



Rainy Day Funds? How Men and Women Adapt to Heavy Rainfall Shocks and the Role of Cash Transfers in Mali

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Melissa Hidrobo, Valerie Mueller, Shalini Roy, Cheikh Modou Noreyni Fall,
Christophe Lavaysse, Anna Belli

Motivation

- Climate change is expected to make weather shocks more frequent, extreme, and unpredictable.
- Extreme weather events disproportionately affect the poor and women in LMIC
 - In an average year, poor households lose 5 percent of their total incomes due to heat stress, and 4.4 percent due to floods, relative to non-poor households (FAO 2024)
 - Annual income gap of 8 percent due to heat stress, and of 3 percent due to floods, compared with male-headed households (FAO 2024)
- Need policies and programs that can improve poor household's and women's adaptive capacities

Motivation

- Social protection is a promising at-scale strategy
 - By providing households with resources, cash transfer (CT) programs can improve poor households' adaptive responses to climate change
 - CT programs (if well designed) can also address constraints women face in adapting to climate change
- Growing evidence that cash transfer programs
 - protects poor households' consumption during adverse weather shocks (Hou 2010; Asfaw et al. 2017; Knippenberg and Hoddinott 2017; Christian et al. 2019; Lawlor et al. 2019; Pople et al. 2021; Premand and Stoeffler 2022).
 - allows them to diversify their incomes (Correa et al. 2023; Macours et al. 2022)
 - adopt climate smart technologies (Aker and Jack 2023; Scognamillo and Sitko 2021; Sitko et al. 2021)
- However, less is known about how CT programs differentially effect men and women's ability to adapt to climate change.

Research questions

1. How do poor, rural households in Mali respond to heavy rainfall shocks, paying special attention to differences in the individual and joint responses of men and women?
 2. How are these responses changed by a CT program?
- Address these questions by combining weather data with household data from an impact evaluation of a cash transfer program

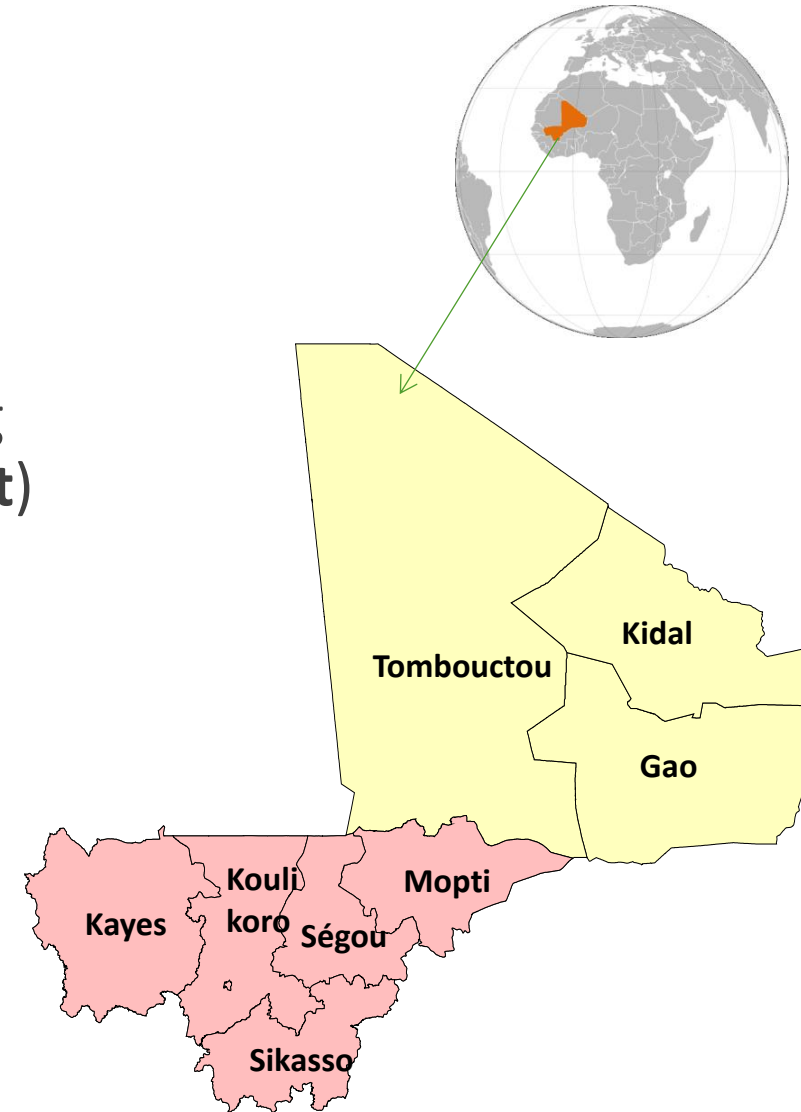


Jigisémèjiri

- Aims to reduce poverty and improve human capital accumulation through targeted cash transfers, accompanying measures.
- 2 components
 1. **Cash transfers (CT):** unconditional transfers of 10,000 FCFA/month (or USD 17/month) paid every trimester
 - 62,000 poor households across 6 regions of Mali and Bamako
 2. **Accompanying Measures (AM):** trainings 1-2x month on infant and young child feeding, prenatal and postnatal care, vaccinations, WASH, respiratory infections, child rights, income generating activities
 - Open to everyone in the commune
 - Not mandatory

Study design

- **Cluster randomized control trial:** 96 communes across 5 regions of Mali randomly assigned to either start receiving the CT and AM components at the end of 2014 (**treatment**) or at the end of 2016 (**control**).
- **Data**
 - **Baseline** (2014): before program began
 - **Midline** (2016): treatment had received CT and AM for 1-2 years, control had not yet received the program



Mali climate context

- Mali is prone to multiple climate shocks including droughts, floods, heatwaves and sand-storms (Climate Center, 2021).
- Increasing intensity of rainfall episodes and longer dry spells in between (Climate Center, 2021), both of which have negative impacts on crop yields (Wood 2021)
- The geographic location and years relevant to this study are characterized by heavy rainfall leading to localized flash floods in 2016 in 4 of our 5 study areas(Koulikoro, Mopti, Segou, and Sikasso) (EM-DAT, 2023).

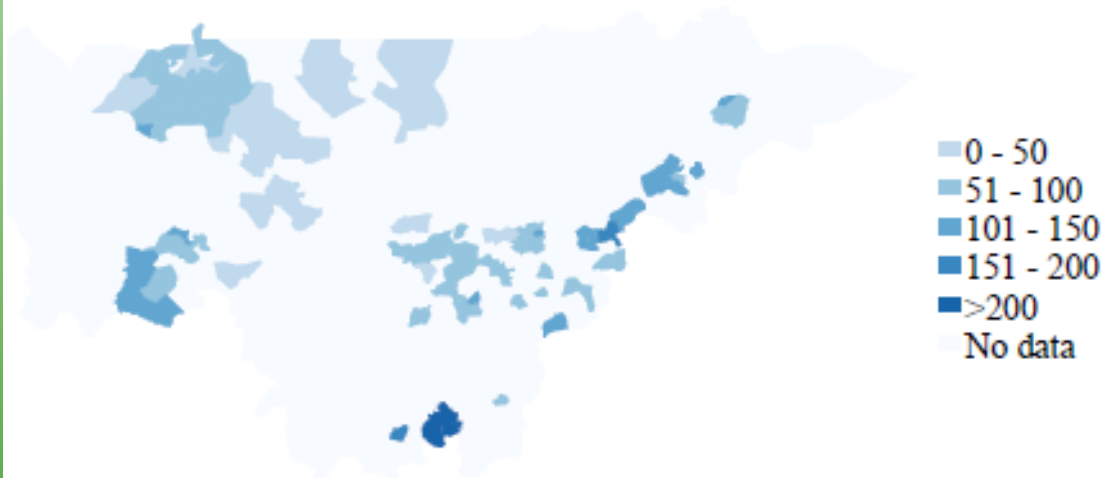


Photo: The Daily Messenger, August 24, 2024

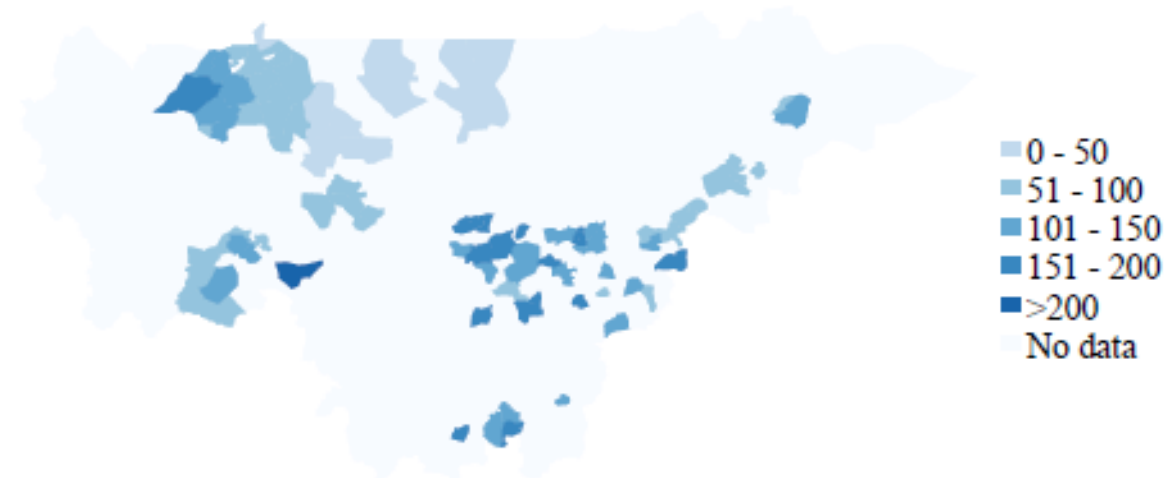
Climate data

- CHIRPS and CHIRTS daily data (5km by 5km resolution)
- Develop indicators of wet and dry spells (defined as episodes when precipitation is abnormally low or high) over the rainy season (June-October) (Fall et al., 2021a,b)
- We analyze how wet and dry spells, temperature, and onset of rainy season correlate with household consumption and food insecurity to determine main specification
- 4 main indicators defined over the rainy season
 - **Dry:** number of episodes without rainfall that last 4 or more days, standardized
 - **Wet:** total amount of precipitation (mm) received from days when rainfall episodes exceeds the 95th percentile of the historical distribution, standardized
 - **Extreme heat:** Number of days that have a maximum temperature that exceeds 40°C
 - **Early onset of rainy season:** binary indicator when onset falls within the 25th percentile of the historical distribution

(d): Precipitation from One-Day Wet Spells, 2014



(e): Precipitation from One-Day Wet Spells, 2016



Estimation equation

$$Y_{hjt} = \beta_0 + \beta_c C_{jt} + \beta_{CW} C_{jt} X Wet_{jt} + \beta_{CD} C_{jt} X Dry_{jt} + \beta_W Wet_{jt} + \beta_D Dry_{jt} + \beta_z Z_{jt} + \beta_x X_{hj} + \beta_t + \varepsilon_{hjt}$$

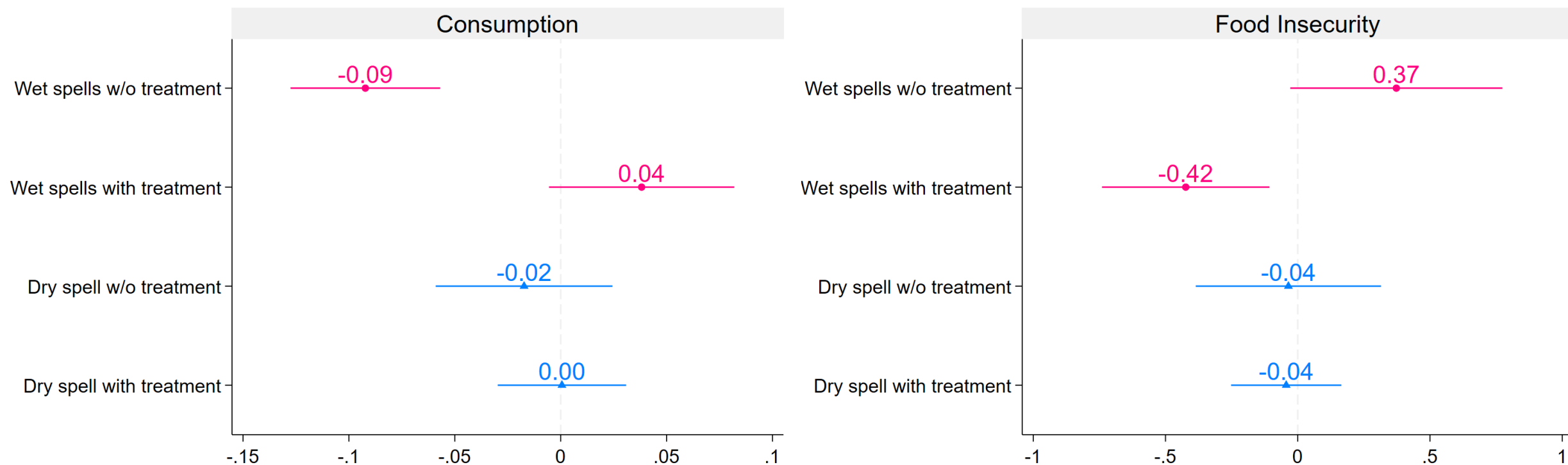
- C_{jt} =indicator if randomized to the cash treatment group
- Wet_{jt} = total amount of precipitation received from days when rainfall episodes exceeds the 95th percentile of the historical distribution, standardized
- Dry_{jt} = number of episodes without rainfall that last 4 or more days, standardized
- Z_{jt} = other climate variables
- X_{hj} = other baseline household variables and region indicators

Estimation equation

$$Y_{hjt} = \beta_0 + \beta_c C_{jt} + \beta_{cW} C_{jt} X_{Wet_{jt}} + \beta_{cD} C_{jt} X_{Dry_{jt}} + \beta_W Wet_{jt} + \beta_D Dry_{jt} + \beta_Z Z_{jt} + \beta_x X_{hj} + \beta_t + \varepsilon_{hjt}$$

- β_W the impact of a 1-SD increase in wet conditions for households in the control communities
- β_{cW} the differential effect of the wet indicator for households in the treatment communities.

Impact of Climate Hazards and Cash Transfer on Consumption and Household Food Insecurity



Strategies to smooth consumption – financial instruments

	Any savings			Any credit			Any tontine		
	(1) Total	(2) Men	(3) Women	(4) Total	(5) Men	(6) Women	(7) Total	(8) Men	(9) Women
β_C	0.238** (0.100) [0.051]	0.215** (0.102) [0.105]	0.181 (0.137) [0.382]	-0.094 (0.126) [0.456]	-0.061 (0.126) [0.627]	-0.154 (0.172) [0.382]	-0.074 (0.098) [0.456]	0.056 (0.106) [0.627]	-0.087 (0.100) [0.382]
β_{CW}	-0.228*** (0.084) [0.010]	-0.204** (0.087) [0.029]	-0.274** (0.119) [0.032]	0.120 (0.098) [0.219]	0.145 (0.096) [0.131]	0.037 (0.116) [0.748]	-0.219*** (0.069) [0.005]	-0.248*** (0.065) [0.001]	-0.215*** (0.073) [0.010]
β_W	-0.046 (0.051) [0.369]	-0.041 (0.049) [0.405]	-0.003 (0.080) [0.971]	-0.063 (0.059) [0.369]	-0.076 (0.057) [0.271]	-0.019 (0.080) [0.971]	0.050 (0.042) [0.369]	0.120** (0.050) [0.047]	0.044 (0.044) [0.964]
N	5072	5072	5072	5072	5072	5072	5072	5072	5072
H1: $\beta_C + \beta_{CW} = 0$	0.923	0.924	0.592	0.875	0.628	0.515	0.010	0.093	0.011
H2: $\beta_{CW} + \beta_W = 0$	0.000	0.001	0.001	0.467	0.397	0.804	0.001	0.032	0.002
DV Control Mean 2016	0.073	0.056	0.020	0.147	0.125	0.036	0.271	0.072	0.247

- Wet spells have a non- significant impact on financial instruments in control communities

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- Wet spells have a non-significant impact on financial instruments in control communities,
- The impact of wet spells in treatment communities is significantly different
- In treatment communities a 1 SD increase in precipitation leads to a -0.24- -0.28 pp decrease in saving

Strategies to smooth consumption – Value of Assets

	(1) Total	(2) Men	(3) Women	(4) Both
β_C	-0.044 (0.112)	-0.065 (0.119)	0.093 (0.122)	0.009 (0.179)
β_{CW}	0.096 (0.078)	0.082 (0.088)	0.039 (0.080)	0.368*** (0.127)
β_W	-0.036 (0.051)	-0.029 (0.056)	-0.006 (0.051)	-0.161** (0.073)
N	5072	5072	5072	5072
H1: $\beta_C + \beta_{CW} = 0$	0.645	0.887	0.365	0.138
H2: $\beta_{CW} + \beta_W = 0$	0.263	0.413	0.548	0.024
DV Control Mean 2016	777.513	638.777	80.916	57.820

- Wet spells decrease the value of joint assets in control communities. This is primarily in livestock, transport and farming

Strategies to smooth consumption – Assets

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- Wet spells decrease the value of joint assets in control communities. This is primarily in livestock, transport and farming
- The cash transfer mitigates this impact and leads to an expansion of joint assets primarily in livestock and farming

Consumption smoothing strategies - labor

	Farm work		Livestock work		Wage work		Self-employed work		Domestic work	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
β_C	0.015 (0.030) [0.757]	0.039 (0.036) [0.888]	0.040 (0.032) [0.543]	0.004 (0.028) [0.888]	-0.003 (0.017) [0.882]	0.004 (0.012) [0.888]	-0.017 (0.022) [0.715]	0.019 (0.024) [0.888]	0.036 (0.028) [0.543]	-0.003 (0.011) [0.888]
β_{CW}	0.002 (0.013) [0.900]	-0.020 (0.020) [0.419]	0.039* (0.023) [0.228]	0.020 (0.020) [0.419]	0.011 (0.013) [0.728]	0.012 (0.011) [0.419]	-0.002 (0.016) [0.900]	0.002 (0.015) [0.878]	0.043* (0.023) [0.228]	0.016** (0.008) [0.233]
β_W	0.005 (0.008) [0.581]	0.025** (0.011) [0.076]	-0.033*** (0.012) [0.036]	-0.024** (0.011) [0.076]	0.006 (0.005) [0.301]	0.008** (0.004) [0.076]	0.015 (0.009) [0.301]	0.006 (0.011) [0.618]	-0.012 (0.010) [0.301]	0.004 (0.004) [0.391]
N	5072	5072	5072	5072	5072	5072	5072	5072	5072	5072
R ²	0.060	0.063	0.055	0.043	0.023	0.031	0.015	0.027	0.063	0.027
H1: $\beta_C + \beta_{CW} = 0$	0.510	0.652	0.064	0.539	0.730	0.440	0.516	0.477	0.042	0.293
H2: $\beta_{CW} + \beta_W = 0$	0.452	0.720	0.757	0.820	0.188	0.076	0.322	0.397	0.150	0.003
DV Control Mean 2016	0.867	0.769	0.433	0.291	0.093	0.052	0.235	0.170	0.184	0.897

- Wet spells increases the share of women in farming and wage work, and decreases the share of men and women in livestock in control communities

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- Wet spells increases the share of women in farming and wage work, and decreases the share of men and women in livestock in control communities
- The cash transfer mitigates the negative impact in livestock and differentially increases the share of men and women in domestic work

Conclusion

- Cash transfers enable households to smooth their consumption during heavy rains
- Primarily through reductions in savings and tontines, increasing joint livestock and farming assets, and reallocating labor
- No large differences in how cash transfers help men and women adapt in terms of saving and assets, but some differences in how men and women reallocate labor
- We find no other impacts of intense rain or the mitigating of the cash transfer on measures of women's wellbeing (stress, BMI, depression).

Thank you!

Impact of Multiple Climate Hazards on household consumption and food insecurity

	Log consumption (1)	Food insecurity (2)
No. of moderate to severe dry spells, STD	-0.086*** (0.033)	-0.038 (0.253)
Prec (mm) from 1-day wet spells (95th pctl), STD	-0.046** (0.020)	0.030 (0.198)
No. of days exceeding 40 degrees Celsius	-0.017* (0.010)	0.194 (0.123)
Early onset of rainy season	-0.026 (0.060)	1.431** (0.686)
N	5072	5072
R ²	0.173	0.018