UNDERSTANDING THE GENDER AND CLIMATE CHANGE NEXUS

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Adaptation to Climate Change in Remote Rural Households: The Role of Women in Land Management

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I. Introduction

Climate change is widely agreed to be already a reality. In 2020, greenhouse gas concentrations reached new highs. 2021 according to the WMO (World Meteorological Organization) could have been the 5th and 7th warmest year on record and 2015 to 2021 will be the seven warmest years on record. The upper 2000m depth of the ocean continued to warm in 2019 reaching a new record high. (WMO, 2021).The forms of production and consumption of society continuously generate unprecedented pollution of the atmosphere, which is leading to disruptions of the natural cycles of the climate, producing changes in the seasons and in the intensity of rains and droughts.

¿What is the role of women in adopting climate change adaptation strategies in remote rural areas farms? We approach this question by using a unique data set from remote rural areas in Antioquia, Colombia. We start by discussing the principal factors that make household farmers adopt different practices to adapt to climate change. We want to understand better farmers' perceptions of climate change, their actions to adapt, and the main factors that influence this decision.

II. DATA AND METHODS

A. Data

This study focuses on analyzing the vulnerability to climate change of small farmers in the region of Antioquia, Colombia. We conduct a multi-topic household survey in a random sample of 800 smallholders from 22 municipalities and 74 veredas. The questionnaire comprised socioeconomic background, household expenditures, crop and livestock production, access to credit, agricultural production, among others. The survey has a particular module for climate change aimed at capturing household farmers' perceptions and adaptation. In the case of perception, six questions are asked about the perceived changes in terms of rain, hot days, cold days, and droughts, and for adapta- tion. And for the adaptation questions, nine adaptation actions against climate change are listed: change crops, build water storage system, plant trees, increase irrigation, change crops to livestock, increase livestock, migration, work off the farm and lease land, to which they respond "yes or no" adopted this strategy to deal with climate change. We will create intensity indicators to measure climate change adaptation and perception. For perception, the indicator is measured with scales from 0 to 6, depending on the number of affirmative answers. The adaptation index would be a dichotomous variable, which takes the value of 1 if they answered yes to at least one of the nine adaptation measures or 0 otherwise.

B. Methods

To estimate the determinants and significant factors influencing the level of adaptation to climate change in household farmers in Antioquia. We use a logistic model to determine factors influencing the decision to adapt. In this case, the binary logit model is appropriate, as it considers the relationship between a binary dependent variable and a set of independent variables (Fosu-Mensah & Vlek, 2012; Fadina & Barjolle, 2018).

III. RESULTS

The results highlight that the main factors affecting the decision to adapt to climate change are: i) Demographic and socioeco- nomic; ii) Resources, services, and technologies and iii) Cognitive and psychological factors. One of the important results shows that women take the decision about the land has a negative impact on the likelihood of taking the decision to adapt to climate change.

The results of the binary logit model show that the household head job, who takes decisions about the land, applies for credit, the number of plots and perception of climate change are variables that significantly affect the decision to develop adaptation strategies to climate change. This document can provide information for future researchers and adequately guide policy recommendations regarding climate change and its effects on small rural farmers.

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Rainfall, Mothers' Time Use, and Child Nutrition: Evidence from Rural Uganda

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I. Introduction

Care provision is a key component of women's time use with implications for the health and wellbeing of children. In rural areas of developing countries, shifting labor demands resulting from weather shocks may imply that women have less time for care provision, potentially affecting their children's nutrition [1]. Nonetheless, a broad literature focusing on the indirect impacts of climate change on child nutrition has yet to explore the mechanisms whereby this occurs, and whether mothers' time use is one of these mechanisms [2].

I offer a more comprehensive approach to rural female time use and its relationship with child nutrition, in the specific context of rainfall variability. Specifically, I test the relationship between rainfall variability (and drought occurrence) and mothers' time use in the short-run, distinguishing their own farm work from off-farm agricultural work, domestic activities from other household activities, and off-farm non-agricultural market activities. Moreover, I test whether mother's time use is a mechanism explaining the short-run relationship between rainfall variation and child nutrition.

II. DATA AND METHODS

A. *Data*

I use data from the Ugandan National Panel Survey (UNPS) and the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS). The UNPS is a unique dataset that gathers anthropometric measures (for children 6 to 59 months old), extensive information on agricultural activities, and time use in agriculture, labor market, and non-market activities, for a nationally representative sample of rural households, which are heavily dependent on rainfed agriculture and produce mostly food crops. CHIRPS provides high resolution (0.05° x 0.05°, approx. 5 km) data for more than 30 years.

Using the UNPS waves of 2013-2014 and 2015-2016, I define child nutrition as weight-for-age and weight-for-height Z-scores, and mother's time use as the share of weekly time spent on each activity. Moreover, I define rainfall variability as the Standardized Precipitation Index (SPI) or as a drought occurrence. The SPI is the difference between the current rainfall level and the long-term (from January 1981) rainfall level, divided by the standard deviation, aggregated at the parish-level, and taking the survey month as reference month. A drought occurrence is a dummy variable equal to one when the current-month rainfall levels are 1.3 standard deviations or more below the SPI.

B. *Methods*

I use a two-way fixed effects (TWFE) model, with time and household level fixed effects, for two periods, for a balanced panel of 488 children. With this model, I estimate the relationship between rainfall variability (or drought occurrence) and child nutrition, and the relationship between rainfall variability (or drought occurrence) and mothers' time use.

Moreover, to assess whether mothers' time use is a mediating factor in the relationship between rainfall variability (or drought occurrence) and child nutrition in the short run, I use the mediation analysis approach [3]. Specifically, I estimate the average controlled direct effect (ACDE) of rainfall variability on child nutrition demediating the potential impact of the mother's time share in different activities, by performing non-parametric sequential g-estimation. In other words, with this method, I calculate the importance of mothers' time use in explaining the relationship between rainfall variability and child nutrition.

III. RESULTS

TWFE results show that rainfall variability, measured as the SPI, is negatively related to weight-for-height Z-scores, and positively related to the probability of wasting. For instance, one standard deviation from the long-run mean of rainfall decreases weight-for-height by 0.29 standard deviations, and it increases the probability of wasting by 6.5 percentage points.

TWFE results also show that rainfall variability (SPI or drought occurrence) is not related to mothers' time share at their own farm or doing housework. However, a drought occurrence increases mothers' work as laborers (by 2.2 percentage points) and in other household-related activities (by 6.3 percentage points), to the detriment of their work in market activities (-6.4 percentage points).

The mediation analysis shows that the baseline estimates (the relationship between rainfall variability and child nutrition) are the same as the sequential g-estimates that subtract the influence of all mothers' time shares. These results are robust to introducing every activity time share separately and to other definitions of mothers' time use. These results imply that mothers' time use is not a mechanism through which rainfall variability affects child nutrition in the short run, although rainfall variability does change mothers' time allocation.

My interpretation of these results is that mothers' changes in time use do not respond only to a rainfall shock itself, but also have the purpose of maintaining child nutrition levels. These results are in line with previous literature [4] [5] suggesting that even under extreme climate events, parents invest on child nutrition.

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Gendered Effects of Crop Diversification and Climate Shocks on Household Food Security Status in Nigeria

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I. Introduction

Climate shocks represent a major constraint for households' food security status and have varying effects depending on household characteristics [1, 2]. A large proportion of households in Sub-Saharan Africa (SSA) are reliant on agriculture, producing food for home consumption and selling off surplus for income [3]. Hence, a sudden change in rainfall patterns (and temperature) threatens households' food production capacity and security status, disproportionately affecting vulnerable households and individuals. Recent studies suggest crop diversification is important in promoting household food security [4]. However, the crop diversification capability of households or individuals is limited by access to land, inputs, and information. Women in SSA are often characterized as having limited access to these three factors. Hence it is important to understand the nexus between climate shocks, crop diversification, and household food security while exploring the inter-and intra-household gender perspective.

The paper answers the questions – What are the differential impacts of climate shocks on the food security status of households based on the gender of the plot manager? Is crop diversification linked to improved food security status?

II. DATA AND METHODS

A. Data

We combine historical rainfall and temperature datasets with the World Bank Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) for Nigeria. We then use an adapted version of the Crop Diversification Shannon index (WSI) to measure crop diversification. The adopted food security indicators are the Household Dietary Diversity Score (HDDS), the reduced coping strategies (rCSI), and the food per capita expenditures. We focus on plot managers rather than household heads to explore the gender dimension for this study. Nigeria[5, 6].

B. Methods

We use the adapted version of Crop Diversification, the Weighted Shannon index (WSI). We then employed a GMM regression method to answer our research questions and correct for attrition across survey waves using Inverse Probability Weighting (IPW). In addition, we use percentile weight regression to study the heterogeneity of impacts according to a set of other factors, such as land size.

III. RESULTS

Our results show that climate shocks have a negative and significant impact on the food security status of households with men and women plot managers. However, a rise in extreme dryness that is drought is linked to five unit reduction in the number of food groups consumed by households with male plot managers. However, the effect on households with female plot managers is albeit small and not statistically significant. We attribute this to the muting effects of crop diversification as we find that crop diversification is positively linked to food security.

We also find that excess water, that is, flood shock is linked to a large and significant fall in female plot managers' household expenditure on food.

Our results show the need to target policies to encourage crop diversification in households and promote crop diversification components in women empowerment programs.

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Child Brides and Climate Variability

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I. Introduction

Social and cultural norms regarding marital practices in Sub-Saharan Africa perpetuate early age marriage [1]. In particular, Malawi has a relatively high rate of women marrying under the age of 18 relative to its East African counterparts, with no inkling of a decline despite government efforts to restrict the minimum age [2]. Such marriage dynamics perpetuate gender inequality and interfere with a suite of women's future economic, health, and social outcomes. For instance, girls who marry before 18 have a greater likelihood of school dropout and illiteracy, and lower labor force participation and earnings [3]. Disruptions in schooling attendance [4] impede labor market participation through the loss of literacy and transferable skills to industry [5]. Seminal work suggests that early age marriage may be a function of consumption smoothing among liquidity-constrained households [6].

A leading source of income risk in Malawi is the occurrence of droughts; therefore, we investigate the impact of droughts on early age marriage, an adaptation strategy that compromises the well-being of adolescent girls in Malawi. We find that young women exposed to droughts were 5 percentage points more likely to be married by 18 than those living in non-drought areas. Increases in early age marriage coincide with a rise in fertility (3 percentage points) and decline in the completion of primary (2 percentage points) and secondary school (1 percentage point). We show that marriage market conditions play less of a role than the overall motive to insure the origin family during droughts. Social norms around women's inheritance may provide daughters with greater bargaining power in decisions related to reproductive health but not marriage.

II. DATA AND METHODS

A. Data

We use two data sources in the analysis. Marital, education, and fertility outcomes are created from a random sample of 20% from each year of the Malawi Population and Housing Census (2008 and 2018) collected by the National Statistics Office (NSO). Additionally, we assign the status of drought exposure to each municipality using the Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data.

B. Methods

We employ a difference-in-difference strategy that exploits the exogenous, geographical variation and timing of droughts. The identification strategy relies on a comparison of the change in our main outcomes of interest for similarly aged women in affected and non-affected municipalities.

Identification of causal effects relies on two key assumptions. First, that the change in the outcomes of interest would be similar across affected and non-affected municipalities in the absence of the shock (Parallel Trends). Second, that there are no other factors or shocks affecting the age at which women were marrying before and after the drought shocks that could account for the results obtained. Although we cannot directly test for differential pre-trends due to our data limitations, we produced two kinds of exercises to assess such issues and conclude that we can interpret our coefficients as causal impacts.

III. RESULTS

Young women between the ages of 18 and 24 are 5 percentage points more likely to be married by age 18 when exposed to a drought. Early age marital decisions among women exposed to drought coincides with reductions in the completion of primary school (2 percentage points) and secondary school (1 percentage point). They also experience heightened fertility rates (3 percentage points).

To provide insights into the mechanisms through which droughts might influence early age marriage, we examine a number of hypothesis. First, the literature has ascribed the use of early age marriage as a form of consumption smoothing particularly among poor, liquidity-constrained households [7]. The estimated effects show that the magnitudes of the drought effects on early age marriage appear to be 2 percentage points greater in poor municipalities relative to not poor municipalities. In addition, the drought effects are primarily concentrated among the group of women who face limited access to formal credit institutions.

Following earlier work [8], we observe that women exposed to droughts and living in areas where grooms are in limited supply (low sex ratio) face greater rates of early age marriage. We lastly consider the role of kinship type, focusing on whether norms around inheritance in matrilineal systems reduce the incentives for households to marry their daughters prematurely due to differential investments in daughters or elevated agency over marital arrangements. We find that there are no differences in early age marital rates among affected women by kinship type (matrilineal vs. patrilineal). This suggests that women in matrilineal systems may not have greater bargaining power in their marital decisions. Yet, they may bear greater agency in their reproductive health decisions conditional on being married, as they have fewer children. In sum, we show that marriage market conditions play less of a role than the overall motive to insure the origin family during droughts.

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Gender gaps in the adoption of climate-smart agricultural practices in developing countries

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I. Introduction

Climate-smart agriculture (CSA) comprises a range of practices that work to sustainably increase agricultural productivity and incomes, build resilience and adapt agriculture to climate change, and reduce greenhouse emissions [1]. As such, CSA is a critical approach to addressing the pressing issues of climate change and food insecurity in developing countries and being able to meet the Sustainable Development Goals. Understanding the processes of adoption of CSA practices is hence an important task, and forms the motivation of this study. In the paper, we first carefully document the gender differences in CSA adoption across a wide range of diverse practices. Second, we offer insights into the extent to which the gender differences in adoption of CSA practices between men and women can be explained by either differences in observed characteristics of the two groups, or differences in the effects of these characteristics on the adoption of CSA practices.

II. DATA AND METHODS

A. Data

This study uses data from the Climate Change, Agriculture and Food Security (CCAFS) Gender and Climate Survey. The data was collected in early 2013 as part of the Consultative Group for International Agricultural Research (CGIAR) project on Increasing Women's Resilience to Confront Climate Change in four selected CCAFS baseline sites in Kenya, Senegal, and Uganda. The sites are each 10x10km blocks and each site covers a sample of 200 households which are engaged in crop and other agricultural activities. Within each household, multiple members were interviewed leading to a sample of 1,616 respondents, including 731 male and 885 female respondents. The data includes detailed gender-disaggregated information on issues relating to climate change resilience amongst both men and women farmers, providing valuable insights on how men and women perceive and adopt to climate change [2]. The key dependent variables of interest in this study relate to 20 different types of CSA practices.

B. Methods

To examine the gender gap in the adoption of CSA practices, we estimate a probit model of the probability of adopting a given CSA practice with gender as a key variable of interest including a range of covariates and fixed effects. Next, we perform an overall and detailed nonlinear decomposition following the procedure proposed by [3] to investigate the factors that account for the gender differential in the adoption of CSA practices. The high-outcome group is determined automatically in the model and used as a comparison group while the low-outcome group is used as the reference group.

III. RESULTS

The findings of this study reveal that women tend to have a higher likelihood of adopting most of the CSA practices compared to their male counterparts. Interestingly, women tend to have a higher probability of adopting less risky and lower return traditional CSA practices such as water harvest while men have a higher likelihood of adopting high-risk and high-return modern farm technologies including fertilizer and improved high-yielding varieties.

The results from the detailed decomposition of the explained part of the gender gap shows that household income, plot size, competition with neighbors and access to weather forecasts and post-harvest handling are among the most important factors that explain the gender differential in CSA adoptions. Moreover, behavioural differences between women and men explain significant share of the gender gap in the adoption of CSA practices. The results are robust to a suite of sensitivity checks including omitted variable bias and bound tests.

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Gender, Women's Rights, Environment and Climate Change in Rwanda

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I. Introduction

Unpredictable and severe seasonal variations and natural disasters, in particular floods, erosions, and droughts, are aggravating underlying gender inequalities between men and women, increasing incidences of sexual and gender-based violence (SGBV) and are enhancing socio-economic vulnerabilities for women and girls in Rwanda.

The Kvinna till Kvinna Foundation commissioned this study to provide a critical analysis of the intersection of gender, women's rights and the environmental & climate change (ECC) in Rwanda. The study focuses on the intersections with SGBV, sexual reproductive health and rights (SRHR), women's economic empowerment and participation. This study is both inward facing for Kvinna till Kvinna and its partner organisations, as well as externally relevant for other civil society, government, and private sector actors in Rwanda. This study is the first of its nature in Rwanda and its findings are exploratory, informative, and action-oriented in order to inform programme design and advocacy.

II. DATA AND METHODS

A. Data

The study integrates both primary and secondary data. Primary data from Kvinna till Kvinna partner organisations was collected using a guided self-assessment tool while primary data from rights holder was gathered using semi-structured questionnaire and focus group discussions. Secondary data collection was conducted through intensive desk review of existing reports from global, African continent and Rwandan country levels.

B. Methods

The study findings were gathered from September to November 2021 using both quantitative and qualitative methods. Primary data was gathered from guided self-assessments with staff from eleven Kvinna till Kvinna partner organisations, semi-structured interviews with 320 respondents purposively selected from sampled ten districts in Rwanda as well as 1 female-only Focus Group in each district. Key informant interviews were conducted, with 22 at district level and 12 at national level, primarily Government stakeholders.

III. RESULTS

Across all ten districts of the study, 82% of respondents agreed that women compared to men, are more affected by climate change. The majority of respondents (91%) strongly agreed or agreed that limited livelihoods opportunities make it harder for women to adapt to climate change which also reduces their resilience. For example, women in Rwanda comprise 86% of the agricultural sector and the majority are small holder farmers. When small-scale agriculture become untenable, women face unrealistic expectations to generate income and enough food to feed the family, women become more dependent on men, their unpaid care work burden increases and climate change puts women and girls at greater risk of SGBV.

Across all ten districts, the study found a strong linkage between effects of climate change, community, family conflicts and GBV. Respondent and key informants pointed to increased pressure on natural resources and reduced livelihoods as drivers of conflict, particularly succession and inheritance conflicts. At household level, when this is coupled with existing power imbalances and harmful gender norms, it has led to an increase in physical, sexual, emotional and economic violence against women and girls. Girls are being forced to drop out of school and either forced into early marriage or engage in sex in exchange for money. The study also draws clear linkages between SRHR and climate change. Women reported using family planning methods in a desire for smaller families, fearing that the effects of climate change would constrain their capacity to support larger families. For some, this was not supported by their husbands and lead domestic violence. Some women reported a rise in sexually transmitted infections due to migration of men, as a result of ECC impacts, to and from villages and urban centres. Girls and women with disabilities are particularly at risk when it comes to climate crisis, with limited tailored informational material, and enhanced vulnerability when they must rely on others for evacuation and support.

The study further Rwanda's climate strategies and financing to go beyond gender mainstreaming and be intentional about addressing women and girls' unique needs and make clear guarantees for their participation in decision-making, planning and monitoring processes. However, amongst women who participated in the focus group discussions, they reported feeling like their needs were not visible and they generally did not feel that they were engaged in district or local planning and decision-making processes around ECC.

The findings in this study have critically revealed the gendered impact of climate change on women and girls in Rwanda with a level of specificity that is required to take informed and meaningful action. Recommendations presented in the study speak primarily to national level actors in Government, donors and civil society. The study also reveals an urgent need for gender-just and holistic interventions to be included in climate financing.

Gender and Climate Impacts of the C-Quest Capital Cookstove, Jet-Flame, and Solar Home Kit Program

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I. Introduction

Today biomass fuels remain a primary source of energy for cooking by 2.5 billion people each day (IEA, 2017). The time, drudgery, health, and climate impacts of this traditional practice are significant at the global scale and particularly harmful to women and children. Small particulate matter (PM) in the smoke can penetrate deeply into human lungs, causing asthma, COPD, and lung cancer; while also dispersing throughout the atmosphere, where the dark particles composed of black carbon absorb solar radiation and contribute to the greenhouse effect. As a result, traditional cooking is associated with 1.6 million premature deaths each year – the 2nd leading cause of death for women globally (Stanaway et al., 2018) – as well as 1.9-2.3% of global anthropogenic climate change (Masera et al., 2015).

To mitigate these effects, researchers at Aprovecho Research Center in collaboration with Global Health Labs, Inc. have developed the Jet-Flame accessory for cooking fires (www.Jet-Flame.com). This device contains a small electrically-powered fan to inject high momentum jets of primary air up into the cooking fire, which increases mixing and gas velocity to potentially reduce emissions, increase heat transfer efficiency, and improve cooking time, thereby helping to address sustainable development goals for improved health, gender equity, and climate action. When paired with a rocket cookstove and solar home power kit including Jet-Flame, 20W solar panel, battery banks, and LED light, a range of improved energy services are provided in a household.

This suite of technologies is currently under development and undergoing preliminary field tests with partner C-Quest Capital (CQC) in Malawi. As a social impact-investment enterprise, CQC's mission is to transform the lives of the world's most underserved communities by providing access to sustainable energy services and clean energy technologies that reduce greenhouse gas emissions and improve the health and well-being of those most impacted by climate change.

II. DATA AND METHODS

A. Data

An integrated suite of sensors developed and manufactured by Oregon State University and Climate Solutions Consulting was used to monitor technology usage and air quality in the households, including fuel and stove usage, $PM_{2.5}$ concentration and exposure, and battery power consumption. Efficiency and emission factor measurements were taken separately in a laboratory setting. Extensive household surveys were also conducted.

B. Methods

The potential impact of this intervention kit relative to the baseline was monitored using a suite of sensors in three peri-urban villages near Lilongwe, Malawi in 40 households across four study phases: baseline, stove only, stove plus Jet-Flame kit, and double-stove/double-Jet-Flame.

III. RESULTS

Results from the household study revealed the median cooking time across all households was reduced by 29% upon introduction of the Jet-Flame, a significant time savings likely appreciated by cooks. Households using the Jet-Flame more than 80% of cooking time showed a 52% reduction in kitchen particulate matter concentrations relative to the rocket stove alone, and a 64% reduction relative to the baseline, indicating improvements in air quality in these enclosed kitchens.

Solar-charged battery power consumption data revealed the cell phone charging and Jet-Flame were each used an average of about 1.5-2 hours per day, and the LED lights for about 8 hours per day. The daily power consumed by the Jet-Flames (200 mAh) was only about 10% of the power consumed by the lights and phone chargers (1000 mAh each), suggesting a small solar home system can address electricity needs for the Jet-Flame with plenty of power left over for other highly desired applications.

The laboratory estimates of carbon reductions earned by implementing the stove and Jet-Flame kit, including fuel savings and reductions in black carbon fraction from 38 to 19%, indicated a reduction in 6.58 tons of CO_{2e} per stove year from baseline when using the CQC stove and Jet-Flame together and including measured black and organic carbon paired with relevant default values. With the cookstove plus Jet-Flame and solar home kit program, carbon financing can potentially be applied to subsidize cleaner and more sustainable energy services for cooking, heating, lighting, and communication simultaneously via solar home electrification with the suite of technologies evaluated here. Time savings and air quality improvements appear to offer additional opportunities through results-based financing to enable large-scale distribution of the Jet-Flame kit to rural households.

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The Economic Impacts of Climate Change on Women in South Africa

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I. Introduction

In developing countries climate change impacts women more than men [1]–[3] and creates by this problems for gender equity and economic growth. Women have smaller resilience capacities to cope with climate change impacts because of unequal access to productive resources such as land or other assets [2], [4] and women work in the climate sensitive sectors (e.g. agriculture, tourism) with significant gender gaps in salary [5]–[7]. Women are responsible for domestic work, which reduces the time they have available for economic opportunities [8], [9]. Climate change impacts increase additionally the time requirements for women's domestic work and widens the gaps between paid and unpaid work.

At the same time, female labor force in the climate sensitive sectors is important for domestic supply and economic growth [10]–[12]. Moreover, as responsible for family nutrition, health and childcare and education, women are retaining current and future labour forces. Thus, women are essential for the economic development. Climate change impacts are expected to worsen gender inequalities. Understanding the economic and social impacts on women within the economic nexus is the base for designing counteracting policies to mitigate climate change impacts on women [1], [3], [4], [13].

This study analyses the impacts of climate change on the South African economy with a gender lens. South Africa is an interesting case study as women play a key role in the economy but face gender inequalities on the paid and unpaid market, while the country is exposed to climate change impacts [14], [15].

II. DATA AND METHODS

A. Data (Heading 2)

As data base for a Computable General Equilibrium (CGE) model we use the 2015 Social Accounting Matrix (SAM) by [16]. We gender the labor market and households by using the National Income Distribution Survey (NIDS) 2015 [17] and the Live Condition Survey (LCS) 2014-2015 [18]. To operationalise the CGE model we use the time use survey, income elasticity from [19] and trade elasticities from [20], and gender elasticities from [21] and [22]. We derive the scenario assumptions from selected studies: [23]–[33]. As database for the micro simulation and distributive analysis we use the LCS 2014-2015.

B. Methods

We specify a dynamic CGE model based on PEP 1-t from [34], to represent 10 economic activities,19 commodities and gendered skilled and unskilled labour. We dissagregate households according to gender and income decile. Drawing on the work of [21], [22], [35], we consider an endogenous labour supply that integrates a gender dimension and a time constraint that depends on the time households devote to their market and nonmarket activities (i.e., home production). To provide insights on the distributional impacts we link the CGE model in a top down non behavioural approach [36] (by transferring changes of households' income and prices from the CGE model to the micro-data. We measure the impact on poverty by analysing the Foster-Greer-Thorbecke (FGT) indexes by [37].

III. RESULTS

We simulate the impact of climate change as combination of multiple economic shocks via different channels, i.e., the decrease in agricultural productivity, increase in agricultural prices, decrease in water supply and decrease in international tourism demand. We define the magnitudes to represent a scenario for which the impacts are small to moderate (i.e., the Mild Scenario) and another for which the impacts are large (i.e. the Severe Scenario).

As expected, the full economy is negatively affected by the impacts of climate change. Production is decreasing in most of the sectors, leading to a drop in real GDP by -1.9% in the Mild and -2.3% in the Severe Scenario in 2050. The agricultural sector reduces its intermediate consumption, impacting other sectors in the economy. At the same time, the increase in world export prices of agricultural commodities have a positive impact on the sector. Reduced water supply creates an increase in water price, and reduced tourism demand negatively impacts female labour highly represented in this sector. The microsimulation and the poverty analysis show that female headed household are poorer than male headed households, with one and a half to two times higher poverty indexes for female than male headed households. A regional analysis at provincial scale indicates that the impacts on household poverty are regional different.

The presented results show that climate change impacts women stronger than men and confirm the need for pro-gender and pro-poor policies to support the adaptative capacities for individual and families.

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Impact of Exposure to Hot Temperatures In-Utero on Child Health

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I. Introduction

Increasing temperatures pose a deadly threat to human health under climate change. As this could have an indelible impact on our way of life, there has been a growing interest in economics to study the effects of direct exposure to extreme heat on a number of outcomes, including mortality [2], worker productivity [1] and cognitive performance [4].

However, less is understood about the perils of indirect exposure to heat stress on health and quality of life. This paper studies the causal impact of heat experienced by a pregnant mother on the health outcomes of her child, specifically their height-for-age and the probability of stunted growth – i.e. to have sufficiently low height-for-age – up to five years after birth. I study this question in Bangladesh, which is among the countries most vulnerable to climate change and focus on height-for-age of children under five as it is a signal of long-term malnutrition and is therefore likely to capture any effects of elevated temperatures during the pregnancy.

Furthermore, height-for-age in early childhood is known to be a determinant of long-term well-being. For example, many studies have documented the positive relationship between stunted growth in early childhood and poor cognitive performance, low adult wages and poverty [5]. To make matters worse, catch-up growth in height is unlikely after a child's second birthday [8] giving parents only a small window to act and making height-for-age a valuable measure of child's health in impoverished countries.

This study has important implications for policymakers in the wake of changing global temperatures under climate change, particularly in resource-constrained countries. If children born in unusually hot years have a greater probability of being stunted, it could disadvantage them for life, unless individuals and policy makers find sustainable ways to adapt.

II. DATA AND METHODS

A. Data

I use two sources of data. For household and child-level data, I use the Bangladesh Integrated Household Survey (BIHS), which is nationally-representative survey of rural Bangladesh conducted by International Food Policy Research Institute (IFPRI) in 2011/12, 2015, 2018/19 covering around 6,500 households. From these data, I get a sample of 5,837 children for whom I have detailed information on their anthropometry, their birthdate and other household characteristics.

I merge this child-level dataset with data on daily temperature and precipitation from ERA5 [6]. The ERA5, a type of reanalysis data, has information on weather variables over a 31km grid, and I compute the area-weighted average daily temperature and precipitation for all of Bangladesh's 64 districts from 1980 to 2020.

Unlike other studies on the effects of in-utero heat exposure, I distinguish between the effects of relatively short-lived "spikes" in temperature (i.e., the number of heat-wave days) and more prolonged exposure to elevated ambient temperatures during the pregnancy (i.e., average temperatures during the pregnancy). I also compute these variables for each trimester.

B. Methods

The identification strategy relies on exogenous differences in a pregnant woman's environment. I exploit variation in temperature experienced by cohorts of pregnant mothers who give birth in the same district and month but in different calendar years. The identifying assumption is that within a district-month cell and controlling for time-varying differences in the outcome variables that are common in all parts of the country, exposure to higher temperatures is "as good as random".

More explicitly, the outcome is the height-for-age z-score of a child under the age of five, and a binary variable for whether a child is stunted based on WHO definitions. The treatment variable is one of the two definitions of heat exposure defined earlier. I control for rainfall during the pregnancy as it is correlated with temperature. The weather variables should be exogenous given district-month and year fixed effects. I also control for child and household-level characteristics.

III. RESULTS

The results show that short-lived spikes in temperature during the pregnancy – the number of heatwave days – do not have a statistically significant impact on the health of children in early years of life. However, more prolonged exposure to hot temperatures – the average temperature during the gestation period – significantly reduced the height-for-age z-score. On average, children who were exposed to a one standard deviation increase in average temperature (~1.4°C) before birth had a height-for-age that was 0.186 standard deviations below what it would have been had they not been exposed to this increase in temperature. Their probability of stunting also increased by 0.069.

This finding contrasts with other studies in the US that find statistically significant effects of one additional hot day during the pregnancy on child or adult outcomes, including birth weight [3] and long-term adult earnings [7].

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Drought Impacts on Crops Sector and Adaptation Options in Burkina Faso: A Gender-Focused Computable General Equilibrium Analysis

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I. Introduction

Burkina Faso has experienced recurrent droughts since the 1970s. Between 1969 and 2020, drought affected more than 15 million people in Burkina Faso. In 2011, for example, the drought resulted in the loss of half a million tons of grain and caused a food shortage that affected 2.8 million people [1]. In addition, estimates predict reductions in rainfall and increases in temperature by 2050 [1]. Such shocks would increase drought events and have adverse effects on agricultural activities.

Through the effects on the agricultural sector, droughts have an impact on gender disparities in the different economic sectors. The economic and social situation in Burkina Faso is also generally poor, including gender inequality. Approximately 41.4% of the population still lives below the poverty line, and the average per capita income is $1,335 for women versus $2,077 for men [2]. In addition, income poverty affects relatively more women (43.7%) than men (40.6%) [3]. Between 2014 and 2016, 20.7% of the population of Burkina Faso was food insecure and rural areas are the most affected by extreme poverty, with 94.4% suffering from hunger [4].

II. DATA AND METHODS

A. Data

This study uses 2018 Burkina Faso Social Accounting Matrix (SAM) and 2018 Households Living condition survey data for drought impact analysis on agricultural production, food security and poverty in gender perspective.

B. Methods

This study use a dynamic CGE model based on the PEP 1-t model of [5]. To take into account the gender dimension of the Burkina Faso economy, the different labor input categories are subdivided by gender.

As the CGE model does not allow for direct poverty analysis, the CGE model is combined with a micro model. Poverty is measured using the traditional FGT indicators of [6]. To do so, the micro model is linked with the CGE model in a top-down approach. To simulate drought effects, we calculates the variation in crop yields over the last ten years. We then define three types of shocks, a mild shock, a medium shock and a severe shock, according to the amplitude of the variation in crop yields. According to a World Bank study on the climate-smart investment plan for Burkina Faso, investing UDS 55 million in integrated soil management (ISM) or in water resources and irrigation capacity development and or in new improved seeds lead to increase in agricultural yields by 29%, 56% and 39% respectively [7]. These information's are used to simulate the adaptation scenario.

III. RESULTS

The results show that drought intensity results in a deterioration of macroeconomic and household welfare indicators. It is found that an intense (severe) drought results in an average annual reduction in GDP of 3.0% in short term and 3.3% in long run relative to the baseline. However, moderate and mild drought events lead to a reduction in GDP of 2.1% in short run, 2.4% in long run and 1.3% in short term and 1.4% in long term respectively.

The effect on food security is particularly notable. Due to the decline in agricultural production, per capita food availability decreases by 10.4%, 7.3%, and 4.6% in the short term and by 11.1%, 7.5%, and 4.0% in the long term depending on the intensity of the drought for rural households. Similarly, the per capita supply of foodstuffs decreases by 8.8%, 5.9% and 3.3% in the short term and by 9.2%, 5.8% and 2.6% in the long term for urban households and according to the nature of the drought. The different drought scenarios increase poverty rate.

Given that the objective of the selected adaptation measures is to improve the productivity of the agricultural sector, we will first determine the productivity threshold of the overall productivity of the agricultural sector that allows to neutralize the impact of a severe drought. Indeed, the simulations show that an increase in the global productivity of factors of 18.77% would allow to neutralize the effect of an intense drought. In the long term, all the selected adaptation options can neutralise the effects of drought in the crop sector.

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