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Three Essays On Climate Change Adaptation In Rural African Communities

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Abstract

Climate change is one of the defining challenges of the present era, bringing new risks and exacerbating existing vulnerabilities across the world. While there is a broad recognition that solutions around climate change will require coordination and support across borders and governments, a large body of scholarship has focused on the local-level realities of climate change and the disproportionate impacts on the most vulnerable populations. The climate vulnerable poor do not have the privilege of waiting for global policy and commitment to emission reduction targets. They need planned and proactive adaptation support to build resilience to the changing climate and to address the threat on their livelihoods. However, the conditions that render populations vulnerable are the same factors that constrain their ability to adapt to climate change through autonomous actions. Acknowledging the need for pro-poor support, there is an increased focus on funding and supporting climate action and adaptation. In this dissertation, I evaluate both government and development practitioners' interventions to help vulnerable populations adapt to the changing climate. More specifically, I evaluate a bottom-up community driven approach to climate change adaptation funded by the United Kingdom Department for International Development in Senegal and Mali, and a social safety net program implemented at a national scale in Ethiopia.

In the first chapter, I evaluate the Decentralized Climate Funds (DCF) project in Senegal and Mali. DCF aims to support locally led climate change adaptation, encouraging participatory processes at the community level to identify and prioritize public goods investments in adaptation. This chapter explores the impacts of the DCF project on household-level social capital, one of the goals of the project and a necessary condition for strengthening household's overall adaptive capacity. I take advantage of a unique panel dataset in Mali and Senegal that

was gathered from surveys conducted through the four years of the project. I use propensity score matching to compare treatment and control households on a broad range of household characteristics and social capital measures. Further, I leverage the household panel data collected before and after the first cycle of the project to analyze whether changes in the social capital measures can be attributed to DCF through a difference-in-differences approach, controlling for time-invariant unobservables. The results suggest that the DCF project led to increases in household level social capital. The findings indicate that receiving funding through the project increased the likelihood of participating in collective action and providing help to other community members in Mali, with mixed results in Senegal.

In the second chapter, I further examine the results from the first chapter by conducting a qualitative study to gain insight into who benefits from a bottom-up, community driven project. I draw on semi-structured interviews and focus group discussions to explore the involvement and inclusion of women in participatory spaces in community-based adaptation, using the DCF pilot project in Senegal as a case study. The analysis and findings demonstrate that women's participation in decision-making about community adaptation and development varies in levels and depends on a complex, interlinked set of factors across community, household, and individual levels. The findings suggest that the participatory approach to adaptation only encouraged active and empowered participation of women in sites where there was an existing precedent for women's participation, encouraged by social capital and networks, recognition of women's role in income generation, and favorable intrahousehold power dynamics. The chapter concludes that even gender aware community-based adaptation initiatives struggle to engage with issues of unequal power relations, failing to ensure that women's voices are actively considered and included in community decisions.

In my final chapter, I use panel data from the 2011 to 2015 Ethiopia Socioeconomic Survey to evaluate whether low-income households, when faced with a positive income shock through the public works or direct support components of the Productive Safety Net Programme (PSNP), feel more food secure and improve the quality of their household's food consumption. I utilize propensity score matching and difference-in-differences estimation to evaluate whether the beneficiaries of the program are benefiting relative to non-beneficiaries who have similar socio-economic characteristics. I find that that being a beneficiary of the PSNP has different effects on a household's food security depending on the type of cash transfer. For those participating in the public works component of the program, PSNP increased the likelihood of households reporting that they do not have sufficient food to meet their household's needs through the year. For the direct support component, the results suggest that recipients don't experience a statistically significant change in their food security outcomes relative to those who did not receive PSNP. However, for both components, if PSNP payments were coupled with agricultural extension services, households realized a statistically significant increase in the number of unique food groups consumed. The contradictory findings that indicate that PSNP public works recipients are more likely to report food insecurity suggests that there may be concerns of biased strategic reporting to remain in the program. The chapter concludes that the program may not be sufficient by itself to benefit participants and help shift them out of food insecurity.

THREE ESSAYS ON CLIMATE CHANGE ADAPTATION IN RURAL AFRICAN COMMUNITIES

by

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Introduction

Climate change and extreme climate shocks pose a significant threat to resource-dependent rural communities. The Intergovernmental Panel on Climate Change (IPCC) has projected reduced precipitation, longer periods of drought, amplified stress on water availability, more frequent flooding, and further vulnerability of agricultural and pastoralist livelihoods for rural communities on the African continent (IPCC, 2014). These effects are compounded by the low adaptive capacity of those in these regions, as both institutions and households often do not have sufficient resources to cope with and respond to the impacts of climate change (Smit and Pilifosova, 2003).While rural communities have adapted to the risks and impact of a changing climate through their history, the speed and severity of the current changes strain their adaptive capacity in an unprecedented manner (Warren, 2016). The contemporary discourse around climate change and development is now focused on highlighting the need to facilitate and enhance climate change adaptation by supporting existing indigenous knowledge in the face of rapid change (Adger, 2003; Adger et al., 2009; Tompkins and Eakin, 2012).

The ability of communities and households to adapt and build resilience to climate change is a function of their socio-economic characteristics, namely their access to financial, human, physical, and social capital (Adger, 2001; Wolf, 2011; Paul et al., 2016). Those most vulnerable to climate change are often the population most limited in adapting to the changing conditions. The capacity of the poor and marginalized to adapt to climate change is constrained by a number of factors, including a lack of land, access to credit, markets, technology, public services and support, and formal education (Ensor and Berger, 2009). These constraints limit vulnerable populations from adapting to climate change as they have more barriers to implementing solutions such as adopting new technologies, migrating, or switching to alternative

livelihood sources. Understanding the determinants of adaptation is crucial for policy development to strengthen adaptive capacity by investing in those determinants (Yohe and Tol, 2002). Enhancing and providing access to financial, human, physical, and social capital is critical to fostering climate change adaptation and resilience.

Under the United Nations Framework Convention on Climate Change, significant monetary commitments have been made to support climate action in developing countries (IPCC, 2014). This has presented an opportunity for large-scale financing of adaptation projects, especially those focused on targeting the most vulnerable populations. Similarly, social safety nets that have long been implemented to resource-dependent rural communities are shifting focus and framing to emphasize resilience and adaptation to climate change. However, despite this shift in focus, it remains unclear which adaptation approaches and solutions are effective and ensure that all groups of people are able to withstand the threats of climate change. There has been a significant body of scholarship focused on critiquing the conventional top-down approaches to development, on which many adaptation strategies have been modelled (Kirkby et al., 2018). The analyses highlight that top-down approaches to adaptation have also failed to provide adequate support to those most vulnerable to climate change (Ayers & Huq, 2013; Reid, 2016). In response, contemporary adaptation discourses emphasize the value and importance of bottom-up approaches, which work with and engage community to ensure that climate change adaptation is driven by the specific experiences of those most impacted. This dissertation builds on this body of work to evaluate the success of community-driven adaptation, as well as national level public services that aim to build resilience to climate change.

In this dissertation, I present a mixed-methods evaluation of a community-based adaptation initiative (CBA) in Senegal and Mali, and a rigorous analysis of a social safety net

program in Ethiopia that focuses on improving food security in the face of shocks. CBA recognizes that climate change vulnerabilities and impacts are often place-based and local, and that strategies to address these differentiated impacts need a community-led approach (Reid et al., 2009; Reid, 2016). The approach recognizes that climate change adaptation strategies must be generated though participatory processes, driven by local stakeholders and their specific knowledge of locally appropriate solutions to climatic variability and extremes (Ayers and Forsythe, 2009). The goal is to ensure that decisions around solutions and strategies are placed into the hands of those affected by the changing climate. The Department for International Development (DFID) funded the Decentralized Climate Funds (DCF) project in Senegal and Mali with the goal of implementing a CBA project targeted at providing adaptation for the community. Recognizing that participatory processes and community-driven projects are complex and can have different impacts than expected, this dissertation focuses on evaluating the DCF project both quantitatively and qualitatively. Additionally, this dissertation evaluates the Productive Safety Net Programme (PSNP) in Ethiopia, where the changing climate has already led to a greater frequency of droughts, giving way to diminished agricultural productivity, food security, and well-being. The PSNP is tasked with enabling the poor, who are facing chronic food insecurity, to resist shocks and become food self-sufficient. In line with my broader research question, I evaluate whether recipients of the PSNP are better able to adapt to climate shocks and buffer the negative impacts on food security.

This dissertation consists of three chapters. In the first chapter, I examine whether the DCF project is successful in building social capital for households, one of the explicit goals of the project and a determinant of adaptive capacity. The first chapter utilizes a difference-in-differences and propensity score matching approach to evaluate whether the treated communities

realized enhanced social capital, as measured through participation in community development, and acts of reciprocity and community support. In the second chapter, I build upon the findings of the first chapter to focus in on the participatory processes of the DCF project. In particular, I seek to understand whether the efforts to promote inclusive participation in climate change adaptation were successful in giving the most vulnerable a voice. I conducted semi-structured interviews and focus group discussions with women and men in three sites in Kaffrine, Senegal to explore their involvement and inclusion in the decision-making around adaptation. Finally, the third chapter pivots focus to a national program in Ethiopia that seeks to strengthen the adaptive capacity of food insecure households by providing a social safety net program. In this chapter I evaluate the program to assess whether the beneficiaries of the program have experienced improved food security and are able to consume more nutritionally diverse diets. I use a propensity score matching and difference-in-differences estimation approach to understand whether participants have experienced any impacts on food security when compared to non-participants who have similar socio-economic characteristics.

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Chapter I: Does Community-Based Adaptation Enhance Social Capital? Evidence from Senegal and Mali

Abstract

Climate change and extreme climate shocks pose a significant threat to resource-dependent rural communities. Successfully supporting households to anticipate and adapt to climate variability and shocks, as well as build long term climate resilience, is essential to facing these changes. Given the importance of social capital in facilitating collective action and adaptation, the development community has focused on bottom-up, participatory adaptation projects. This paper explores the social capital impacts of a pilot community-based adaptation project in Senegal and Mali that aims to encourage inclusive decision making around public goods investment. The analysis uses both difference-in-differences and propensity score matching estimates to evaluate whether the treated communities realized enhanced social capital, as measured through participation in community development, and acts of reciprocity and community support. The results suggest that the pilot project led to increases in household level social capital. The findings indicate that receiving funding through the project increased the likelihood of participating in collective action and providing help to other community members in Mali, with mixed results in Senegal.

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) has projected that the Western Sahel region will experience reduced precipitation, increased lengths of dry spells, amplified stress on water availability, and further vulnerability of agricultural systems in the coming years (IPCC, 2014). A large proportion of the population in this region live in rural communities that

are not strongly supported by national government institutions, due to lack of funding and an absence of social safety nets. Under these conditions, it becomes incumbent on the local communities themselves to implement climate change adaptation strategies that address their needs and values (Ayers & Forsyth, 2009). Resource-dependent rural communities, who are particularly vulnerable to climate shocks, have adapted to the risks of a changing climate by using their historical and indigenous knowledge (Warren, 2016). However, the speed and severity of the current changes strain the adaptive capacity of the systems in place. The contemporary discourse around climate change and development is now focused on highlighting the need to facilitate and enhance climate change adaptation, supporting the existing indigenous knowledge in the face of rapid change (Adger, 2003; Adger et al., 2009; Tompkins and Eakin, 2012).

Over the last two decades, international and multilateral organizations have increasingly favored bottom-up approaches to development and climate change adaptation. The community-driven approach recognizes that climate change adaptation strategies must be generated though participatory processes, driven by local stakeholders and their specific knowledge of locally appropriate solutions to climatic variability and extremes (Ayers and Forsythe, 2009). There is an extensive literature showing that participation has numerous benefits, including improved project outcomes, service delivery, and sustainability (Mansuri and Rao, 2012). Moreover, community-driven projects are expected to engage with civil society and civic engagement, leading to a greater demand for good governance and enhanced social capital (Chase and Woolcock, 2005; Mansuri and Rao, 2012). While the generation of social capital is beneficial in and of itself, research has shown that it is also one of the factors critical to fostering climate change adaptation and resilience (Adger, 2001; Wolf, 2011; Paul et al., 2016). Pelling and High

(2005, p. 317) state "social capital offers ways into understanding the role of fundamental social attributes that contribute towards building capacity for social collectives and individuals to respond to climate change." One of the determinants of a household's adaptive capacity to climate change is its position within social relations and networks, as that can determine the pool of available resources, information and help when experiencing climate stressors (Woolcock and Narayan, 2000; Pelling and High, 2005). Social ties, shared values and goals can influence household involvement in community level initiatives that may help everyone withstand the impacts of the changing climate. Social capital, through mechanisms such as risk sharing, mutual assistance, and collective action, helps individuals and communities adapt to climate change (Adger, 2003; Tompkins and Adger, 2004; Adger et al., 2007; Rotberg, 2010; Hagedoorn et al., 2019).

The Decentralized Climate Funds (DCF) project in Senegal and Mali was a community-driven project targeted at providing adaptation for all households within a community. The DCF project formed part of the Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) program, which was funded by the Department for International Development (DFID) of the UK Government. The project aimed to support locally led climate change adaptation, encouraging participatory processes at the community level to identify and prioritize public goods investments in adaptation, and strengthen the ability of local authorities and communities to mobilize and manage funds. One of the project pathways to build long-term resilience was through enhancing social capital and inclusive governance, as collective action is of paramount importance and integral to climate resilience (Adger, 2003; 2006; Ostrom, 2009; Ostrom and Ahn, 2009; Wolf et al., 2010; Pelling, 2011; Jones and Clark, 2013). While the literature on the benefits of direct stakeholder participation on social capital is growing, there is

little empirical research done on understanding whether community driven projects are able to enhance social capital.

This paper explores the impacts of the DCF project on household-level social capital. The study takes advantage of a unique panel dataset in Mali and Senegal that was gathered from surveys conducted through the four years of the project. As the DCF project in these two countries is a pilot program, this paper will be the first of its kind to evaluate the DCF project on social capital outcomes. This paper draws from existing quasi-experimental research on other participatory projects' impact on fostering collective action and social capital. I use propensity score matching to compare treatment and control households on a broad range of household characteristics and social capital measures. Further, I leverage the household panel data collected before and after the first cycle of the project to analyze whether changes in the social capital measures can be attributed to DCF through a difference-in-differences approach, controlling for time-invariant unobservables.

To preview results, the propensity score matching, and difference-in-differences estimates highlight that the DCF project has positive impacts on the measures of household social capital in Mali. Households that are in villages where public goods investments were made through the DCF project experienced increases in participation in other community development activities. Additionally, the results indicate that treated households are more likely to engage in reciprocal acts of support and aid with their fellow community members. In Senegal, the results also suggest that the DCF project had positive impacts on household social capital. However, these results were not robust to alternative matching methods and variable definitions, suggesting that the impact of the project in Senegal cannot be precisely estimated.

The rest of the paper is organized as follows. Section 2 defines the DCF project and discusses how it interacts with social capital. Section 3 describes the conceptual framework for how DCF can lead to enhanced social capital. Section 4 reviews existing evidence on enhancing social capital. Section 5 provides information on the setting, while section 6 describes the data and analytical sample. The estimation strategy is presented in Section 7, and results are discussed in Section 8. Finally, Section 9 concludes.

2. The Decentralized Climate Funds Project

The DCF project aims to support locally led climate change adaptation. The project encourages participatory processes for investment decisions and strengthens local authorities' and communities' ability to mobilize and manage funds. The DCF mechanism builds on the premise that local communities have in-depth knowledge about climate variability and local risks. The approach aims to bridge bottom-up and local planning with formal planning and budgeting to create more informed and inclusive governance processes[1]. Practically, the DCF pilot projects have supported climate change adaptation on the ground by engaging with local stakeholders to identify, prioritize, finance, and implement locally defined adaptation projects (Hesse, 2017).

The DCF project's community-based approach strives to address the critiques of the previous top-down approach to development where investments in public goods failed after the donor was no longer involved. As Ostrom (2000, p. 173) stated, "Only the crumbling remains of poorly maintained ... facilities are left today in many countries for all the billions invested. There

[1] DCF broadly is a climate finance model that offers a mechanism for investing in public goods at the local level with the goal of encouraging and enabling climate resilient livelihoods. In this paper, analysis focuses on the project as it was implemented and experienced Senegal and Mali (see https://www.neareast.org/braced/ for details).

is a serious need to rethink the overemphasis on physical capital alone. The recent groundswell of attention in the development literature on social capital is a refreshing and needed change." The DCF mechanism recognizes that the outcomes of the project are not just to build community and household resilience to climate change but also to create long-standing practices of participation in local decision-making that will influence future adaptation measures and enhance community collective action.

The project was implemented in five stages: (i) social preparation; (ii) community deliberation and investment identification; (iii) proposal selection, approval and distribution of funds through local entities, (iv) investment construction or implementation, and (v) monitoring and evaluation. For the purposes of this study, I refer to the processes in two broad stages: community preparation and participation, which includes (i) and (ii), and funding, which includes (iii), (iv), and (v).

Preparation and Participation

The first stage consisted of informing and facilitating community level discussions on identifying the most pressing problems facing the village members. The local implementing agencies, *Innovation, Environnement et Développement en Afrique* (IED-Afrique) and Near East Foundation Mali, informed communities within their respective regions of the DCF project, specifically encouraging them to collaborate to discuss and deliberate on their priorities for a public goods investment. The deliberation process itself was determined by the respective villages, though DCF encouraged an inclusive participatory approach that included women and young people in the planning and decision-making. Depending on the village's approach, there may have been a village wide meeting to decide which investment best met their needs.

Following this, a community forum, which is required by DCF, is held at the municipal level to identify the priorities and needs of the villages within the municipality. The forum provided a space for representatives of villages and local groups to deliberate on the investments needed to build resilience to climate change. This forum was required by DCF as a means to ensure and strengthen social inclusion and a participatory approach. After arriving to a consensus, the municipality was then tasked with submitting a proposal or multiple proposals to the departmental adaptation committee to request projects for funding[2]. It is important to note that the DCF team defined public goods as an investment that incorporated the needs of the whole community and not just one group within it. To that end, it was required that submitted proposals had to include a formal theory of change on how the proposed public good would help improve community resilience.

Funding

DCF established key partnerships with government bodies in Kaffrine, Senegal and Mopti, Mali to ensure that the decentralized funding mechanism would operate through local governments. The climate adaptation funds were disbursed to communities through local officials, creating an infrastructure for future local government interventions. DCF also established the capacities of departmental level committees to support community planning and the prioritization, selection, and technical implementation of resilience-building investments. The role of the committees was to provide guidance to communities on their proposals, as well as identify and fund resilience investments based on predefined eligibility criteria. Once the departmental level adaptation committee selected proposals and the investment was funded, the

[2] A department is the administrative division that is roughly equivalent to a district or county in the US.

recipients of the public goods were charged with creating a monitoring and maintenance management committee to oversee the construction of the investment.

Through these stages, the DCF project approach worked to build social cohesion, enhance individual participation in development initiatives, and emphasize the inclusion of different social cleavages of local communities. The DCF annual report (2019, p.12) stated that "By focusing on public goods, the DCF project seeks to reinforce the community dimension, social cohesion and equity in access to opportunities to build climate change resilience." By its very design, the project could only be implemented by interacting with social capital characteristics within communities, which subsequently enhances or changes the character of social capital within the community.

3. Conceptual Framework for DCF Generated Social Capital

It is empirically challenging to test the claim that the DCF approach helps reinforce social capital and enhance collective action. One of the reasons for the difficulty is that there is no formal consensus around the definition of social capital. Social capital is a multifaceted concept that has long been debated in the literature, with no clear consensus on its definition (Farr, 2004; Claridge, 2004). Another challenge is that existing literature provides mixed evidence on whether social capital can be formed. Putnam (1993) argued that while social capital is critical for better governance outcomes, the stock of social capital cannot be grown. According to his arguments, every society inherits and possesses a certain amount of social capital from their historical experiences and that stock cannot be changed. However, more recently, there is empirical research being done to understand how social capital can be formed and how it changes through time (Ostrom, 2000; Krishna, 2007; Avdeenko and Gilligan, 2015). This paper

builds upon that strand of literature to evaluate whether the DCF project was able to generate social capital.

Following prior literature, this study operationalizes one key component of social capital: cognitive social capital (Nahapiet and Ghoshal, 1998; Pronyk et al., 2008). Social capital is defined in this paper as the social relationships, networks, and norms that enable and facilitate cooperation and collective action (Bourdieu and Richardson, 1986; Coleman, 1988; Putnam, 1993; 2000; Woolcock & Narayan, 2000). The key components of the concept include trust, solidarity, reciprocity, and shared norms and values that can help in the achievement of collective goals (Coleman, 1988; Putnam, 1993; Arneil, 2006). Cognitive social capital is the norms, values, attitudes, and beliefs that drive the web of relationships that provide opportunities for cooperation (Ostrom and Ahn, 2009). The web of relationships can take different shapes, classified in the literature as: bonding, the close ties within a group; bridging, the ties between groups; and linking, the vertical relationships defined by hierarchies such as those between a citizen and their representative government official (Woolcock, 2001). Notions of cognitive capital that this paper will focus on are collective action and the concepts of trust and reciprocity, which refer to the confidence that you can rely on others for help and support just as you would in turn help them. This paper considers and analyzes how the DCF project may affect households' cognitive social capital through its focus on participation and inclusive decision-making.

The main direct effect of the projects is expected to operate through the required participatory approach in receiving public goods investments. Through participation in community forums, members of a community might be meeting and making new social connections. Discussions on their specific needs in the face of increased climate stressors could

help households identify that others are in similar situations and that group level solutions would help numerous members of the community. The meetings could also provide a space to voice other concerns outside of the direct impacts of climate change, acting as a forum for deliberation and problem solving on other development issues. Assuming that the meetings introduce new connections and discussions, the first hypothesis states:

H1: Households participating in DCF are more likely to have knowledge about community development activities that occur after the DCF deliberation process.

The villages that received a public goods investment were selected after they submitted a proposal that met the eligibility criteria. This suggests that, though there may have been disagreements during the community meeting, there was an eventual consensus that led to the creation of the proposal. Experiencing forums and meetings that led to a collective decision and action from the participants leads to the second hypothesis:

H2: Households participating in DCF are more likely to participate in future community development activities, given the success of their experience with DCF.

Finally, working together to deliberate and arrive at a consensus on the needs of the members of the community can help build trust and solidarity. Identifying the needs of the general community may foster feelings of community care and support. Households may be more inclined to contribute to public goods and community well-being, leading to the following set of hypotheses:

H3: Households participating in DCF are more likely to help others in their community.

H4: Households participating in DCF are more likely to receive help from others in their community.

4. Existing Evidence

There is no literature empirically evaluating whether DCF projects have built social capital. The existing empirical work mostly focuses on evaluating the World Bank's social funds program and, more recently, the community driven development (CDD) programs. Wong (2012) and Mansuri and Rao (2012) provide a comprehensive review of the research that has been conducted on the effects of CDD programs on social capital. They find mixed evidence on the impact of CDD programs; they improve local public service delivery but have little or no impact on local social capital (Wong, 2012). Mansuri and Rao (2012) point to the difficulty in evaluating whether these projects enhance social capital because of the challenges in measuring social capital and identifying accurate comparison communities. The authors highlight a few studies that conduct randomized field experiments in different settings to make a causal statement on the relationship between community-driven projects and the generation of social capital. Evaluating a community reconstruction project in Liberia, Fearon et al. (2009) find a reduction in social tension and an increase in trust in leadership as a result of the project. However, the authors note that these results were limited to only one of the treatment arms, mixed groups of men and women as opposed to the only women groups. The National Support Program in Afghanistan, a randomized community-driven reconstruction program, finds significant shifts in political attitudes and social cohesion (Beath, Christia, and Enikolopev, 2011). Casey, Glennerster, and Miguel (2012) also randomize treatment, a block grant to the community for public goods and training, in Sierra Leone, finding no impact of the project on village decision-making processes, including women or communities' abilities to raise money for public goods. Humphreys, de la Sierra, and van der Windt (2012) also find a no impact on social capital for an extensive randomized study of a community driven reconstruction project in

eastern Congo. Running a randomized field experiment in Sudan, Adveenko and Gilligan (2015) find that the participatory program did not affect either networks or norms, but it did increase civic participation and the participatory nature of local governance. In other words, social capital did not grow, but local governing institutions became more open and participatory. In summary, the existing literature that uses randomized experiments finds mixed evidence on social capital generation.

As Mansuri and Rao (2012) demonstrate, the causal relationship between community driven projects and social capital is very hard to evaluate without using randomization or field experiments. In studies that are unable to exploit randomization, several authors have used difference-in-differences estimations and matching to identify causal effects of community-driven projects (Chase, Christensen, and Thongyou, 2006; Deiniger and Liu, 2009; Labonne and Chase, 2011). Labonne and Chase (2011) aggregate household-level data and match treatment and control groups at the village level in Philippines, finding that CDD increased participation in village assemblies and the frequency with which local officials met with residents. However, their findings also show that there was a negative impact on group membership and collective action in other avenues, suggesting a potential crowd out effect.

This paper contributes to the existing literature in the following ways. First, I address the endogeneity issue by employing a quasi-experimental design used in previous studies. The structure of the DCF project suggests that communities with an existing high capacity for collective action are more likely to successfully receive funding for their proposal than others. To adjust for these differences, I match the treated and control households on observables that influence their likelihood of receiving a public goods investment under the DCF project to get accurate counterfactuals for the treated group. Additionally, to account for time-variant sources

of bias, I estimate the difference across time for both treated and control groups, and then the difference between the treated and control pair to get a better estimate of the causal impact of the DCF project on social capital.

Second, this paper fills a gap in the literature by examining the impact of the newly implemented DCF project in the Western Sahel region. Community-driven efforts vary in impacts depending on the setting and project approach, as suggested in previous research. Community-driven reconstruction projects have had different impacts on social capital when compared to representation quotas or CDD projects. Each evaluation helps provide more information and understanding on how different projects work with and build upon social capital. For that reason, evaluating this project and its relationship to social capital will be helpful when considering its scale up to other resource dependent rural communities. This context is particularly important to evaluate due to the collective action solutions needed to face climate change. Any enduring support for building resilience to climate change needs to build upon trust, reciprocity, pooled resources, and collective action. This is the first paper to examine the impact of the DCF project in this specific region on social capital. I further elucidate the importance of the setting and my empirical methods in Section 5, 6, and 7 respectively.

5. The Setting

This analysis is based on the DCF project that operated in the region of Kaffrine in Senegal and the region of Mopti in Mali (Figure 1). The project is relevant to the communities in these regions, as agro-pastoral livelihoods are their primary source of income generation. Their sources of income are underpinned by natural resources and rainfed agricultural systems that are vulnerable to the rapidly changing climate. The Western Sahel region, which includes the DCF

project sites, has been experiencing slow-onset climate change through increasing temperatures, desertification, changing rainfall and flooding patterns, as well as a greater number of climate shocks that impact food security and overall well-being (IPCC, 2014). Both Kaffrine and Mopti comprise of diverse agro-ecological systems that are affected by these changing conditions (Beauchamp et al., 2019). Kaffrine is divided administratively into four departments, Koungheul, Kaffrine, Birkelane, and Malem Hodar. It comprises of three distinct ecosystems, the Ferlo agro-pastoral region, the central peanut basin, and the southern humid zone bordering the Gambia. There is a major international highway running through Kaffrine, but many of the villages within the region can only be accessed via unpaved roads that are in poor conditions. Mali's Mopti region is divided into eight cercles[3], but DCF operates only in Koro, Mopti and Douentza which are situated in the Inner Niger River Delta. The most important economic activities in the region are flood plain cultivation, nomadic grazing, rainfed cultivation, and important fishery resources. The Niger river runs through this region. The repeated exposure in these sites to difficulties with crop and livestock productivity diminish adaptation strategies that have historically been used against fluctuating climate conditions. The speed of the current changes have contributed to concerns of food insecurity and sustainability of livelihoods, creating a need to help facilitate and support climate adaptation and resilience.

[3] A cercle is the administrative division that is roughly equivalent to a district or county in the US.

Figure 1: DCF Project Regions in Mali and Senegal

Source: Beauchamp, Teppe, and McPeak, *forthcoming*.

The DCF project works with the existing decentralization in Mali and Senegal. Following the 1991 uprising in Mali, decentralization was enshrined in the country's constitution. The country worked towards administrative decentralization and the devolution of power to the village level, bringing the government to the people (Pringle, 2006). Since the crisis that erupted in Mali in 2012, efforts around decentralization and strengthening the institutional capacity of

local governments have been hindered. However, though Mali does not have policies and laws in place to enable the decentralized management of funds, responsibility of certain sectors such as education and public health have been relegated to the local governments. There is a relationship between the local governments and citizens, allowing for DCF to work in partnership with the government to create a framework that strengthens local governance and local climate adaptation. However, it is important to note that during the project timeline, Mopti, Mali has experienced increased insecurity, violence, and internal conflict, including ethnic and religious fractionalization within villages. This turmoil could drive some of the changes in perceived levels of trust, reciprocity, and community.

Senegal also has a long history of political decentralization, with the federal government reinforcing the autonomy of local governments to fully manage the development of their jurisdictions (O'Bannon, 2006; OECD, 2016). In 2013, the government of Senegal adopted a program of reform with the aim of strengthening local territories, promoting participatory democracy, and emphasizing good governance. Elections, democratic deliberation, and civil society have long been associated with Senegal's decentralized government. The DCF project works within this context of decentralization to encourage community-level deliberation and local governance around climate change adaptation.

6. Data and Sample

This study spans 13 villages in Mali and 14 villages in Senegal located in the municipalities where the DCF project was conducted. The data used in this research is based on household surveys conducted during the course of the BRACED-DCF project. Survey data was collected for a longitudinal panel of households in 2015, 2017 and 2018 (Table 1). A two-stage

clustered sampling method was used in the selection of households. In the first stage, villages in Mali and Senegal were stratified based on geographical characteristics (distance to the Niger river in Mali and type of agro-ecological zone in Senegal), their distance to markets, and population size. In the second stage, households were randomly selected within each village from a household roster obtained from local leaders (Beauchamp et al., 2019).

The distinction between treatment and controls was made at the village level by putting forward a proposal that was selected for funding. However, for the purposes of this analysis, the treated group is defined as the randomly sampled households within villages where investments in public goods were implemented by the DCF project. Non-beneficiaries, or the control group, are randomly sampled households in villages that did not receive a DCF investment at any point in the project timeline. As Table 1 indicates, there were several new households introduced in 2018. This is due to the second phase of the DCF project known as BRACED-X. The project team added a new set of villages in the survey to capture the impact of DCF on treated villages that were not initially included in the baseline survey done in 2015. However, these new households are not included in the analytical sample for this paper. Additionally, due to the insecurity and conflict in the Mopti region, several villages (Inkalou Bourema, Moukeye, and Madougou Dogon) were not accessible for follow up surveys after the baseline. These sites had to be dropped for the analytical sample.

For the analytical sample, I construct a household-year dataset for households that are present in at least two consecutive years within the data and that have pre-treatment data available. I further exclude households who are missing data on the outcomes of interest. Table 1 provides an overview of the unrestricted and analytical sample sizes.

Table 1: Number of Villages and Households

	Baseline (2015)	Assessment (2017)	Re-assessment (2018)
Unrestricted Sample			
Mali			
Control villages	10	8	8
Treatment villages	9	8	13
Total households (N)	**565**	**520**	**720**
Senegal			
Control villages	11	11	11
Treatment villages	7	7	14
Total households (N)	**442**	**442**	**680**
Analytical Sample			
Mali			
Control villages	8	8	8
Treatment villages	8	8	6
Total households (N)	**451**	**451**	**389**
Senegal			
Control villages	11	11	11
Treatment villages	7	7	7
Total households (N)	**422**	**422**	**422**

A major limitation with the household surveys is that nearly all villages in Senegal that received an investment in the first BRACED funding wave did not have baseline survey data. Instead, a recall section was added to the survey in 2017 to ask respondents about their circumstances and conditions in 2015. As prior work on this has shown, recall bias is a significant concern (Bell et al., 2019). Introducing a recall section is an imperfect solution, as the cognitive burden for respondents is high and memories are sometimes poor. However, in the absence of panel data for those villages, it provides one approach to estimating change. I conducted a test of bias with the recall data to see if there are significant differences in the average recall responses compared to the responses of those who were in the survey through the

years, finding that there is no evidence of bias in Mali. However, in Senegal the recall data shows an underestimation in the recall variables. Those responding in 2017 leaned towards saying they were doing much worse in 2015 on all questions. It is impossible to run the analysis without the recall villages, but this finding suggests that any results found for Senegal will likely be biased upwards.

Another challenge while conducting the longitudinal household surveys is the concerns of attrition. Of the surveyed households, excluding the dropped villages in Mali, 93.6% of households in Mali and 95.5% of households in Senegal were available for at least 2 consecutive years.[4] In Mali, the attrition rate is higher in treated groups than control groups (7.8% vs. 4.5%). Comparing the attritors by treatment status suggests that those leaving in the treated groups have older household heads, smaller household sizes, higher education levels, and have experienced more shocks than the control group attritors. This aligns with the hypothesis that treated households are more likely to have an older household head and be more educated on average, as these households command respect and can push for their proposals within the community wide meetings. This differential attrition rate amongst the control and treated groups could bias the results, but as my identification strategy employs propensity score matching, I control for the different composition of the sample by treatment status. The attrition rate in Senegal is similar across treated and control groups (4.3% vs. 4.8%), and therefore, not a concern.

Of note, there are several households where the respondent for the surveys changed over the panel (10.3% in Mali, and 22.4% in Senegal). While this could be a problem for our analysis if the questions were based on the individual, given that the household composition is the same

[4] Of the households that were not present, the enumerators worked to find replacements, with the replacement households selected by the chief of the village as households that were most similar in characteristics to the household from the prior year. This is not a sufficiently unbiased process; therefore, the analysis drops the households that have been replaced.

across all periods and the questions are asked at a household level, it is debatable whether the variable respondents constitute a bias. In Senegal, the higher rate of variable respondents is likely driven by temporary migration for work or the 2018 presidential elections that drew household heads out to major cities.

Data collection was conducted through independent enumerators who were trained in the project framework, project activities, and questionnaire. Following a pilot, the questionnaire was administered to the heads of the sampled households, with a section of the survey specifically targeting the household head's spouse, if the household was not female-headed and a spouse was physically present at the time of the survey. In the case of polygamous households, the presence of any spouse was sufficient for conducting the survey. Prior verbal consent was acquired before each survey, in which enumerators described the purpose of the research and informed participants that they were in no way obligated to participate. For each household, the survey requested information on their household composition and members demographics, primary livelihood activities and strategies, access to resources, infrastructure, markets and services, community support, coping strategies for income fluctuations, shocks, food security, and resilience to climate change. Unfortunately, the survey did not ask questions on income or expenditure; therefore, food security is used as a proxy for household well-being. Food security was measured through the number of months a household felt food secure in the year. The survey also asked additional questions to both treated and control communities in the 2017 and 2018 waves on their understanding of the DCF project and their involvement in it. In addition to the survey data, I merged CHIRPS rainfall data at the village level to create an exogenous measure of the rainfall variability experienced. I use the approach outlined in Teppe (2018) to

calculate standardized z-scores[5] that capture the rainfall variation in the survey observation window when compared to the baseline period of 1980-2010. I also created a measure of village level ethnic fractionalization, as described by Labonne et al. (2007).[6]

For the purposes of this study, I use the social integration and aid section of the household survey as measures of social capital. In measuring the concept, I draw on the World Bank's Social Capital Assessment Tool and related literature for assessing social capital (Putnam, 2000; Grootaert, Narayan, Jones, &Woolcock, 2004; Labonne and Chase, 2011). I consider multiple different measures to capture cognitive social capital. Specifically, I measure the concepts of collective action, awareness of community activity, reciprocity, and community support. To capture collective action, the survey contains information on household's participation in community development projects (Collective Action), as well as their level of awareness and information on the projects within their community (Knowledge of Collective Action). In this context, other community development projects could reference government projects that are occurring within villages, other external development project interventions, or collective projects initiated by the community themselves. These variables demonstrate the supply of collective action independent of the intervention itself, capturing participation in community projects outside of DCF. For reciprocity and community support, I create an averaged index using a series of question on whether the respondent household helped others in the community with various livelihood activities (Reciprocity), and an index capturing whether the household was helped by others in the community (Community Support). While these measures were asked on a Likert Scale ranging from 0 – non-existent to 4 – very often, the

[5] $Z - score_{i,j,k,l} = \frac{Mean\ Observation\ Window_{i,j,k,l} - Mean\ Climate\ Normal_{i,l}}{Standard\ Deviation\ Mean\ Climate\ Normal_i}$

[6] I draw from Labonne et al., 2007 to create the fractionalization index. I estimate $F_k = 1 - \Sigma s_{ik,}$ where s_{ik} is the share of individuals from group i in village k. In this case, groups are the different ethnicities in the countries.

distribution of responses were clustered largely around 0 and 1. For that reason, and for ease of interpretation, these variables were recoded as binary variables where 0 is non-existent and 1 indicates any participation, awareness, reciprocity, and community support. The exact questions asked for these variables are available in Table A-1.

7. Identification Strategy

This paper aims to determine the average effect of the preparation, participation, and funding of a public goods investment through the DCF project on the social capital of the beneficiary households. This requires estimating what would have happened to the treated households had they not gone through a structured process of participation and had not received funding to aid with adaptation. Access to the project was not randomly assigned and we cannot observe what would have happened to a household had it not received funding for a public goods investment. To address this issue, I utilize a difference-in-differences approach with propensity score matching.

7.1 Difference-in-Differences

I start with a difference-in-differences approach. The level Y_{ict} of social capital in household *j* in village/community *c* at time *t*(t=0 (2015), or 1 (2017 or 2018)) is determined by:

$$Y_{jct} = \beta_0 + \beta_1 treat_{jc} + \beta_2 did_{jct} + \gamma X_{jct} + \tau_t + \varepsilon_{jct} \quad (1)$$

where β_0, β_1, and β_2 are coefficients to be estimated, X_{jct} is a vector of control variables that vary across households, communities, and time, $treat_{jc}$ is a dummy indicating if household j is in community c that received funding for a public goods investment program at time t, did_{jct} is the difference-in-differences estimate of the relative impact on treated households, τ_t indicates time

dummies and, ε_{jt} is the idiosyncratic error term clustered at the household level, which is assumed to be independent of X_{jct}, $treat_{jct}$, did_{jct} and τ_t. As mentioned earlier, the treatment variable is coded as 1 for households in villages that "won" funding with their proposal submissions and received a public goods investment from the local government. Comparison households are from villages where a proposal was not selected for funding but within the same department. Based on the determinants of social capital, the set of control variables X_{jt} include household characteristics, proxy for household well-being through months of food security and resilience to climate change, weather shocks experienced, and dummies for departments.

The difference-in-differences approach allows us to take the difference between pre-treatment and post treatment in each household to eliminate time-invariant sources of bias and then difference across the treated and comparison groups to get an estimate of the causal impact of the project. This method, however, would lead to biased estimates of the impact if receiving a public goods investment is a function of the initial levels of social capital. The main concern in evaluating the impact of the project on social capital is that households with a higher capacity to work together are more likely to receive funding, therefore any effect on social capital I estimate will likely be driven by this underlying tendency to work together. While care was taken during the selection of sample villages, ensuring that the villages were similar in geographical characteristics, the treated households may be significantly different to the comparison households in factors associated with the outcome variables. To deal with this potential source of bias, this paper additionally uses propensity score matching.

7.2 Propensity Score Matching

The idea behind the propensity score is to create a function that summarizes the exogenous observable attributes of a household and their likelihood of being treated prior to treatment (Rubin, 1973; Rosenbaum and Rubin, 1983). Based on this function, households in treated villages are matched with households in control villages that have a similar propensity of participation in the project. If there are treated and control households that have very different likelihoods of participating, they will lie outside the common support of the propensity score. The household outside the common support are dropped from the sample to reduce bias in the estimate of the impact. The propensity score is calculated through a logit model on the basis of:

$$P_j = f(H_j, X_j)$$

where P_j is the probability that the household belongs to a village that received a public goods investment through DCF, H_j is a vector of exogenous household characteristics and X_j is a vector of exogenous measures of participation and social capital of the household prior to the introduction of the DCF process (baseline data from 2015). The vector H includes the age of the household head, the household size, the number of dependents in the household, the highest level of education in the household, the ethnicity of the household members, the number of income sources for the household, the number of food secure months, the self-reported resilience to shocks, and the number of shocks experienced. The vector X includes the level of participation in community activities prior to DCF, and the household awareness of community development projects in their villages. While the survey did not include other social capital measures that may explain selection into DCF (e.g., the availability of social networks, the number of influential people known by the household, and their relationship to the village chief), matching villages on

geographic characteristics, as well as including all possible observables correlated with selection, minimizes the possible bias.

Results from the logit regression are available in Table 2. The results demonstrate that in Mali, the likelihood of treatment can be predicted based on household size, dependents, ethnicity, levels of education, food security, resilience, shocks experienced, information on community activity, and being involved in community development. In Senegal, the likelihood of treatment is predicted based on household head age, household size, dependents, income diversification, food security, resilience, shocks experienced, and having information on community activity.

Table 2: Propensity Scores for Mali and Senegal

	(1) Mali	(2) Senegal
Household Head Age	-0.003	-0.017
	(0.010)	(0.010)*
Household Size	0.088	0.108
	(0.048)*	(0.051)**
Dependents	-0.175	-0.077
	(0.083)**	(0.092)
Highest Level of Education	0.298	0.127
	(0.090)***	(0.097)
Dogon Ethnicity	1.769	-
	(0.411)***	-
Other Ethnicity	0.595	0.736
	(0.385)	(0.435)*
Peulh Ethnicity	0.925	-0.472
	(0.406)**	(0.361)
Income Diversification	0.150	-1.195
	(0.158)	(0.187)***
Months Food Secure	0.224	-0.143
	(0.051)***	(0.060)**
Resilience	0.431	0.500
	(0.168)**	(0.193)**
Number of Shocks Experienced	0.265	0.330

	(0.080)***	(0.075)***
Level of Information on Community Development	0.713	-0.500
	(0.190)***	(0.227)**
Involvement in Community Development	-0.670	0.028
	(0.169)***	(0.244)
Observations	442	387

Notes: results from a logit regression. The dependent variable is a dummy equal to one if the DCF project is awarded and implemented in the household's village. The standard errors are in parentheses and * denotes significance at the 10%, ** at the 5% and, *** at the 1% level. These scores generate the propensity to be treated function used for matching.

The pre-match density of propensity to receive a public goods investment is available in Fig. 2 and Fig. 3, demonstrating an overlap between treated and control households. To deal with concerns over common support, I drop the treatment observations whose propensity scores are higher than the maximum propensity of the controls. These constitute 15% of the observations in Mali and 17% of the observations in Senegal. Dropping these extreme observations substantially reduces the bias in the estimated impact of the project (Heckman et al., 1998). I use nearest neighbor matching procedures to match the treated and control households (Dehejia and Wahaba, 1998). Since the sample size is small, it is difficult to find an exact match. Therefore, I take the average of the five nearest neighbors from the control sample. The summary statistics in Table 3 and Table 4 assess whether the observable characteristics are well-balanced between the matched treated and control groups. The pre-match sample comparison shows that there is a need for propensity score matching. In Mali, the treated households were larger, more educated, more likely to be from the majority ethnic group (Dogon), and experienced greater levels of food security and resilience to climate change. In Senegal, treated households were also larger, more educated, and more likely to be from the majority ethnic group (Wolof). However, the treated households experienced lower levels of food security, poor resilience to climate change, and a

greater number of shocks. In Senegal, counter to what was hypothesized, treated households were less likely to be involved in community development activities prior to the program. However, results of the balancing tests indicate that the two groups are well-balanced after the matching, with most of the t-tests for the difference of means showing no statistical significance at the usual levels of confidence.

Figure 2: Mali Pre-match Density of Household Treatment Propensity

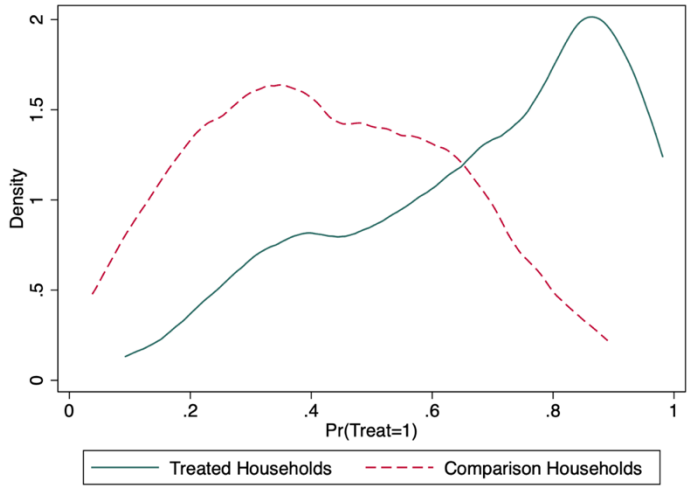

Figure 3: Senegal Pre-match Density of Household Treatment Propensity

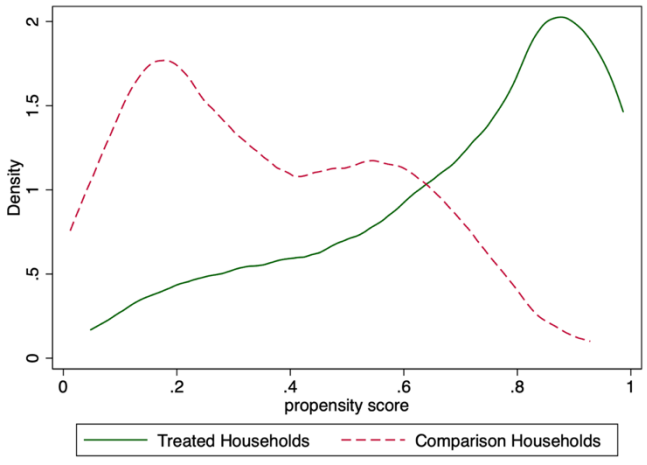

Table 3: Mali Summary Statistics Matched and Unmatched

		Mean			
Variable	Sample	Treatment	Comparison	t-test	p-value
Male Household Head (%)	**Unmatched**	**94.27**	**98.42**	**-2.17**	**0.031**
	Matched	**94.27**	**99.06**	**-2.63**	**0.009*****
Household Head Age	Unmatched	50.21	50.07	0.11	0.916
	Matched	50.21	50.05	0.13	0.897
Household Size	**Unmatched**	**6.89**	**6.04**	**2.61**	**0.009**
	Matched	**6.89**	**6.89**	**-0.02**	**0.988**
Dependents	Unmatched	1.53	1.45	0.42	0.671
	Matched	1.53	1.56	-0.19	0.846
Highest Level of Education	**Unmatched**	**2.93**	**2.61**	**2.32**	**0.021**
	Matched	**2.93**	**3.15**	**-1.55**	**0.122**
Bambara (%)	**Unmatched**	**10.42**	**18.42**	**-2.24**	**0.026**
	Matched	**10.42**	**14.69**	**-1.26**	**0.208**
Dogon (%)	**Unmatched**	**35.94**	**26.32**	**2.04**	**0.042**
	Matched	**35.94**	**31.88**	**0.84**	**0.402**
Other Ethnicity (%)	Unmatched	30.21	30.00	0.04	0.965
	Matched	30.21	31.67	-0.31	0.758
Peulh (%)	Unmatched	23.44	25.26	-0.41	0.679
	Matched	23.44	21.77	0.39	0.697
Income Diversification	Unmatched	2.83	2.81	0.26	0.796
	Matched	2.83	2.94	-1.29	0.198
Months Food Secure	**Unmatched**	**9.12**	**7.79**	**4.62**	**0.000**
	Matched	**9.12**	**9.01**	**0.38**	**0.707**
Resilience	**Unmatched**	**2.81**	**2.54**	**3.41**	**0.001**
	Matched	**2.81**	**2.83**	**-0.25**	**0.799**

Number of Shocks Experienced	Unmatched	1.44	1.37	0.42	0.674
	Matched	1.44	1.40	0.28	0.781
Level of Information on Community Development	Unmatched	2.27	2.18	0.84	0.403
	Matched	2.27	2.25	0.21	0.830
Involvement in Community Development	Unmatched	1.23	1.36	-0.98	0.325
	Matched	1.23	1.17	0.48	0.633

Notes: covariate balance test to see if the distributions of the variables of interest were similar in 2015 between households in villages in which the project will be implemented and comparison municipalities where the project will never be implemented. * denotes significance difference between matched and unmatched at the 10%, ** at the 5% and, *** at the 1% level.

Table 4: Senegal Summary Statistics Matched and Unmatched

		Mean			
Variable	Sample	Treatment	Comparison	t-test	p-value
Male Household Head (%)	Unmatched	92.98	93.71	-0.27	0.785
	Matched	92.98	90.41	0.86	0.390
Household Head Age	**Unmatched**	**46.86**	**49.26**	**-1.72**	**0.086**
	Matched	**46.86**	**46.20**	**0.48**	**0.634**
Household Size	**Unmatched**	**6.61**	**5.58**	**2.66**	**0.008**
	Matched	**6.61**	**6.47**	**0.33**	**0.743**
Dependents	**Unmatched**	**1.95**	**1.54**	**1.90**	**0.059**
	Matched	**1.95**	**1.85**	**0.44**	**0.661**
Highest Level of Education	**Unmatched**	**3.00**	**2.71**	**1.98**	**0.048**
	Matched	**3.00**	**3.17**	**-1.09**	**0.278**
Other Ethnicity (%)	Unmatched	12.87	8.00	1.48	0.139
	Matched	12.87	12.40	0.13	0.897
Peulh (%)	**Unmatched**	**9.94**	**24.00**	**-3.53**	**0.000**
	Matched	**9.94**	**8.19**	**0.56**	**0.573**

Wolof (%)	**Unmatched**	**77.19**	**68.00**	**1.92**	**0.056**
	Matched	**77.19**	**79.42**	**-0.50**	**0.619**
Income Diversification	**Unmatched**	**1.95**	**2.42**	**-5.71**	**0.000**
	Matched	**1.95**	**1.87**	**0.94**	**0.348**
Months Food Secure	**Unmatched**	**8.01**	**8.87**	**-2.94**	**0.004**
	Matched	**8.01**	**8.24**	**-0.72**	**0.470**
Resilience	Unmatched	2.42	2.46	-0.52	0.604
	Matched	2.42	2.35	0.72	0.471
Number of Shocks Experienced	**Unmatched**	**2.14**	**1.36**	**3.78**	**0.000**
	Matched	**2.14**	**1.71**	**1.96**	**0.050***
Level of Information on Community Development	**Unmatched**	**1.36**	**1.93**	**-5.28**	**0.000**
	Matched	**1.36**	**1.36**	**-0.03**	**0.979**
Involvement in Community Development	**Unmatched**	**0.37**	**0.82**	**-4.36**	**0.000**
	Matched	**0.37**	**0.31**	**0.72**	**0.471**

Notes: covariate balance test to see if the distributions of the variables of interest were similar in 2015 between households in villages in which the project will be implemented and comparison municipalities where the project will never be implemented. * denotes significance difference between matched and unmatched at the 10%, ** at the 5% and, *** at the 1% level.

Unfortunately, the baseline survey did not include questions on reciprocity and community support. For that reason, I am unable to run my difference-in-differences estimation for those variables. To estimate the impact of the project on the outcome variables reciprocity and community support, I run the following equation through an OLS model on my matched sample:

$$Y_{jct} = \beta_0 + \beta_1 treat_{jc} + \gamma X_{jc} + \varepsilon_j \qquad (2)$$

where β_0 and β_1 are coefficients to be estimated, X_{jc} is a vector of household and community control variables, $treat_{jc}$ is a dummy indicating if household j is in community c that receiving funding for a public goods investment program, and, ε_j is the idiosyncratic error term, which is assumed to be independent of X_j, and $treat_j$. This approach is not able to account for time trends, but selection bias concerns are reduced through the propensity score matching methods. The propensity score matched (PSM) sample estimates and difference-in-differences estimation of 'nearest neighbor' households allows us to evaluate the causal impact of the project on cognitive social capital.

8. Results

In this section, I discuss project impacts on household-level social capital. The first set of results looks at matched difference-in-differences estimates, as well as the matched estimates in Mali. The second set of results evaluates the same for Senegal.

8.1 Mali

In Mali, receiving one cycle of funding for a public goods investment has a positive impact on our measures of cognitive social capital (Columns 1-4 of Table 5). Specifically, after

going through the project process, the matched difference-in-differences results suggest that households are 18 percentage points more likely to participate in community development activities outside of the DCF project. The results also indicate that there is a 19 percentage point increase in the likelihood of being informed of community development activities. These results are robust to the inclusion of our controls and logit estimation. The findings suggest that households' perception of the benefits associated with participating in community development increased by gaining experience with a similar process through DCF. The treated households might be more informed about other community level projects as they are now seeking to find other ways to participate in collective action, or through new connections made during the community forums. One concern related to these results is that respondents in the treated households may have been aware of project objectives and answered accordingly. However, I posit that this is not a big concern for the outcomes of interest as the DCF project was perceived to be about delivering public goods and enhancing climate resilience by recipients, not about building social capital.

Table 5: Mali Project Effects on Collective Action

	Collective Action		Knowledge of Collective Action	
	(1)	(2)	(3)	(4)
Treat	-0.271***	-1.381***	0.0544	0.252
	(0.0653)	(0.363)	(0.0645)	(0.360)
Post Treat*	0.181***	0.924**	0.192***	1.096***
	(0.0669)	(0.393)	(0.0720)	(0.399)
Constant	0.381**	-1.600	0.451**	-0.149
	(0.179)	(1.115)	(0.186)	(1.068)
N	1,073	1,073	1,063	1,063
R2	0.259		0.141	
Model Type	LPM	Logit	LPM	Logit

Controls	Yes	Yes	Yes	Yes
Cercle Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Clustered S.E.	Yes	Yes	Yes	Yes

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Our propensity score matched estimates for reciprocity and community support indicate that a household in a village that received treatment is more likely to interact positively with their community members. The results suggest that treated households were 34 percentage points more likely to help others in their community than the control group (Column 1 of Table 6). Similarly, treated households were 29 percentage points more likely to receive help and support from community members than those in the control sites (Column 3 of Table 6). The results are robust to the inclusion of our controls and logit estimation. These findings could support the hypothesis that working together on a community level project for DCF generated feelings of trust and solidarity amongst households, encouraging them to support one another. However, these results need to be interpreted with caution. While the propensity score function allows us to match on observables, there were no baseline values for reciprocity and community support. The results could be picking up on the higher likelihood of the treated group to work with and support each other, which is correlated with their treatment status.

Table 6: Mali Project Effects on Reciprocity and Community Support

	Reciprocity		Community Support	
	(1)	(2)	(3)	(4)
Treat	0.335***	2.255*	0.292***	1.857**

	(0.0731)	(1.219)	(0.0827)	(0.916)
Constant	1.766***	0.547	1.846***	-0.343
	(0.418)	(6.063)	(0.448)	(6.825)
N	342	331	342	331
R2	0.448		0.294	
Model Type	LPM	Logit	LPM	Logit
Controls	Yes	Yes	Yes	Yes
Cercle Dummies	Yes	Yes	Yes	Yes
Clustered S.E.	Yes	Yes	Yes	Yes

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

8.2 Senegal

In Senegal, the results indicate that receiving one cycle of funding for a public goods investment has a smaller but still positive impact on one of the measures of cognitive social capital (Columns 1-4 of Table 7). The matched difference-in-differences estimates suggest that treated households are 12 percentage points more likely to participate in community development activities outside of the DCF project. These results are robust to the inclusion of the set of controls and a logit estimation. However, for the knowledge and awareness measure, the results provide no evidence of a treatment impact in Senegal. Similar to Mali, the findings in Column 1-2 of Table 7 could be interpreted as the treatment fostering a desire amongst households to work collectively as their experience with the DCF project resulted in a success.

Table 7: Senegal Project Effects on Collective Action

	Collective Action		Knowledge of Collective Action	
	(1)	(2)	(3)	(4)

Treat	0.0540	0.319	0.00888	-0.0326
	(0.0536)	(0.363)	(0.0590)	(0.364)
Post Treat*	0.118**	1.006**	0.0236	0.248
	(0.0582)	(0.441)	(0.0838)	(0.430)
Constant	0.225	-1.196	-0.343*	-4.114***
	(0.165)	(1.021)	(0.202)	(1.052)
N	951	951	953	953
R2	0.155		0.152	
Model Type	LPM	Logit	LPM	Logit
Controls	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
Clustered S.E.	Yes	Yes	Yes	Yes

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

The hypothesis that the DCF project encourages community support and action is also borne out in the PSM estimates on reciprocity and community support (Column 1-4 of Table 8) . In Senegal, treated households are 11 percentage points more likely to help others in their community than control households. Similarly, treated households were 13 percentage points more likely to receive help and support from community members. However, the impact on community support is not robust to a logit estimation. Once again, these findings need to be interpreted with caution. Though matched on observables, the lack of baseline information does not allow for certainty that the treatment is driving the effects.

Table 8: Senegal Project Effects on Reciprocity and Community Support

	Reciprocity		Community Support	

	(1)	(2)	(3)	(4)
Treat	0.107*	1.186**	0.125*	0.632
	(0.0608)	(0.563)	(0.0712)	(0.450)
Constant	0.770***	1.167	0.507*	0.268
	(0.197)	(1.994)	(0.299)	(1.732)
N	316	316	316	316
R2	0.189		0.174	
Model Type	LPM	Logit	LPM	Logit
Controls	Yes	Yes	Yes	Yes
Department Dummies	Yes	Yes	Yes	Yes
Clustered S.E.	Yes	Yes	Yes	Yes

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Overall, results from Mali and Senegal suggest a positive enhancement in select measures of social capital on account of the treatment. I run a series of robustness checks to ensure that the findings are providing precise estimates of the treatment effect. For both countries, I run alternative propensity score matching techniques. I test nearest neighbor 1:1, caliper matching (with the caliper width equal to 0.2 of the standard deviation of the logit of the propensity score), and kernel. I find that my difference-in-difference results in Mali (Table A-2 in Appendix) are robust to the alternative propensity score matching techniques, with varying magnitudes. Similarly, the PSM estimates (Table A-3 in Appendix) are robust to alternative matching techniques in Mali, with the point estimates varying in magnitude. On the other hand, in Senegal, I find that the results are not robust to alternative specifications, for both difference-in-differences and PSM estimations (Table A-4 and A-5 in Appendix). It seems that I am not able to precisely estimate the impact of the project on social capital outcomes in Senegal.

I also run the analysis using the original classification of the survey questions as Likert scales using ordered logit. For the composite indexes reciprocity and community support, I run the variables comprising the index separately to determine if one particularly variable is driving the findings. Finally, I redefine my binary outcome variables such that 0 is non-existent or one time, and 1 indicates responding some, often, or always on measures of participation, awareness, reciprocity, and community support. In Mali, these additional checks highlight that my results are still robust and similar to different definitions and model assumptions for my outcomes. In Senegal, the difference-in-differences estimates are robust to my outcome variable definitions. However, the PSM estimates are not robust to broken out Likert variables for reciprocity and community support. The results also lose all significance when I redefine my binary outcome variables. The robustness checks suggest that the estimates on project impacts in Mali are picking up a precisely estimated positive treatment effect. However, the results for Senegal indicate that it is unclear how the project is impacting social capital outcomes, which may be due to the use of problematic recall data.

9. Conclusion and Policy Implications

In this paper, I draw from existing research on the impacts of community-driven development projects to evaluate a climate change adaptation project implemented in Mali and Senegal. I use a unique household panel dataset with three survey waves to estimate whether the project led to changes in social capital outcomes. I provide difference-in-differences and propensity score estimates to capture whether beneficiary households experienced changes in cognitive social capital relative to non-beneficiaries who look similar on observables. The overall results suggest that that the project has positive impacts on household involvement in and

knowledge of other community development activities, and reciprocal acts of support and aid within their community in Mali. These results are robust to alternative matching techniques and definitions of the outcome measures. This suggests that the DCF process led to changes in household level social capital in Mali, accomplishing one of the goals of the project. The growth of social capital may be beneficial for future climate change adaptation initiatives in these communities, as households work better together and are more open to working as a collective. In Senegal, the main specification suggests that that the project has some positive impacts on involvement in other community development activities and reciprocal acts of support and aid. However, these results are not robust to alternative specifications, and therefore should be interpreted with caution. Given the lack of precise estimates for the findings in Senegal, it is unclear whether the DCF process was able to change household level social capital.

This research has several limitations that are worth noting. First, as noted in the data section, there are concerns with the reliability of all the data collected. The analysis required the use of recall data that may be biased. Additionally, as the survey was not designed explicitly to identify changes in social capital, the outcomes evaluated were limited to what was available in the survey. I was able to find some evidence that the DCF project works with and builds on notions of collective action and prosocial norms of reciprocity and aid. However, the analysis is unable to identify whether the DCF project changed the frequency and style of formal village decision-making, households social networks, and membership in groups and associations. There was also no information on whether engagement with local government officials changed on account of the DCF project. Future research is needed to generate useful knowledge on these other important aspects of household social capital.

There are several aspects of this study that deserve attention from future researchers. The analysis does not provide insight into long term generation of social capital, as the data available was limited to at most two years after the intervention. It is still unclear whether the generation of prosocial norms and collective action can be sustained for long periods after the project intervention. Additionally, one of the key limitations of the findings is that there is no separation in the treatment between the two broad steps in the DCF process: preparation and participation, and funding. The conceptual framework hypothesizes that the preparation and participation stage could be enhancing social capital amongst households through the deliberation and collective action process required by DCF. However, as treatment status in the analysis is determined by villages whose proposals were accepted, the results could be picking up the benefit of simply receiving a public goods investment. Households could be more likely to participate in other community development activities and support their neighbors because the investment they received has freed up their available time. More research is needed to determine the exact mechanisms driving the results.

This paper finds increased social capital, operationalized as collective action and prosocial norms towards community members, for beneficiary households of the DCF project in Mali. However, the pre-match summary statistics indicate that these households already had higher pre-existing levels of social capital, higher levels of education, and greater food security and climate resilience. They were also more likely to be from the majority ethnic group. This leads to concerns that the participatory process could be compounding and worsening existing inequities. It raises the question of who the target population for community-driven projects is, given resource constraints. Ideally, every village would be eligible and able to receive funds for a public goods investment that helps them adapt to climate change. However, in the presence of

constraints, it seems that communities with an existing level of social capital end up benefitting from the locally driven approach. It is important to understand who is excluded from these participatory spaces and how those populations can be reached for future interventions. Further research on understanding the participatory processes, the role of the facilitators, and who is able to access the process will help improve community-based adaptation project design and ensure that the money allocated for these projects is being used effectively.

10. Appendix

Table A-1: Question Wording for Cognitive Social Capital Survey Questions

Variable	Question
Collective Action	Did you participate in a community level project (infrastructure, social, etc.)?
Knowledge of Collective Action	What is your level of information on community development activities?
Reciprocity	During the last twelve months: ▪ I contributed to helping another household by providing cash or other support. ▪ I worked in the fields of other households' for collective help ▪ I watched and helped oversee other households livestock
Community Support	During the last twelve months: ▪ Other households have helped my household by providing cash or other support. ▪ Other households have worked in my household's fields as collective help ▪ Other households have kept watch over my household's livestock

Table A-2: DiD Estimates in Mali with Alternative Matching

	Collective Action		Knowledge of Collective Action	
	(1)	(2)	(3)	(4)
Nearest Neighbor Matching 1:1				
Treat	-0.336***	-1.828***	0.0586	0.219
	(0.0542)	(0.319)	(0.0554)	(0.310)
Post Treat*	0.204***	1.202***	0.256***	1.484***
	(0.0582)	(0.360)	(0.0587)	(0.326)
Constant	0.443***	-0.989	0.541***	0.447
	(0.152)	(0.982)	(0.148)	(0.820)
N	1,104	1,104	1,094	1,094
R2	0.247		0.140	
Caliper Matching				

Treat	-0.420***	-2.450***	-0.0572	-0.535
	(0.0693)	(0.505)	(0.0750)	(0.423)
Post Treat*	0.173**	1.057**	0.300***	1.864***
	(0.0724)	(0.500)	(0.0784)	(0.461)
Constant	0.476**	-1.138	0.542***	0.410
	(0.187)	(1.467)	(0.194)	(1.107)
N	716	716	715	715
R2	0.300		0.162	
Kernel Epanechnikov				
Treat	-0.272***	-1.382***	0.0562	0.261
	(0.0638)	(0.352)	(0.0626)	(0.347)
Post Treat*	0.177***	0.911**	0.197***	1.123***
	(0.0652)	(0.381)	(0.0702)	(0.383)
Constant	0.357**	-1.645	0.438**	-0.180
	(0.172)	(1.081)	(0.179)	(1.009)
N	1,109	1,109	1,099	1,099
R2	0.253		0.136	
Model Type	LPM	Logit	LPM	Logit

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A-3: PSM Estimates in Mali with Alternative Matching

	Collective Action		Knowledge of Collective Action	
	(1)	(2)	(3)	(4)
Nearest Neighbor Matching 1:1				
Treat	0.270***	1.731	0.285***	2.537***
	(0.0608)	(1.095)	(0.0618)	(0.759)
Constant	1.728***	-0.698	1.854***	3.175
	(0.334)	(4.724)	(0.322)	(5.544)
N	353	342	353	342

R2	0.401		0.279	
Caliper Matching				
Treat	0.289***	1.120	0.227***	1.462
	(0.0731)	(1.099)	(0.0741)	(0.985)
Constant	2.034***	6.000	1.563***	-1.752
	(0.441)	(6.621)	(0.456)	(7.094)
N	229	223	229	223
R2	0.421		0.303	
Kernel Epanechnikov				
Treat	0.317***	1.812	0.306***	1.984**
	(0.0727)	(1.148)	(0.0843)	(0.895)
Constant	1.788***	-0.628	1.813***	0.0103
	(0.419)	(6.304)	(0.451)	(6.632)
N	354	343	354	343
R2	0.443		0.290	
Model Type	LPM	Logit	LPM	Logit

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A-4: DiD Estimates in Senegal with Alternative Matching

	Collective Action		Knowledge of Collective Action	
	(1)	(2)	(3)	(4)
Nearest Neighbor Matching 1:1				
Treat	-0.177***	-0.960***	-0.297***	-1.503***
	(0.0513)	(0.266)	(0.0517)	(0.262)
Post Treat*	0.322***	1.962***	0.269***	1.388***
	(0.0532)	(0.323)	(0.0615)	(0.293)
Constant	0.577***	0.605	0.288*	-0.981
	(0.129)	(0.749)	(0.150)	(0.663)
N	1,015	1,015	1,017	1,017

R2	0.166		0.111	
Caliper Matching				
Treat	-0.0426	-0.139	-0.0650	-0.307
	(0.0665)	(0.375)	(0.0730)	(0.351)
Post Treat*	0.247***	1.614***	0.0854	0.433
	(0.0747)	(0.454)	(0.0881)	(0.396)
Constant	0.357**	-0.504	0.197	-1.430
	(0.174)	(1.007)	(0.235)	(1.047)
N	543	543	543	543
R2	0.159		0.085	
Kernel Epanechnikov				
Treat	0.0324	0.199	-0.0234	-0.211
	(0.0522)	(0.350)	(0.0595)	(0.351)
Post Treat*	0.110*	0.839*	0.0486	0.353
	(0.0597)	(0.431)	(0.0818)	(0.409)
Constant	0.375*	-0.357	-0.282	-3.712***
	(0.198)	(1.092)	(0.219)	(1.096)
N	1,027	1,027	1,029	1,029
R2	0.146		0.126	
Model Type	LPM	Logit	LPM	Logit

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A-5: PSM Estimates in Senegal with Alternative Matching

	Collective Action		Knowledge of Collective Action	
	(1)	(2)	(3)	(4)
Nearest Neighbor Matching 1:1				
Treat	0.0767*	0.929**	0.0712	0.432
	(0.0409)	(0.454)	(0.0513)	(0.317)
Constant	0.797***	1.928	0.878***	2.039
	(0.176)	(1.869)	(0.228)	(1.377)

N	337	337	337	337
R2	0.166		0.050	
Caliper Matching				
Treat	0.0747	0.846	0.0565	0.332
	(0.0627)	(0.684)	(0.0790)	(0.530)
Constant	0.581**	-1.271	0.384	-0.795
	(0.281)	(3.025)	(0.368)	(2.112)
N	180	180	180	180
R2	0.187		0.087	
Kernel Epanechnikov				
Treat	0.0836	1.042**	0.137**	0.683
	(0.0536)	(0.529)	(0.0642)	(0.422)
Constant	0.809***	1.413	0.513*	0.285
	(0.187)	(1.894)	(0.285)	(1.668)
N	341	341	341	341
R2	0.162		0.221	
Model Type	LPM	Logit	LPM	Logit

Notes: Columns (1) and (3) are linear probability models for the matched sample. Columns (2) and (4) are logit estimations for the matched sample. All models include dummy variables for the year. Controls include household head sex, age, household size, number of dependents, income diversification, ethnicity dummies, ethnic fractionalization, months food secure, resilience, CHIRPS rainfall variability z-score (1 and 2 year observation window lags), village population, and department dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

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Chapter II: Gender and Participation in Community Based Adaptation: Evidence from the Decentralized Climate Funds Project in Senegal

Abstract

Efforts to promote inclusive participation in community-based adaptation projects highlight the importance of giving those most vulnerable to climate change a voice. This paper explores the involvement and inclusion of women in participatory spaces in the Decentralized Climate Funds pilot project in Senegal to evaluate whether only the voices and demands of the powerful and vocal few were raised and heard. Using semi-structured interviews and focus group discussions, the paper explores and analyzes the factors motivating and constraining women's active and empowered meaningful participation. The findings reveal that women in the Kaffrine region of Senegal experienced different levels of participation in community decision-making, ranging from nominal and passive participation to active and substantive participation. Results highlight that women's social capital and networks, community-level recognition of women's role in income generation, and favorable intrahousehold power dynamics were instrumental in encouraging active and empowered participation. The paper finds that the community-based adaptation approach of devolving decision-making to the community level is by itself not sufficient to ensure that women can meaningfully access the participatory process. Future community-based adaptation initiatives can improve their approach and ensure that women are able to voice their needs by understanding the local gender dynamics and designing projects to acknowledge and work within those dynamics.

1. Introduction

Development professionals and practitioners have increasingly recognized that climate change differentially impacts the lives and livelihoods of the most vulnerable groups in society (Adger and Kelly, 1999; Tompkins and Adger, 2004; Ribot, 2013; Sultana, 2014; Otto et al., 2017). Gender, intersecting with other social markers such as age, income, caste, assets, ethnicity, and power, is identified as a critical social cleavage that shapes differentiated difficulties and burdens (Kakota et al., 2011; Nelleman et al., 2011; Munang et al., 2013; Ali et al., 2014; Carr and Thompson, 2014). The social and economic structures that ascribe distinct roles to women in society also expose them to specific environmental risks, as well as limit their ability to avoid or adapt to these risks (Terry, 2009; Goh, 2012; Eastin, 2018). These gender norms that separate men's and women's domains of work and expertise also reflect their distinct knowledge of solutions to the impacts of climate change (Agarwal, 2001; 2009). Women work closely with their environment to manage their family's daily living needs, making their unique knowledge and experiences essential to communities adapting to climate change (Glazebrook, 2011; Carr et al., 2016).

A growing approach to adaptation is community-based adaptation (CBA), which recognizes that climate change vulnerabilities and impacts are local, and that strategies to address these differentiated impacts need a community-led approach (Reid et al., 2009; Dodman and Mitlin, 2013; Reid, 2016). The approach identifies that climate change adaptation strategies must be generated though participatory processes, driven by local stakeholders and their specific knowledge of locally appropriate solutions to climatic variability and extremes (Ayers and Forsythe, 2009; Forsythe, 2013). However, there are limited studies on a gendered analysis of the CBA framework. Are the differentiated vulnerabilities and specific knowledge of women voiced

and incorporated in CBA initiatives? Ali et al. argue that a crucial step in scaling up and expanding CBA projects is to ensure that women are identified and included as key actors and beneficiaries (2014). Earlier studies on women's participation in community-driven development programs and resource management committees has found that there continue to be barriers to meaningful and active participation (Agarwal, 2001; Kongolo and Bamgose, 2002; Cornwall, 2003; Prokopy, 2004; Opare, 2005; Agarwal, 2009; Das, 2014; Evans et al., 2017). This extensive body of work highlights that women are often token participants, and that claims of full participation under these projects masks that decisions are driven by gendered interests (Cornwall, 2003; Prokopy, 2004; Evans et al., 2017; Ngigi et al., 2017). This paper builds off this body of work to apply a gendered lens on the participation and inclusion of women in climate change adaptation decisions. The paper fills the gap in research around understanding whether CBA interventions are effective in empowering both men and women, along intersecting diverse identities, in the face of climate change. Understanding the success of such programs for women is relevant for future program design to ensure that the gender reality on the ground is reflected in solutions to adapting to climate change.

The paper is based on findings from the Decentralized Climate Funds (DCF) pilot project[7] in Senegal funded by the Department for International Development (DFID), and implemented from 2014-2019 by the Near-East Foundation (NEF), *Innovation, Environnement et Développement en Afrique* (IED-Afrique), the International Institute for Environment and Development (IIED), and Maxwell School, Syracuse University. The DCF project aimed to support locally led climate change adaptation, encouraging participatory processes at the

[7] DCF is a climate finance model that offers a mechanism for investing in public goods at the local level with the goal of encouraging and enabling climate resilient livelihoods. In this paper, I focus on the pilot project as it was implemented in the Kaffrine Region of Senegal (see https://www.neareast.org/braced/ for details).

community level to identify and prioritize investments in adaptation, and strengthening the ability of local authorities and communities to mobilize and manage funds. Analyzing this project through a gendered lens, this paper explores whose voices were raised and heard during community level deliberations. The key research questions guiding this work are: what does participation for different women under the DCF project look like; and what are the factors and conditions motivating or constraining these women's active and meaningful participation within this context?

The results highlight that women's participation in decision-making about community adaptation varies in levels and depends on a complex, interlinked set of factors across community, household, and individual levels. The women interviewed did not have uniform experiences of participation during the DCF project, with socioeconomic and demographic factors intersecting with their gender identity to shape differential experiences of participation. Additionally, the findings suggest that the participatory approach to adaptation only encouraged active and empowered participation of women in sites where there was an existing precedent for women's participation, encouraged by social capital and networks, recognition of women's role in income generation, and favorable intrahousehold power dynamics. The paper concludes by discussing the ways in which even gender aware CBA initiatives struggle to engage with issues of unequal power relations, which can lead to a failure to ensure women's voices across intersecting diverse identities are actively considered and included in community decisions. The findings highlight the need for future participatory initiatives to make a concerted effort to engage with and build capacity for women to ensure that their voices and needs are being raised and heard.

2. Decentralized Climate Funds Project

The pilot project analyzed in this study was implemented in Kaffrine, Senegal and Mopti, Mali. The project is part of a wider approach referred to as the "Devolved Climate Finance" mechanism that has been piloted in Mali, Senegal, Tanzania, and Kenya. For the purposes of this study, the analysis focused on the implementation of DCF in Senegal[8]. The DCF mechanism builds on the premise that local communities have in-depth knowledge about climate variability and risks (Dodman and Mitlin, 2013). Drawing from the CBA framework, the approach focused on the intersection of social, economic, cultural, political and environmental stressors on poverty and vulnerability, recognizing that climate change is only one of the range of problems that poor people face (Reid et al., 2009; Forsyth, 2013). The DCF project supported climate change adaptation on the ground by engaging with local stakeholders to identify, prioritize, finance, and implement locally defined adaptation projects (Hesse, 2017). The project design focused on facilitating a participatory approach to prioritizing investments in public goods, creating links between local communities, local authorities and other technical actors. Creating these channels for local communities to identify and receive resilience and poverty-reduction investments in turn empowers them to achieve long-term collective action and sustainable development goals (Bahadur et al., 2010; Chambers, 2014).

The project operated in Kaffrine, which is situated in the 'peanut basin' of Senegal and is comprised of rich agro-ecological systems, diverse ethnic groups, and a variety of livelihood strategies (Beauchamp et al., 2019). The project benefited from and utilized the existing structures of decentralized governance in Senegal. In 1996, Senegal implemented a law that recognized the competence and power of local authorities, transferring the responsibility of

[8] The author was unable to conduct research in Mopti, Mali due to security concerns in the area.

management of public lands; environment and natural resource management; health; population and social welfare; youth, sports, and recreation; culture; education; planning; and land management, zoning, and local development from the central state to the local governments (Gellar, 2005; Monkam, 2010; Wilfhart, 2018). Despite this significant progress, local governments remain largely dependent on the central government for funding and guidance on climate adaptation. The DCF project sought to disrupt this trend by developing institutional mechanisms to channel climate funds to local governments while building their capacity for effective, equitable and inclusive planning and delivery of climate adaptation measures that respond directly to local needs.

The Kaffrine Region is divided administratively into four departments[9], Koungheul, Kaffrine, Malem Hodar and Birkelane. Under the DCF project, local climate adaptation funds were created through the devolution of funds across all four administrative departments. The disbursement of funds followed a multi-stage process that engaged all levels of stakeholders. Initially, DCF established and built the capacities of department and commune level adaptation committees to support community planning and the prioritization, selection, and technical implementation of resilience-building investments. Following that, villages across the four departments were informed of the DCF project and were encouraged to collaborate to discuss and deliberate on their priorities for a local resilience investment. The deliberation process itself was determined by the respective communities, though DCF encouraged an inclusive participatory approach that includes women and young people in the decision-making. Following this, a community forum was held at the municipal (*commune*) level to identify the priorities and needs of the many villages in the municipality. The forum provided a space for representatives of

[9] A Department is the administrative division that is roughly equivalent to a county in the US.

villages and local groups to deliberate on the investments needed to build resilience to climate change. This forum was required by DCF as part of the investment selection process as a means to ensure and strengthen social inclusion and equitable participation. After arriving to a consensus, the municipality was then tasked with submitting a proposal or multiple proposals to the departmental adaptation committee to request projects that could help their community adapt. After the submission of the proposals, the committee assessed and selected to fund the proposals that best met the agreed upon eligibility criteria. The criteria required that proposals described a theory of change on how the proposed public goods investment would help improve the whole community's resilience to climate change, and provided proof of community level deliberation. Upon receiving funds for an investment, local communities were required to establish a management committee that included women. The committee was tasked with overseeing construction and ensuring proper management of the public good investment.

While the project engages with all levels of stakeholders, this study focuses its analysis on the first step of the DCF process. The paper analyzes the involvement and inclusion of women during the deliberation and decision making processes that determined what was needed to help the whole community adapt to climate change.

3. Conceptual Framework

The DCF project aimed to enhance adaptive capacity for all by investing in resources and infrastructure identified by communities as helpful for collectively adapting to climate change. This paper evaluates whether the decision-making process was equitable across gender lines, allowing both men and women to express their experiences and posit solutions to help facilitate community adaptation. In this section, I discuss the frameworks used to identify the different

levels of participation within the DCF community deliberation process and categorize the factors and conditions that may be influencing the difference in degree of participation amongst women.

3.1 Classifying Participation

Views diverge on the exact nature and definition of participation, but regardless of the perspective from which it is conceptualized, typologies of participation exist. There are numerous scholars who have different interpretations of the levels of participation (Arnstein, 1969; Pretty, 1995; White, 1996; Michener, 1998; Agarwal, 2001; Prokopy, 2004). To define participation, this study draws on Agarwal's (2001) typology, which identifies a spectrum of participation. At its narrowest, participatory behavior is defined as "nominal participation", which is equivalent to membership in a group, to the broadest view of participation defined as a dynamic and interactive process whereby everyone has a voice and can influence the decisions being made (see Table 9).

Table 9: Typology of Participation

Form/Level of Participation	Characteristic Features
Nominal participation	Membership in the group.
Passive participation	Being informed of decisions *ex post facto*; or attending meetings and listening in on decision-making, without speaking up.
Consultative participation	Being asked an opinion in specific matters without guarantee of influencing decisions.
Activity-specific participation	Being asked to (or volunteering to) undertake specific tasks.
Active participation	Expressing opinions, whether or not solicited, or taking initiatives of other sorts.
Interactive (empowering) participation	Having voice and influence in group decision-making.

Women's participation in decision-making around climate change adaptation is imperative to tackling community vulnerability to climate change. It is well-established that women play a central role in sustaining livelihoods and managing environmental resources.

However, they are often excluded from actively participating and influencing community decisions that help govern the use of these resources (Agarwal, 2000; Tompkins and Adger, 2004; Nellemann et al., 2011; Van Aelst and Holvoet, 2016). In the context of climate change, women face social and culturally constructed gender-specific barriers that make them vulnerable to its effects, while also limiting their ability to participate in locally based adaptation activities (Carr, 2008; Dankelman, 2010; Alston, 2013; Dodman and Mitlin, 2013; Sultana, 2014; Detraz, 2017; Eastin, 2018). Women often do most of the agricultural work, bear disproportionate responsibility for household food security and management, and manage natural resources such as water and fuel for their livelihoods - domains that are impacted significantly by climate variability (Terry, 2009; Goh, 2012; Alston, 2013; Jost et al., 2016). The nature of their work gives them unique perspectives on climate change, in addition to generations of experience managing and sustaining their households' livelihoods in response to historical changes in weather patterns (Rodda, 1991; Agarwal, 2001; 2009; Glazebrook, 2011; Nellemann et al., 2011). Women are active agents of adaptation even with discourses and policies that disadvantage them. For these reasons, women's knowledge and participation are paramount in developing effective strategies of adaptation to secure and sustain livelihoods in the face of climate change (Djoudi et al., 2011; Ngigi et al., 2017).

The DCF project emphasizes inclusive participatory processes to encourage the involvement and knowledge sharing of all members of a society. However, there remains a long-standing concern that participatory processes are just another tool in the box that works to limit the political nature of development and empowerment (Ferguson, 1994; Cleaver, 1999; Li, 2007; Green, 2010). A common critique of the participatory approach is that the term 'community' assumes a cohesive group that is open and willing to work collectively to plan, make decisions,

and have similar values and goals, a vision of communities that is not rooted in reality (Kirkby et al., 2018). Communities are diverse and multi-faceted in their individual priorities, needs, vulnerabilities and capacities, and are comprised of a variety of power relationships and exclusions (Paddison et al., 2002; Buggy and McNamara, 2016; Kais and Islam, 2016; Kirkby et al., 2018). There is socio-cultural and socio-political heterogeneity and complexity, with clashes of interests based on gender, age, socioeconomic class, religion, and ethnicities (Nelson and Wright, 1995; Dorsner, 2004; Kais and Islam, 2016; Thompson-Hall et al., 2016; Beauchamp et al., 2019). Though participatory processes are set up to operate on principles of cooperation and inclusiveness, a poorly designed process can exclude the disadvantaged and marginalized within a community in favor of local elites and the privileged (Cooke and Kothari, 2001; Platteau, 2004; Fritzen, 2007; Mansuri and Rao, 2012). This limitation is particularly true for women, as participatory tools often fail to engage with the diversity of men and women's experience (Gujit and Shah, 1998). The subsumption of women under the broader category of community takes away from the distinct nature of their experiences and masks the gender inequities prevalent in the larger community.

The development field has changed over the past decade and there is a greater recognition by participatory initiatives of the complex realities of communities, with a particular focus on the need to account for women's different status. However, even when participatory engagement is conducted with good intention and acknowledges the heterogeneity within communities, the process does not always achieve meaningful participation (Wong, 2009; Wong, 2010; Warrick, 2011; Mansuri and Rao, 2012; Kirkby et al., 2018). One of the main reasons for this is that projects like DCF still avoid engaging with the inequitable distributions of power within a community. The projects fail to address the different levels of access to knowledge, resources,

and decision-making structures within a community that limit inclusive participation (Dodman and Mitlin, 2013; Kirkby et al., 2018). For example, some of the resource management literature has highlighted that simply requiring the presence of women in participatory bodies does not address the underlying power imbalances that disproportionately disadvantage women and limit their ability to speak up for themselves (Mohanty, 2002; Agarwal, 2009; Das, 2014; Evans et al., 2017). The presence of women in community-decision making bodies does not necessarily translate into real influence, highlighting the risk of assuming that community-driven projects are truly inclusive (Mayoux, 1995; Mohanty, 2002; Cornwall, 2003).

3.2 Factors and Conditions Influencing Participation

Beyond identifying the level of participation, it is necessary to understand the factors and conditions influencing the difference within participation (Coulibaly-Lingani et al., 2011; Evans et al., 2017). The study draws on the "Gender Box" conceptual framework established by Colfer and Minarchek (2013) to understand the role of gender in participation. The framework categorizes factors that condition gender differentials in participation in decision-making into macro-, meso-, and micro- levels (Figure 4).

At the macro-level, a country's formal policies and laws, as well as informal religious and cultural contexts can determine women's ability to participate. A nation's involvement in gender-relevant international agreements, commitment to gender equality, policies on girl's education, land tenure and ownership laws, women's health and family planning, and training and employment, all influence women's participation. Additionally, a nation's relationship with religious and patriarchal norms and structures trickle down to shape the behaviors of men and women at the local level. Senegal's population is around 94% Muslim (Cochrane, 2020). After

independence, the country established itself as a secular state within its Constitution. However, Villalón finds that democracy in Senegal has worked in conjunction with a rapid expansion of religious influence in public life (2010). This relationship with religion is particularly important in providing context for gender equality. Unlike other Muslim nations in West Africa, Senegal has a family code in effect, passed in 1972 (Villalón, 2010). The code stipulated that all prior family laws were to be abolished, with the exception of the traditional marriage ceremony (Camara, 2007). While this move was marked as a symbol of Senegal's modernity over traditional customs, the family code maintains the husband in an elevated status and stipulates that women's duties to their families come before their individual rights (Camara, 2007). Additionally, there remain discriminatory gender and ethnic laws regarding ownership of assets and inheritance rights. In positive steps towards gender equality, the government signed and adopted a gender parity law in 2010 that requires political parties to ensure at least half of their candidates in local and national elections are women candidates. Following the passing of this law, the 2012 national election saw an increase of women representatives from 22.7% to 42.7% in the National Assembly, and from 16% to 47% in local legislatures in the 2014 local election (Tøraasen, 2019). These macro-level factors set the context for understanding and evaluating women's experience at the local level under the DCF project.

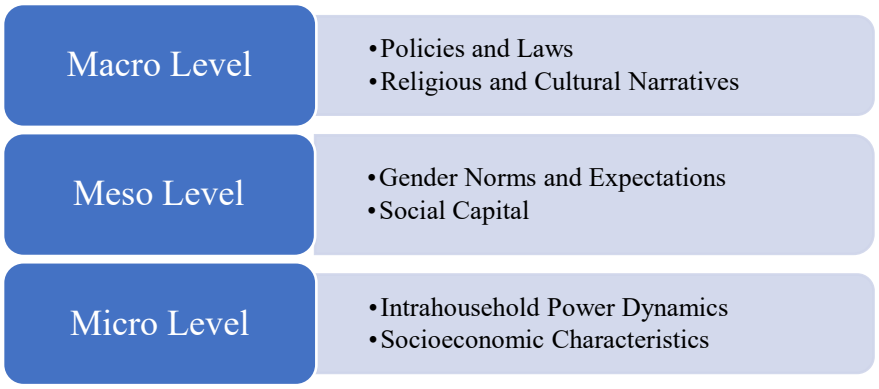
At the meso-level, socio-cultural norms and traditions, and social capital are integral to shaping the decision-making capacity of women. Gender divisions of labor often determine women's ability to spare time from domestic duties to engage in community work and attend meetings. Cultural and social norms often dictate the segregation of public spaces where meetings are held, potentially excluding women from participating by meeting in spots that are not safe, respectable, or allowed for women (Agarwal, 2000). Notions of appropriate behavior of

women can render participation impossible or entail challenging prevailing norms at the cost of household and community dynamics (Nuggehali and Prokopy, 2009; Das, 2014). Cultural norms of respect and deference to older members of the community and to men, who are seen as bearing the burden of governance and decision-making, also prevent women from participating in community decision-making (Prokopy, 2004). Research on collective action, particularly in environmental resource management, has found that social networks and capital are strongly associated with an increase in participation and community-decision making (Ostrom, 1990; Brady et al., 1995; Verba et al., 1995; Agarwal, 2000; Putnam, 2000; Nuggehali and Prokopy, 2009). Social capital is often generated through participation in other formal and informal groups, so women who have experience with other groups are better positioned to join and participate in future groups (White and Runge, 1995; Weinberger and Jutting, 2011). Arora-Jonsson found that in natural resource management women preferred to operate and participate through the women's groups, where they felt stronger and more confident, than participate as individuals in a community meeting (2011).

Finally, at the micro-level, personal and household characteristics encourage or constrain women's participation in community organizations. Intra-household dynamics, where the household has culturally defined roles for men and women, can bar women from participating in domains perceived to be outside their expertise. On the other hand, changing expectations of women's roles in household income generation can encourage women's participation in community decision making. The ability to bargain and negotiate, vulnerability to violence, and husband's expectations and support shape women's participation outside of the household. Additionally, it is possible that women do not participate outside of the household because they spend all their energy negotiating and convincing their husbands inside the household. Finally,

individual socioeconomic characteristics such as women's education, marital status, and age are strong influencing factors in their participation.

Figure 4: Adapted Colfer's Gender Box Framework



4. Research Methodology

To understand women's involvement and participation in the deliberation and decision-making process, this study used in-depth semi-structured interviews and focus group discussions. Fieldwork was conducted in two villages and one city in the Kaffrine region of Senegal (Table 10). Study sites were selected from a list of 27 villages and cities that had engaged in a community decision-making process and received funding for a public good from the DCF project. The sites were selected such that there is variation in (1) geography, to avoid any systematic, administrative-level specific factors that might influence the overall findings, and (2) investment type, to understand the processes that led communities to prioritize different public goods with distinct target beneficiaries.

Table 10: Research Sites

Department	Commune	Village/City	Investment	Context
Kaffrine	Kaffrine	Kaffrine	Boreholes for Community Garden	Urban

Birkelane	Segre Gatta	Keur Sette Awa	Grain Storage Facility	Rural
Koungheul	Lour Escale	Niolé	Potable Water Supply	Rural

Data collection occurred between March and April 2019. In-depth semi-structured interviews and focus groups provided rich insight into people's perceptions of participation in the DCF project, and the factors that influenced their levels of participation. The interview guides were reviewed and validated by IED-Afrique staff members and the translator to ensure that questions were appropriate for the context and that the appropriate Wolof words were being used for key concepts such as "participation" and "resilience". The questions asked focused on understanding the roles and involvement of the interviewee in household and community level decision-making. The interviews used open ended questions to understand the participants experience with DCF, their thoughts on gender and power relationships at household and community levels, and their personal experiences with climate change.

Recruitment for both the focus group discussions and the semi-structured interviews varied by site. In Keur Sette Awa and Niolé, both rural villages, recruitment for the focus group interviews was through the head of the village and targeted women only. For the semi-structured interviews, the research team used a convenience sampling strategy, where we walked around the sites and found residents, men or women, to speak with contingent on their willingness and availability. As part of our strategy, we stopped at alternating households within sites (we skipped every other household in a row of households). This strategy was described to and approved of by the heads of the respective villages to ensure the team conducted the study in a manner consistent with community norms and in alignment with the human subjects review (see Appendix A for details on IRB approval). The concern of convenience sampling for this study is

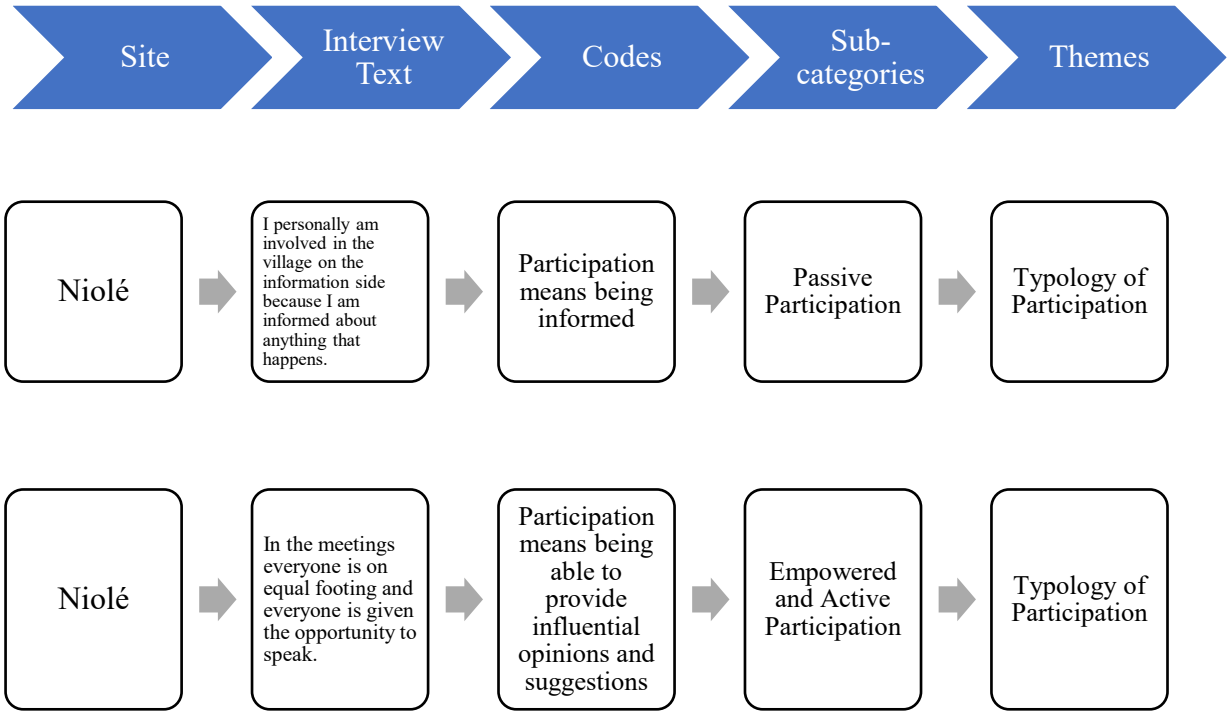
that the type of woman available for interviews at the household may not reflect the larger sample of women in the sites, and may bias our results to reflect women that do not participate in income generating activities. However, to reduce this concern, we conducted our interviews on the weekend during the afternoons when it was too hot for people to be out working. In Kaffrine, a city, we had to use a different approach. In Kaffrine, the DCF regional adaptation committee selected to fund a women's association proposal for the construction of boreholes in their community garden. For that reason, we conducted our focus group discussions and one-on-one interviews with only women from the association. To recruit participants, we received a list of the members of the women's association from the DCF project and selected participants to contact at random (using a random number generator to determine which participants to contact). We invited this random selection of women to the focus group discussion, and then reached out to a different set of women for one on one interviews at their households.

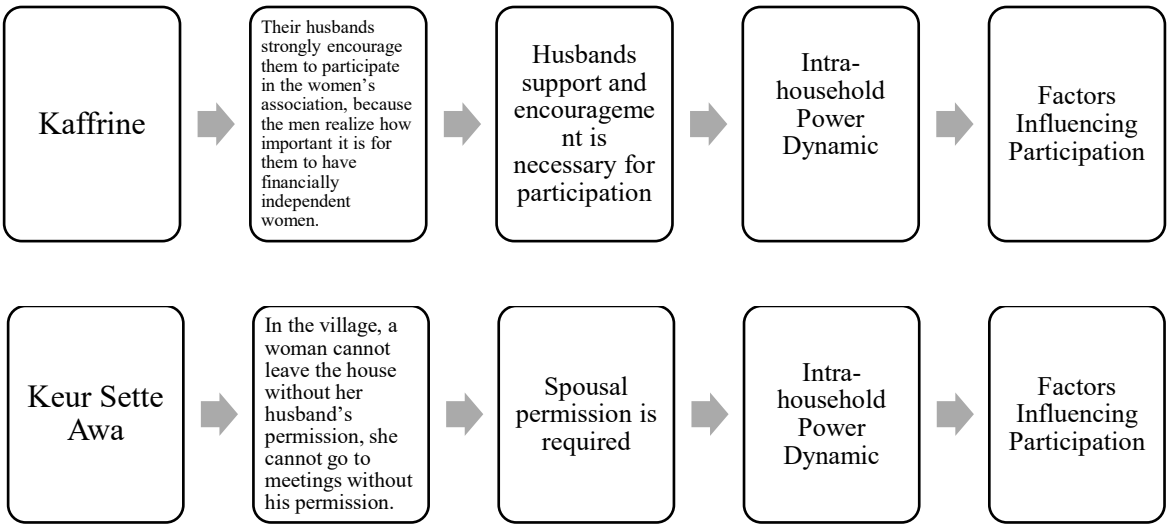
For the focus group discussions, we spoke to 15 women in total in the three sites. For the semi-structured interviews, we did a total of 30 interviews with people who were not present at the focus group discussions. While the focus group interviews were for women only, we spoke to both men and women during the semi-structured interviews. Of those surveyed for one-on-one interviews, 30% were men and 70% were women as the men were often in the village center instead of their households, enjoying their day off with friends.

All of the interviews were transcribed in Wolof, translated to French, and then English for data analysis. The collected data was analyzed using an inductive qualitative content analysis approach that systematically identified themes and patterns in the data (Drisko and Maschi, 2015). Hsieh and Shannon (2005) describe this approach as conventional qualitative content analysis, where the researcher immerses themselves in the data, prior to reading any of existing

theoretical frameworks, to allow new insights and themes to emerge (Kondracki and Wellman, 2002). The researcher compared the emergent categories from the actual data to theory and frameworks that are commonly found in the literature on women's participation. The data from the interviews and focus groups reflected and supported broader conceptual frameworks of typology of participation (Agarwal, 2001) and factors influencing participation (Colfer and Minarchek, 2013). Following this identification, the sub-categories were placed under these overarching themes that linked to the theoretical perspectives (Glaser and Strauss, 1967). Figure 5 provides examples of the data coding process (also see Appendix B for an overview of all coding categories).

Figure 5: Data Coding Process





Before discussing the results, it is important to understand what investments each site received to contextualize the findings. In Keur Sette Awa, local stakeholders invested in and constructed a grain storage facility. The residents interviewed described that the grain storage facility helps them improve their food security and stabilize their income generation. Prior to the facility, households would place their harvested products in the house, where it was susceptible to damage from insects, mice, fires, floods, and personal theft. With the facility, people can protect their harvest from external damage and theft, ensuring that there is enough food for the household and seed for the next cultivation period. In Niolé, DCF provided funds for potable water access, installing three taps and a trough. The women interviewed at this site were emphatic in their belief that easier access to water would transform their lives. Without this access, women collect water by going to a 60-meter-deep well outside the village, leaving the women exhausted and in chronic pain, in addition to reducing their time for other household or income-generating tasks. In Kaffrine, as mentioned, DCF invested in a borehole and water distribution system for the women's association community garden to ensure reliable water supply. The women's association use their garden to plant, harvest, and sell produce and by-

products of the produce, expanding their opportunities for income generation. The DCF investment helps enhance the productive capacity of the garden, helping these women provide income to their families.

5. Results

5.1 Typology of Participation

The interviews and content analysis revealed that women's experience of participation and community decision-making differ. Women across and within the study sites had different conceptions of what it means to participate, ranging from participating by being informed and present to participating by debating and discussing their own needs in front of the greater community. Women interviewed experienced three different levels of participation within the same context of community decision-making: passive participation; consultative participation; and interactive and empowered participation.

Several interviewees in Niolé and Keur Sette Awa emphasized that participation and involvement in the community means being informed and/or being present at community level meetings. Participants in Niolé expressed satisfaction at their level of involvement in the DCF project as the head of the village and the women's association leader kept them informed on the progress accessing funding for an investment, and on all the meetings and trainings being conducted. Similarly, in Keur Sette Awa, interviewees expressed that for them inclusion and involvement in the community means knowing what is happening in the village and being informed of all the decisions made. Several people interviewed in Keur Sette Awa felt involved in the project because they were informed of the construction of the grain storage facility and the rules and regulations related to its management.

"I personally am involved in the village on the information side because I am informed about everything that happens and I attend almost all the meetings of the village. But as far as decision-making is concerned, I am not involved, it is my husband who is involved in decision-making. Most of the time it is the men who make the decisions and keep us informed." – 40-year-old woman, Keur Sette Awa, author's translation.

In Keur Sette Awa, many participants of the study revealed that they did not feel comfortable expressing any of their own needs during meetings, even though they attended most community discussions. For the DCF project, the head of the village announced that they had found someone to invest in a grain storage facility and then turned to the participants of the meeting to ask for their thoughts on the matter. The women described that the way the meeting was structured left no room for choice in the matter, because women and even other residents of the village will never push back against a decision made by the village chief. However, one of the women expressed that if there had genuinely been a choice, she thinks women would have chosen to receive a machine for grinding millet, an income source for women specifically. The women explained that this meeting structure and style also occurred when the community met to convey the rules of the grain storage facility. The men leaders described the established rules and then asked for opinions from the rest of the community. During the meeting women expressed being content with the rules, but they described meeting with other women after to express their actual concerns with the rules. By corroborating the information from different interviews in Keur Sette Awa, it is evident that when an opinion is solicited during a group meeting, the

women speak up to agree with and provide support for the decisions made, despite potentially holding alternative opinions.

"Women attend all community meetings, but they don't speak out, they say 'yes it's good' for all decisions. It is the men who decide everything that happens here."- 40-year-old woman, Keur Sette Awa, author's translation.

The interviews across the sites revealed that men and some of the women in Niolé and Kaffrine strongly believe that men and women have equal rights and opportunities to share their thoughts and opinions, with people listening to both groups' ideas fairly. During meetings the women in Niolé expressed that they can voice their opinions and commonly do so, as meetings are all organized to encourage people to provide input. Many of the women in Niolé cited, as an example of their comfort levels with stating their own needs, the number of times they ask the heads of the village for investments in gardening and crop transformation. They argued that they know their input is taken seriously and respected, because if it wasn't, they would never have received the potable water supply investment from DCF, a project that the women in the community had been pushing for years. Both men and women interviewed in Niolé explained that they feel a sense of ownership over the decisions made in the community, because no decision is made until everyone is in agreement. This perceived open and inclusive approach to community meetings ensured that women, different ethnic groups, and younger populations felt free and comfortable to express their needs.

"In the meetings everyone is on an equal footing, everyone is given the opportunity to speak, and there is no embarrassment or exclusion of ideas. All participants are comfortable expressing their thoughts. If someone makes a mistake, they are corrected but not judged." – 25-year-old woman, Niolé Wolof, author's translation.

"Yes, we are able to engage in contradictory debates with men in the choice of investments because we know how to defend ourselves and give solid arguments. We are able to say no to anything that doesn't suit us."- FGD 1, Niolé, author's translation.

In Kaffrine, the women's association operates based on values of open discussion, deliberation, voting, and arriving at a conclusion together. They are inclusive and ensure that everyone has equal opportunities to participate. The interviewees described the community meeting to select the women's investment priority as dynamic and filled with debates and contestation. Eventually, through open deliberation, a consensus was reached, and a proposal submitted. In addition to the association's meetings, these women are also actively involved in meetings with other stakeholders. For these, the women emphasized that they are always ready to speak up and push for their priorities. They explained that women are very brave in Kaffrine, and that they would speak up in front of the President, if they had the opportunity to ensure that women's development occurs. They never shy away from opportunities to demand funding and investments for the women in the community.

"In the general assemblies or in the presence of men we speak when and where we want, and we express ourselves as we should. Women have woken up - we are women in development, and we

will dare to speak up even before the President of the Republic to tell him what we have to say. We no longer let men speak for us because when they do so it is for their own interests." – FGD 1, Kaffrine, author's translation.

5.2 Factors Influencing Women's Participation

Conversations with the men and women in all three sites revealed that several factors influence women's participation and can explain some of the differences amongst women's levels of participation. While it is important to recognize Senegal's laws, policies, and cultural and religious norms that set the context for understanding local level participation, the macro-level factors do not help explain the variation amongst women between and within the sites. Therefore, data analysis occurred through the meso- and micro- lens. Though there were many factors that emerged from these interviews, the following reflect the factors and conditions cited most frequently by all the interviewees as motivating or constraining women's active participation.

Meso Level Factors

Gender Norms and Expectation

Community religious and cultural values have mandated differentiated roles for women and men, and these norms have long been learned and internalized. In all three sites, interviews revealed that the traditions and beliefs from both men and women on women's role in society greatly shaped the ability of women to actively participate. One of the major limiting factors for women's participation was the ingrained norm of respect and deference towards men and elders that made it difficult to express opinions or demands that differed from these groups. This was

most frequently expressed in Keur Sette Awa, with nearly all of the women emphasizing that it is the norm and culture in their village that only men and the older generations speak during meetings, making it disrespectful to speak up as someone who does not fall into those categories. The women said that they would never talk during a meeting if their husbands and/or mothers-in-law are present, because it is those people that represent the whole family's needs.

"In public even if men talk about something that doesn't suit us personally, I don't dare to speak out of respect…… Yes, it is our culture, for example, I do not dare to speak in a meeting with my mother-in-law present."- 36-year-old woman, Keur Sette Awa, author's translation.

"Sometimes women will be whispering after the meeting that they didn't agree, but they don't say that to the men ever. Everything that the men decide they say is fine."- 40-year-old woman, Keur Sette Awa, author's translation.

Though these deeply held beliefs were present to some degree in all three sites, there was variation in gender norms and expectations between the urban setting of Kaffrine compared to the rural settings of Niolé and Keur Sette Awa. In Kaffrine, several of the women interviewed described that the passing of the gender parity law had helped establish a new social norm in their city, where the women now know that everything that men do, women can do as well. The women in Kaffrine fight for their rights, in part because of the enforced gender equality in the political sphere that reminds them that they deserve and are entitled to everything that men have.

The researchers asked the women in Kaffrine why they believe this changing gender norm has not been internalized and borne out more in the rural areas of the Kaffrine region. They

responded that in the bush, the expectations of girls are still to stay quiet and submissive to be seen as good and worthy of being married one day. In the bush women sit separately from men during meetings and show respect by staying out of the way, a virtue that is reinforced by praise from mothers-in-law. This was clearly observed in all of the meetings in Keur Sette Awa and Niolé, with women collected on one side and sitting on the ground, while the men all sat in chairs and closer to the researchers. One of the men in Keur Sette Awa explained that women do this despite being encouraged by the men to join in on the meetings and speak up.

"We always ask them to speak but here the women do not want to speak because it is not in their habit. It is a cultural phenomenon because here women do not talk in front of their husbands, fathers or even mothers, so-called in Wolof 'kilifa' [meaning that there is always a superior that you need to respect]. A girl who has received this education will not find it easy to speak out publicly."- 53-year-old man, Keur Sette Awa, author's translation.

The patriarchal system embodied in this region values and expects women to be homemakers. In Kaffrine, though the women were significantly more active in their own development, they still had to overcome traditional limitations to be in the women's association and work independently. One of the interviewees described to us that she had to lie to her husband about going to meetings with the association because he would be furious if she did anything outside of taking care of the family. Interviewees in all the sites described that the biggest factor holding back women from participating in their own development was the community expectation that they remain in the household. In Keur Sette Awa, many of the women interviewed explained that the reason they cannot attend meetings or participate in

income-generating activities is because they are too busy ensuring that all the household work is completed.

"I think my generation is not in any way active or even present during meetings because we have to do all the household activities. We don't have time to attend meetings, do commerce, or sell small items. We have to do the cooking and the cleaning and take care of the kids."- 20-year-old woman, Keur Sette Awa, author's translation.

In the opposite vein, women's perceived traditional roles and vulnerability were expressed by some interviewees, particularly in Niolé, as a reason motivating their active participation in the community. In Niolé, the women were actively sought out for the community forum meeting to request investment in potable water supply because women knew best and most acutely the importance of water. Both the men and the women in Niolé explained that women's participation is essential because it is the women that actually live in the village year-round, and conduct all the household activities, understanding what is needed to improve the lives of the families in the community.

"Men are less represented in community meetings because in the dry season almost all men have gone to the big cities [Dakar was most frequently mentioned] to look for work. It is the women who stay in the village and take care of all household tasks. That is why they are the ones who participate more in meetings."- 50-year-old man, Niolé, author's translation.

"It is also women who manage households, so it is very normal that men accept our participation in the investment decision-making process - we know what the household needs best."- FGD 1, Niolé, author's translation.

Social Capital and Networks

Both Niolé and Kaffrine had very strong women's groups, organized independently of DCF, while the women in Keur Sette Awa did not have any organized associations. In Niolé and Kaffrine, the strength and confidence generated from the women's group was frequently cited as a factor for their participation. The women explained that having strong women leaders who they could trust to represent them helped foster their own involvement and participation. Being able to organize and form a group reminded the women that they were numerous and often a majority in the village, giving them the power to speak up for what they wanted. In Niolé, the women's group is viewed as an important entity in the village and is frequently invited to community level meetings. Many of the women expressed that as a member of the group, they are pushed to think about projects for the betterment of the women. They are constantly thinking of ways to earn additional income and management strategies for existing projects. They believe they feel comfortable participating because they present a united front in the village, ensuring that the men take their needs seriously. They all feel comfortable speaking up because there are more women than men in the community from men's labor emigration, and they know that the other women will provide support. In Kaffrine, the women interviewed frequently claimed that their lives were changed for the better after they became a part of the association. Their strength is in their solidarity and unity, bonded by a shared passion and fervor for development and the advancement of women in Kaffrine.

"It is we who decide everything concerning women, we do not let anyone decide for us because we have united well and organized. We even organize meetings to discuss among us how to be independent women - that is why we help each other."- FGD 1, Niolé, author's translation.

Another important factor in encouraging participation was the exposure to women becoming independent and pushing for their own rights within these social networks. In Niolé, the Peulh women, who were described by the Wolof as being quieter and more traditional, told us that when they saw the independence of the Wolof women, they knew they had to aim for that as well. They wanted the ability to support their husbands and children, and they did not want to fall behind as the Wolof women in the village advanced and improved their well-being. Similarly, in Kaffrine, the women believe that things are changing slowly in Senegal because there is more exposure to women who do not stay at home. People are seeing in their own networks that there are many ways that the woman can earn money for the household, and that encourages them to pursue their own opportunities. In Keur Sette Awa, the women interviewees expressed that they have never been exposed to women that speak up during community meetings or in front of men. Several of them conveyed that they had never seen their mothers participate in meetings, or work on anything outside of household activities. Though the women interviewed did not explicitly state this as a reason for their minimal participation, the lack of a women's group and a long-standing norm of women following traditional gender roles were differences between Keur Sette Awa and the other two study sites, where women seemed to be more actively involved in community decision-making.

Micro Level Factors

Intra-household Power Dynamics

In two of the study sites, the interviewees expressed that women are driven and encouraged to participate because of their own and their husbands' increasing realization that women are integral to improving family welfare. Women's participation in development and their push for their own growth is key to improving the family socioeconomic status and reducing male breadwinning responsibilities, creating an impetus for women to speak up and voice their needs. This is possible because their husbands support and encourage them to speak up during community meetings and find opportunities to generate income to support the whole family.

In Niolé, the men were content with the push for easier access to water as the investment choice because aiding their wives benefited them. Their wives were getting injured from going to the well each day, which had a negative impact on the whole family unit. The women explained that men will purportedly prioritize women's activities because when women advance, the whole family benefits. In Kaffrine, the women interviewed emphasized that though there are many points in which men can limit women's development, for the most part they are aligned because all they want is to support their families. Having men understand that women partaking in economic roles leads to men's development is a key factor for women's participation.

"Yes, that's all we want [women seeking income opportunities], and we encourage them on that. We do everything to ensure that they have an income-generating activity, because if they work, they will be able to satisfy their needs, the needs of the family, and the needs of their children." – 56-year-old man, Niolé, author's translation.

In Niolé, many of the men explained that they find it very difficult to be the only one providing money, especially given the diminished harvest during the rainy seasons. Many said that their wives are often asking for money for the household, and it is nearly impossible to keep up with their demands. In order to reduce the burden on men, the men push women to participate in community meetings and request funding for their own income opportunities.

"God has made that we [men] do not have the means to take full responsibility for our women and that is why we help them to let them work to satisfy their needs and those of our children."- 78-year-old man, Niolé, author's translation.

On the other hand, unfavorable intrahousehold dynamics, where men fear losing power and authority in their household, inhibited women's active participation. Interviewees expressed that many men are still uncomfortable with treating women as equals and allowing them to participate in community development because they are afraid of losing control. Men are scared of feeling inferior to their wives or seen as not fully in control of their household. The more a woman becomes financially independent, the less her husband is able to control her with threat of cutting off money. The power dynamic between the spouses often determines the ability of the woman to participate.

"There are also women who are willing to participate in the activities, but they do not have the permission of their husbands. You see a man will forbid his wife to go out because of fear of losing control over her."- FGD 1, Kaffrine, author's translation.

Women in both Niolé and Keur Sette Awa stated that though they do not feel comfortable expressing disagreements during a community meeting, they often wait until they are home alone with their husbands to convey their thoughts and opinions, talking it out at home before heading to meetings to present a united front. Participation and contestation are occurring, it is just happening within the home before being expressed by husbands at the larger community meetings. Respect and equality in intra-household dynamics make women comfortable participating through their husbands, ensuring that their opinions are being expressed at the community level.

Going a step further, in Kaffrine, the women said that they are able to hold such high positions in their association because their husbands have stepped up to handle the housework while they are gone to meetings or if they have to go out of the city to meet with vendors or sell products. Women's participation is encouraged and fostered when there is an understanding between the husband and the wife that working together and sharing household responsibilities maximizes family welfare.

"We are lucky because it is our husbands who encouraged us. My husband is my secretary [he manages her schedules and meetings], when we travel in the sub-region even for days they do not forbid us. It is just lucky to have understanding husbands who encourage and support us."- FGD 1, Kaffrine, author's translation.

Socioeconomic Characteristics

Spatial differences in levels of education were found to be significant factors influencing women's participation. From the women interviewed, the most cited level of education in Niolé and Keur Sette Awa was Qu 'uranic or no education at all. It was only in Kaffrine that some of the women interviewed had received adult education (a special training and education opportunity for adults to develop skills) and several of them were able to speak some French. Many of the women in Niolé and Keur Sette Awa expressed that they were not educated or experienced enough to contribute to community decision-making. This lack of education intersected with ethnic and age differences as well. For example, several of the younger women in Keur Sette Awa said that they were too young and uneducated to know anything, so they couldn't make any suggestions for the community. In Niolé, there were many Peulh women who expressed that they do not feel comfortable suggesting ideas because of the language barriers. They often do not want to burden the Wolof women with translating for them, so instead they just don't speak up.

"No, I couldn't suggest an investment for my community because my knowledge doesn't allow me to do."- 25-year-old woman, Niolé, author's translation.

On the other hand, women who had the opportunity to work on projects in the past or who have been working on income-generating activities felt that they had developed skills that allowed them to participate and push for their demands. For example, the women in Niolé explained that their past work with a USAID funded project had helped them develop and made them confident to seek out other opportunities for women.

6. Conclusion and Recommendations

In principle, the DCF approach aimed to be participatory and empowering, engaging with local stakeholders to provide relevant and helpful means to adapt to climate change. This paper examined whether women felt included and involved in that participatory decision-making process and analyzed the factors that influenced their participation to understand differences in experiences. The findings reveal that there were variations in the level of participation, with several women citing active and substantive participation in community decision-making and some women describing engaging in nominal participation. The findings of the study suggest that the factors and conditions motivating active and empowered participation of women in these sites were social capital and networks, community recognition of women's role in income generation, and favorable intrahousehold power dynamics. Additionally, differential experiences of participation occurred across intersecting diverse identities, as younger, less educated, and ethnic minority women described lacking the confidence to voice their needs.

The interviews highlighted that women's social capital, and collective solidarity and support within their networks helped encourage them to participate more actively. Both the Niolé and Kaffrine sites illustrated how women's collective empowerment and unity allowed them to increase their bargaining power within the community and their households (Das, 2014). Women in these sites discussed feeling confident and supported by other women in their networks, facilitating their comfort exercising their own agency in public settings. In Keur Sette Awa, where women acted as individuals, women did not express feeling comfortable engaging in meaningful discussions of their needs and their ideas in public forums. In Niolé and Kaffrine, women described the changing intra-household dynamics as factors contributing to their participation. Their husbands were increasingly supportive of their roles in providing income for

the household and encouraged their participation in community. The men interviewed cited the changing climate, that led to difficulties around agriculture and pastoralism in the rural sites, for the greater need for additional sources of income for the household. While this particular factor facilitated women's participation, as their financial needs and opportunities are increasingly becoming as important as men's, it is important to note that the feminization of climate change adaptation and resilience can push even more of the burden of ensuring the household's well-being onto the shoulders of women (Chant, 2010). Similarly, women's active participation can come at a price of a potentially increased workload, and it can be a strategic choice for women to limit their involvement in community-decision making to reduce that burden. The goal of CBA is not to add undue burden onto women by requiring them to participate actively, but rather to create a space where women can voice their needs to help adapt to climate stressors, if they choose to. Though the findings of this study cannot be generalized broadly, it does help in understanding the possible avenues through which a CBA project can work to engage all women more meaningfully.

This paper finds that even the people-centered and participatory devolved approach of the DCF project did not guarantee inclusive decision-making for women. By devolving decision-making to the community level, the status-quo power dynamics between intersecting marginalized identities remained, suggesting that the approach by itself is not sufficient to ensure that all women can meaningfully access the participatory process. While these results are unique to the particular context of Kaffrine, the findings mirror prior work on women's participation and the importance of women's solidarity and social capital in influencing typologies of participation (Cornwall, 2003; Das, 2014; Evans et al., 2017). The findings suggest that future CBA initiatives need to ensure that those engaged in the community-level process operate on the basis of a good

understanding of the local gender dynamics and intersecting inequalities. Early context analysis and baseline understandings are needed for deeper contextualized knowledge of the gender dynamics before a project is initiated. This can be achieved by conducting a round of qualitative assessments in the capture phase of proposal development in order to demonstrate that gender dynamics have been appropriately understood and applied to the project design. While there are funding and time constraints for doing this at an expanded scale, the findings indicate the importance of initiating the project in a constrained geographical area and deeply comprehending the gender issues and conditions before scaling up. As evident from this paper, providing funds for climate change adaptation without a clear idea of the existing socioeconomic and cultural dynamics could prevent marginalized communities from actively participating and building their resilience. Factors in this context such as the importance of women's organizations and social capital could have been leveraged in the DCF project design to encourage and facilitate women's meaningful participation, instead of the *ex-post facto* realization that women were not included and participating actively in all project sites.

The analysis suggests that community-led projects can encourage women's active participation in this context by recognizing that women have certain barriers to participation in public forums. Instead of starting with a village level community wide meeting, project facilitators could first have meetings with the women in the village. They could do this through the existing women's organizations within the community or seek out spaces where women might be more likely to be congregated (the well collecting water, or a small market in the village center). As the results indicate, projects should also be designed to facilitate the development of social capital as that has the potential to increase and sustain women's participation. In the event that a community does not have an existing women's organization, the

project should help support the creation of one. Support can include linking up with other actors to provide training and empowerment programs for women that help encourage and enable them to organize and form associations. These trainings and capacity building programs should include conflict resolution, assertiveness training, and advocacy on gender issues at every step of the project at the local, state, and national levels. Projects should also encourage municipal level government officers to help create alliances amongst women, expanding their social networks. Many of the women interviewed in the city of Kaffrine expressed a desire to work with other women to educate and empower them on their agency and independence, a connection that could be facilitated by municipal level officers.

This paper explores factors at the household and community level that influence women's ability and motivation to participate, finding that there are meso- and micro- level factors that can be leveraged to improve participation. However, it is important to recognize that many of these constraints are consequences of deep-rooted structural inequalities. CBA projects cannot be divorced from the political and power dynamics that operate above the level of communities and influence the adaptive capacity of women. The targeted recommendations outlined above will help improve women's participation, but structural and systematic changes in the rules, norms, and perceptions of women in society are also important for women to transition to active and empowered participation within all spheres of decision making. Women's agency and empowerment should not be confined to the formalities of inclusion related to specific project deliverables, but should be engaged in political action and social movements. In order to encourage women to participate and make decisions beyond the project framework, initiatives need to encourage structural reforms in parallel to project work. Long-term policy measures that institutionalize and implement women's equal rights to men should be supported and

encouraged, such as property rights for women, and greater facilitation of women in the workplace. Long-term investments such as the implementation of universal education and formalized capacity building for women will enable changing power relations, which in turn ensures increased adaptive capacity to climate change. While these measures are beyond the scope of a project, it is important to recognize that women's empowerment needs to be addressed in parallel to project interventions to create a truly systemic, broad change that empowers participation and development broadly.

Climate change has unequal effects and impacts, and projects that aim to alleviate and manage these effects need to be cognizant of the complex and intersecting power relations that produce these unequal vulnerabilities. Project interventions should support and enable resilience in the face of a changing climate for all of those who are affected by engaging with the complexity and adapting approaches to the needs of diverse intersecting identities.

7. Appendix

Appendix A: Ethical Considerations

This study was approved by the Human Research Ethics Committee at Syracuse University (Ref. IRB # 18-362, Dated: January 25, 2019), and reviewed by senior staff at IED-Afrique for cultural appropriateness. Informed consent was obtained from all participants, and it was explained that participation was entirely voluntary. Participants were informed that all data collected during semi-structured interviews would be kept confidential, while anything said during the focus group discussions could not be kept confidential. Additionally, they were informed that their identities would not be revealed in any report.

Appendix B: Coding Categories

The following are the themes, sub-categories, and codes that came out during content analysis:

1. Typology of Participation
    a) Passive Participation
        i. Participation means being informed
        ii. Participation and involvement means being present
    b) Consultative Participation
    c) Active and Interactive Participation
        iii. Ability to provide influential inputs and suggestions pre-decision
        i. Participation means being able to take decisions
        ii. Comfortable with contestation and disagreements to ensure that everyone is happy with the decision made
        iii. Democratic tools are utilized to come to a decision

2. Factors Influencing Female Participation

a) Fears of Losing Male Authority

iv. Men take women's agency and power away

v. Men are self-interested

vi. Men fear losing control over women

b) Recognizing Women's Role in Family Welfare

vii. Improving family socioeconomic status

viii. Reducing male bread-winning responsibilities

c) Organizing Power

i. Organizing power and women's unity and solidarity encourages participation

ii. Women participate and are more involved because they are the majority

iii. Strong female leadership and trusting them as a representative foster's involvement and participation

iv. Exposure or lack thereof to women becoming independent and pushing for their own rights

d) Traditions and Cultural Norms

v. Traditional norms of respect and deference towards men

vi. Expectations of women being home-makers

vii. Women's household roles make them most knowledgeable about certain difficulties and needs within the community

viii. Women are vulnerable

ix. Traditional norms of respect and deference towards elders

x. Traditional norms of respect and deference towards mothers-in-law

xi. Male perception that women don't know anything

e) Social Capital

xii. Close relationships with the head of the village encourages participation

xiii. Fear of having no support when contradicting opinions in a meeting

xiv. Fear of gossip and slander

f) Political Conditions

xv. Women are a political tool, not constituents to be helped

xvi. Equal gender parity law has advanced women's development

g) Technical Assistance

xvii. Training and awareness will encourage women to participate

xviii. Family planning is necessary for women's liberation

xix. Training and awareness for men to understand importance of women's development

h) Role of Husband

xx. Husbands support and encouragement is necessary for participation

xxi. Husbands represent the needs of wives; they are a united front

xxii. Spousal permission is required

xxiii. Spousal permission is a formality

i) Preferences

xxiv. Personal preference for not speaking

xxv. Women exercise more agency and contestation within the privacy of the household

xxvi. Lack of interest as a limit to participation

j) Socioeconomic Characteristics

xxvii. Order of wife is a determinant for level of participation

xxviii. Lack of education, experience, and knowledge as a limit to participation

xxix. Language barriers

xxx. Competence and experience

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Chapter III: Can the Productive Safety Net Programme Improve Household Food Security in Rural Ethiopia?

Abstract

Ethiopia's Productive Safety Net Programme provides income to chronically food insecure households for labor-intensive projects or as a direct cash transfer. The goal is to ensure that the positive income transfer from the program enables households to meet their food requirements through the year, with additional government investments and programs helping to build assets to address long-term food insecurity and chronic poverty. This paper explores the impacts of the public works and direct support components of the Productive Safety Net Programme. The paper also evaluates the impact of the safety net program when it is combined with agricultural extension services for beneficiary households. The analysis uses both difference-in-differences and propensity score matching estimates to evaluate whether beneficiary households improve their food security, as measured through the household dietary diversity score, whether a household is able to meet its food needs for the year, the coping strategies index, and the Household Food Insecurity Access Scale classification. The results suggest that those participating in the public works component of the program self-reported worsened food insecurity compared to the control group. For the direct support component, the results demonstrate no statistically significant change in food security. However, for both components, if the social safety net was coupled with agricultural extension services, households experienced an improvement in dietary diversity.

1. Introduction

In the last few decades, social safety nets have increased in prominence around the world, becoming one of the key tenets of discourse around poverty reduction (World Bank, 2018). There is an established body of evidence to show that the poor are rarely able to insure themselves against adverse shocks such as weather fluctuations or the death of a household head. As a result, they cope with shocks by selling productive assets such as livestock or farmland, and reducing consumption of food or education, further perpetuating the poverty trap (Zimmerman and Carter, 2003; Dercon, 2005; Carter and Barrett, 2006; McPeak, 2006). The proliferation of social protection schemes is an attempt to address this vulnerability, helping enable individuals to escape the poverty trap. The basic conceptual framework is that individuals can be trusted and empowered to make effective use of resources to improve their living standards, but are limited by low and variable income and assets. Cash transfers and public works programs are part of the concerted effort towards providing households with resources in hand so that they can directly invest in and improve their well-being. The global expansion of cash transfer programs has been supported and driven by a steady accumulation of robust evidence on the effectiveness and impact of these programs (Rawlings and Rubio, 2005; Fiszbein and Schady, 2009; Adato and Hoddinott, 2010; Arnold et al., 2011; Baird et al., 2011; Davis et al., 2016). However, the impact evaluation literature on these programs has predominantly focused on conditional cash transfers, neglecting analysis of public works programs. This paper aims to contribute to the evidence gap on social protection schemes in Africa, focusing on evaluating a workfare program instead of the commonly researched conditional and unconditional cash transfers.

The Productive Safety Net Programme (PSNP) was implemented in 2005 in Ethiopia, and is a broad social safety net with a specific focus on workfare. The program was implemented

at scale and was designed to target a largely low-income and food insecure population (Favara et al., 2019). Given that it is the largest social protection program in sub-Saharan Africa outside of South Africa, there has been prior research conducted on the program. Several evaluations have found that the program has been well targeted (Gilligan et al., 2009), and that it has had positive impacts on rural household's wellbeing through an increase in households' reported months of food security per year, asset accumulation, and marginal improvements on chronic poverty (Gilligan et al., 2009; Nega et al., 2010; Berhane et al., 2014; Debela and Holden, 2014). Additionally, there has been research conducted on the mixed impacts of PSNP on children's educational and nutritional outcomes, access to credit, modern farming techniques, non-farm business activities, asset accumulation, and economic growth (Andersson et al., 2011; Hoddinott et al., 2012; Alderman and Yemtsov, 2013; Sabates-Wheeler and Devereux, 2013; Debela et al., 2015; Berhane et al., 2016; 2016a; Gebrehiwot and Castilla, 2019). While this research has helped better understand the impact of the PSNP, a key concern with the prior literature is that the evaluations were done during the first two phases of the program, when the payments for PSNP were not disseminated correctly (Gilligan et al., 2009). Households were going several years before they were getting paid wages for their participation in the public works program. To address this gap, this study pivots focus to Phase 3 of the program implemented from 2010 to 2015, where the government sought to address the payment dissemination issues and reformed the goals of the program to focus on shifting households out of chronic food insecurity. This paper fills a gap in the literature by evaluating a phase of the program that focused on addressing the limitations and problems identified during the first two phase evaluations. This paper seeks to understand whether the changes made to PSNP in Phase 3 were sufficient and impactful in improving household's food security. Additionally, this paper

adds to the existing literature on the program by evaluating the effect of the PSNP on improvements in food security as measured through reduced adoption of damaging coping strategies, increased household dietary diversity, and better access to sufficient food (Household Food Insecurity Access Scale), outcomes that have not been considered in the prior literature.

This paper uses panel data from the 2011 to 2015 Ethiopia Socioeconomic Survey to evaluate whether low-asset level households in Ethiopia, when faced with a positive income shock through the PSNP, feel more food secure and improve the quality of their household's food consumption. The results demonstrate that being a beneficiary of the program has different effects on a household's food security. For those participating in the public works component of the program, PSNP increased the likelihood of households reporting that they do not have sufficient food to meet their household's needs through the year compared to the control group. For the direct support component, the results suggest that recipients don't experience a statistically significant change in their food security outcomes relative to those who did not receive PSNP. However, for both components, if PSNP payments were coupled with agricultural extension services, households realized a statistically significant increase in the number of unique food groups consumed. The results suggest that even with the expanded and reformed PSNP implementation, households were unable to meet their food needs, or were experiencing worsened food insecurity. This finding is a contribution to the literature as it confirms that even with timely payments occurring, the disbursement of PSNP did not help improve the dietary diversity of households or their food insecurity classification. The contradictory findings for greater likelihood of being food insecure suggest that there may be concerns of biased reporting to remain in the program. While more research is needed to determine the exact mechanisms driving the results, a potential take-away is that the program is not sufficient by itself to benefit

participants and help shift them out of food insecurity. This explanation is strengthened by the results that indicate that households who receive both the PSNP and agricultural extension services experienced an improvement in the diversity of their food consumption. The paper concludes with the suggestion that the PSNP needs to be coupled with government employee training to improve targeting and implementation, and increased technical assistance and support to beneficiaries to help them build assets and develop skills for resilient livelihoods.

2. Overview of the Productive Safety Net Programme

Ethiopia has experienced significant economic development over the past few decades, yet the nation remains vulnerable to high rates of poverty and worsening climate conditions. Chronic food insecurity has been a defining feature of the poverty levels in the country, exacerbated by natural disasters. The vast majority of the poor in Ethiopia live in rural areas that are heavily reliant on agriculture for their livelihoods, increasing vulnerability to weather fluctuations. Since the 1983 – 1984 famine, the policy response to this threat of chronic food insecurity has been emergency assistance, either through requests for food aid from the international community, or through other short-term, ad-hoc solutions (Gilligan et al., 2009). While these measures worked to ensure the short-term survival of the population, the policy responses failed to ensure the resilience of the population to future threats of famine and other adverse shocks. In particular, the responses did not prevent asset depletion of marginally poor households who were severely impacted by adverse rainfall shocks, further trapping the households in long-term poverty (Zimmerman and Carter, 2003). The provision of emergency assistance failed to be integrated with ongoing economic development activities, limiting poorer household's ability to escape the poverty trap (Subbarao and Smith, 2003).

Starting in 2005, the government of Ethiopia and its development partners implemented a new policy in response to chronic food insecurity, the PSNP. The PSNP is tasked with enabling the poor, who are facing chronic food insecurity, to resist shocks and become food self-sufficient. More specifically, the objective of the PSNP is to provide transfers to the food insecure population in chronically food insecure *woredas* (districts) in a way that prevents asset depletion at the household level and creates assets at the community level (GFDRE, 2004, 2009a, 2010, 2014). The PSNP operates through two means, a public works program that provides income for labor-intensive projects that are designed to build community assets, and a direct support program, which is a cash or food transfer program. The public works portion engages able-bodied adult labor for six months in a year, commonly between January and June to avoid interfering with farming activities that occur in the second half of the year. As rainfall in Ethiopia is bimodal, farming activities follow those periods and occur during the rainfall season. The program aims to provide work and wages to adults during the period of the year when they are unable to work on the farm. The public works focus on integrated community-based watershed development, such as soil and water conservation measures, rangeland management, and the development of community assets such as roads, water infrastructure, schools, and clinics (GFDRE, 2014). The direct support portion, which is rendered in the form of cash or food transfers, is provided to labor-poor households including those whose primary income earners are elderly, disabled, or chronically ill. Currently, the program is in its fourth phase, and covers households in the regions of Afar, Amhara, Dire Dawa, Harari, Oromia, Southern Nations, Nationalities and Peoples (SNNP), Somali and Tigray (Table 11).

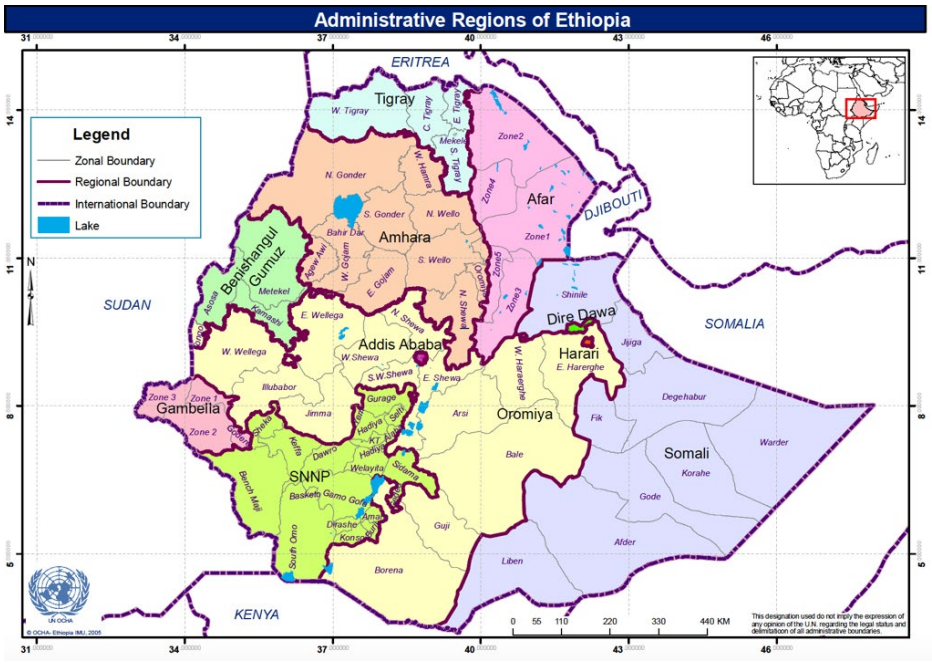
Table 11: Administrative Units in Ethiopia

Administrative Unit	Definition
Regions	Equivalent to a state. Ethiopia is divided into 11 regions, including 9 regions and 2 chartered cities. These 9 regions are Afar, Amhara, Benishangul-Gumuz, Gambela, Harari, Oromia, Somali, Southern Nations, Nationalities, and Peoples' (SNNP), and Tigray. The two chartered cities are Addis Ababa and Dire Dawa.
Woredas	Equivalent to a county or district. There are 700 woredas in all of Ethiopia.
Kebeles	Equivalent to a sub-district or ward. It is the smallest unit of government in Ethiopia and is an administrative sub-unit of a woreda.

In 2005, the PSNP was implemented and targeted in four principal regions. The regions were Tigray, Amhara, Oromiya, and SNNP (Figure 6). The program was supplemented with the Other Food Security Programme (OFSP), tasked with providing productive asset packages on credit to help households build assets and enable escaping the poverty trap (GFDRE, 2014). Though the program was lauded as an ambitious social safety net, the first phases of the program were focused on replacing food aid with more sustainable forms of support (Gilligan et al., 2009). The program was not designed in its initial form to be a comprehensive pathway out of poverty, it was designed as an income smoothing program instead of an asset accumulation program. At the end of Phase 1 and 2, it was realized that very few households could escape the poverty trap which translates into "graduating" from the PSNP, because payments had failed to reach the households in a timely manner and households were not able to build assets. This led to a comprehensive review and subsequent improvement in the program design and implementation. Building on the successes and the lessons from the previous phase, the government, along with its consortium of donors, attempted to improve the timeliness and predictability of transfers, strengthen public works and accountability, and replace the OFSP

program with a Household Asset Building Program (HABP) that was better suited to help build households level assets. The goal of the program transitioned to helping households escape the poverty trap and graduate from the PSNP, which meant that a household is able to meet all of its food needs for the whole year. Additionally, Phase 3 included a significant expansion of the program to newer regions, specifically Afar, Dire Dawa, Harari, and Somali (Figure 6). In 2015, at the end of Phase 3, PSNP was further expanded into Phase 4, with an increased focus on building resilience to climate change (the newest phase is outside the scope of this study).

Figure 6: Map of Ethiopia's Administrative Regions and Zones



Source: UN Office for the Coordination of Humanitarian Affairs, 2005

The PSNP uses a mix of geographic and community-based targeting to identify chronically food-insecure households in chronically food-insecure *woredas*. Geographic

targeting is done at the higher administrative units, where the federal and regional levels of government determine eligible *woredas* that are chronically food insecure based on historical receipt of food aid. In 2005, there were 190 *woredas* selected for the PSNP based on historical data of food aid allocations (Berhane et al., 2014). However, with the ongoing expansions, there are now 290 *woredas* targeted. The higher administrative units work with the existing food aid dissemination system in place to determine which *woredas* have historically needed aid and then assign a PSNP quota to these *woredas* based on the average number of relief recipients in the past. Following receipt of the quota, the *woreda* level government officials provide subsequent quotas to the *kebeles* within their jurisdiction. The *kebele* is a locally elected administrative unit, and they create a *Kebele* Food Security Task Force to be in charge of conducting the community level targeting process to determine the exact list of beneficiaries for the program.

The criteria for determining the exact list of beneficiaries is based on which households are chronically food insecure or have suffered significant asset losses (Devereux et al., 2008). Chronically food insecure households are defined by the Ethiopian Ministry of Agriculture as households who have faced continuous food shortages, specifically a three month or more food gap in a year (GFDRE, 2014). Beneficiaries also include households who have suffered asset depletion due to adverse shocks. In addition to this initial criterion, the following characteristics are used to verify and refine the selection of eligible households: total household assets, land holdings, oxen, and income from nonagricultural activities and alternative sources of employment (Berhane et al., 2014). Working off the quota assigned to the *kebele*, the task force that identifies beneficiaries will assemble and vote on eligible households based on the criteria of a food gap of 3 or more months in a year, number of available farming assets, and non-farm income. The task force is supposed to deliberate with the wider community, including placing a

public list of the selected households for at least one week to be endorsed by a general meeting of villagers (Bishop and Hilhorst, 2010). The process of deliberation is complicated, but the key takeaway is that communities are given significant discretion to modify the criteria based on local needs and understanding. While there is work showing that people felt involved with the targeting process, there is a larger body of literature highlighting the problems with the PSNP targeting process (Sharp et al., 2006). Fekadu and Ignatius (2009) utilize a case study approach in the Kuyu *woreda* in the Oromia region to find that local populations in this area perceive the PSNP targeting process to be rife with nepotism and corruption. The focus group discussions with both beneficiaries and non-beneficiaries of PSNP highlighted that the selected households tend to be those who are related to or in the favor of the *kebele* leadership (Fekadu and Ignatius, 2009). Caeyers and Dercon (2012) find similar patterns using nationally representative data, arguing that targeting in food aid distribution in Ethiopia depends on local political leaders who are closely aligned with those in power regionally and nationally. Their work finds that households that have close associates holding official positions are 12 percentage points more likely to obtain food aid than other households in the same village that are not as well connected (Caeyers and Dercon, 2012). Past research has also highlighted the involvement of clan leaders in the targeting process, suggesting that clan leaders favor their own family or clan members in the allocation of PSNP beneficiaries (Sabates-Wheeler et al., 2013). Finally, a major concern of the targeting process is that there is no objective measurement of poverty, relying instead on the poor to speak up and advocate for themselves. As research in community decision-making has shown, people who feel comfortable speaking up are not necessarily the poorest and most marginalized members of the community (Cooke and Kothari, 2001; Platteau, 2004; Fritzen, 2007; Mansuri and Rao, 2012).

As the above paragraph highlights, access to PSNP was not randomized, it was designed to be targeted to the poorest households who had disproportionately suffered in terms of food access and asset loss. While this makes impact evaluation difficult, the process by which households are determined to be eligible presents an opportunity to find similar groups of people who were not chosen to be beneficiaries of the program. The problem in Ethiopia is that the needs of the population must be reconciled with finite resources, so even if there are 5000 eligible food insecure households within a *woreda*, the beneficiary list can only include the number of households assigned by the federal and regional governments. The process used to determine eligible households is such that there are a lot of households in communities within a *woreda* that have similar socio-economic characteristics, but one household was assigned access to PSNP compared to another similar household. This could have occurred because they were just slightly worse off than another household, they had connections, or it was random chance that determined their eligibility. The chronically food insecure are not an easily separable minority in Ethiopia, resulting in the case that there are many households that should be receiving aid through the PSNP but are not because of limited resources.

3. Theoretical Framework

Social safety net schemes, such as cash transfers and public work programs, aim to help vulnerable households protect themselves against livelihood risks, in particular helping households maintain adequate levels of food consumption and improve food security. The goal of such programs is to help prevent households from adopting damaging coping strategies and further depleting their assets in the event of an adverse shock. Ethiopia's PSNP aims to accomplish this goal by providing liquidity and reliable flows of income to the individuals who participate in the program, allowing their households to smooth consumption and sustain or

increase spending on food, schooling, and healthcare (Arnold et al., 2011). The PSNP's explicit goal is to ensure that households are able to meet their food requirements, with additional government investments and programs helping to build assets and address long-term food insecurity and chronic poverty. In the short term, the cash transfer itself aims to provide households with the financial means to purchase adequate and sufficient food. As the targeted households are suffering from chronic food insecurity, the first expenditures from the positive income shock will likely be on food. PSNP shifts out households' budget constraints, which in turn increases households' ability to access food and improve the quantity, quality and diversity of food they consume (Alderman et al., 2009; Ruel et al., 2013; Gebrehiwot & Castilla, 2019). However, while a positive impact from a rise in income is plausible, the degree to which the Ethiopian PSNP can impact food security and household dietary diversity is contingent on several additional factors, including the magnitude of the increase in income, the marginal propensity to consume food from cash, and the conditionality attached to the cash transfer (Debela et al., 2015).

Households have the option to use the additional income in any manner that they prioritize: seeking to ensure food security and improve dietary diversity; sending their children to school; spending on necessary healthcare; or investing in productive assets such as livestock or agricultural equipment. There is also a possibility that the program is not leading to an increase in household income, as the labor requirement of the PSNP may reduce the number of days the individual is working on other employment opportunities or the farm. Qualitative research has also found that targeted populations believe that the amount of the cash transfer is too little to support the consumption level of households, which may limit the impact of the program (Fekadu and Ignatius, 2009). Another concern is that the fixed wages or direct transfer amounts

for the PSNP are insufficient in altering a household's budget constraint as inflation rates may reduce the real purchasing power of cash payments (Sabates-Wheeler and Devereux, 2010). While Phase 3 of the PSNP calls for *woredas* to set their wages daily based on the cost of buying 3kg of cereals and 0.8kg of pulses per day in the market, there is no evidence to show whether wages changed to keep up with inflation (GFDRE, 2014). Due to the various possible effects of the PSNP, evaluating the program's impact on its intended goals of addressing food shortages and insecurity is an important question. It is necessary to evaluate and ensure that the government is investing in a program that has a positive effect on the participants and improves livelihoods.

Based on the theoretical framework outlined above, this paper hypothesizes that the positive income shock from the PSNP for both public works beneficiaries and direct support beneficiaries will improve household's food security. The framework posits that the transfer itself will relieve household's cash constraint, allowing them to purchase food and meet their food needs, bolstering human capital through improved food security and nutrition. More specifically, the hypotheses state:

H1: Households participating in PSNP through public works or direct support are more likely to report that they have sufficient food for their household through the year.

H2: Households participating in PSNP through public works or direct support are more likely to experience a reduction in the household's adoption of damaging coping strategies to ensure that there is enough food for everyone to survive.

H3: Given the ability of a household to use this additional cash to purchase any type of available food, households that are PSNP participants through public works or direct support will

likely see an increase in their dietary diversity as compared to households that did not participate in the program (Ruel, 2013).

H4: Households that are PSNP participants through public works or direct support are more likely to experience a decline in food insecurity as operationalized by the Household Food Insecurity Access Scale (HFIAS).

4. Existing Literature

Prior literature on PSNP in Ethiopia has empirically tested the effectiveness of the program in improving household-level measures of food security and consumption, finding mixed results (Yablonski and Woldehanna, 2008; Gilligan et al. 2009; Berhane et al., 2014). As mentioned earlier, the evaluations were done at a time when payments were not being correctly disseminated and the goal of the program was to address immediate food insecurity. However, what the findings suggest is that there are mixed impacts on beneficiaries. Gilligan et al. (2009) used survey data collected in 2006 in the four targeted PSNP regions to demonstrate that the program had little impacts on participants on average, largely due to income transfers that fell far below the targeted amounts. However, the paper did find that when coupled with access to the OFSP, beneficiaries increased food consumption and prevented the depletion of assets (Gilligan et al., 2009). In Berhane et al. (2014), the beneficiaries of PSNP who had been in the program for at least three years experienced significant improvements in their food security, despite the formidable background of rising food prices and widespread drought. This paper also found that the joint impact of access to PSNP and OFSP/HABP was larger than access to only one program (Berhane et. al, 2014). However, both these papers surveyed specific *woredas* that had a high proportion of chronically food-insecure households, generating concerns of location bias. *Woredas* with a high number of food insecure individuals could also be getting additional help

that may not apply to *woredas* with only a few food-insecure households, limiting the generalizability of the findings. The prior research helps answer the question of whether the PSNP worked in that specific location, but it does not tell us the effect on the entire rural population. As will be detailed in the data section, the survey utilized for this study is a nationally representative survey of the rural population, allowing for a more generalizable estimate of the impact of PSNP across Ethiopia. Gebrehiwot and Castilla (2019) use this nationally representative data (the Ethiopia Rural Socioeconomic Survey), similar to this paper, to test the impact of the PSNP on household dietary diversity and children's nutrition. They utilize an instrumental variables approach and find that the PSNP has no impact on household dietary diversity or children's nutritional outcomes (Gebrehiwot and Castilla, 2019).

Several papers consider additional outcomes of interest for the PSNP. Debela and Holden (2014) use a treatment effects model to find that participants in the public works program component of the PSNP invested more in livestock holdings (asset increase) and in children's education compared to non-participant households. Other works on evaluating the effects of the PSNP have focused on children's educational attainment, cognitive abilities, and nutritional status (Woldehanna, 2010; Tafere and Woldehanna, 2012; Debela et al., 2015; Berhane et al., 2016; 2017; Porter and Goyal, 2016; Favara et al., 2019; Gebrehiwot and Castilla, 2019). Though there are mixed results, the general direction of the effect indicates that PSNP improved children's schooling and nutritional outcomes. Again, a major limitation of this prior literature is that they utilize data from the period of the program where payments were not being disseminated correctly, potentially biasing the results.

The evidence already generated suggests that the PSNP is having a direct impact on the investment behavior of rural households, at least in relation to investment in productive assets

and children's education. However, there is still a lack of evidence on the food security outcomes of all households participating in the program, and more specifically, a lack of evidence on the improvements for all household members, not just the children. It is possible that the cash injection from the public works component may be allocated towards asset purchases and the children, as noted in the prior literature, at the expense of the other members of the household. The transfers inherent in the PSNP may not be increasing the quantity and quality of food consumed by all members of the household, leading to improved nutritional outcomes for children but continued malnutrition for the parents in the house. This paper aims to address the paucity of impact evaluation of the PSNP on improved food security and dietary diversity for the entire household. Additionally, as prior literature has found that any improvement in food security only occurred when a household was a participant of the PNSP and OFSP/HABP, this study evaluates the effect of participating in both programs on household food security and dietary diversity (Gilligan et al., 2009; Hoddinott et al., 2012; Berhane et al., 2014).

5. Data Source

My analysis is based on panel data from the Ethiopia Rural Socioeconomic Survey (ERSS), a survey conducted by the Government of Ethiopia and the World Bank. The ERSS provides longitudinal household and individual-level data in 2011, 2013, and 2015. The survey covers all states in Ethiopia except the capital, Addis Ababa. In the second wave of the data the survey sampled large towns in Ethiopia, but to maintain a balanced panel those observations are excluded from the analysis. This is not a limitation for the study as the PSNP is only targeted to rural areas. The ERSS sample is designed to be representative of rural and small-town areas of Ethiopia. The sample is a two-stage probability sample, where the first stage entailed selecting primary sampling units by randomly selecting enumeration areas and the second stage entailed

randomly selecting households within those enumeration areas. To ensure sufficient sample size for the most populous regions of Amhara, Oromiya, SNNP, and Tigray, the first stage sampling weighted enumeration areas in these regions more heavily. In the end, the survey was implemented in 290 rural and 43 small town enumeration areas (EAs), and consisted of five questionnaires.

The household questionnaire was administered to all households in the sample and the community questionnaire was administered to the community (represented by focus groups of community informants and direct observation) to collect information on the socio-economic indicators of the enumeration areas where the sample households reside. Additionally, there were three agriculture questionnaires including a post-planting agriculture questionnaire, post-harvest agriculture questionnaire, and livestock questionnaire that were administered to all households engaged in agriculture activities. Most of the information pertinent for this study comes from the household survey which provides information on basic demographics; education; health; labor and time use; partial food and non-food expenditure; household nonfarm income-generating activities; food security and shocks; safety nets; housing conditions; assets; credit; and other sources of household income. Information from the agriculture questionnaire was also used to assess land ownership, and farm and livestock assets. In the end, a total of 3,969 households were interviewed with a response rate of 99.3 percent in 2011. Following the two successive surveys done for the same households in 2013 and 2015, 3,699 households had complete information in all three points of the panel, indicating an attrition rate of around 6%. The households that could not be followed up with were largely due to security reasons, which could potentially bias the results of the impact evaluation. For this reason, all results should be interpreted with caution on external validity.

6. Food Security Outcome Measures and Covariates

The outcome variables for measuring food security are taken from the section in the household survey on food consumption and expenditures, and food security. Food security, especially in the context of Ethiopia, is a broad and complex concept and this paper aims to capture its multidimensionality (i.e., availability, access, utilization and stability) by employing widely used indicators. The measures are commonly utilized in the development literature to reflect availability and access to food consumption (Upton et al., 2016). The first indicator considers the measure that is used to indicate the success of the PSNP, the food gap. This is coded as a binary variable and is defined as whether the household has been faced with a situation when it did not have enough food to feed the family through the entire year. Additionally, the paper evaluates the impact of receiving a PSNP transfer on the adoption of damaging coping strategies. The coping strategy index (CSI) is considered a proxy indicator of the food access component of food security, similar to the food gap. CSI is calculated based on a specific set of behaviors employed by households in response to food needs, with each behavior receiving its own weight to account for reversibility and severity (Maxwell, 1996). The CSI consists of the following five coping strategies with their weights in parentheses: eating less preferred/less expensive foods (1.0); borrowing food or relying on help from friends and relatives (2.0); limiting portion sizes at mealtimes (1.0); limiting adult intake so that small children can eat (3.0) and reducing the number of meals per day (1.0). The weights are calculated based off whether the behavior employed is a modest adjustment that can be easily reversed (low weight), or if it suggests extreme behaviors that may have long-term consequences (high weight). The information for these categories comes from questions in the survey that ask, "in the past 7 days, how many days have you or someone in your household had to… (asks about 8

different coping strategies)?" The raw score for the index is the number of days that households had to adopt specific coping strategies to deal with food insecurity. Those scores are then multiplied by their respective weights and summed to arrive at the final CSI score. Higher values of the index indicate more severe food insecurity (Maxwell, 1996).

As mentioned this paper seeks to look beyond whether the quantity of food purchased changed under the PSNP to evaluating how the quality and diversity of food changed. Dietary diversity has long been recognized as an important aspect of nutrition (Hatloy et al. 1998; Ogle et al. 2001; Hoddinott and Yohannes, 2002; Arimond and Ruel, 2004; Torheim et al. 2004). Increasing the variety of foods across and within food groups is recommended in most dietary guidelines as a strategy to ensure adequate intake of essential nutrients and to promote good health (Ruel, 2003). Recently there is work being done to understand the links between dietary diversity and chronic diseases, with findings suggesting that increased dietary diversity along with reducing intake of selected nutrients can help reduce the risk of chronic diseases (Ruel, 2003). Lack of dietary diversity is particularly a problem in developing countries, where households tend to rely on starchy staples and little to no meat or vegetables due to low incomes and difficult agrarian conditions. Swindale and Bilinsky (2006) worked with USAID's Food and Nutrition Technical Assistance project to develop a validated and more cost-effective measure of food security through dietary diversity, establishing the household dietary diversity score (HDDS). The HDDS calculates the number of different food groups consumed rather than the number of different foods consumed, to better reflect a quality diet. The HDDS conveys that an increasing number of food groups consumed reflects greater diversity in both macro- and micronutrients. Reflecting key food groups in Ethiopia, in this study HDDS was coded based on the consumption of the following food groups: cereals, dairy, eggs, fats, fish and seafood, root

and tubers, pulses/legumes/nuts, vegetables, fruits, meat, sugar/honey, and condiments. Though dietary diversity does not guarantee that a household has improved nutritional adequacy, a diverse diet has long been associated with good nutritional status. This is demonstrated by the large literature that shows dietary diversity to be highly correlated with dietary quality and nutrient adequacy (Hatloy et al. 1998; Ogle et al. 2001; Hoddinott and Yohannes, 2002; Arimond and Ruel, 2004; Torheim et al. 2004).

Finally, this paper measures household food insecurity through the HFIAS, which captures household food access insecurity by measuring the frequency of occurrence of food insecurity in the week prior to the survey (Coates et al., 2007). The measure captures three dimensions of food security; anxiety and uncertainty about the household's food supply, insufficient quality of foods available to the household, and insufficient food intake for various members of the household (Coates et al., 2007). The HFIAS is then calculated by summing over the frequency-of-occurrence of food insecurity-related conditions. Higher values on the HFIAS indicate worsening and severe food insecurity. Following the recommended cut-offs (Coates et al. 2007), households were then categorized into food secure, and food insecure, which includes mild, moderately and severely food insecure. For robustness, I also test non-binary versions of the measures.

The ERSS also provides information on a wide array of topics that can be used as controls. Most relevant to this study are the demographic and socioeconomic variables of the population. Demographic and socioeconomic variables of importance include education level, age, land ownership, livestock assets, shocks experienced, an asset index, access to safe water, electricity, income, sanitation practices, household size, annual rainfall, and others. These

characteristics will be used as controls in the analysis to attempt to narrow focus on a causal relationship between the PSNP and measures of food security.

My key independent variable of interest is a binary variable that captures whether a household was a participant of the public works (PW) component or direct support (DS) component of the program. To distinguish households who participated versus households that did not, I utilized the household survey question that asked individuals if they had been employed as temporary labor by the PSNP in the past year and the survey question that asked individuals if they had received PSNP direct support (excluding PSNP labor payments). These two questions capture the PW and DS components respectively. Additionally, as I am utilizing a difference in difference design, my treatment sample comprises of individuals who start with no access to the PW or DS program but eventually get access during the time period of the data set. Therefore, I define treatment as 1 if the individual did not have access to PSNP in 2011 but is a beneficiary of the program through PW or DS in 2013 and/or 2015. To capture my dosed treatments, I define a beneficiary household as one that has both PW or DS and access to agricultural extension services in 2013 and/or 2015. Agricultural extension services comprise of advisory and training services from a professional agent who helps farmers understand improved seeds, fertilizers, soil conservation strategies, crop protection and irrigation, and/or farm management practices (Berhane et al., 2018). After defining the treatment variables, I then look at outcomes from the final round survey conducted in 2015 as this ensures that the participant has benefited from the program for at least a year before I evaluate their food outcomes. Of note, though the participant of the program is an individual, I assign his or her whole household as participants as they will benefit from the positive income shock to the participant. Table 12 below summarizes the number of households that receive PSNP in ERSS and the amount of

money they receive. The table shows the amount received in both birr and US dollars (based on the exchange rate as of March, 2021).

Table 12: Summary Statistics on PSNP and Ag Extension Beneficiary Households

	Households	% of Pop	Payments (birr)	Payments (real birr)[10]
Public works	212	6.43	1233.17 ($31)	632.20 ($16)
Direct support	223	6.76	2666.11 ($66)	1380.85 ($34)
Ag Extension	842	25.53	-	-
Dosed PW + Ag	68	2.06	1076.92 ($27)	555.77 ($14)
Dosed DS + Ag	80	2.43	3011.3 ($75)	1544.98 ($38)

Notes: The payments amounts are in birr (with dollars for reference) and capture the household wages or transfers received for the entire period they are treated.

7. Empirical Strategy

The simplest way of assessing the impact of the PSNP would be to compare mean outcomes for households that were participants of the PSNP to outcomes for households who did not have access to the PSNP in any of the years in the data set. The problem with such an approach is that beneficiary households are likely to be systematically different from non-beneficiary households, and these different characteristics will also affect food security outcomes. If the targeting worked according to the program design, we could expect beneficiary households to be poorer and more food insecure on average than the full sample. As a result, any estimate of the effect of the PSNP will be biased as they reflect the different conditions for the beneficiaries compared to the non-beneficiaries. To address this concern, this paper utilizes a propensity score matching technique to establish a valid counterfactual for the beneficiaries, and estimates a difference-in-differences model for program impact.

To test the effect of the safety net program on food security and diversity outcomes, I use the difference-in-differences method. The regression will be as follows:

[10] Income amounts adjusted for inflation to 2010 levels.

$$Y_{ht} = \beta_0 + \beta_1 PSNP_h + \beta_2 did_{ht} + \gamma X_{ht} + \tau_t + \varepsilon_{ht} \quad (1)$$

where Y_{ht} is one of the food security outcomes to be tested, and β_2 is the parameter of interest capturing the impact of household h participating in the PW or DS component of the program. X_{ht} is a vector of time-invariant household head demographics, and household characteristics to control for variation in other factors that could influence outcomes outside of the PSNP. The difference-in-differences estimate removes the effect of any unobserved variables that represent time-invariant differences between the treatment and comparison groups. However, this is contingent upon the baseline treatment and comparison groups being as comparable as possible and having parallel trends over time. As the allocation of the PSNP is not randomized, this method alone does not address concerns of bias. To tackle the potential bias and produce unbiased difference-in-difference estimates, I first use matching methods to construct a comparison group that looks nearly identical to the treated group on recorded observables.

The first step in the matching process is to drop all households from *woredas* that are not eligible for the PSNP. Additionally, I drop anyone that was on the PSNP through PW or DS in 2011. I then follow the Imbens and Rubins algorithm to identify predictors of treatment, considering the PW component and the DS component as separate treatments (2015). The algorithm uses program participation criteria and theory to determine what model should be used to estimate the propensity score of households to be beneficiaries of the PSNP through the PW or DS component. To test variables with this algorithm I used the program participation criteria of food gap, asset count, and whether the household had suffered from an adverse shock. Additional variables were chosen based on prior literature and theory (Gilligan et al., 2009; Berhane et al., 2014).

7.1 Propensity Score and T-Tests for PW

The algorithm produced a model of estimating propensity scores for receiving the PW component of the PSNP based on the following variables; food gap, binary food insecurity, household dietary diversity, household size, household head education level, household head age, household head employment status, number of dependents, non-farm income, whether the household owned its house, whether the household has access to a sanitary facility, total annual non-food expenditures, total annual expenditures, whether the household received additional sources of aid, religious affiliation, number of shocks experienced (drought, flood, death of a family member, etc.), mean annual rainfall for the *woreda*, and state dummies. These factors influence the likelihood of households receiving the PW program, as seen in Table 13. To reiterate, the outcome is 1 if the individual did not have access to PSNP in 2011 but is a beneficiary in 2013 and/or 2015. Table 13 presents results from the logit regression that are used to estimate the propensity scores.

Table 13: Propensity Scores for PW

Household Head Age	-0.0134**
	(0.00591)
Household Size	-0.124*
	(0.07)
Dependents	0.103
	(0.09)
Household Head Elementary Education	0.186
	(0.21)
Household Head Employed	-0.0224
	(0.3)
Orthodox Christian	-0.972***
	(0.243)
Traditional Religions	0.933
	(0.776)

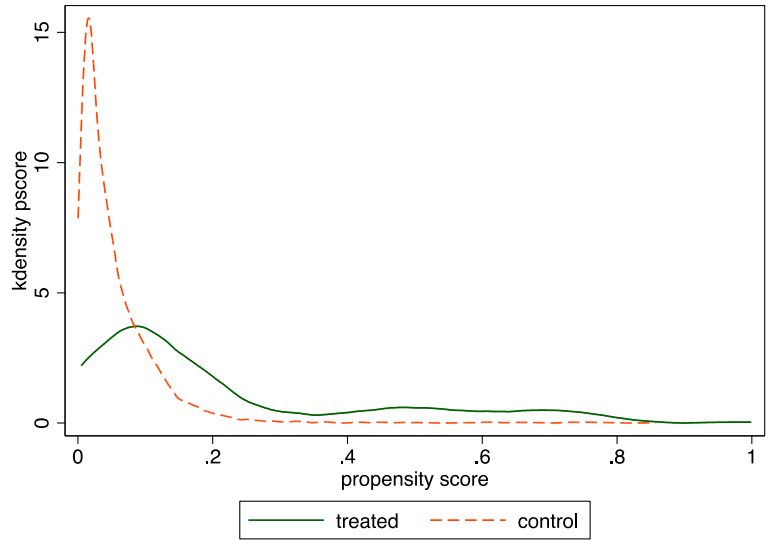
House Ownership	1.564***
	(0.374)
Sanitation Access	-1.119*
	(0.622)
Real Non-Food Consumption	0.0000151
	(0.0000312)
Real Total Consumption	0.00000461
	(0.00000373)
Real Non-PSNP Aid	0.660***
	(0.212)
Real Nonfarm Sales	0.00000248
	(0.0000123)
Shock Count	-0.11
	(0.108)
HFIAS Food Insecure	0.321
	(0.299)
Food Gap (Months)	-0.0225
	(0.0728)
Food Gap (Binary)	0.328*
	(0.189)
Household Dietary Diversity Score	-0.0873*
	(0.0484)
Annual Rainfall	-0.00124***
	(0.000337)
Afar	1.701***
	(0.341)
Harari	-2.629**
	(1.028)
Oromia	-1.112***
	(0.312)
Somali	-1.367***
	(0.382)
Tigray	0.845***
	(0.3)
SNNP	-0.508*
	(0.277)
Constant	-1.381**
	(0.621)

Observations	2,935

Notes: The dependent variable is a dummy equal to one if any household member worked and made wages from the PSNP public works component. The standard errors are in parentheses and * denotes significance at the 10%, ** at the 5% and, *** at the 1% level. These scores generate the propensity to be treated function used for matching.

After using this model to estimate the propensity score, I then utilized nearest five neighbors propensity score matching to ensure that the treatment and control group are similar on observables prior to program implementation. The figure below demonstrates that there was significant overlap between my treatment group's propensity to be treated compared to the control group's propensity to be treated. This indicates that there are many households that look similar on observables to households that were beneficiaries of the PSNP, but were not able to get access to the program. Given the large number of households that were not beneficiaries of the PSNP, nearest five neighbors without replacement was plausible due to the large control group sample that overlapped with the treatment group.

Figure 7: Pre-match Density of PW Household Treatment Propensity



The nearest neighbor matching constructs a comparison group that is similar on observables to the participants of the PW component of the program. This constructed counterfactual now allows for a difference-in-differences model to capture the unbiased effect of the program on food security outcomes. To test whether the propensity score matching technique created a similar comparison group, the table below outlines the t-test differences between mean outcomes of the control group compared to the mean outcomes for the treated group when using the full sample and the matched sample (Table 14). The table demonstrates that before matching there were significant differences between the treated and the control group on key characteristics. However, after matching, these differences are no longer significant, and the treated and control groups look very similar on observables.

The summary statistics prior to matching show that the PSNP has targeted food insecure populations, but it does not necessarily demonstrate that those targeted are the poorest of the poor. The treated sample experienced more months of a food gap, lower household dietary diversity, a lower asset count, owned less land, experienced more shocks, and had lower mean annual rainfall experienced. The treated sample also had household heads that were younger, less likely to be literate, and more likely to have no formal education. The treated sample were also disproportionately Muslim on average. However, the treated sample also had a higher amount of non-PSNP aid provided, a higher number of total productive livestock units, and were more likely to own their own homes. Overall, these characteristics reflect the criteria for PSNP, and matching allows us to ensure that the control group looks similar but did not receive treatment. It is important to note here that the data source used did not include information on political party affiliation, ethnicity, or clan affiliation, factors that research has shown to matter in receiving PSNP (Fekadu and Ignatius, 2009; Caeyers and Dercon, 2012; Sabates-Wheeler et al., 2013).

There may be unobservables that determine whether a household received PSNP that this paper is unable to match on due to data limitations.

Table 14: Summary Statistics Matched and Unmatched

		Mean			
Variable	Sample	Treatment	Comparison	t-test	p-value
Household Head Age	**Unmatched**	**42.81**	**44.70**	**-1.65**	**0.099**
	Matched	**42.81**	**42.92**	**-0.07**	**0.943**
Household Head Sex (%)	Unmatched	74.87	76.75	-0.60	0.549
	Matched	74.87	74.36	0.12	0.908
Household Head Literate (%)	**Unmatched**	**34.36**	**41.65**	**-2.00**	**0.046**
	Matched	**34.36**	**33.54**	**0.17**	**0.865**
Household Head Employed (%)	Unmatched	8.72	9.71	-0.45	0.651
	Matched	8.72	7.39	0.48	0.630
Household Head Sex (%)	Unmatched	74.87	76.75	-0.61	0.544
	Matched	74.87	74.36	0.09	0.926
Household Head Married (%)	Unmatched	76.41	77.80	-0.45	0.652
	Matched	76.41	76.82	-0.10	0.924
Household Size	Unmatched	4.97	5.01	-0.19	0.848
	Matched	4.97	4.90	0.34	0.737
Dependents	Unmatched	2.59	2.52	0.61	0.541
	Matched	2.59	2.53	0.38	0.706
No Education (%)	**Unmatched**	**69.23**	**63.32**	**1.66**	**0.097**
	Matched	**69.23**	**70.15**	**-0.20**	**0.843**
Informal Education (%)	Unmatched	0.51	0.33	0.43	0.670
	Matched	0.51	0.31	0.32	0.752
Elementary Education (%)	Unmatched	20.51	20.15	0.12	0.902
	Matched	20.51	19.49	0.25	0.801
Middle Education (%)	Unmatched	8.21	11.46	-1.39	0.165
	Matched	8.21	8.62	-0.15	0.884
Secondary Education (%)	Unmatched	0.51	0.84	-0.49	0.625
	Matched	0.51	0.31	0.32	0.752
Vocational Education (%)	Unmatched	0.00	1.24	-1.56	0.118
	Matched	0.00	0.31	-0.77	0.440
Tertiary Education (%)	Unmatched	1.03	2.23	-1.12	0.264
	Matched	1.03	0.82	0.21	0.833
Christian Orthodox (%)	**Unmatched**	**29.74**	**45.44**	**-4.27**	**0.000**

	Matched	**29.74**	**29.64**	**0.02**	**0.982**
Catholic (%)	Unmatched	0.51	0.40	0.24	0.814
	Matched	0.51	0.31	0.32	0.752
Protestant (%)	**Unmatched**	**14.36**	**19.23**	**-1.68**	**0.093**
	Matched	**14.36**	**12.62**	**0.50**	**0.615**
Muslim (%)	**Unmatched**	**54.36**	**31.93**	**6.46**	**0.000**
	Matched	**54.36**	**54.26**	**0.02**	**0.984**
Traditional (%)	Unmatched	1.03	0.69	0.53	0.595
	Matched	1.03	0.82	0.21	0.833
Other Religion (%)	Unmatched	0.00	0.99	-1.39	0.164
	Matched	0.00	1.03	-1.42	0.157
Asset Count	**Unmatched**	**8.41**	**10.42**	**-3.32**	**0.001**
	Matched	**8.41**	**9.21**	**-0.93**	**0.351**
Total Livestock Units	**Unmatched**	**4.50**	**2.72**	**5.37**	**0.000**
	Matched	**4.50**	**4.04**	**0.59**	**0.555**
Number of Shocks Experienced	Unmatched	0.59	0.52	1.14	0.254
	Matched	0.59	0.52	0.93	0.354
Shock Experienced (%)	**Unmatched**	**41.54**	**34.85**	**1.89**	**0.059**
	Matched	**41.54**	**34.97**	**1.33**	**0.183**
Non PSNP Aid (%)	**Unmatched**	**28.72**	**12.85**	**6.23**	**0.000**
	Matched	**28.72**	**28.00**	**0.16**	**0.875**
Non PSNP Aid Total (birr)	**Unmatched**	**146.72**	**79.96**	**2.54**	**0.011**
	Matched	**146.72**	**131.00**	**0.43**	**0.665**
Household Field Sqm	**Unmatched**	**0.76**	**1.04**	**-1.87**	**0.061**
	Matched	**0.76**	**0.73**	**0.15**	**0.883**
Household Number of Land Parcels	**Unmatched**	**2.39**	**2.95**	**-2.70**	**0.007**
	Matched	**2.39**	**2.49**	**-0.45**	**0.651**
Sanitary Toilet Available (%)	Unmatched	1.54	3.80	-1.63	0.104
	Matched	1.54	1.44	0.08	0.934
Household Owned (%)	**Unmatched**	**94.36**	**88.29**	**2.59**	**0.010**
	Matched	**94.36**	**92.21**	**0.85**	**0.397**
Annual Rainfall (mm)	**Unmatched**	**776.99**	**1090.00**	**-10.50**	**0.000**
	Matched	**776.99**	**773.13**	**0.1**	**0.918**
Food Gap (Months)	**Unmatched**	**1.10**	**0.80**	**2.58**	**0.010**
	Matched	**1.10**	**1.09**	**0.01**	**0.988**
Food Gap (%)	Unmatched	30.26	29.38	0.27	0.786
	Matched	30.26	29.64	0.22	0.825
Household Dietary Diversity	**Unmatched**	**5.14**	**5.55**	**-2.94**	**0.003**
	Matched	**5.14**	**5.07**	**0.37**	**0.715**

CSI	Unmatched	3.73	3.22	1.03	0.303
	Matched	3.73	3.50	0.32	0.749
HFIAS Food Insecurity (%)	Unmatched	35.90	34.64	0.36	0.721
	Matched	35.90	36.82	-0.19	0.85

Notes: covariate balance test to see if the distributions of the variables of interest were similar in 2011 between households that worked for and made wages from PSNP and comparison households who never receive PSNP in the duration of the survey. * denotes significance difference between matched and unmatched at the 10%, ** at the 5% and, *** at the 1% level.

7.2 Propensity Score and T-Tests for DS

The DS component of PSNP targets household that are unable to provide labor for the PW component. For that reason, the likelihood of being treated will be different for the DS component of the program. Therefore, I run matching separately for those who received direct cash transfers. The algorithm produced a model of estimating propensity scores for receiving the DS component based on the following variables; food gap in months, food gap binary, HFIAS food insecurity, household head education level, household head literacy, household head age, household head marital status, household head employment status, non-farm income, total livestock units, whether the household owned its house, whether the household has access to a sanitary facility, total annual non-food expenditures, total annual food expenditures, whether the household received additional sources of aid, the amount of non-PSNP aid received, religious affiliation, number of shocks experienced (drought, flood, death of a family member, etc.), shocks experienced, mean annual rainfall for the *woreda*, and state dummies. The outcome for the logit model below is 1 if the individual did not have access to PSNP in 2011 but is a beneficiary through DS in 2013 and/or 2015. Results from the logit regression are available in Table 15.

Table 15: Propensity Scores for DS

Household Head Age	0.0168***

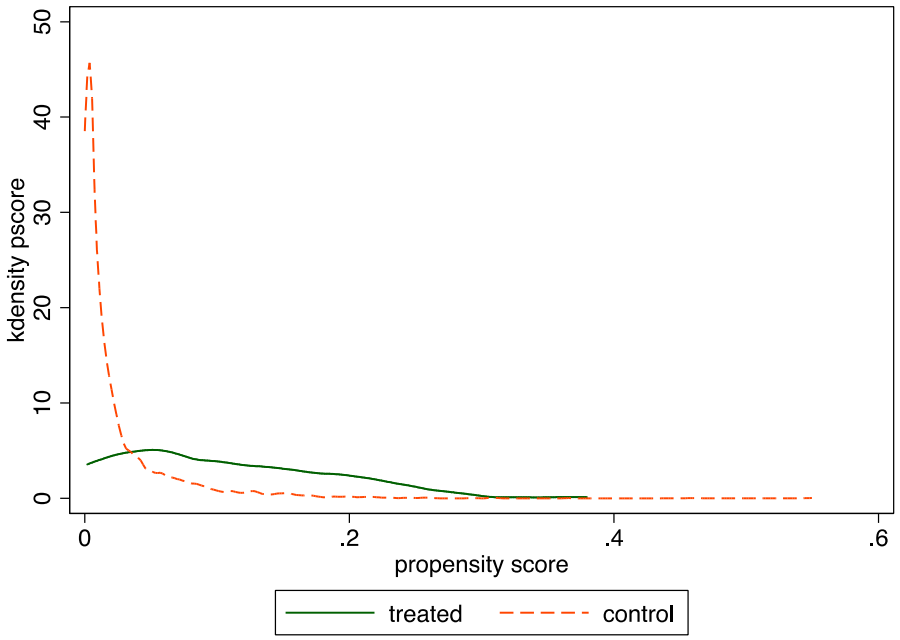
	(0.00519)
Household Head Married	-0.324*
	(0.183)
Household Head Literacy	-0.540**
	(0.228)
Household Head Elementary Education	0.305
	(0.267)
Household Head Employed	-0.216
	(0.349)
Orthodox	1.135***
	(0.397)
Muslim	1.573***
	(0.389)
Traditional Religions	1.469
	(1.096)
House Ownership	0.673**
	(0.33)
Sanitation Access	-0.636
	(0.494)
Real Non-Food Consumption	-0.00000538
	(0.00000587)
Real Food Consumption	-0.00000545
	(0.00000588)
Non-PSNP Aid	0.623**
	(0.263)
Real Non-PSNP Aid Total	-0.000568
	(0.000348)
Real Nonfarm Sales	-0.00000335
	(0.0000343)
TLU	-0.0271
	(0.0224)
Shock Experienced	0.491
	(0.32)
Shock Count	-0.347*
	(0.194)
Food Insecure	0.166
	(0.182)
Food Gap (Months)	-0.0741
	(0.0743)

Food Gap (Binary)	0.530*
	(0.29)
Annual Rainfall	-0.00338***
	(0.000432)
Afar	-2.339***
	(0.564)
Diredwa	0.946***
	(0.336)
Harari	-0.794*
	(0.446)
Oromia	-1.207***
	(0.346)
Somali	-1.616***
	(0.418)
Tigray	-0.39
	(0.294)
SNNP	0.461
	(0.302)
Observations	2,931

Notes: The dependent variable is a dummy equal to one if any household member received direct support from the PSNP cash transfer. The standard errors are in parentheses and * denotes significance at the 10%, ** at the 5% and, *** at the 1% level. These scores generate the propensity to be treated function used for matching.

After using this model to estimate the propensity score, I again utilized nearest five neighbors propensity score matching to ensure that the treatment and control group are similar on observables prior to program implementation. The figure below demonstrates that there was significant overlap between the treatment group's propensity to be treated compared to the control group's propensity to be treated. Again, this suggests that there are many households that look similar on observables to households that were beneficiaries of the DS component, but were not able to get access to the program.

Figure 8: Pre-Match Density of Household Treatment Propensity



The table below outlines the t-test differences between mean outcomes of the control group compared to the mean outcomes for the DS component group when using the full sample and the matched sample (Table 16). Similar to the previous section, the table demonstrates that before matching there were significant differences between the treated and the control group on key characteristics. However, after matching, these differences are no longer significant, and the treated and control groups look very similar on observables. The summary statistics prior to matching show that the PSNP DS component has targeted labor poor and food insecure populations. The treated sample experienced lower household dietary diversity, a lower asset count, owned less land, experienced more shocks, and had lower mean annual rainfall experienced. The treated sample also had household heads that were older, less likely to be literate, less likely to be employed, more likely to have no formal education, and more likely to be Muslim. The treated households were also smaller on average, and the household heads were more likely to be female and unmarried. This is in line with the criteria for receiving DS from PSNP, as these households are more likely to be labor poor but still in need of support. However,

once again, the treated sample also had a higher amount of non-PSNP aid provided and were more likely to own their own homes. After matching, the table demonstrates that the control group looks similar on observables but did not receive treatment.

Table 16: Summary Statistics Matched and Unmatched

		Mean			
Variable	Sample	Treatment	Comparison	t-test	p-value
Household Head Age	**Unmatched**	**50.00**	**44.15**	**5.34**	**0.000**
	Matched	**50.00**	**49.78**	**0.14**	**0.891**
Household Head Sex (%)	**Unmatched**	**65.88**	**77.43**	**-3.83**	**0.000**
	Matched	**65.88**	**63.89**	**0.43**	**0.669**
Household Head Literate (%)	**Unmatched**	**20.85**	**42.76**	**-6.27**	**0.000**
	Matched	**20.85**	**20.85**	**0.00**	**1.000**
Household Head Employed (%)	**Unmatched**	**5.21**	**10.00**	**-2.27**	**0.023**
	Matched	**5.21**	**5.12**	**0.04**	**0.965**
Household Head Sex (%)	**Unmatched**	**65.88**	**77.43**	**-3.83**	**0.000**
	Matched	**65.88**	**63.89**	**0.43**	**0.669**
Household Head Married (%)	**Unmatched**	**66.83**	**78.53**	**-3.94**	**0.000**
	Matched	**66.83**	**66.07**	**0.16**	**0.869**
Household Size	**Unmatched**	**4.59**	**5.04**	**-2.69**	**0.007**
	Matched	**4.59**	**4.63**	**-0.19**	**0.846**
Dependents	**Unmatched**	**2.30**	**2.54**	**-1.92**	**0.055**
	Matched	**2.30**	**2.32**	**-0.12**	**0.908**
No Education (%)	**Unmatched**	**80.10**	**62.39**	**5.17**	**0.000**
	Matched	**80.10**	**79.62**	**0.12**	**0.904**
Informal Education (%)	Unmatched	0.47	0.33	0.34	0.731
	Matched	0.47	0.19	0.51	0.613
Elementary Education (%)	**Unmatched**	**13.74**	**20.70**	**-2.43**	**0.015**
	Matched	**13.74**	**15.92**	**-0.63**	**0.530**
Middle Education (%)	**Unmatched**	**4.74**	**11.77**	**-3.11**	**0.002**
	Matched	**4.74**	**3.51**	**0.64**	**0.526**
Secondary Education (%)	Unmatched	0.00	0.88	-1.37	0.171
	Matched	0.00	0.00	-	-
Vocational Education (%)	Unmatched	0.00	1.25	-1.63	0.102
	Matched	0.00	0.28	-0.77	0.439
Tertiary Education (%)	Unmatched	0.95	2.24	-1.25	0.212
	Matched	0.95	0.47	0.58	0.563

Catholic (%)	Unmatched	0.00	0.44	-0.97	0.334
	Matched	0.00	0.00	-	-
Protestant (%)	**Unmatched**	**5.21**	**19.93**	**-5.29**	**0.000**
	Matched	**5.21**	**5.12**	**0.04**	**0.965**
Muslim (%)	**Unmatched**	**54.50**	**31.80**	**6.78**	**0.000**
	Matched	**54.50**	**54.31**	**0.04**	**0.969**
Traditional (%)	Unmatched	0.47	0.70	-0.38	0.703
	Matched	0.47	0.47	0.00	1.000
Other Religion (%)	Unmatched	0.47	0.96	-0.71	0.480
	Matched	0.47	0.00	1.00	0.318
Asset Count	**Unmatched**	**8.74**	**10.41**	**-2.85**	**0.004**
	Matched	**8.74**	**8.05**	**0.82**	**0.414**
Total Livestock Units	Unmatched	2.46	2.86	-1.27	0.205
	Matched	2.46	2.28	0.56	0.575
Number of Shocks Experienced	Unmatched	0.57	0.53	0.81	0.416
	Matched	0.57	0.57	0.04	0.970
Shock Experienced (%)	**Unmatched**	**40.76**	**34.85**	**1.73**	**0.084**
	Matched	**40.76**	**41.90**	**-0.24**	**0.813**
Non PSNP Aid (%)	**Unmatched**	**23.22**	**13.20**	**4.06**	**0.000**
	Matched	**23.22**	**25.12**	**-0.45**	**0.650**
Non PSNP Aid Total	Unmatched	103.49	83.04	0.81	0.421
	Matched	103.49	108.78	-0.20	0.839
Household Field Sqm	**Unmatched**	**0.73**	**1.04**	**-2.18**	**0.030**
	Matched	**0.73**	**0.73**	**0.06**	**0.954**
Household Number of Land Parcels	Unmatched	2.73	2.92	-0.97	0.331
	Matched	2.73	2.57	0.70	0.482
Sanitary Toilet Available (%)	Unmatched	2.37	3.75	-1.03	0.303
	Matched	2.37	1.71	0.48	0.631
Household Owned (%)	**Unmatched**	**94.31**	**88.27**	**2.67**	**0.008**
	Matched	**94.31**	**93.93**	**0.17**	**0.869**
Annual Rainfall (mm)	**Unmatched**	**785.57**	**1090.60**	**-10.62**	**0.000**
	Matched	**785.57**	**776.41**	**0.37**	**0.712**
Food Gap (%)	Unmatched	34.12	29.04	1.56	0.119
	Matched	34.12	38.96	-1.03	0.304
Household Dietary Diversity	**Unmatched**	**5.11**	**5.55**	**-3.27**	**0.001**
	Matched	**5.11**	**5.19**	**-0.44**	**0.657**
CSI	Unmatched	2.93	3.28	-0.74	0.462
	Matched	2.93	2.65	0.52	0.606
HFIAS Food Insecurity (%)	Unmatched	33.18	34.82	-0.48	0.630

Matched	33.18	33.08	0.02	0.984

Notes: covariate balance test to see if the distributions of the variables of interest were similar in 2011 between households that received direct support from PSNP and comparison households who never receive PSNP in the duration of the survey. * denotes significance difference between matched and unmatched at the 10%, ** at the 5% and, *** at the 1% level.

8. Results

In this section, I discuss program impacts on household-level food security outcomes. The first set of results looks at matched difference-in-differences estimates for those who are on the PW component of the PSNP. The second set of results evaluates the same for those on the DS component of the PSNP. In addition, I include results for dosed treatments that take into consideration PSNP beneficiaries who have also received agricultural extension services that can help them address their long-term asset and income accumulation.

8.1 Public Works

Table 17 presents results on whether being a participant of the PW component of the PSNP improved household's food security relative to households that look similar on observables but did not receive any income from the PSNP. The estimate captures the effect of a household being a participant, controlling for variation in household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. These variables are included as controls because theory and prior literature predict that these factors have an impact on household food security (Gilligan et al., 2009; Berhane et al., 2014). The results state that households who receive PSNP through PW did experience a statistically significant change in their food gap over the year and their classification of HFIAS food insecurity. Specifically, after receiving PSNP, the matched difference-in-differences results

suggest that households are 12 percentage points more likely to report that they did not have sufficient food for the year. The results also indicate that there is a 12 percentage point increase in the likelihood of being classified as food insecure based on the HFIAS. These results are robust to the inclusion of our controls and logit estimations. The results show that being a participant of the PSNP did not statistically significantly change the household's dietary diversity or coping strategies index. These findings are counter to the hypotheses outlined earlier, as well as the goals of the program. These results suggest that program recipients are, if anything, experiencing worsening food security relative to their counterparts. A potential explanation for this unexpected direction of the coefficient could be biased reporting, which I will discuss in more depth in the conclusion and discussion section.

The difference-in-differences estimates demonstrate a statistically significant impact on two of the food security outcomes. Though not provided in the table below, it is also important to note that several covariates also strongly influenced the food security measures. Households with single male heads were worse off on all outcomes, suggesting that women are important to ensure that the household is eating well. Literacy, formal education at any level, and employment were positively associated with household dietary diversity and negatively associated with the food gap, coping strategies, and HFIAS food insecurity. Having a greater number of dependents negatively influences the food gap, suggesting that a greater number of dependents in the household leads to a greater likelihood of having insufficient food to meet everyone's needs over the year. An increase in the asset count is significantly associated with a decrease in the food gap and an increase in the dietary diversity score. Similarly, an increase in household land ownership is significantly associated with a reduction in the likelihood of being food insecure as classified by HFIAS, experiencing a food gap, and engaging in negative coping strategies. Across all

indicators, the results demonstrate that experiencing a shock is strongly and significantly associated with worsening food gaps, increased adoption of damaging coping strategies, reduction in the number of diverse food groups consumed, and a greater likelihood of being food insecure by HFIAS classifications. The results also indicate that being Muslim is significantly associated with negative food security outcomes. Finally, in line with expectations, greater annual rainfall is significantly associated with positive outcomes on food security.

Table 17: PW Program Effects on Food Security

	Food Gap	HDDS	CSI	HFIAS
	(1)	(2)	(3)	(4)
Treat	-0.02	0.0914	0.0707	-0.0241
	(0.0365)	(0.162)	(0.589)	(0.0408)
Post* Treat	**0.116*** **	**-0.179**	**0.604**	**0.116** **
	(0.0444)	**(0.167)**	**(0.769)**	**(0.0488)**
Constant	0.0908	5.773***	0.368	0.124
	(0.103)	(0.546)	(1.775)	(0.0973)
N	2,342	2,344	2,338	2,335
R2	0.237	0.233	0.142	0.189

Notes: Columns (1) - (4) are OLS estimations for the matched sample. All models include dummy variables for the year. The food gap (1) is defined as having insufficient food for the year to meet the household's food needs. HDDS (2) is defined as the number of food groups consumed. CSI (3) is the weighted index score for negative coping strategies employed to manage food insecurity. Finally, HFIAS (4) is the binary classification of food insecurity based on the frequency of occurrence of food difficulties in the week prior to the survey. Controls include household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Following prior literature that finds that PSNP alone does not change household food security outcomes, I run analysis on whether households that received both PSNP and access to agricultural extension services experience any change in their food security (Berhane et al.,

2014). The results, as shown in Table 18, suggest that dosed treatment changes food security more in line with the hypotheses outlined in section 3. The results show that households who have received both PSNP and agricultural extension services realized increased diversity of food groups consumed, significant at the 10% level. However, the results suggest that there is no discernable effect of the dosed treatment on the food gap, the coping strategy index, or the HFIAS food insecure classification for the sample. While this result is more in line with our hypotheses, it is important to note that the number of households with both programs is very low and therefore, the analysis has low statistical power. This may not be capturing the true impact of receiving both the programs.

Table 18: Dosed PSNP and Ag Extension Program Effects

	Food Gap	HDDS	CSI	HFIAS
	(1)	(2)	(3)	(4)
Treat	-0.00861	0.0245	-0.481	-0.0397
	(0.0581)	(0.217)	(1.118)	(0.0639)
Post* Treat	**-0.0538**	**0.429***	**1.135**	**0.0635**
	(0.0696)	**(0.249)**	**(1.329)**	**(0.0757)**
Constant	-0.136	5.662***	-1.257	0.114
	(0.174)	(0.632)	(2.51)	(0.15)
N	901	901	898	897
R2	0.256	0.346	0.156	0.174

Notes: Columns (1) - (4) are OLS estimations for the matched sample. All models include dummy variables for the year. The food gap (1) is defined as having insufficient food for the year to meet the household's food needs. HDDS (2) is defined as the number of food groups consumed. CSI (3) is the weighted index score for negative coping strategies employed to manage food insecurity. Finally, HFIAS (4) is the binary classification of food insecurity based on the frequency of occurrence of food difficulties in the week prior to the survey. Controls include household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

8.2. Direct Support

Table 19 presents results on whether being a recipient of the DS component of the PSNP improved household food security relative to households that look similar on observables but did not receive support. The estimates capture the effect of a household being a participant, controlling for household and *kebele* characteristics. The results indicate that households who receive PSNP through DS did not statistically significantly change any of the household's food security outcomes. As the results are not significant, there is not much that can be said about their meaning. However, the direction of the coefficient suggests that participants of PSNP were more likely to report being food insecure or not having sufficient food for the household.

The difference-in-differences estimates indicate that there is no discernable impact of the DS component of the PSNP on food security outcomes. Though not provided in the table below, it is notable that several covariates strongly influenced the food security measures. Similar to section 8.1, literacy and receiving secondary or higher level of education were positively associated with household dietary diversity and negatively associated with the food gap, coping strategies, and HFIAS food insecurity. An increase in the asset count is significantly associated with a decrease in the food gap, HFIAS food insecurity, coping strategies, and an increase in the dietary diversity score. Similarly, an increase in household land owned is significantly associated with a reduction in the likelihood of being food insecure as classified by HFIAS, experiencing a food gap, and engaging in negative coping strategies. An increase in total livestock units was also significantly associated with a reduction in adoption of negative coping strategies and a decline in the likelihood of being HFIAS food insecure. Across all indicators, the results demonstrate that experiencing a shock is strongly and significantly associated with worsening food gaps, increased adoption of damaging coping strategies, reduction in the number of diverse food groups consumed, and greater likelihood of being food insecure by HFIAS classifications.

The results also indicate that being Catholic is strongly indicative of positive food security outcomes across all outcomes, though it is important to note that this a very small segment of the population. Finally, greater annual rainfall is significantly associated with negative outcomes on food security for this population.

Table 19: DS Program Effects on Food Security

	Food Gap	HDDS	CSI	HFIAS
	(1)	(2)	(3)	(4)
Treat	-0.0346	-0.117	0.406	0.00889
	(0.0366)	(0.141)	(0.419)	(0.0366)
Post* Treat	**0.0689**	**0.216**	**0.0588**	**0.0392**
	(0.0425)	**(0.15)**	**(0.564)**	**(0.0445)**
Constant	0.312***	5.360***	1.972	0.220**
	(0.101)	(0.442)	(1.709)	(0.103)
N	2544	2547	2543	2540
R2	0.183	0.234	0.114	0.146

Notes: Columns (1) - (4) are OLS estimations for the matched sample. All models include dummy variables for the year. The food gap (1) is defined as having insufficient food for the year to meet the household's food needs. HDDS (2) is defined as the number of food groups consumed. CSI (3) is the weighted index score for negative coping strategies employed to manage food insecurity. Finally, HFIAS (4) is the binary classification of food insecurity based on the frequency of occurrence of food difficulties in the week prior to the survey. Controls include household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

The table below tests whether households that received both PSNP through DS and access to agricultural extension services experienced any change in their food security. The results, as shown in Table 20, suggest that the combined treatment changes food security in line with expectations. The results show that households who have received both PSNP and agricultural extension services realized increased diversity of food groups consumed, significant

at the 1% level. However, the results suggest that there is no discernable effect of the dosed treatment on the food gap, the coping strategy index, or the HFIAS food insecure classification for the sample.

Table 20: Dosed PSNP and Ag Extension Program Effects

	Food Gap	HDDS	CSI	HFIAS
	(1)	(2)	(3)	(4)
Treat	0.022	-0.265	0.515	0.0223
	(0.054)	(0.23)	(0.703)	(0.0541)
Post* Treat	**0.00782**	**0.621*** **	**0.0527**	**0.019**
	(0.0569)	**(0.237)**	**(0.762)**	**(0.0646)**
Constant	0.082	6.685***	1.413	0.226
	(0.158)	(0.667)	(2.586)	(0.158)
N	1,121	1,122	1,121	1,119
R2	0.213	0.215	0.19	0.213

Notes: Columns (1) - (4) are OLS estimations for the matched sample. All models include dummy variables for the year. The food gap (1) is defined as having insufficient food for the year to meet the household's food needs. HDDS (2) is defined as the number of food groups consumed. CSI (3) is the weighted index score for negative coping strategies employed to manage food insecurity. Finally, HFIAS (4) is the binary classification of food insecurity based on the frequency of occurrence of food difficulties in the week prior to the survey. Controls include household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Overall, results for the PW and DS component of the PSNP suggest a negative impact of the program on measures of food security. I run a series of robustness checks to ensure that the findings are providing precise estimates of the treatment effect. For both components, I run alternative propensity score matching techniques. I test nearest neighbor 1:1, caliper matching (with the caliper width equal to 0.2 of the standard deviation of the logit of the propensity score), and kernel. I find that my difference-in-differences results for the PW component (Table A-2 in

Appendix) are robust to the alternative propensity score matching techniques, with varying magnitudes. For those receiving DS from PSNP, I find that the results are also robust to alternative specifications for the difference-in-differences estimations (Table A-3).

I also run the analysis using the original classification of the survey questions using alternative regression types such as ordinal logit, poisson, logit, or probit. For the HFIAS scale, I run the analysis on the score, the ordered categories, and the binary classification separately. For the PW component, these additional checks highlight that my results are still robust and similar to different definitions and model assumptions for my outcomes. For the DS component, the difference-in-differences estimates are robust to the different outcome variable definitions and model assumptions as well. The robustness checks suggest that the estimates found on program impacts in Ethiopia are picking up a precisely estimated negative treatment effect for the PW component.

9. Conclusion and Discussion

This study examined the impact of Ethiopia's PSNP on food security outcomes for households during the third phase of the program from 2010 to 2015. It used panel data from the ERSS on a nationally representative sample of rural households. Using a propensity score matching and difference-in-differences model, the study finds that the PSNP through both the PW and the DS component has no effect on improving food security for beneficiaries. Instead, the results demonstrate that being a beneficiary of the PW component of the program increases the likelihood of households reporting that they do not have sufficient food to meet their household's needs through the year relative to households who did not receive wages. For the DS component, the results suggest that recipients don't experience a statistically significant change in their food security outcomes relative to those who did not receive support.

It is counter to the goals of the program to see recipients report worsening food security. The findings in this paper contradict those presented by some of the prior literature where participants of the PSNP realized reduced months of food insecurity and improved dietary diversity from their received cash transfer (Yablonksi and Woldehanna, 2008; Gilligan et al. 2009; Berhane et al., 2014). Given that the results are robust to alternative matching methods and model assumptions, it is possible that this study presents different findings to the prior flagship evaluations because it evaluates a different phase of the program and uses a nationally representative survey. Of note, the findings of this paper on household dietary diversity are consistent with Gebrehiwot and Castilla (2019) where the authors found results that indicate no effect of the change in the amount of PSNP transfers on dietary diversity, iron, calorie or protein intake. Gebrehiwot and Castilla (2019) also use the ERSS, though they employ an instrumental variables approach to causally evaluate the impact of PSNP.

The findings indicate that both the PW and DS component of PSNP did not lead to a statistically significant change in household dietary diversity. There are many possible explanations for the lack of a discernable effect of PSNP on this outcome. A major concern is that the average real income received from the PSNP for those participating in the labor component was 632 birr ($16) for the entire year. For DS recipients, they received slightly more money (1381 birr/$34), but it is still not enough in both cases to significantly change the composition of food consumed. The FAO report on food prices (2011) shows that social safety net transfers are appropriate when markets are functioning, and food is available. However, markets in rural Ethiopia have been shown to be thin, with high rates of reliance on one's own production (Hoddinott et al., 2015). This suggests that even if incomes of the disadvantaged populations are increased by the PSNP transfer amount, it is not immediately evident that they

will be able to buy sufficient food. This is particularly true in the event of droughts, which Ethiopia experienced in 2011 and 2015. These were extremely severe droughts, and as the results demonstrate, experiencing a shock has a very strong and significant negative impact on food security outcomes. Low-income transfers, thin markets, and poor cultivation and production in one's own land make it difficult for households to substantially change their dietary diversity. This explanation is strengthened by the findings presented in Table 18 and 20 where households that had received both PSNP and agricultural extension services realized a statistically significant increase in the number of diverse food groups consumed. With the backdrop of drought and thin markets, households that had access to additional income from PSNP as well as much-needed guidance and technical assistance on best practices for farm cultivation and production were able to consume a more diverse set of food groups.

The more perplexing result in this paper is the finding that households receiving the PW component of the PSNP were self-reporting that they do not have sufficient food to meet their household's needs through the year. A potential explanation for the unexpected direction of the impact could be biased strategic reporting. As mentioned earlier, the goal of the program is to have households graduate from the program. Though there are no clear cut-off criteria for graduation, the government states that any household that has reduced its food gap and is able to provide for their families will have graduated from the program. The goal of the PSNP is to improve household food security up to the point that it leaves the program. "A household has graduated when, in the absence of receiving PSNP transfers, it can meet its food needs for all 12 months and is able to withstand modest shocks" (GFDRE, 2009a). The story of graduation from the PSNP was underwhelming during the first two phases, prompting the change in design and wages in the third phase. However, research shows that over the past few years, a financial and

political urgency has been placed on graduating households to show that the program is working (Sabates-Wheeler et al., 2020). This has led to a contradictory situation where high numbers of households were graduated despite evidence showing that they were not in a position to do so (Sabates-Wheeler et al., 2020). Field staff were giving large sums of money to households to falsely show that they could be graduated out of the PSNP because the field staff had quotas to fulfill on the required number of graduated households in their *kebeles* (Sabates-Wheeler et al., 2020). Within this context, it is possible that households had a disincentive to report improved months of food security, as improved conditions could lead to households being "kicked off" the program even though they hadn't achieved sustainable livelihood improvement. The direction and significance of the coefficient may be explained by households over-reporting their food gap and food insecurity to remain eligible for continued participation in the program.

The evaluation techniques used in this paper attempt to capture an unbiased effect of the PSNP on certain outcomes, but it is important to note that there are weaknesses to this approach. The application of matching methods to calculate difference-in-differences estimates does not account for time-varying unobservables, potentially biasing the results. Additionally, the use of propensity score matching means that the estimate captures the average treatment effect on the treated, limiting the generalizability of the findings to those outside the sample. However, with these caveats, the results do indicate that the PSNP by itself has not helped improve food security. It also suggests that a forced benchmark of graduation on field staff could be causing households to misreport worsened food security despite receipt of the PSNP. Finally, the dosed treatments indicate that PSNP, when coupled with other government investments in farming support and asset accumulation, does have the potential to significantly improve household dietary diversity.

The policy implications of these findings are that continued reform is still needed for PSNP to ensure that it is providing participants with a means to buffer negative income shocks and improve food security. In order to reform the program to address the needs of the population, the Ethiopian government may need to further increase the amount of the transfer itself to reflect higher food prices during droughts as well. It may be worth implementing both cash and food transfers depending on the conditions of the markets in different *woredas*. Additionally, to encourage further improvements in household dietary diversity, the cash transfer program should be paired with nutrition education interventions that help promote awareness and understanding of the importance of eating numerous different food groups. Finally, it is important to keep the main goal of social protection programs in mind when redesigning and retargeting the program. Graduation thresholds are critical for programming and budgeting purposes, but they must not deflect from the key objective of the program which is to enable households to escape the poverty trap and cultivate sustainable livelihoods.

10. Appendix

Table A-6: PW DiD Estimates with Alternative Matching

	Food Gap	HDDS	CSI	HFIAS
	(1)	(2)	(3)	(4)
Nearest Neighbor Matching 1:1				
Treat	-0.0478	0.104	-0.121	-0.015
	(0.0424)	(0.167)	(0.668)	(0.0444)
Post Treat*	0.141***	-0.207	1.134	0.132***
	(0.0496)	(0.178)	(0.847)	(0.0504)
Constant	0.201*	5.667***	0.276	0.158
	(0.114)	(0.508)	(1.722)	(0.118)
N	1161	1163	1160	1160
R2	0.267	0.254	0.168	0.222
Caliper Matching				
Treat	-0.0319	0.107	0.442	0.00858
	(0.0453)	(0.172)	(0.69)	(0.0468)
Post Treat*	0.119**	-0.229	0.646	0.109**
	(0.0525)	(0.184)	(0.883)	(0.0531)
Constant	0.187	5.366***	0.477	0.152
	(0.122)	(0.554)	(1.812)	(0.125)
N	1041	1043	1041	1041
R2	0.262	0.265	0.175	0.223
Kernel Epanechnikov				
Treat	0.00769	-0.0328	0.254	0.00359
	(0.0339)	(0.146)	(0.544)	(0.0375)
Post Treat*	0.0838**	-0.0429	1.004	0.122***
	(0.0425)	(0.153)	(0.711)	(0.0448)
Constant	0.0197	6.065***	-0.913	0.0916
	(0.0887)	(0.477)	(1.442)	(0.0827)
N	8728	8742	8731	8721
R2	0.223	0.226	0.14	0.176

Notes: Columns (1) - (4) are OLS estimations for the matched sample. All models include dummy variables for the year. The food gap (1) is defined as having insufficient food for the year to meet the household's food needs. HDDS (2) is defined as the number of food groups consumed. CSI (3) is the weighted index score for negative coping strategies employed to

manage food insecurity. Finally, HFIAS (4) is the binary classification of food insecurity based on the frequency of occurrence of food difficulties in the week prior to the survey. Controls include household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A-7: DS DiD Estimates with Alternative Matching

	Food Gap	HDDS	CSI	HFIAS
	(1)	(2)	(3)	(4)
Nearest Neighbor Matching 1:1				
Treat	-0.0383	-0.118	0.835*	0.0305
	(0.0428)	(0.162)	(0.492)	(0.0439)
Post Treat*	0.0365	0.276	-0.651	-0.0142
	(0.0486)	(0.177)	(0.628)	(0.0512)
Constant	0.343***	5.412***	2.731	0.340***
	(0.126)	(0.526)	(2.129)	(0.123)
N	1257	1258	1256	1254
R2	0.191	0.256	0.121	0.151
Caliper Matching				
Treat	-0.0338	-0.11	0.893*	0.0313
	(0.0429)	(0.163)	(0.492)	(0.0437)
Post Treat*	0.0314	0.253	-0.71	-0.0124
	(0.0487)	(0.178)	(0.628)	(0.051)
Constant	0.340***	5.401***	2.704	0.335***
	(0.126)	(0.527)	(2.134)	(0.124)
N	1251	1252	1250	1248
R2	0.192	0.257	0.121	0.153
Kernel Epanechnikov				
Treat	0.00871	-0.143	0.415	0.00946
	(0.0339)	(0.132)	(0.405)	(0.0337)
Post Treat*	0.0345	0.196	0.375	0.057
	(0.0387)	(0.138)	(0.536)	(0.0407)
Constant	0.313***	5.351***	3.294**	0.248***
	(0.0889)	(0.381)	(1.447)	(0.0836)

N	8721	8735	8724	8714
R2	0.182	0.24	0.099	0.135

Notes: Columns (1) - (4) are OLS estimations for the matched sample. All models include dummy variables for the year. The food gap (1) is defined as having insufficient food for the year to meet the household's food needs. HDDS (2) is defined as the number of food groups consumed. CSI (3) is the weighted index score for negative coping strategies employed to manage food insecurity. Finally, HFIAS (4) is the binary classification of food insecurity based on the frequency of occurrence of food difficulties in the week prior to the survey. Controls include household head age, sex, education, marital status, literacy, employment status, household size, dependents, religious affiliation, house ownership, sanitary facility ownership, household land owned, total livestock units, asset count, shocks experienced, non-PSNP aid, mean annual rainfall, and state dummies. Standard errors are clustered at the household level and in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

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Conclusion

In this dissertation, I examine the implementation and impact of policies and projects that aim to support climate change adaptation for vulnerable populations. I focus on understanding and evaluating a community-based adaptation initiative (CBA) in Senegal and Mali, and analyze a social safety net program in Ethiopia that focuses on improving food security in the face of shocks. While climate change has and will pose significant threats on human well-being on a global scale, resource-dependent rural populations face a disproportionate risk. Significant work has already been done to identify the determinants that help build vulnerable population's resilience and adaptation to climate-induced risks. This dissertation builds on that body of work by evaluating the strategies employed to enhance the availability and access to those determinants. With this work, I seek to understand whether certain policies and projects are able to ameliorate the effect of climate change on vulnerable populations.

In the first and second chapters of this dissertation, I focus on the Decentralized Climate Funds (DCF) project in Senegal and Mali. DCF aims to support locally led climate change adaptation, recognizing that those most impacted need to identify and prioritize public goods investments in adaptation to build resilience. In the first chapter, I use a difference-in-differences and propensity score matching approach to examine whether households who are able to participate and receive a public goods investment in the project are more likely to develop social capital. I find that in Mali treated households increased participation in community development outside of the DCF project, and presented more prosocial norms such as acts of reciprocity and community support for their neighbors. In the second chapter, I further examine the previous results to understand who was able to participate and receive funding for a public goods investment. I focus in on the participatory processes of the DCF project to understand whether

the efforts to promote inclusive participation in climate change adaptation were successful in giving the most vulnerable a voice. I conducted semi-structured interviews and focus group discussions with women in three sites in Kaffrine, Senegal to explore their involvement and inclusion in the decision-making around adaptation. I find that women's participation varied across sites and depended on a set of factors independent of the DCF project intervention. Women who had strong existing social networks, lived in a community where women's role in income generation was recognized, and experienced favorable intrahousehold power dynamics were able to actively participate and demand their needs for climate change adaptation.

Finally, the third chapter pivots focus to the Productive Safety Net Programme (PSNP) implemented at a national scale in Ethiopia. In this chapter, I evaluate Phase III of PSNP to assess whether the beneficiaries of the program have experienced improved food security and are able to consume more nutritionally diverse diets, even with the background of severe droughts. I use a propensity score matching and difference-in-differences estimation approach to understand whether participants of the program experienced any changes in their food security relative to non-participants who have similar socio-economic characteristics. I find that the public works component of the PSNP actually led to households self-reporting worsened food security than the control households. For those receiving direct support, the results indicate no significant impact on household food security. However, when any form of transfer under the PSNP was coupled with agricultural extension services, households experienced an improvement in their dietary diversity.

I identify three main policy implications from my analysis. First, all three chapters point to the importance of policy and project design. The design and structure of the intervention determines whether or not the objectives are met. In the DCF project, I find that the community-

driven approach to climate change adaptation did not ensure equitable participation across all marginalized people, one of the explicit goals of the program. The project design allowed for the replication of existing power dynamics that further exacerbated vulnerabilities. Future community-based interventions need to consider early context analysis to understand the existing power dynamics and design the project to work around those limitations. For example, different funds could be allotted for women's groups to ensure that public goods investments did not always rely on women's active participation in spaces where it is hard for them to speak up. If there is significant ethnic fractionalization in a village, the project could be restructured to have the household as its unit of intervention instead of relying on cooperation at the village level. In Ethiopia, the PSNP was designed to address short-term food insecurity by providing wages or cash transfers for short time periods. However, the goal of the program was specified as helping enable households to escape the poverty trap. There is a disconnect between the outlined objectives of the program and the design of the intervention.

Secondly, my analysis points to the substantial importance of program and project implementation. In both the DCF project and PSNP, the targeted beneficiaries are often not those that need the intervention the most. In Senegal and Mali, under the DCF project, households with higher education and more influence in their communities were able to receive investments for public goods. As the project worked with local implementing agencies (Near East Foundation Mali, and IED-Afrique), the targeted sites happened to reflect villages that had a history of working with the personnel at the non-profits. Those facilitating and implementing the project were more likely to identify villages and communities that understood how to write a theory of change or host a community forum so that the implementation process was efficient. This is an understandable goal, but it creates a situation where those who receive project or program

interventions are not the most vulnerable populations in the region. In Senegal, I found that the sites that received a public goods investment often had development interventions and programs from other international agencies as well, suggesting that these villages were well positioned to always work with non-profits and international aid. In Ethiopia, the discretion in implementation is a significant factor in determining who is eligible for the program. Despite the criteria being targeted to the chronically food insecure and most at risk members of a *kebele*, qualitative work has found that *kebele* level officials often sign up members of their network or politically aligned households. On the ground civil servants also have to consider their quotas and top-down requirements on demonstrating success of the program. This burdens' implementing officers, as well as incentivizes them to choose households that are more likely to demonstrate improvements in their outcomes. My research points to the importance of recognizing that socio-political power dynamics between the population and on the ground implementing officers play a significant role in determining beneficiaries of development interventions.

Finally, one of the main policy implications of this work is that policies and programs operating in isolation do not build resilient livelihoods. In order to address the disproportionate risks of climate change for vulnerable populations, coordinated and packaged approaches are needed. Climate change adaptation recognizes the socio-economic nature of vulnerability and the need for policy solutions to focus explicitly on building resilient livelihoods. A clear objective of sustainable poverty reduction is needed for vulnerable populations to be able to strengthen their capacity to adapt to living in riskier and fluctuating climates. Both the PSNP and the DCF project address short term needs and insecurities, but the interventions do not attain the ultimate objective of sustainable poverty reduction and climate resilience. In order to build the adaptive capacity of households, governments and development practitioners need to engage with

transformational change that focuses on social safety nets, environmental recovery, strengthening human and physical capital, and improving institutional systems and delivery. Our collective goal to ensure that those most vulnerable to climate change are prepared and can adapt to climate risks requires us to provide a foundation for households to build more secure livelihoods over the longer term. Policies and projects need to work with the broader structural environment to build sustainable and resilient livelihoods.

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WORKING PAPERS

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