

Fuelwood substitution, gender, and shadow prices in western Kenya

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ONLINE APPENDIX

Table A1. Asset index weights

Variable	Weight	Variable	Weight
Durables: number of		Characteristics: indicator for	
House	0.411	Brick/cement walls	0.700
Radio	0.389	Mabati (corrugated iron) roof	0.379
Telephone (mobile)	0.649	Cement/wood floor	0.666
Fridge/freezer	0.620	Private piped water	0.447
Television	0.688	Water from neighbor	-0.068
Electronic Equipment	0.559	Borehold water	0.036
Air conditioning	0.339	River/stream water	-0.184
Furniture	0.743	No toilet	-0.279
Kettle/iron	0.446	Traditional toilet	-0.293
Mosquito net	0.602	Improved toilet	-0.703
Computer	0.529	Kerosene light	-0.717
Internet access	0.351	Electricity light	-0.763
Electric/gas stove	0.526	Solar light	-0.112
Improved stove	0.217		
Bicycle	0.332		
Motorcylce	0.483		
Car/truck	0.568		
Bank account	0.699		
Generator	0.291		
Large battery	0.177		
Solar panel	0.338		
LPG	0.636		
Observations	309	Observations	309

Table A2. Wage regressions

VARIABLES	Male			Female		
	OLS	MLE Heckman		OLS	MLE Heckman	
	Male Wages (KES/Month)		Selection	Female Wages		Selection
Household Head Measures						
Years of education	0.0772*** (0.0150)	0.0596*** (0.0177)	-0.00993 (0.0194)	0.106*** (0.0234)	0.102*** (0.0209)	0.00807 (0.0220)
Age	0.0778*** (0.0239)	0.173*** (0.0311)	0.213*** (0.0230)	-0.0148 (0.0225)	0.0253 (0.0441)	0.185*** (0.0296)
Age squared	-0.000807*** (0.000296)	-0.00195*** (0.000381)	-0.00244*** (0.000280)	0.000368 (0.000277)	-0.000126 (0.000554)	-0.00225*** (0.000387)
TLU Herd Size	0.0554*** (0.0205)	0.0170 (0.0252)	-0.0669** (0.0262)	0.0461 (0.0332)	0.0414 (0.0320)	-0.0178 (0.0319)
Dependency Ratio†			-0.196*** (0.189)			0.0986 (0.321)
Distance from Village Center (Km)			-0.518*** (0.205)			-1.236*** (0.322)
Village dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered SE at household level	Yes			Yes		
Constant	6.058*** (0.480)	3.687*** (0.667)	-3.565*** (0.526)	7.032*** (0.570)	5.837*** (1.159)	-4.091*** (0.667)
Observations	202	536	536	105	540	540
R-squared	0.432			0.436		
LR Test P-value			0.0030***			0.2091

Robust standard errors in parentheses. †Dependency Ratio=number of household members less than 15 and over 65 years old divided by the number of household members between 15 and 65 years old. *** p<0.01, ** p<0.05. All dependent variables are in log form.

Table A3. First stage joint linear regressions for shadow price estimation

VARIABLES	(1) Collect wood	(2) Produce wood	(3) Buy wood
Full Shadow Price Collecting		0.038*** (0.007)	-0.018** (0.007)
Full Shadow Price Producing	0.087*** (0.015)		0.033** (0.014)
Full Market Price	-0.044 (0.027)	0.011 (0.022)	
Female Wage	-0.014 (0.077)	0.012 (0.063)	-0.079 (0.069)
Male Wage	-1.74*** (0.063)	0.090* (0.049)	0.045 (0.055)
Household Head Measures			
Age	-0.005** (0.002)	0.004 (0.002)	-0.002 (0.002)
Male	0.040 (0.080)	0.185*** (0.064)	0.011 (0.071)
Land Area (Acres)	-0.024** (0.010)	0.003 (0.008)	-0.010 (0.009)
Asset Index	-0.330*** (0.126)	-0.119 (0.101)	0.236** (0.110)
TLU Herd Size	0.037 (0.046)	0.006 (0.038)	0.017 (0.044)
Adult Men	0.069** (0.030)	-0.039 (0.024)	0.047 (0.026)
Adult Women	-0.010 (0.033)	0.040 (0.027)	0.060** (0.029)
Children Number	0.001 (0.010)	-0.008 (0.008)	0.017* (0.009)
Female Children Number	-0.026 (0.026)	0.021 (0.021)	0.041* (0.023)
Charcoal Price	-0.043 (0.058)	-0.013 (0.047)	0.014 (0.054)
Kerosene Price	-0.200** (0.090)	-0.104 (0.074)	0.213 (0.079)
Number of Parcels	0.114*** (0.041)		
Slope		0.042* (0.022)	
Distance to Town (Km)			-0.043** (0.017)
Block Dummies	Yes	Yes	Yes
Constant	2.435*** (0.511)	0.272 (0.426)	-0.157 (0.501)
Observations	301	301	301

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All shadow prices, market prices, and wages are in log form. Continuous variables in per-capita form after Cavendish (2002). "Full" variables include imputed values for households not participating in respective fuelwood source groups. Regressions are jointly estimated. *** p<0.01, ** p<0.05, * p<0.1.

Table A4. First stage instrumental variable regressions for demand estimation

VARIABLES	(1) Shadow price of collecting	(2) Shadow price of producing	(3) Market price
Hours Collect (IV)	0.252*** (0.054)		
Number of Trees (IV)		0.023*** (0.006)	
Except-own Mean Market Price (IV)			-57.64*** (14.31)
Shadow Price Collecting (Full)		0.0277 (0.028)	-0.000 (0.020)
Shadow Price Producing (Full)	0.157*** (0.057)		0.043 (0.034)
Market Price (Full)	0.012 (0.137)	0.021 (0.097)	
Female Wage	0.413* (0.250)	-0.386* (0.223)	0.227 (0.233)
Male Wage	-0.115 (0.225)	0.839*** (0.213)	-0.159 (0.156)
HH Controls, Block Dummies	Yes	Yes	Yes
Constant	-3.950 (2.565)	-2.476 (1.756)	127.1*** (32.34)
Observations	131	243	103

All variables in log form. Continuous variables in per-capita form after Cavendish (2002). "Full" variables include imputed values for households not participating in respective fuelwood source groups. All regressions bootstrapped with 1000 repetitions. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Elasticity of labor for fuelwood collection

VARIABLES	(1)	(2)	(3)
	OLS	2SLS	2SLS+Olsen
Shadow Price Collecting	0.417*** (0.112)	0.368* (0.200)	0.363* (0.220)
Full Shadow Price Producing	0.0721 (0.0523)	0.0789 (0.0524)	0.114 (0.138)
Full Market Price	0.171 (0.124)	0.173 (0.131)	0.152 (0.151)
Female Wage	-0.283 (0.269)	-0.244 (0.315)	-0.259 (0.318)
Male Wage	-0.133 (0.190)	-0.138 (0.200)	-0.188 (0.297)
Household head age	-0.0231*** (0.00854)	-0.0243** (0.00952)	-0.0266** (0.0135)
Household head sex (1=male)	0.330 (0.291)	0.320 (0.301)	0.344 (0.311)
Land area (acres)	0.0817 (0.135)	0.0771 (0.142)	0.0706 (0.152)
Asset index	-0.436 (0.866)	-0.528 (0.954)	-0.685 (1.158)
TLU herd size	0.175 (0.188)	0.189 (0.195)	0.213 (0.231)
Number adult males	-0.183 (0.123)	-0.183 (0.124)	-0.208 (0.149)
Number adult females	0.0653 (0.137)	0.0721 (0.143)	0.0700 (0.145)
Number of children	0.0151 (0.0340)	0.0197 (0.0365)	0.0212 (0.0399)
Number of female children	-0.0369 (0.0900)	-0.0359 (0.0942)	-0.0440 (0.0969)
Charcoal price	-0.119 (0.213)	-0.117 (0.229)	-0.132 (0.231)
Kerosene price	0.303 (0.354)	0.319 (0.341)	0.233 (0.470)
Lambda coefficient			-0.414 (1.359)
Constant	2.703 (2.506)	2.366 (2.465)	2.942 (3.007)
Observations	131	131	131
Kleibergen-Paap rk LM P-value		0.0000	0.0000
Kleibergen-Paap rk Wald F stat		35.657	31.271
Stock-Yogo 10% maximal IV size		16.38	16.38
Hausman Test P-value		0.801	0.784

All variables are in log form. Explanations for ``full'' variables and IV provided in text. Bootstrapped standard errors (1000 replications) in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table A6. Fuelwood demand elasticities - additional variables used in regression analysis

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Fuelwood collected (kg/month)			Fuelwood produced (kg/month)			Fuelwood bought (kg/month)		
	OLS	2SLS	2SLS+Olsen	OLS	2SLS	2SLS+Olsen	OLS	2SLS	2SLS+Olsen
Household head age	-0.0250** (0.0120)	-0.0282** (0.0128)	-0.0300* (0.0181)	0.0206*** (0.00786)	0.0207*** (0.00783)	0.0262** (0.0108)	0.0133 (0.0123)	0.0139 (0.0132)	0.0075 (0.0163)
Household head sex (male=1)	0.453 (0.361)	0.427 (0.358)	0.446 (0.366)	-0.0631 (0.246)	-0.0838 (0.258)	0.164 (0.435)	0.0154 (0.400)	0.00833 (0.415)	0.0379 (0.429)
Land area (acres)	0.132 (0.196)	0.120 (0.188)	0.115 (0.214)	0.0161 (0.0380)	0.0170 (0.0392)	0.0177 (0.0422)	0.599*** (0.224)	0.592*** (0.229)	0.559** (0.237)
Asset index	-1.141 (1.148)	-1.377 (1.110)	-1.499 (1.334)	0.0307 (0.356)	0.0457 (0.372)	-0.0963 (0.408)	0.217 (0.746)	0.216 (0.729)	1.031 (1.839)
TLU herd size	0.242 (0.259)	0.278 (0.262)	0.297 (0.320)	0.0434 (0.108)	0.0329 (0.109)	0.0519 (0.113)	-0.0206 (0.264)	-0.0181 (0.269)	0.0526 (0.336)
Number adult men	-0.170 (0.172)	-0.170 (0.161)	-0.190 (0.207)	-0.120 (0.0789)	-0.116 (0.0815)	-0.171 (0.112)	-0.158 (0.135)	-0.178 (0.145)	-0.0127 (0.332)
Number adult women	0.124 (0.192)	0.142 (0.184)	0.140 (0.188)	-0.0933 (0.0908)	-0.0900 (0.0917)	-0.0315 (0.124)	0.0634 (0.155)	0.0558 (0.164)	0.275 (0.459)
Number of children	-0.0185 (0.0495)	-0.00663 (0.0523)	-0.00544 (0.0535)	-0.0449 (0.0353)	-0.0429 (0.0351)	-0.0532 (0.0389)	0.0279 (0.0523)	0.0271 (0.0539)	0.0928 (0.130)
Number female children	-0.0710 (0.114)	-0.0686 (0.117)	-0.0748 (0.130)	-0.157** (0.0722)	-0.161** (0.0765)	-0.128 (0.0830)	-0.0959 (0.131)	-0.0944 (0.135)	0.0493 (0.314)
Charcoal price	-0.175 (0.315)	-0.171 (0.301)	-0.182 (0.309)	-0.0750 (0.185)	-0.0597 (0.185)	-0.0777 (0.187)	0.119 (0.278)	0.137 (0.282)	0.169 (0.297)
Kerosene price	0.649 (0.462)	0.690 (0.461)	0.623 (0.623)	-0.418* (0.249)	-0.407* (0.245)	-0.521* (0.286)	0.229 (0.555)	0.197 (0.591)	0.966 (1.635)

All continuous variables are in log form and in adjusted per capita units after Cavendish (2002). Bootstrapped standard errors (1000 replications) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.