

**Households' responses to climate change:  
contingent behavior evidence from rural South Africa**

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**ONLINE APPENDIX**

**Appendix A. Multivariate probit model estimates of factors affecting undertaking future livelihood activities a (n = 324 responses)**

	<b>Garden</b>	<b>Livestock</b>	<b>Natural resource harvesting</b>	<b>Casual labor</b>	<b>Small business</b>	<b>Formal employment</b>
<b>Climate variables (X<sub>1</sub>)</b>						
Moderate increase in dry-spells	-1.015*** (0.275)	0.766*** (0.268)	0.520** (0.256)	0.623** (0.265)	0.601** (0.261)	-0.319 (0.293)
Extreme increase in dry-spells	-0.996*** (0.270)	-0.462* (0.258)	0.653** (0.254)	0.571** (0.264)	0.869*** (0.265)	-0.225 (0.276)
Mild increase in wet- spells	0.829*** (0.301)	0.759*** (0.269)	0.389 (0.253)	0.048 (0.259)	0.308 (0.260)	-0.130 (0.272)
Moderate increase in wet-spells	0.058 (0.279)	1.161*** (0.291)	-0.098 (0.262)	0.031 (0.269)	0.064 (0.265)	-0.078 (0.286)
Extreme increase in wet-spells	-1.843*** (0.325)	0.329 (0.271)	0.038 (0.267)	-0.829*** (0.289)	0.268 (0.271)	-0.028 (0.287)
High temperature	0.174 (0.224)	-0.184 (0.220)	0.158 (0.212)	0.138 (0.218)	0.031 (0.217)	-0.060 (0.236)
<b>Capital stocks (X<sub>2</sub>)</b>						
Education	-0.004 (0.023)	-0.027 (0.023)	0.023 (0.021)	0.021 (0.022)	0.031 (0.021)	0.049** (0.023)
Skills	-0.163* (0.095)	0.039 (0.093)	0.065 (0.086)	-0.041 (0.091)	0.151* (0.090)	0.006 (0.094)
Social capital	0.188* (0.104)	0.066 (0.096)	0.116 (0.093)	-0.011 (0.094)	0.162 (0.102)	0.020 (0.095)
Physical capital	0.398* (0.232)	0.360 (0.245)	0.028 (0.211)	-0.192 (0.219)	-0.009 (0.220)	-0.314 (0.239)
Natural capital	-0.035 (0.081)	0.142* (0.076)	-0.082 (0.069)	-0.090 (0.071)	0.097 (0.071)	0.079 (0.075)
<b>Health status (X<sub>3</sub>)</b>						
Long-term ill	-0.069 (0.176)	-0.472*** (0.174)	0.223 (0.161)	0.426** (0.170)	0.113 (0.163)	-0.220 (0.177)
<b>Risk aversion (X<sub>4</sub>)</b>						
Risk	0.108* (0.060)	0.023 (0.058)	0.122** (0.055)	-0.007 (0.057)	-0.013 (0.054)	-0.011 (0.059)
<b>Demographic factors (X<sub>5</sub>)</b>						
Age of the household head	-0.007 (0.008)	0.002 (0.007)	-0.001 (0.007)	-0.008 (0.007)	-0.006 (0.007)	0.009 (0.007)
Gender of the household head	-0.632*** (0.199)	0.114 (0.181)	0.228 (0.173)	0.340** (0.178)	0.413 (0.244)	-0.132 (0.190)
Gender of the survey respondent	0.120 (0.267)	-0.427 (0.269)	0.140 (0.239)	0.173 (0.254)	0.365** (0.175)	-0.288 (0.261)
Number of male adults	0.163 (0.111)	0.060 (0.101)	0.036 (0.098)	-0.033 (0.101)	-0.028 (0.097)	-0.209** (0.108)
Number of female adults	-0.185 (0.116)	-0.011 (0.116)	0.133 (0.110)	-0.065 (0.113)	0.156 (0.111)	0.072 (0.117)
Household size	0.033 (0.051)	0.020 (0.051)	-0.056 (0.047)	0.050 (0.050)	-0.077 (0.048)	0.026 (0.052)
<b>Experience (X<sub>6</sub>)</b>						
Currently adopted	0.530*** (0.192)	0.203 (0.244)	0.183 (0.217)	0.990*** (0.219)	0.342 (0.263)	0.509 (0.362)
<b>Village Fixed Effects (X<sub>7</sub>)</b>						
Area 2	0.083 (0.272)	-0.372 (0.253)	-0.169 (0.241)	-0.076 (0.253)	0.219 (0.242)	0.061 (0.250)
Area 3	0.041 (0.191)	-0.058 (0.188)	0.139 (0.176)	-0.137 (0.184)	0.260 (0.179)	-0.526*** (0.184)
Intercept	0.890 (0.683)	-0.176 (0.683)	-1.063 (0.648)	-0.336 (0.660)	-0.725 (0.639)	-0.941 (0.670)
Log likelihood -1092.45 Wald chi2(132) 323.54						
Likelihood ratio test rho=0 cross the six equation chi2(15) = 22.89						

Notes: \*\*\* significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

**Appendix B. Construction of capital stock variables using principle component analysis (PCA)**

Index variables for physical and social capital are derived using principal component analysis (PCA). The physical assets index is derived from 17 physical asset characteristics (see table B1). The PCA generates factor scores for each asset characteristic. The factor scores are computed by assuming a regression method based on uncorrelated rotated factors. The 17 factors are standardized to zero mean and unit variance. Table B1 shows factor scores from factor 1, which is the factor that explained most of the variation in the asset characteristics. Factor 1 is used to generate the physical asset index. The physical asset index is generated by weighting the asset characteristics with the scoring coefficient and adding them up.

**Table B1.** *Descriptive statistics and scoring coefficients for retained factors of the variables included in the PCA model for physical assets (n =155 households)*

<b>Physical Capital Factors</b>	<b>Mean</b>	<b>Std. Dev</b>	<b>Min</b>	<b>Max</b>	<b>Factor 1 Scores</b>
Do you have a kraal?	0.9	0.296	0	1	0.378
Do you have a car?	0.0559	0.23003	0	1	0.365
Do you own a bicycle?	0.0235	0.1518	0	1	-0.104
Do you own a cell?	0.8794	0.32613	0	1	0.514
Do you own a TV?	0.5059	0.5007	0	1	0.82
Do you own a radio?	0.5235	0.50018	0	1	0.397
Do you own a DVD?	0.3441	0.47578	0	1	0.697
Do you own a stove?	0.5912	0.49234	0	1	0.699
Do you own a fridge?	0.4676	0.49969	0	1	0.792
Do you own a plough?	0.1324	0.33937	0	1	-0.327
Do you own a cart?	0.0618	0.24108	0	1	-0.2
Do you own a bed?	0.9824	0.13186	0	1	0.007
Do you own a solar panel?	0.0647	0.24637	0	1	0.035
Do you own a sewing machine?	0.0676	0.62269	0	11	-0.101
Do you own a Jojo tank?	0.2059	0.40494	0	1	-0.13
Do you own a wheelbarrow?	0.2941	0.45632	0	1	0.131
Do you own a generator?	0.2824	0.45081	0	1	0.561

The social capital index is generated using the same procedure as for the physical assets index. The social capital index is derived from 21 variables that measure social capital. Table B2 presents descriptive statistics for the scoring coefficients for retained factors of the variables included in the PCA model for social capital. A summary of the PCA scoring criteria used to generate the physical

and social capital indices is presented in table B3. As mentioned, the indices are based on component one scores, which explain the greatest amount of variation in factors.

**Table B2.** *Descriptive statistics and scoring coefficients for retained factors of the variables included in the PCA model for social capital (n = 155 households)*

<b>Social Capital Factors</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>	<b>Factor 1 Scores</b>
How long have you been established in this village?	4.61	1.522	1	7	-0.129
Does anyone in this household take part in community decision making?	2.37	0.858	1	3	0.135
Is household involvement in community activities less (1), the same (2), more (3) compared to 10 years ago?	1.76	0.97	1	3	0.186
Do you have free access to human rights advice?	0.19	0.389	0	1	0.444
Do you have free access to legal advice?	0.18	0.384	0	1	0.311
Do you have free access to medical advice?	0.62	0.487	0	1	0.409
Do you have free access to veterinary advice?	0.2	0.403	0	1	0.542
Do you have free access to medical advice?	0.22	0.417	0	1	0.569
Do you have free access to building advice?	0.12	0.326	0	1	0.519
Do you have free access to schooling advice?	0.21	0.407	0	1	0.588
Do you have free access to moving/relocating advice?	0.04	0.192	0	1	0.448
Do you have free access to market/business advice?	0.1	0.296	0	1	0.592
Do you have free access to credit/financial advice?	0.17	0.374	0	1	0.494
People around here are willing to help their neighbors.	3.21	0.751	1	4	0.291
This is a close-knit or 'tight' neighborhood where people generally know one another?	3.19	0.914	1	4	0.389
If I had to borrow R50 in an emergency, I could borrow it from a neighbor	3.1	1.036	1	4	0.22
People in this neighborhood generally get along with each other	3.14	0.822	1	4	0.241
People in this neighborhood can be trusted	2.71	0.983	1	4	0.209
If I were sick I could count on my neighbors to shop for groceries for me	3.14	0.787	1	4	0.236
People in this neighborhood share the same beliefs, culture and values	2.94	1.143	-5	4	-0.202

**Table B3.** *Components extracted from principal component analysis and proportion of variation in factors explained by components (n = 155 households)*

<b>Component</b>	<b>Physical capital index</b>			<b>Social capital index</b>		
	<b>Eigen value</b>	<b>Proportion</b>	<b>Cumulative %</b>	<b>Eigen value</b>	<b>Proportion</b>	<b>Cumulative %</b>
1	3.215	17.863	17.863	2.821	14.104	14.104
2	2.078	11.547	29.411	2.318	11.588	25.692
3	1.677	9.314	38.725	2.008	10.04	35.732
4	1.573	8.738	47.463	1.583	7.917	43.648
5	1.33	7.39	54.852	1.42	7.098	50.746
6	1.242	6.9	61.753	1.143	5.714	56.459

### **Appendix C. Risk aversion questions**

Suppose that your family income (cash and in-kind) that you get from your livelihood activities is guaranteed for every year for life. An extension agent comes and gives you an opportunity to adopt a new technology that would change your income. There is a 50-50 chance that this new technology will double your family income and a 50-50 chance that it will cut your family income by a third. Would you adopt this new technology, Yes or No?

If the answer is “no,” please answer the following question (**Gamble 2**):

Suppose the chances were 50-50 that the new technology would double your family income and 50-50 chances that it would cut it by 20 percent. Would you adopt this new technology, Yes or No?

If the answer to the first question is “yes,” please answer the following question (**Gamble 3**):

Suppose the chances were 50-50 that the new technology would double your family income and 50-50 that it would cut it by half. Would you adopt this new technology, Yes or No?

These three questions allow categorization of respondents into four groups.

Respondents who answered “no” to both questions: **very strongly risk averse**

Respondents who answered “yes” to both questions: **weakly risk averse**

Respondents who answered “no” to the first question but “yes” to the second: **strongly risk averse**

Those who answered “yes” to the first question and “no” to the second: **moderately risk averse**

**Appendix D. Random parameters model coefficients (n = 324 responses)**

	<b>Garden</b>	<b>Livestock</b>	<b>Natural resource harvesting</b>	<b>Casual Labor</b>	<b>Small Business</b>	<b>Formal Employment</b>
Moderate increase in dry-spells	-1.032*** (0.315)	0.958*** (0.311)	1.874*** (0.495)	0.611** (0.272)	0.602** (0.268)	-0.348 (0.353)
Extreme increase in dry-spells	-0.974*** (0.320)	-0.597** (0.306)	2.082*** (0.507)	0.642** (0.280)	0.837*** (0.272)	-0.213 (0.325)
Mild increase in wet-spells	0.874** (0.361)	1.056*** (0.319)	1.171** (0.469)	0.040 (0.269)	0.321 (0.265)	-0.110 (0.304)
Moderate increase in wet-spells	0.056 (0.291)	1.537*** (0.351)	-0.301 (0.459)	0.031 (0.281)	0.033 (0.272)	-0.085 (0.328)
Extreme increase in wet- spells	-1.841*** (0.381)	0.475 (0.314)	0.026 (0.473)	-0.803*** (0.301)	0.229 (0.287)	-0.025 (0.295)
High temperature	0.173 (0.263)	-0.270 (0.253)	0.566 (0.382)	0.127 (0.223)	0.023 (0.220)	-0.051 (0.279)
Education	-0.004 (0.030)	-0.030 (0.027)	0.082** (0.037)	0.030 (0.023)	0.108*** (0.039)	0.049 (0.026)
Skills	-0.150 (0.109)	0.066 (0.112)	0.159 (0.153)	-0.023 (0.100)	0.379** (0.166)	0.000 (0.112)
Social capital	0.182 (0.119)	0.085 (0.115)	0.444** (0.180)	-0.023 (0.100)	0.473** (0.190)	0.015 (0.097)
Physical capital	0.373 (0.323)	0.455 (0.290)	0.096 (0.363)	-0.231 (0.226)	-0.439 (0.380)	-0.321 (0.251)
Natural capital	-0.048 (0.102)	0.165** (0.086)	-0.259** (0.124)	-0.121* (0.071)	0.376*** (0.134)	0.083 (0.090)
<b>Health status (X<sub>3</sub>)</b>						
Long-term ill	-0.079 (0.255)	-0.620*** (0.214)	0.717** (0.298)	0.440** (0.179)	0.101 (0.162)	-0.251 (0.197)
<b>Risk aversion (X<sub>4</sub>)</b>						
Risk	0.102 (0.084)	0.027 (0.067)	0.388*** (0.105)	-0.023 (0.059)	-0.003 (0.054)	-0.016 (0.071)
Age of the household head	-0.007 (0.010)	0.009 (0.007)	-0.005 (0.011)	-0.002 (0.006)	-0.010 (0.007)	0.009 (0.008)
Gender of the household head	-0.714*** (0.275)	0.188 (0.213)	0.740** (0.313)	0.399** (0.185)	0.329 (0.175)	-0.138 (0.224)
Gender of the survey respondent	0.097 (0.359)	-0.436 (0.307)	0.306 (0.411)	0.302 (0.264)	1.490*** (0.475)	-0.301 (0.319)
Number of male adults	0.162 (0.149)	0.090 (0.120)	0.112 (0.173)	-0.033 (0.109)	-0.034 (0.098)	-0.207 (0.115)
Number of female adults	-0.187 (0.149)	0.008 (0.135)	0.469** (0.201)	-0.046 (0.112)	0.150 (0.115)	0.092 (0.118)
Household size	0.031 (0.069)	0.022 (0.058)	-0.196** (0.085)	0.046 (0.053)	-0.078 (0.048)	0.019 (0.059)
<b>Experience with an activity (X<sub>6</sub>)</b> Currently adopted	0.617** (0.292)	0.265 (0.288)	0.779** (0.405)	0.962*** (0.237)	0.391 (0.275)	0.565 (0.451)
<b>Village Fixed Effects (X<sub>7</sub>)</b>						
Area 2	0.055 (0.359)	-0.525* (0.297)	-0.482 (0.429)	-0.086 (0.258)	0.201 (0.243)	0.050 (0.306)
Area 3	0.023 (0.258)	-0.111 (0.224)	0.483 (0.314)	-0.179 (0.196)	0.271 (0.183)	-0.541** (0.217)
Intercept	0.891 (0.958)	-0.289 (0.743)	-3.361*** 1.134	-0.861 (0.620)	-0.374 (0.618)	-0.922 (0.657)
Standard deviations of the intercept	0.002 (0.091)	0.934*** (0.113)	3.250*** (0.393)	0.214*** (0.077)	0.022 (0.073)	0.266*** (0.083)
Log likelihood function	-161.703	-183.601	-206.162	-189.219	-199.265	-169.523
AIC	1.1463	1.274	1.412	1.308	1.369	1.194
BIC	1.426	1.552	1.691	1.586	1.648	1.474

Notes: \*\*\* significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.