

Table S1: Multivariate probit estimates of individual management without CRE framework

	Fertilizer	Variety	Manure	Pesticide	Herbicide	Erosion control	Intercropping	Crop rotation
<i>Field characteristics</i>								
Ownership of land (1= owned)	-0.335*	-0.083	0.553***	0.201	-0.194*	-0.193*	0.251*	-0.058
	(0.181)	(0.153)	(0.128)	(0.170)	(0.111)	(0.110)	(0.146)	(0.086)
Field size (log)	0.951***	1.624***	-0.570***	0.317	1.500***	0.137	-0.752***	-0.463***
	(0.236)	(0.280)	(0.183)	(0.249)	(0.180)	(0.184)	(0.262)	(0.151)
Distance from home (log)	0.368***	0.314***	-0.672***	0.080**	-0.003	-0.005	-0.083*	0.192***
	(0.042)	(0.042)	(0.035)	(0.041)	(0.029)	(0.027)	(0.047)	(0.026)
Number of years acquired (log)	-0.103	0.305***	0.064	-0.171	0.076	0.120	-0.397***	-0.210***
	(0.114)	(0.102)	(0.087)	(0.110)	(0.080)	(0.078)	(0.108)	(0.057)
<i>Household characteristics</i>								
Age of head (log)	0.020	0.006	-0.248	0.047	0.018	0.214	-0.467	-0.024
	(0.188)	(0.208)	(0.151)	(0.248)	(0.202)	(0.169)	(0.364)	(0.108)
Gender of head (1 =Male)	-0.108	-0.163	0.098	0.301	-0.334**	-0.048	0.109	-0.024
	(0.176)	(0.182)	(0.134)	(0.226)	(0.167)	(0.173)	(0.212)	(0.116)
Education of head (log)	0.037	0.195***	-0.032	-0.137**	0.094*	0.104**	-0.217***	-0.066**
	(0.052)	(0.058)	(0.041)	(0.064)	(0.050)	(0.046)	(0.080)	(0.031)
Adults (log)	-0.134	-0.329*	0.222*	-0.014	-0.223	-0.107	0.563**	0.163*
	(0.158)	(0.188)	(0.117)	(0.201)	(0.148)	(0.141)	(0.274)	(0.094)
Asset value (log)	0.045	0.159**	0.139***	0.020	-0.009	-0.077	-0.062	0.030
	(0.059)	(0.070)	(0.043)	(0.071)	(0.055)	(0.052)	(0.079)	(0.037)
Livestock (log)	-0.108	0.280***	0.129*	-0.059	0.221**	0.013	-0.063	-0.147***
	(0.094)	(0.096)	(0.071)	(0.135)	(0.088)	(0.085)	(0.107)	(0.052)
Number of plots (log)	0.074	-0.688***	-0.492***	0.182	0.103	0.171	0.222	0.183**
	(0.152)	(0.197)	(0.111)	(0.190)	(0.132)	(0.138)	(0.210)	(0.092)
<i>Community characteristics</i>								
Extension visits(log)	0.046	0.025	0.053	0.100	0.087	0.403***	0.219*	0.022
	(0.065)	(0.072)	(0.049)	(0.097)	(0.059)	(0.061)	(0.113)	(0.040)
Distance to market (log)	-0.071	-0.034	0.015	0.031	-0.237***	0.007	-0.026	0.107***
	(0.050)	(0.062)	(0.039)	(0.065)	(0.049)	(0.049)	(0.077)	(0.032)
Rainfall variability in the previous season (log)	0.351	-0.207	0.572***	0.152	0.244	-0.232	1.809***	0.221
	(0.235)	(0.273)	(0.156)	(0.256)	(0.199)	(0.211)	(0.310)	(0.142)
Total rainfall in the previous season (log)	1.085***	1.676***	0.073	-0.576**	0.961***	0.344	-0.808***	0.378***
	(0.223)	(0.297)	(0.184)	(0.290)	(0.222)	(0.220)	(0.291)	(0.142)
Year (1=2018)	0.366***	0.243***	-0.067	0.721***	0.068	-0.278***	0.455***	-0.078*
	(0.064)	(0.082)	(0.050)	(0.117)	(0.057)	(0.079)	(0.111)	(0.042)
Zone	0.233***	0.207***	-0.061	-0.090	0.182***	-0.131***	-0.217***	0.020
	(0.046)	(0.064)	(0.040)	(0.072)	(0.046)	(0.041)	(0.058)	(0.025)
Constant	-6.533***	-11.325***	0.947	1.523	-7.325***	-4.378***	7.185***	-3.044***
	(1.505)	(1.986)	(1.260)	(1.753)	(1.654)	(1.539)	(1.948)	(0.998)
3914								

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table S2: Multivariate probit estimates of individual management with CRE framework

Field characteristics								
Ownership of land (1= owned)	-0.284 (0.197)	0.180 (0.157)	0.557*** (0.145)	0.221 (0.136)	-0.107 (0.092)	-0.104 (0.104)	0.232 (0.151)	-0.088 (0.105)
Area size (log)	1.547*** (0.234)	1.728*** (0.279)	-0.606*** (0.208)	0.311 (0.199)	1.341*** (0.163)	0.534*** (0.183)	0.060 (0.290)	-0.300* (0.178)
Distance from home (minute)	0.374*** (0.042)	0.317*** (0.042)	-0.672*** (0.035)	0.083** (0.040)	0.001 (0.029)	-0.005 (0.027)	-0.083* (0.047)	0.188*** (0.025)
Number of years acquired (log)	0.018 (0.116)	-0.003 (0.103)	0.194* (0.108)	-0.149 (0.092)	0.010 (0.071)	0.167** (0.085)	-0.241** (0.111)	-0.157** (0.071)
Household characteristics								
Age (log)	0.130 (0.207)	-0.325 (0.224)	-0.106 (0.161)	0.068 (0.249)	-0.044 (0.214)	0.257 (0.180)	-0.404 (0.430)	0.018 (0.114)
Gender (1 =Male)	-0.155 (0.177)	-0.090 (0.177)	0.064 (0.134)	0.292 (0.225)	-0.299* (0.167)	-0.072 (0.173)	0.033 (0.208)	-0.029 (0.114)
Education (log)	0.057 (0.053)	0.185*** (0.060)	-0.017 (0.041)	-0.135** (0.062)	0.083 (0.051)	0.111** (0.046)	-0.182** (0.079)	-0.063** (0.031)
Adults (log)	-0.061 (0.162)	-0.346* (0.189)	0.221* (0.117)	-0.009 (0.204)	-0.222 (0.148)	-0.060 (0.144)	0.706*** (0.268)	0.178* (0.094)
Asset value (log)	0.058 (0.060)	0.181** (0.071)	0.122*** (0.045)	0.018 (0.074)	-0.014 (0.056)	-0.061 (0.054)	-0.017 (0.086)	0.048 (0.038)
Livestock (log)	-0.043 (0.124)	0.155 (0.159)	0.259** (0.114)	0.013 (0.224)	0.091 (0.138)	0.146 (0.145)	0.190 (0.194)	-0.046 (0.085)
Number of plots (log)	0.005 (0.160)	-0.724*** (0.195)	-0.463*** (0.112)	0.194 (0.194)	0.107 (0.135)	0.166 (0.142)	0.131 (0.200)	0.183** (0.092)
Community characteristics								
Extension visit (log)	0.058 (0.067)	0.022 (0.072)	0.053 (0.050)	0.096 (0.096)	0.083 (0.059)	0.402*** (0.061)	0.267** (0.109)	0.018 (0.040)
Distance to market (log)	-0.079 (0.052)	-0.023 (0.061)	0.009 (0.040)	0.034 (0.065)	-0.231*** (0.049)	0.003 (0.049)	-0.032 (0.078)	0.106*** (0.032)
Lagged total rainfall (log)	1.069*** (0.224)	1.650*** (0.289)	0.073 (0.185)	-0.591** (0.286)	0.966*** (0.224)	0.295 (0.220)	-0.767** (0.308)	0.368*** (0.142)
Lagged rainfall variability (log)	0.295 (0.237)	-0.230 (0.274)	0.554*** (0.159)	0.129 (0.256)	0.216 (0.201)	-0.272 (0.208)	1.679*** (0.292)	0.221 (0.140)
Year (1=2018)	0.360*** (0.065)	0.236*** (0.081)	-0.064 (0.050)	0.712*** (0.118)	0.063 (0.057)	-0.296*** (0.080)	0.441*** (0.111)	-0.093** (0.041)
Zone	0.192*** (0.049)	0.209*** (0.068)	-0.062 (0.043)	-0.090 (0.074)	0.191*** (0.049)	-0.160*** (0.044)	-0.284*** (0.072)	0.007 (0.027)
CRE variables								
Mean field size	-1.045*** (0.331)	-0.205 (0.372)	0.130 (0.281)	0.063 (0.362)	0.266 (0.300)	-0.677** (0.325)	-1.544*** (0.504)	-0.303 (0.236)
Mean number of years acquired	-0.018 (0.024)	0.074*** (0.021)	-0.027 (0.017)	-0.005 (0.023)	0.016 (0.017)	-0.005 (0.017)	-0.027 (0.029)	-0.008 (0.011)
Mean ownership	-0.252 (0.381)	-0.445 (0.315)	-0.053 (0.236)	-0.081 (0.329)	-0.213 (0.238)	-0.288 (0.259)	-0.114 (0.406)	0.017 (0.178)
Mean livestock	-0.008 (0.027)	0.029 (0.036)	-0.026 (0.025)	-0.017 (0.061)	0.024 (0.027)	-0.027 (0.026)	-0.052 (0.042)	-0.023 (0.018)
Constant	-6.449*** (1.538)	-9.897*** (1.940)	0.362 (1.289)	1.487 (1.789)	-7.110*** (1.672)	-4.011** (1.571)	7.051*** (2.149)	-3.133*** (1.040)
No of observations	3914	3914	3914	3914	3914	3914	3914	3914

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table S3: Multinomial logit estimates of management package decisions without CRE framework. The control group is use of fertilizer and improved maize variety.

	2	3	4	5	6	7	8
Field characteristics							
Ownership of land (1= owned)	1.955*** (0.529)	-0.175 (0.204)	0.390 (0.427)	-0.223 (0.261)	0.565 (0.511)	-0.232 (0.242)	0.521 (0.502)
Field size (log)	-1.225* (0.637)	-1.105*** (0.405)	-1.831** (0.770)	1.284*** (0.481)	0.170 (0.773)	1.054** (0.439)	0.887 (0.820)
Distance from home (log)	-1.430*** (0.109)	0.140** (0.063)	-0.981*** (0.107)	0.164* (0.084)	-1.096*** (0.137)	0.181** (0.080)	-0.867*** (0.126)
Number of years acquired (log)	0.060	-0.239	0.230	0.000	-0.355	-0.203	0.175
Household characteristics							
Age (log)	-0.358 (0.423)	0.165 (0.279)	-0.471 (0.400)	0.215 (0.377)	-0.802 (0.691)	0.071 (0.411)	-0.217 (0.617)
Gender (1 =Male)	-0.080 (0.426)	-0.101 (0.284)	-0.333 (0.542)	0.034 (0.443)	-0.183 (0.621)	0.081 (0.417)	-0.266 (0.559)
Education (log)	-0.012 (0.113)	-0.030 (0.082)	0.067 (0.137)	-0.243** (0.121)	-0.203 (0.164)	-0.228** (0.111)	-0.005 (0.178)
Number of adults (log)	0.992*** (0.354)	0.537** (0.243)	0.430 (0.399)	-0.116 (0.336)	-0.296 (0.633)	0.113 (0.310)	0.086 (0.500)
Asset value (log)	0.053 (0.136)	-0.077 (0.094)	0.156 (0.144)	0.174 (0.127)	0.268 (0.171)	0.046 (0.125)	0.519*** (0.186)
Livestock (log)	0.414* (0.236)	-0.003 (0.140)	0.147 (0.263)	-0.034 (0.208)	0.216 (0.302)	-0.147 (0.211)	-0.089 (0.274)
Number of plots (log)	-1.031*** (0.341)	0.281 (0.250)	0.198 (0.410)	0.324 (0.344)	0.366 (0.486)	0.514 (0.334)	0.336 (0.484)
Community characteristics							
Rainfall variability in the previous season (log)	0.014 (0.756)	-0.856 (0.552)	0.452 (0.972)	-3.269*** (1.022)	-1.822* (1.101)	-3.123*** (0.922)	-1.121 (1.122)
Total rainfall in the previous season (log)	0.614 (1.130)	0.136 (0.632)	0.018 (1.218)	5.308*** (1.071)	4.677*** (1.467)	5.996*** (0.956)	4.571*** (1.344)
Number of extension visits (log)	0.349** (0.154)	0.329*** (0.118)	0.468*** (0.171)	0.318** (0.148)	0.351 (0.214)	0.611*** (0.142)	0.589*** (0.220)
Distance to market (log)	-0.160 (0.127)	0.157* (0.094)	0.035 (0.148)	-0.172 (0.109)	-0.188 (0.164)	-0.119 (0.112)	-0.177 (0.178)
Year (1=2018)	-0.004 (0.180)	-0.201 (0.129)	-0.521** (0.205)	0.036 (0.185)	-0.053 (0.257)	-0.311* (0.162)	0.234 (0.281)
East Wollega	-1.237 (1.071)	0.236 (0.518)	-0.256 (1.128)	-2.234** (0.870)	-3.517*** (1.314)	-3.229*** (0.850)	-3.638*** (1.205)
Jimma	-1.404 (1.082)	0.049 (0.507)	-0.380 (1.182)	-4.383*** (0.977)	-4.844*** (1.477)	-5.867*** (0.966)	-4.777*** (1.321)
West Gojjam	-0.362 (1.144)	0.480 (0.561)	0.826 (1.191)	-4.217*** (0.968)	-3.900*** (1.493)	-5.057*** (0.931)	-3.697*** (1.346)
West Shoa	-0.961 (1.018)	0.559 (0.514)	-0.057 (1.121)	-1.124 (0.865)	-2.411* (1.286)	-2.675*** (0.825)	-2.777** (1.151)
Constant	-2.516 (7.449)	-3.265 (4.149)	0.031 (7.996)	-38.623*** (6.961)	-27.898*** (9.816)	-41.538*** (6.375)	-31.619*** (8.719)
Number of Obs.	3341						

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table S4: Multinomial logit estimates of management package decisions with MC device and study zones. The control group is use of fertilizer and improved maize variety.

	2	3	4	5	6	7	8
Variables	Mgt2	Mgt3	Mgt4	Mgt5	Mgt6	Mgt7	Mgt8
<i>Field characteristics</i>							
Ownership of land (1= owned)	1.861 (0.571)***	-0.494 (0.262)**	-0.036 (0.547)	-0.48 (0.293)	0.708 (0.543)	-0.307 (0.26)	1 (0.548)*
Field size (log)	-1.059 (0.697)	-0.494 (0.441)	-1.446 (0.833)*	1.509 (0.466)***	1.482 (0.793)*	1.656 (0.443)***	1.867 (0.943)**
Distance from home (log)	-1.42 (0.109)***	0.135 (0.064)**	-0.982 (0.107)***	0.168 (0.083)**	-1.104 (0.136)***	0.188 (0.081)**	-0.852 (0.127)***
Number of years acquired (log)	0.462 (0.36)	-0.046 (0.197)	0.825 (0.429)**	0.168 (0.215)	-0.098 (0.308)	0.007 (0.208)	0.394 (0.519)
<i>Household characteristics</i>							
Age (log)	-0.057 (0.432)	0.26 (0.3)	-0.136 (0.441)	0.325 (0.405)	-0.511 (0.776)	0.296 (0.437)	0.183 (0.692)
Gender (1 =Male)	-0.174 (0.432)	-0.132 (0.286)	-0.45 (0.546)	0.011 (0.451)	-0.237 (0.633)	0.055 (0.422)	-0.366 (0.566)
Education (log)	-0.008 (0.111)	-0.035 (0.082)	0.054 (0.135)	-0.236 (0.12)**	-0.197 (0.163)	-0.216 (0.11)**	-0.007 (0.178)
Number of adults (log)	1.034 (0.353)***	0.563 (0.244)**	0.491 (0.396)	-0.117 (0.337)	-0.203 (0.641)	0.166 (0.313)	0.19 (0.495)
Asset value (log)	0.067 (0.139)	-0.038 (0.095)	0.167 (0.154)	0.208 (0.132)	0.332 (0.181)*	0.097 (0.127)	0.554 (0.193)***
Livestock (log)	0.591 (0.344)*	0.003 (0.227)	0.218 (0.411)	0.23 (0.314)	0.871 (0.537)	0.411 (0.331)	0.147 (0.49)
Number of plots (log)	-1.035 (0.338)***	0.235 (0.253)	0.189 (0.412)	0.329 (0.348)	0.403 (0.49)	0.554 (0.337)	0.327 (0.492)
<i>Community characteristics</i>							
Total rainfall in the previous season (log)	0.606 (1.133)	0.172 (0.631)	-0.013 (1.237)	5.326 (1.075)***	4.86 (1.521)***	6.063 (0.961)***	4.783 (1.378)***
Rainfall variability in the previous season (log)	-0.038 (0.773)	-0.89 (0.548)	0.428 (0.991)	-3.312 (1.027)***	-2.091 (1.104)*	-3.204 (0.91)***	-1.434 (1.077)
Number of extension visit (log)	0.348 (0.155)**	0.336 (0.118)***	0.475 (0.171)***	0.321 (0.148)**	0.363 (0.212)*	0.619 (0.144)***	0.597 (0.222)***
Distance to market (log)	-0.18 (0.126)	0.14 (0.093)	0.018 (0.147)	-0.186 (0.11)*	-0.193 (0.163)	-0.128 (0.111)	-0.179 (0.179)
Year (1=2018)	-0.038 (0.182)	-0.213 (0.13)	-0.547 (0.204)***	0.026 (0.187)	-0.105 (0.264)	-0.344 (0.163)**	0.171 (0.282)
<i>Study zone</i>							
	-1.26 (1.081)	0.16 (0.529)	-0.254 (1.164)	-2.234 (0.883)**	-3.873 (1.369)***	-3.35 (0.864)***	-4 (1.244)***
East Wollega	-1.481 (1.124)	-0.131 (0.523)	-0.454 (1.235)	-4.47 (0.987)***	-5.511 (1.569)***	-6.17 (0.977)***	-5.367 (1.422)***
Jimma	-0.47 (1.176)	0.292 (0.579)	0.726 (1.229)	-4.311 (1.001)***	-4.624 (1.583)***	-5.402 (0.957)***	-4.334 (1.42)***
West Gojjam	-1.048 (1.047)	0.379 (0.536)	-0.124 (1.164)	-1.167 (0.894)	-3.033 (1.361)**	-2.939 (0.848)***	-3.386 (1.231)***
West Shoa	-0.364 (0.826)	-1.251 (0.55)**	-0.773 (0.942)	-0.385 (0.729)	-2.424 (1.119)**	-1.015 (0.752)	-1.754 (1.253)
Mean area	-0.075 (0.044)	-0.042 (0.031)	-0.115 (0.058)**	-0.034 (0.04)	-0.046 (0.062)	-0.045 (0.038)	-0.034 (0.063)
Mean number of years acquired	0.072 (0.625)	0.842 (0.44)*	0.919 (0.804)	0.623 (0.596)	-0.494 (0.848)	0.098 (0.535)	-1.377 (0.767)*
Mean ownership							

Mean TLU	-0.037 (0.067)	0.005 (0.045)	-0.006 (0.091)	-0.06 (0.062)	-0.138 (0.097)	-0.124 (0.061)**	-0.052 (0.091)
Constant	-3.495 (7.507)	-3.777 (4.14)	-1.15 (7.969)	-39.465 (6.989)***	-29.853 (10.254)***	-42.945 (6.406)***	-33.618 (8.873)***
Number of Obs.	3341	3341	3341	3341	3341	3341	3341

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note:

2= Mgt2= Fertilizer + improved variety + manure

3= Mgt3= Fertilizer + improved variety + Integrated management

4= Mgt4= Fertilizer + improved variety + Integrated management + manure

5= Mgt5= Fertilizer + improved variety + crop protection

6= Mgt6= Fertilizer + improved variety + crop protection + manure

7= Mgt7= Fertilizer + improved variety + crop protection + Integrated management

8= Mgt8= Fertilizer + improved variety + crop protection + manure + Integrated management

Analysis of variance (ANOVA) was also used to compare mean values of outcome variables – maize yield, labor productivity– across the management packages. We applied the Bonferroni correction (Field, 2013) to correct for potential spurious inference that could come from making multiple comparisons between group means of outcome variables.

Table S5: maize yield comparisons across the management packages

	1	2	3	4	5	6	7
2	-0.31						
3	0.08	0.39*					
4	-0.06	0.25	-0.14				
5	0.28	0.59***	0.20	0.34			
6	0.09	0.40	0.01	0.15	-0.19		
7	0.29	0.59**	0.21	0.35	0.01	0.20	
8	-0.12	0.19	-0.20	-0.06	-0.40	-0.21	-0.40