by Brazil’s major rural microfinance providers, i.e. Agroamigo and Cresol, and site-specific climate change strategies. Albeit with different outcomes, these two examples corroborate the rationale for microfinance actions in the climate change realm on at least two fronts: opportunities and exposure. According to the authors, most of the existing products offered by these two MFIs have either a direct or indirect link with potentially affected sectors (e.g. agriculture, livestock, water), and as such, would automatically contribute to adaptation and [to a lesser extent] mitigation to climate change (MOSER and GONZALEZ, 2014). In other words, as currently structured, these programmes offer an intrinsic opportunity for these MFIs to i) enhance the adaptive capacity of clients; and, ii) better protect their portfolios from adversities arising from a new climatic reality.

On the other hand, however, the studies also showed that 24% of Cresol’s programmes and 14% of Agroamigo’s product envelope will need to be climate-proofed so as to take better consideration of site-specific climate change vulnerabilities as they may be significantly exposed to climate change impacts. To Agroamigo, this would include, for instance, greater effort towards portfolio diversification, in particular towards non-agricultural lending and drought-tolerant crops; enhance loans for acquisition of more efficient irrigation/water technologies, and technical assistance provision; devise insurance schemes to areas not covered by the governmental crop insurance, for instance, livestock investment projects; whereas for Cresol, it would need to: forge new insurance schemes, improve data system collection, set up *ex-ante* risk management plans in view of eventual losses stemming from increased climatic variability, as well as areas in which it may benefit from a warmer climate, and ultimately, incorporate tailored *ex-post* climate change initiatives into its strategic planning and day-to-day operations. Moreover, in some cases, Cresol would be simply missing the “perks” arising from increased temperatures.

**2. METHODOLOGY**

This cross-case study was guided by three general research questions:
1) What is the degree of vulnerability of MFIs’ portfolios and their clients to climate change?
2) Are there synergies between existing MFIs programmes and green microfinance actions?
3) What can we learn from microfinance actions in the CC domain?

In order to facilitate understating and provide insight into the subject matter, we applied a comparative method analysis as defined by (LIJPHART, 1971) on Brazil’s two largest rural microfinance providers, Agroamigo of the Bank of the Northeast of Brazil (BNB), and the Cresol System. According to Arend Lijphart, systematic comparative analysis of ‘small N’ is the fittest methodological approach when there exist only a few instances of the phenomenon under scrutiny, and when the overall objective is to discover empirical relationships among variables, as opposed to actual measurement (LIJPHART, 1971, p. 683). This concept is also seconded by Robert Yin who argues that, due to limited knowledge on the topic under consideration, multiple-case studies are more compelling than single case studies to unveil empirical evidences (YIN, 1994).

The strategy will be to assess the existence of certain initiatives and procedures at MFI level that would increase the resilience of households to CC and then use past weather hazards as proxy for future CC impacts to look for institutions and clients vulnerability.

Building on the notion of risk put forward by IPCC (2014), we understand that the portfolios of MFIs, in particular in the global south, are vulnerable to various CC related risks and, at the same time, MFIs have various opportunities in hand to deal with CC, both from an adaptation and mitigation viewpoint. We then provide here a simple theoretical framework to analyse the vulnerability to CC of the portfolios of MFIs and the associated opportunities that an MFI could grab to cope with CC. The theoretical framework provides a nuanced subdivision of the possible strategies that MFIs can adopt to support adaptation and, to a lesser extent, mitigation at the institutional and end user levels. These strategies are analysed along three “metadimensions”: i) economic (fostering asset accumulation, diversification of income sources, loans for renewable energy, agroforestry and silvopasture activities, and energy efficiency projects, etc); ii) financial (access to emergency loans, voluntary savings, flexibility of credit conditions during extreme events, carbon credits market projects,); iii) additional services for human/social capital (institutionalisation of local knowledge, training and capacity building for better agricultural practices, adapted seeds and practices, and so forth.). Accordingly, by distinguishing among specific dimensions, we analyse how programmes, products and services provided by these selected MFIs relate, either implicitly or explicitly, to climate change initiatives and how much vulnerable, as currently structured, they are to forecasted climatic changes.

We believe that the absence of a combination of these strategies for MFIs operating in CC prone regions may result in greater and additional credit risks for MFIs and a missing opportunity
for these players to aid their clients better respond to the harsh impacts arising from a changing climate.

Data Collection

This article draws on various evidences: primary data (field observation and interviews) and secondary (documentations and reports) data, and their complementarity and comparison to offset eventual biases (BERG, 2004; MORAN-ELLIS et al., 2006; YIN, 1994).

Five main social groups relevant for our investigation were identified within Agroamigo and Cresol and interviewed during the data collection. The sources for the primary data used in this paper are then summarised in Table 1. For the Agroamigo case, these included: national and regional programme managers, coordinators, credit agents and clients. National programme managers are responsible for the general supervision of Agromigo’s branches in all states it operates in, as well as for setting up business strategies. Regional programme managers are responsible for the supervision of regional and local units. Coordinators are charged with specific areas in the surroundings of an Agroamigo’s branch and also supervise local credit agents. Credit agents, in turn, are the point of contact between clients and Agroamigo, as well as responsible for credit information, contract analysis, and so forth. Lastly, clients are smallholder farmers, often very poor, that benefit from rural microlending. Likewise, for Cresol these ranged from the president, programme managers, branch managers, to credit analysts, and clients. The President is the highest management level within the Cresol System and chairs the steering committee. Programme managers at Cresol’s headquarters are integral parts of the steering board, and as such, participate in the setting up of business strategies and strategic planning. Branch managers, as the name suggests, are in charge of specific branches, whereas credit analysts are the point of contact between clients and Cresol, as well as responsible for credit portfolio management within branches. Similarly to Agroamigo, clients are smallholder farmers that benefit from Cresol’s lending programmes and other non-financial services.

In November 2013, we visited Agroamigo’s headquarters and also inland/coastal Ceará, whereby we applied semi-structured interviews to all five identified social groups and conducted field observation, as well as collected further documents. Three localities spread over the State of Ceará were chosen for interviews: Poço da Pedra located in inland Ceará, a rural community within the municipality of Canindé, one of the most arid regions of the state and as such serving as sample for a typical rural community contemplated by Agroamigo; on the coastal area, the municipality of Icapuí, a poor rural village, was chosen to represent a sample of clients living on coastal areas; and,
the Agroamigo’s headquarters in Fortaleza, the capital of the State. In November 2013, similar on-site field research was conducted at Cresol’s headquarters in the city of Francisco Beltrão in the state of Paraná, Southern Brazil, for the same purpose of collecting materials, and applying semi-structured interviews to the social groups. We chose to visit the aforementioned city because it gathered in a single location all five social groups subject of our investigation.

For Agroamigo, twenty-one respondents were selected in loco according to their belongings to specific social groups and availability to participate in the interviews. Accordingly, two national managers, one regional manager, two coordinators, six credit agents, and twelve clients were interviewed. For Cresol, in turn, we have interviewed thirteen respondents during field research: the president, three national managers, one branch manager, one credit analyst, and seven clients.

For each identified social group we applied semi-structured questionnaires commensurate with its activities, experiences and contextual perception of the subject matter. For instance, to the president, national and regional programme managers, we posed questions related to the overall design, administration, and performance of their MFIs as well as questions related to the performance of available products during hazardous weather events—e.g. programmes aimed to reduce vulnerability of clients ahead of extreme climatic events; coping mechanisms against losses arising from such events, and so forth. To coordinators, branch managers and credit agents/analysts we sought to design questions that better reflected their perceptions and experiences regarding the performance of products during extreme weather events. For instance, perception about exposure of clients to drought events and how their MFIs usually reacts in the occurrence of weather-related losses faced by clients. Lastly, to clients we designed questions associated to their own experiences vis-à-vis actual impacts of climatic events on their rural activities, for example, by asking whether they have already suffered drought-related losses; how they usually deal with such shocks; and whether they received disaster relief aid from the analysed MFIs. Interviews’ length varied from fifteen minutes, as for clients, to one hour as was the case for managers and the Cresol’s president.

Limited time and resource, and availability of clients to participate in the interviews were a major constraint we faced during field research. In addition, one could argue that our sample is rather limited in comparison to the universe of clients these programmes possess, and that as consequence generalisations to broader contexts and population should be done cautiously. However, our expectation a priori was not in fact to generalise to a broader sample, but rather to, through a qualitative analysis of primary data, grasp insights into the actual mechanisms and dynamics of the two major rural MF programs in Brazil related to vulnerability to CC of their clients and portfolio.
Table 1 – Summary of major primary data collected during field research

<table>
<thead>
<tr>
<th>Major primary data</th>
<th>Agroamigo</th>
<th>Cresol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic location of data collection</td>
<td>Northeast</td>
<td>South</td>
</tr>
<tr>
<td>Number of interviewed clients</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Number of interviewed officers/managers/CEO</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Number of interviewed branch staff</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Total of interviewees</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>Semi-structured questionnaire applied</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Source: Authors

3. PROGRAMMES AND DATA ANALYSIS

In this section we briefly introduce the two MF programmes discussed in the paper: Agroamigo and Cresol, before analysing their links with climate change actions.

Agroamigo

Agroamigo was established in 2005 by the BNB as an attempt to enhance the socioeconomic conditions of smallholder farmers and rural microentrepreneurs across Brazil’s Northeast (ABRAMOVAY et al, 2013), one of the poorest regions in the country. Also, it aimed at reducing default rates, as high as 37%, the National Programme to Strengthening Smallholder Farmers (PRONAF4) faced when lending to poor smallholder farmers in the region (ABRAMOVAY et al., 2013, 19). Since inception, Agroamigo has allocated about US$ 2 billion in rural microloans in nearly 2.3 million operations via its 170 branches covering over 1,945 municipalities in the Northeast (BANCO DO NORDESTE, 2013). As of December 2013, the Programme had US$ 651 million in outstanding loans delivered to 734,265 active borrowers (BANCO DO NORDESTE, 2013), “remaining unrivalled as Brazil’s largest rural microfinance programme” (MOSER and GONZALEZ, 2014).

Climate change will pose significant risks to Agroamigo and its borrowers. Most part of the regions where Agroamigo operates are characterised by semiarid climate, with average annual

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4 Pronaf is a governamental programme aimed at providing financial excluded and unbanked smallholder farmers with loans at low interest rates.
precipitation not exceeding 700mm and evapotranspiration losses three times as high as annual rainfalls (SILVA et al., 2012). Throughout the century, surface air temperatures are projected to increase up to 4.5°C and rainfalls to decrease markedly by between 40% and 50% (PBMC, 2013a), resulting in significant water deficit (MARENGO et al., 2011).

Previous study conducted by (MOSER and GONZALEZ, 2014) identified water access and agriculture/livestock as key sectors in terms of climate change impacts and vulnerabilities to Agroamigo and its clients. Added pressure on water access and irrigation, reduction in arable land caused by increasing desertification, and associated decrease in agricultural yields will affect substantially the region’s rural population as they rely greatly on such resources for their livelihoods. Human health is a second major concern identified by the authors, mainly due to expected increase in vector-borne diseases as a result of climate change as well to greater stress on water access. A third identified issue is related to energy generation because a reduction in river runoff would pose significant threats on the regional power grid, markedly reliant on hydroelectric power. Lastly, migration flows, a historical burden on Northeast’s semiarid population, would increase considerably as socioeconomic conditions deteriorate in the incidence of intensified climatic events.

**Cresol**

Established in 1996, Cresol is a System of Rural Credit Cooperatives with Solidarity Interaction acting in the southern states of Paraná, Santa Catarina, and more recently expanded to the southeastern states of Minas Gerais and Espírito Santo. The System is composed of Singular Cooperatives and Services Regional Bases, as well as the Central Cooperative and is entirely administered by smallholder farmer members. It aims at the promotion of financial inclusion among smallholder farmers through credit access, savings and knowledge transfer with a view of local development and institutional sustainability (CRESOL, 2014). Albeit much of its funding stems from the government’s PRONAF, Cresol has increasingly used savings collected from members of its affiliate cooperatives to finance its loans, allowing the System to scale up credit while at the same time achieve its financial sustainability mission. In 2013, Cresol had provided, through its 200 branches, more than US$ 500 million in outstanding loans to 62,691 member clients, and had collected nearly US$ 200 million in savings from 121,352 depositors, ranking as the second largest rural microfinance programme in Brazil (MIXMARKET, 2014).

Most villages Cresol operates in are covered by Atlantic Forest and characterised by diverse weather and pluviometric regimes, with its coastal portion receiving more abundant rainfalls.
Weather oscillations in monthly average discharge and weather regimes in southern and southeastern states have been associated with periods of La Niña and El Niño (YAMASHIKI et al., 2010). These are leading climate modes affecting weather patterns in South America (MCGLONE and VUILLE, 2012). El Niño events have usually been related to increased precipitation indices along the coastal areas of southern Brazilian states, whereas La Niña’s have tended to produce the opposite effect, i.e. drought events (MCGLONE and VUILLE, 2012).

Unlike Brazil’s Northeast, rainfall distributions are projected to increase markedly across Southern and Southeastern Brazil, up to 30%, whereas temperature increases may vary between 0.5°C and 3°C, even though abnormal seasonal drought events associated with La Niña are also expected to increase in parts of inland Southern Brazil. Increased temperature coupled with changes in the climate cycle will likely induce a “tropicalisation” of Southern and parts of South-eastern Brazil by the end of the century (PBMC, 2013b).

Previous identified site-specific climate change vulnerabilities placed agriculture and livestock production at the top as being of highest priority for Cresol and its clients. Production of milk and meat, as well as rice, maize and soya bean will likely be reduced by increased temperatures and higher precipitation variation [varying from drought to floods], potentially impacting farmers’ income. In addition, as past instances have shown (see, for instance, SOUSA, SAUSEN, LACRUZ, 2010; MCGLONE and VUILLE, 2012), drought episodes associated with La Niña may exacerbate stresses related to irrigation and water, affecting pasture based production systems and rice crops, widely practiced by local farmers.

Right next are human health due to increased incidence of endemic infectious and vector-borne diseases as well as heat waves, life losses during landslides and flooding, and food insecurity as a result of reduced crop production (GONZALEZ and MOSER, 2014). This is followed by water resources, in particular, because, on the one hand, greater rainfall distribution and river runoff will impact positively the regional water availability, and on the other, mixed precipitation pattern outcomes, particularly in South-eastern Brazil, varying from state to state, sub-region to sub-region, village to village, will have both negative and positive impacts on water access/availability.

Climate change may also bring advantages to Cresol’s members. For example, a climate change-induced “tropicalisation” and increased temperatures in South and Southeast Brazil may reduce frost damages and favour production of tropical crops such as coffee and sugarcane (PBMC, 2013b). Table 2 summarises main financial and institutional data for the two Programmes.
Table 2 - Main institutional data for both Agroamigo and Cresol in 2013

<table>
<thead>
<tr>
<th>MFI’s main data</th>
<th>Agroamigo</th>
<th>Cresol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up year</td>
<td>2005</td>
<td>1995</td>
</tr>
<tr>
<td>Number of branches</td>
<td>170</td>
<td>200</td>
</tr>
<tr>
<td>Number of active clients</td>
<td>734,265</td>
<td>62,691</td>
</tr>
<tr>
<td>Number of cumulated clients</td>
<td>2,652,586</td>
<td>121,352</td>
</tr>
<tr>
<td>Cumulated loan portfolio</td>
<td>USD 2,061 million</td>
<td>n/a</td>
</tr>
<tr>
<td>Gross loan portfolio</td>
<td>USD 651 million</td>
<td>USD 593 million</td>
</tr>
<tr>
<td>Averaged loan size</td>
<td>USD 1,118</td>
<td>USD 1,956</td>
</tr>
<tr>
<td>Number of depositors</td>
<td>0</td>
<td>USD 121,352</td>
</tr>
<tr>
<td>Savings</td>
<td>0</td>
<td>USD 200 million</td>
</tr>
<tr>
<td>Portfolio at risk &gt; 30 days</td>
<td>3.30%</td>
<td>6.41%</td>
</tr>
<tr>
<td>Major funding source</td>
<td>Pronaf/government (100%)</td>
<td>Government (57%) / Own resources (43%)</td>
</tr>
<tr>
<td>Major activity financed</td>
<td>Livestock</td>
<td>Agricultural inputs</td>
</tr>
</tbody>
</table>

Source: MIX MARKET, 2014; CRESOL, 2014; BANCO DO NORDESTE, 2014; authors.

Data analysis

In this section we would like to address our proposed research questions using the experiences of Agroamigo and Cresol according to the simple theoretical framework described elsewhere in the methodology. More specifically, we explore these two programmes along three “descriptive metadimensions” for CC actions geared to microfinance: economic, financial, and additional services for human/social capital. Table 3 summarises our main findings and provides a sectoral comparison between the two programmes.

Economic dimension

Most of Agroamigo and Cresol’s programmes aim to build-up client’s asset base and support job creation by financing projects that generate extra income for clients and/or that help them sustain their micro-businesses. The bulk of Agroamigo’s microloans, for instance, are directed towards investment projects in livestock, such as pasture fencing installation, farming repairs, and agricultural machines. Unlike Agroamigo, Cresol finances primarily working capital to meet customers’ agricultural production needs such as crop inputs and fertilisers. In terms of climate
change implications this means that by stimulating asset accumulation and employment generating activities, these MFIs implicitly contribute to increase resilience and the adaptive ability of clients to cope with CC impacts.

Likewise, synergies between these MFIs’ products and governmental programmes, offer additional tools to help clients enhance their adaptive capacity, in particular because they provide local market opportunities for clients to expand their asset base. Most of such synergies stem from the various lines of credit under Pronaf. During field research and from secondary data analysis, it was possible to ascertain a high recourse to such instruments by both Programmes. For instance, the whole of Agroamigo’s microcredit resources derive from Pronaf’s credit lines, whereas, about 45% of total Cresol’s microcredit provision is financed via Pronaf’s funds. Other governmental programmes operated by Cresol and Agroamigo include the School Feeding Programme (PNAE), Food Acquisition Programme (PAA), The Family Farm Support Price Programme (PGPAF), Technical Assistance and Rural Extension (ATER), and the Guarantee Programme for Agriculture and Livestock Activities (PROAGRO). On the other hand, such dependence on governmental funding could also represent a major challenge to these MFIs should public funding be withdrawn.

Albeit during interviews Agroamigo’s management considered income diversification as an important strategy and despite credit agents’ efforts, we observed a tendency towards income source concentration. 5 out of 7 clients argued that they would not change and/or vary their current professional activities even if they knew these were drought-sensitive areas and were offered financial incentives by Agroamigo to diversify. We noticed, in fact, a strong intergenerational tradition in livestock production among Agroamigo’s clients which hinders a de facto ability of the programme to nudge diversification of client’s income sources, vision also seconded by managers interviewed. This peculiarity also helps explain the fact that 79% [in cross-temporal terms, i.e. 2005-July/2014] of Agroamigo’s loan portfolio is invested in livestock projects.

On the other hand, Cresol’s clients seem more prone toward diversification of assets and/or income sources. All interviewed clients (i.e. seven) argued that silage-based production systems, widely practiced by Cresol’s borrowers, allow them to diversify income sources because the marginal produce can be sold year-round on local markets. This is mirrored in Cresol’s loan portfolio in which about 50% of lending is directed to farming operating capital—in particular, seed purchase for silage-based production—, and the remainder to investment projects either in livestock or farming. From a portfolio analysis perspective, there would seem to be that Agroamigo and its clients are more exposed to CC impacts and hazards than Cresol since most of their financings are concentrated around a single activity, which also happen to be very sensitive to increased
temperatures. Moreover, added to low diversification of assets, geographical location and harsher weather conditions seems to accrue greater CC related risks for Agroamigo’s portfolio.

With respect to mitigation strategies, both Agroamigo and Cresol provide loans for clean energy and more sustainable technologies and practices, albeit their share in total disbursements remains somewhat timid. Agroamigo, for instance, finances improved water systems—water wells and irrigation technologies, renewable energy, solar home systems—through Pronaf Eco and Semiarid. Furthermore, under the Biofuel Programme, Agroamigo purchases sugarcane from clients to be processed as ethanol (a transport biofuel widely used in Brazil). There are, however, opportunities for Agroamigo to scale up such programmes. Abramovay et. al. (2013), for instance, claims that albeit most clients have access to electric power, 40% of them still burn coal or wood for cooking and only 40.6% have access to safe drinking water.

Likewise, the Cresol System finances improved irrigation systems, eco-friendly projects and renewable energy through Pronaf Eco and Agroecology. 4 out of 7 Cresol’s clients argued that they have not expressed interest in accessing such loans because projects under these lines are rather expensive for them to bear and usually runs over the long term, i.e. generates financial commitments whose benefits are only reaped in the very long-run, discouraging them to access such funding lines. Lastly, none of these MFIs are engaged in the carbon credit market, or have partnered locally, nationally or internationally, to finance or promote mitigation projects.

A preliminary assessment of existing economic-led programmes in light of CC strategies and risks unveils enormous potentialities to strengthen synergies between these variables so as to enhance the adaptive capacity of both programmes and also of local populations, in particular in the Agroamigo case.

**Financial Dimension**

Agroamigo and Cresol already allows for loan restructuring and amortisation reschedules ahead of asserted difficulties clients may face in the wake and/or aftermath of climatic shocks, albeit such actions are more pronounced in the Agroamigo case. Furthermore, Agroamigo also provides emergency loans to aid borrowers recover from production and asset losses due to recurrent large-scale droughts. To this regard, 2 interviewed managers claimed that during the 2012-2013 intense droughts, the BNB, Agroamigo’s host institution, allocated over US$ 1.49 billion in emergency loans of up to US$ 1,062 each, to help clients cope with increasing economic losses. This amount corresponds to approximately 75% of all loans provided by Agroamigo since inception. Also, it rescheduled and provided 80% debt write-off on maturing loans. When questioned about such
loans, 1 manager and 2 credit agents expressed concerns regarding the efficiency of the delivery process, which according to some of them is lengthy and usually the result of claims from rural trade unions.

Caution is needed here once emergency loans cannot be delivered indefinitely on a sustainable basis if climatic conditions continue to worse and affect local smallholder farmer clients. This would turned out to be costly to the government (and obviously to tax payers) which would need to step in every time Agroamigo faced liquidity issues as a result of defaults on maturing loans triggered by climate-related impacts. Unlike Agroamigo, management in Cresol said that because the region is barely affected by large-scale weather events, the System never had to resort to weather related emergency loans throughout its history. From the analysis emerge then that the specific environmental conditions in which the two Programmes are inserted deeply influence their credit risk and the need for flexibility in loan repayments which, in the absence of sound coping mechanisms, may not be sustainable in the medium-long run.

With regard to voluntary savings, according to Brazilian regulation, MFIs under civil society organisation (OSCIP) status, and so Agroamigo, are bound by a statutory prohibition on collection of savings deposits from clients, with credit unions (and banks) being exceptions. In this fashion, in order to strengthen its financial sustainability, Cresol induces voluntary savings from clients which in addition to serve as unofficial safety nets during shocks, provides additional source of funding for the institution. As of December 2013, total deposits collected by the Cresol System amounted US$ 202,199,530 (CRESOL, 2014). Even though Agroamigo is not allowed to collect savings due to its OSCIP status, it promotes discussion among clients on the advantages of such arrangements against eventual shocks. Besides, Agroamigo offers its clients the possibility to open bank accounts at BNB.

On the insurance front, Cresol seems to be more secured against climate shocks than Agroamigo since most of its productive loans are covered by the governmental crop insurance, i.e. the Proagro, and its supplementary lump-sum, Proagro Mais. Proagro consists of a subsidised crop insurance linked to Pronaf’s crop operating lendings, a.k.a. Custeio, and it is aimed at protecting smallholder farmers against eventual shocks and related harvest losses during an agricultural year, in particular in the harvest phase. The insurance claim is triggered whenever crop failures are identified, following individual field loss assessments, and is meant to cover instalments due commensurate with the percentage of alleged crop losses. In addition, PROAGRO Mais (Plus) pays an additional lump sum—up to US$ 2,049 in the 2013/2014 agricultural year—to policyholders so that they can cope with immediate livelihood needs. While PROAGRO Mais is compulsory for Pronaf Custeio loans, they are voluntary for Pronaf’s investment credit lines (CARDENAS, 2013).
All 7 Cresol’s clients interviewed during field research argued that these insurance programmes are quite satisfactory both in terms of loss coverage and delivery.

In addition, Cresol has established its own insurance company offering a wide array of micro-insurance schemes at lower market prices. These range from credit life, collective, and life insurance policies, to vehicle, business, property, livestock, and hail/frost insurance schemes. In 2013, the Cresol insurance company sold nearly US$ 10 million in insurance premiums, with life, home and car insurance policies accounting for 85% of total (CRESOL, 2014).

As for Agroamigo, 2 interviewed managers said that roughly 2% of outstanding loans are insured against eventual weather-related losses. Accordingly, they argued that this is because the great bulk of Agroamigo’s lending is indexed in livestock investment projects whose losses are not covered by the governmental Proagro. Besides, although Agroamigo includes life, health, credit life, and burial insurance policies into its product envelope, 6 out of 7 interviewed clients argued they were not even aware of the existence of such schemes. As previously showed, lacking a substantial insurance mechanism, Agroamigo, in cases of wide-spread losses, reacts by providing emergency loans, restructuring and rescheduling maturing debts. This, however, could augment the vulnerability of clients [indebtedness] and its loan portfolio [solvency issues] at large ahead of increasing losses resulting from climate change in key sectors such as livestock.

In terms of non-productive loans, under Habitasol, Cresol provides its clients with housing loans, allowing wooden huts owners to construct more weather resilient houses, and ultimately, increasing their adaptive capacity. Indeed, 2 managers argued that the region is recurrently hit by windstorms which affect, in particular, poorer clients, wooden huts owners. Since its launch in 2004, Habitasol has already financed more than 6,000 houses in 30 villages in Southern Brazil (CRESOL, 2014). On the other hand, Agroamigo does not offer non-productive loans to clients.

Additional services for human/social capital

In both cases, credit agents endeavour to institutionalise local knowledge on adaptation to natural disasters. For instance, 4 Agroamigo’s credit agents argued that during initial sessions and field assessments, there is regular exchange of best practices and lessons learnt between them and clients, and also among clients themselves, on better ways to withstand weather-related shocks. Cresol’s managers, in turn, said that the System promotes information sharing of such practices during mini-assemblies and over the Programme of Community Agents of Development and Credit (PACDC) which aims at encouraging members to participate actively in the management of Singular
Cooperatives as well as at boosting discussion over important issues such as environmental protection and local development (CRESOL, 2014).

In terms of environmental education and training to clients and employees, Agroamigo seems slightly more active than Cresol. In fact, Agroamigo organises environmental literacy courses to clients and provide regular training to improve staff’s capacity on sustainable agriculture. Besides, all credit agents have background on agricultural practices and farming techniques. During interviews, we could indeed assert the high quality knowledge on sustainable agricultural practices credit agents possess. On a lower scale, the Cresol System offers environmental training to clients during mini-assemblies and the PACDC and, through its educational institution it promotes discussion on environmental-related issues and sustainable farming practices among its personnel.

None of the analysed MFIs have specific programmes to finance weather tolerant crops. At the institutional level, Agroamigo seeks to reduce its ecological footprint by limiting paper use and waste, for instance. Also, the Programme launched in 2014 an internal environmentally-friendly campaign to foster and enhance the share of green lines of credit in its portfolio as well environmental awareness among clients. To date and to our knowledge, Cresol has not yet implemented actions to reduce its carbon footprint at the institutional level.
Table 3 – Identified Links between Cresol and Agroamigo’s Actions and Green MF Strategies

<table>
<thead>
<tr>
<th>CC Strategies by Metadimensions</th>
<th>Agroamigo</th>
<th>Cresol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Availability¹</td>
<td>Main activity/tool</td>
</tr>
<tr>
<td>Economic Dimension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stimulate asset accumulation</td>
<td>Yes</td>
<td>Cattle</td>
</tr>
<tr>
<td>Stimulate employment generating activities</td>
<td>Yes</td>
<td>Livestock</td>
</tr>
<tr>
<td>Synergies with other governmental programmes</td>
<td>Yes</td>
<td>Pronaf</td>
</tr>
<tr>
<td>Diversification of income sources</td>
<td>Yes</td>
<td>Crop/services</td>
</tr>
<tr>
<td>Renewable energy/water access financing</td>
<td>Yes</td>
<td>Pronaf</td>
</tr>
<tr>
<td>Sustainable agricultural financing</td>
<td>Yes</td>
<td>Pronaf eco-friendly credit lines</td>
</tr>
<tr>
<td>Carbon credits market projects</td>
<td>No</td>
<td>n.a.</td>
</tr>
<tr>
<td>Financial Dimension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repayment flexibility and loan restructuring</td>
<td>Yes</td>
<td>Ad hoc</td>
</tr>
<tr>
<td>Emergency loans</td>
<td>Yes</td>
<td>Ad hoc</td>
</tr>
<tr>
<td>Voluntary savings</td>
<td>Yes</td>
<td>Financial Literacy</td>
</tr>
<tr>
<td>Micro-insurance</td>
<td>Yes</td>
<td>Proagro</td>
</tr>
<tr>
<td>Non-productive loans for climate proof houses</td>
<td>No</td>
<td>n.a.</td>
</tr>
<tr>
<td>Avoidance of debt write-offs after weather shocks</td>
<td>No</td>
<td>Emergency loans</td>
</tr>
<tr>
<td>Additional Services for Human/Social Capital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information sharing /awareness raising</td>
<td>Yes</td>
<td>Informative sessions</td>
</tr>
<tr>
<td>Environmental training</td>
<td>Yes</td>
<td>Informative session</td>
</tr>
<tr>
<td>Reduce institutional ecological footprint</td>
<td>Yes</td>
<td>Internal policy</td>
</tr>
<tr>
<td>Institutionalisation of local knowledge on adaptation</td>
<td>Yes</td>
<td>Credit agents</td>
</tr>
<tr>
<td>Stimulation of more weather adapted production</td>
<td>No</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Source: CRESOL, 2014; BANCO DO NORDESTE, 2014; Field observation; and, transcript interviews.

¹Availability in the institution’s product envelope, either explicit or implicitly.
2 Degree of *de facto* recourse to specific green microfinance strategies. Degrees are split into: low (never or barely use the recourse) – medium (intermittently or eventually use the recourse) – high (often or always use the recourse).

4. MAIN RESULTS AND CONCLUSION

Our analysis seems to corroborate the idea that microfinance has good potentialities to deliver climate change actions to the poor segments of society. The analysis of the case studies showed indeed that MFIs, especially if operating in rural and/or climate change prone areas, or financing agricultural activities (i.e. whenever hazard, exposure and vulnerability intersect), need to take a firm hand on climate change actions to reduce part of eventual credit risks associated with a CC or weather hazard in general. Albeit with different levels of hazards, exposure and vulnerability, in both Agroamigo and Cresol, climatic variables such as drought events already affect the business performance of clients. To Agroamigo, in particular, periods of droughts were considered among the most important hazard factors affecting clients ability to repay their debts and as such constitute an utmost risk component impacting the MFI’s portfolio. Such idiosyncratic risk factor combined with great propensity to be affected by weather adversities and lack of capacity to cope with such impacts on their own make Agroamigo’s clients, and so the MFI portfolio, particularly exposed to climate change.

This study also showed that, when analysed through a simple theoretical framework geared specifically for green actions that can be implemented at the micro/end-user level, there exist important synergies between green microfinance actions and existing programmes, services and products offered by the analysed MFIs. These synergies, which encompass the economic, financial and services for human/social capital dimensions, offer in fact handy mechanisms that help clients increase their adaptive ability and MFI’s to reduce weather related risks. On the other hand, in spite of different degrees of actual recourse to specific green microfinance strategies and bearing in mind different weather conditions, we found that, in both cases, synergies should be enhanced in order to take better account of site-specific weather risk factors that may affect clients’ livelihood and businesses performance, and to ultimately limit potential impacts upon their product and financial portfolios, e.g. forward planning based on a non-regret strategy, boost portfolio diversification and insurance schemes in uncovered areas, and so forth.

Caution is needed, however, when downscaling such actions at microfinance level. From our analysis important tradeoffs emerged in the promotion of green microfinance strategies by both Agroamigo and Cresol that need duly consideration. From Cresol’s clients reports on green financings emerged issues related to the balance between short-term livelihood needs and the medium to long-term financial commitments needed for CC initiatives. From Agroamigo’s analysis,
dilemmas between mechanisms aimed to deal with the delivery of emergency loans in the very short-term ahead of climate shocks and the potential debt burden increases on borrowers in the medium to long-terms if climatic events occur more often and with more intensity in the future. From both cases, we found trade-offs arising from the need to find sound incentives to nudge portfolio sustainability and diversification in a public-financed microfinance context.

There exist probably a long path to go before microfinance fully integrates CC strategies into its activities and credit risk assessment, and shapes its initiatives to channel international CC funds and tools. However, we believe that, albeit mitigation can still be an option for MF, adaptation is no longer a question of choice as sooner or later the whole of society will eventually need to adapt to a new climatic reality. Taking early actions could provide comparative advantages for both MFIs and clients, as well as generate additional savings in terms of lives, assets, and money.

ACKNOWLEDGMENT
We would like to express our gratitude to Agroamigo and Cresol’s teams and clients for all the assistance prior to and during the field researches as well as for their willingness in sharing their experiences and time during interviews.

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