The Implication of Water and Electricity Supply in Ghana for the Time Allocation of Women

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PRESENTATION OUTLINE

1. Introduction
2. Brief Literature Review
3. Theoretical Model
4. Data and Methodology
5. Descriptive Statistics
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7. Conclusion

1. Introduction

Main objective:

How the access to infrastructure (namely water and electricity) impacts the time allocation of women?

2. Brief literature review

- Not much empirical evidence about the implications of infrastructure to women's time allocation. One exception is Ilahi and Grimard (2000), which shows empirical evidence for Rural Pakistan that poor infrastructure (water access) reduces the time that women devote to market oriented activities and increase the total work burden of women.

- Recent studies try to measure Time Poverty: Bardasi and Wodon (2006) for Guinea; Coulombe and Wodon (2008) for Ghana. Coulombe and Wodon (2008) present empirical evidence that women are more likely to be time poor than men and that access to infrastructure does not affect significantly the total amount of hours worked.

3. Theoretical Model

Based on Becker's model (1965) of time allocation:

- Household consumption (c_i) is determined by a Home Production Function:

$$c_i = c(W_i, E_i, x_i, t_i^h; g_i)$$

W_i : amount of water used by household i

E_i : amount of energy used by household i

x_i : market purchased goods by household i

t_i^h : time allocated to home production by household i

g_i : home production technology parameter

- Water Production Function:

$W_i = f\left(t_i^w ; \alpha_i\right)$

t_i^w : time allocated to water collection by household i

α_i : community level water collection infrastructure

- Energy Production Function

$E_i = f\left(t_i^e ; a_i\right)$

t_i^e : time allocated to wood fetching by household i

b_i : community level electricity infrastructure

- Household Decision

$$\max_{c_i, t_i^l} u_i = u(c_i, t_i^l; t_i)$$

$$\text{s.t. } t_i^m + t_i^w + t_i^e + t_i^h + t_i^l \leq T$$

$$x_i \leq w_i t_i^m + V_i$$

where :

t_i^m : time allocated to market activities

t_i^h : time allocated to other household activities

T : time endowment

w_i : market wage

V_i : non - labor income

t : household preferences

- First order solution

$$t^{j*} = t^{j*}(w, v, t, a, b, g)$$

$$x^* = x^*(w, v, t, a, b, g)$$

where $j = m, w, e, h, l$.

4. Data and methodology

Data

- Ghana Living Standards Survey Round Four (GLSS 4) 1998/1999
- Survey covers 5 regions (Accra, Other Urban, Rural Coastal, Rural Forest, Rural Savannah); 300 communities; 5,998 households; 26,411 individuals
- Sample of 4,698 women between 25 and 59 years old

Infrastructure definitions:

- **hh access to water**: non-zero distance from the source of drinking water
- **community access**: >50% of households have access to water
- **hh access to electricity**: main source of lighting
- **community access**: >50% of households have access to electricity

Methodology

Reduced form equations to be estimated

$$t^{j*} = t^{j*}(w, v, t, a, b, g) + e$$

To estimate our empirical models:

$$t_i^j = \theta_0 + \theta_1 I_i + \theta_2 H_i + \theta_3 C_i + \theta_4 O_i + \varepsilon$$

where:

I stands for a set of individual characteristics

H stands for a set of household characteristics

C stands for a set of community characteristics

O stands for other characteristics (regions and weather conditions)

We use:

- **Heckman procedure** to correct for sample selection bias (estimated by maximum likelihood):

56.5% of women fetch water
41.9% collect wood
75.4% work in the market

- **OLS** for unpaid work and total hours of work

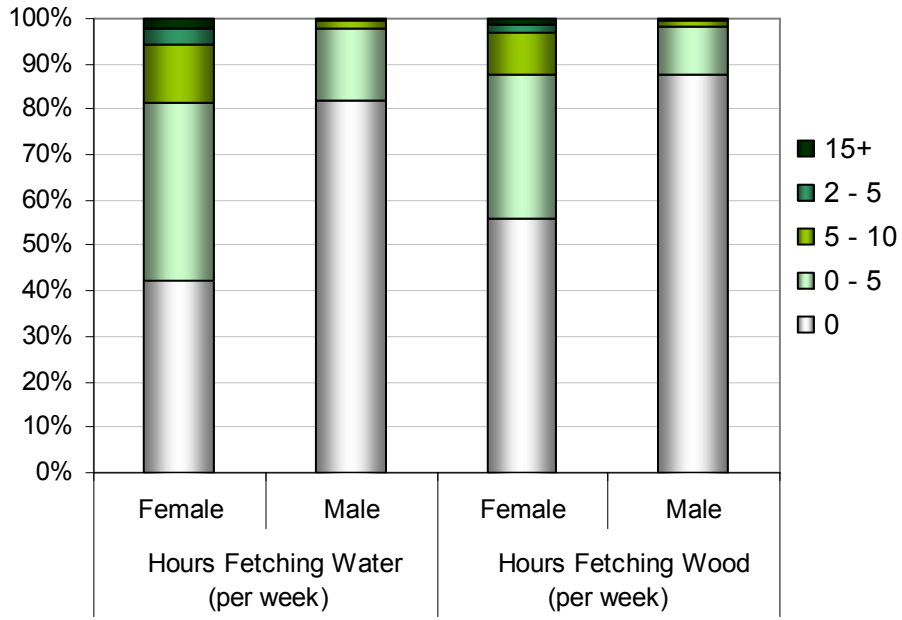
94.25% of women do domestic work
95.7% of women do any kind of work (domestic and/or market work)

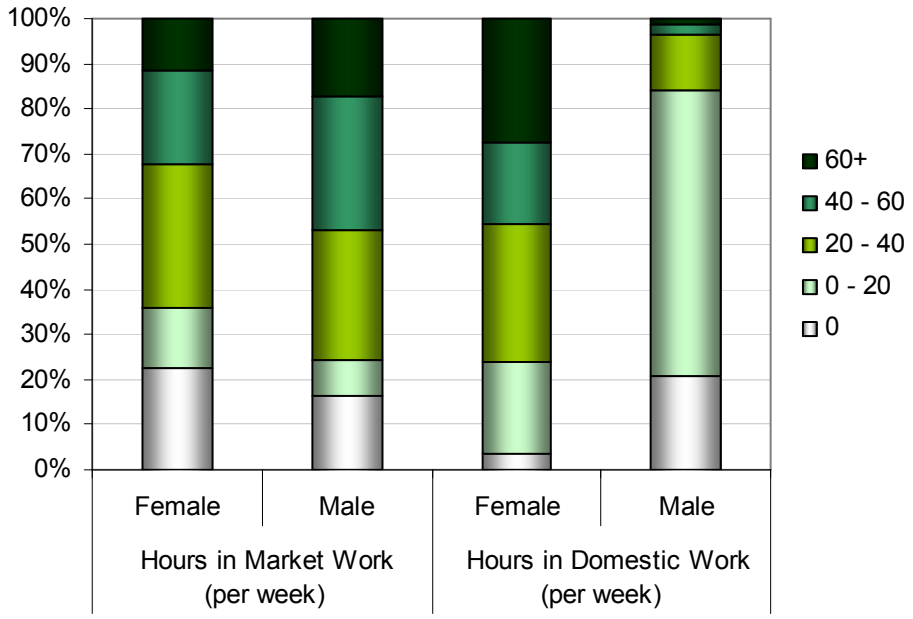
5. Descriptive Statistics

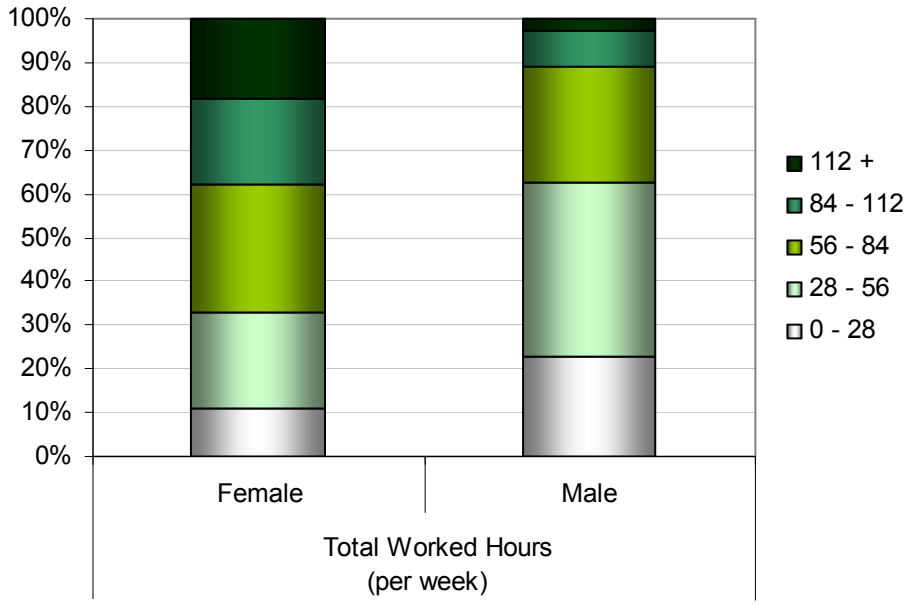
Table 1: Regional Characteristics in Ghana

Region	Percentage of households with water access	Average distance from the household to the main water source(km)	Percentage of households with electricity access	Average per capita income (GHS)	Average distance from the community to the market(km)
Accra	100.00%	0.00	90.02%	69964.17	0.00
Other Urban	79.75%	0.15	73.29%	35270.83	0.25
Rural Coastal	42.20%	0.28	28.02%	23287.83	7.77
Rural Forest	24.19%	0.28	24.71%	22793.66	10.89
Rural Savannha	4.55%	0.55	3.13%	12063.24	11.98

Chart 1: Time allocation of women and men

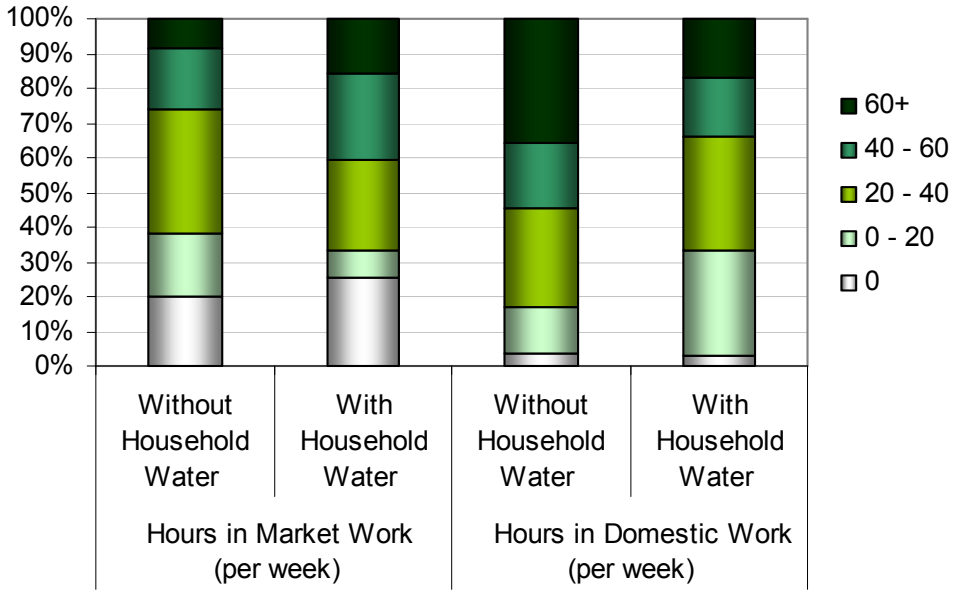


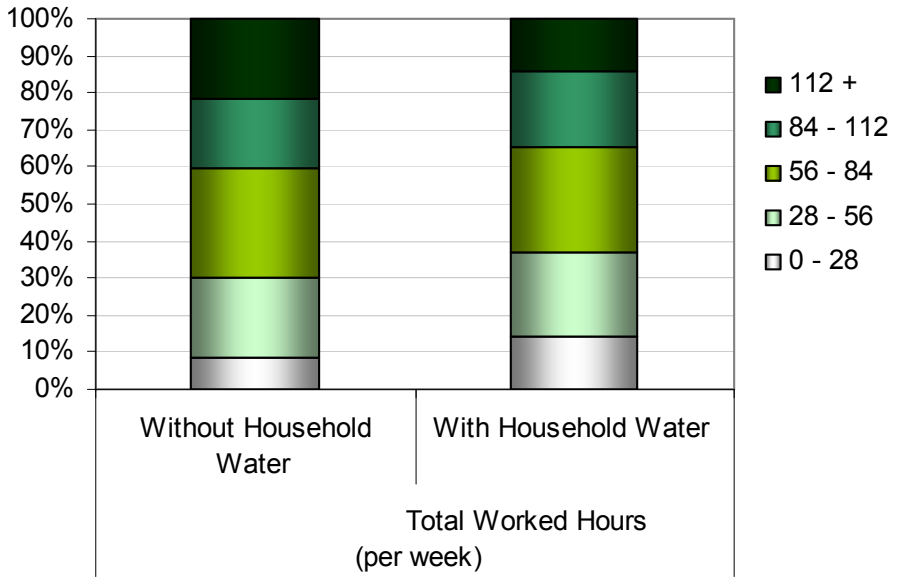




Source: Authors' calculations based on GLSS 4

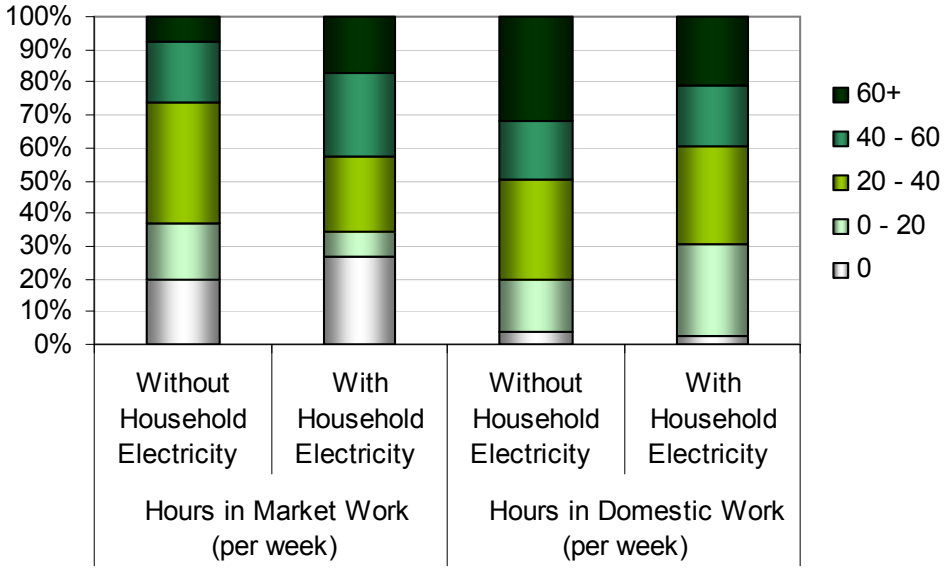
Chart 2: Women's Time allocation and Water Access

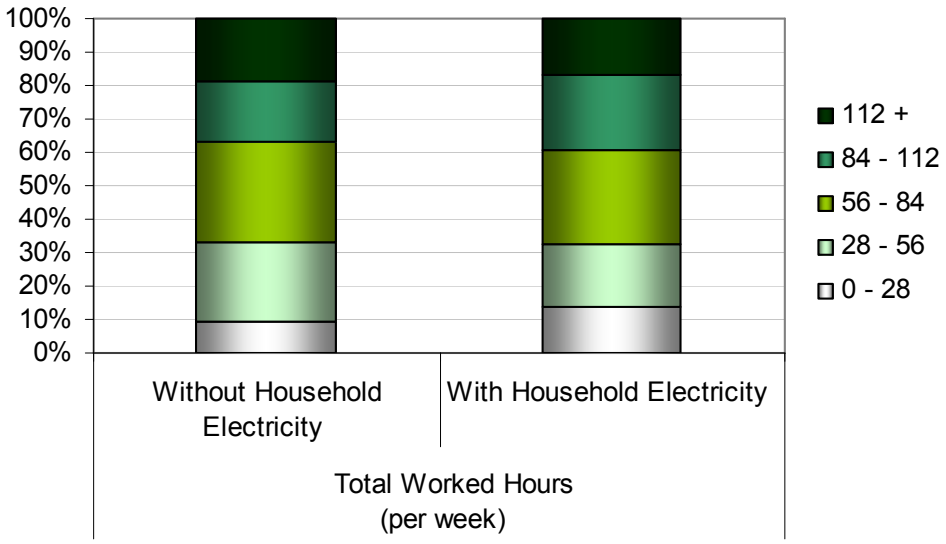




Source: Authors' calculations based on GLSS 4

Chart 3: Women's Time allocation and Electricity Access





Source: Authors' calculations based on GLSS 4

6. Results

- Determinants of Hours Fetching Water
- Determinants of Hours Fetching Wood
- Determinants of Worked Hours at Domestic Activities
- Determinants of Worked Hours at Market Activities
- Determinants of Total Worked Hours

Table 1: Determinants of Hours Fetching Water

	Hours Fetching Water			Probability of Fetching Water		
Variables	**Coefficient**	**Std. Error**		**Coefficient**	**Std. Error**	
Individual Characteristics						
Intercept	0.963	(0.421)	**	1.628	(0.424)	***
Age	0.010	(0.022)		-0.064	(0.021)	***
Age Squared	0.000	(0.0003)		0.000	(0.0003)	
Incomplete Primary	0.030	(0.062)		-0.089	(0.062)	
Complete Primary	-0.108	(0.057)	*	-0.199	(0.054)	***
Secondary or higher	-0.190	(0.107)	*	-0.392	(0.090)	***
Head	-0.075	(0.090)		-0.064	(0.084)	
Spouse	-0.076	(0.079)		0.153	(0.075)	**
Non-labor Per Capita Income	-1.20E-06	(0.000)	**	9.06E-08	(0.000)	
Household Demographic Composition						
No of Children (0-3 Yrs)	-0.083	(0.029)	***	0.071	(0.031)	**
No of Children (4-6 Yrs)	-0.009	(0.030)		0.066	(0.032)	**
No of Girls (7-10 Yrs)	0.030	(0.037)		-0.082	(0.036)	**
No of Girls (11-14 Yrs)	0.079	(0.043)	*	-0.254	(0.037)	***
No of Boys (7-10 Yrs)	0.111	(0.034)	***	-0.066	(0.034)	*
No of Boys (11-14 Yrs)	0.047	(0.040)		-0.137	(0.036)	***
No of Women	0.054	(0.028)	*	-0.194	(0.024)	***
No of Men	0.051	(0.025)	**	-0.082	(0.023)	***
No of Elderly	0.051	(0.048)		0.047	(0.047)	
Household Characteristics						
If Land Owner	-0.067	(0.048)		-0.039	(0.049)	
Value of Home Goods	2.23E-09	(0.000)		-4.96E-09	(0.000)	***
Value of Enterprise Goods	3.31E-09	(0.000)		-2.61E-09	(0.000)	
Community Conditions						
Per Capita Income	-3.79E-06	(0.000)	***	2.15E-06	(0.000)	**
Distance from Market				0.002	(0.0008)	**
Electricity Access	**0.156**	**(0.065)**	**	**0.064**	**(0.066)**	
Water Access				**-0.242**	**(0.065)**	***
Distance from Water's Source	**0.653**	**(0.097)**	***	**0.202**	**(0.108)**	*
Distance from Water's Source Squared	**-0.147**	**(0.030)**	***	**-0.070**	**(0.029)**	**
Number of Observation	4432		athrho			***
Censored Observation	1888		lnsigma	-0.893	(0.091)	***
Uncensored Observation	2544		rho	0.085	(0.027)	***
Wald chi2(29)	303.57	***	sigma	-0.713	(0.045)	
chi2(1)	16.74	***	lambda			***
				1.089	(0.029)	

Table 2: Determinants of Hours Fetching Wood

	Hours Fetching Wood			Probability of Fetching Wood		
Variables	Coefficient	Std. Error		Coefficient	Std. Error	
Individual Characteristics						
Intercept	-1.054	(0.854)		-2.645	(0.568)	***
Age	-0.003	(0.018)		0.061	(0.023)	***
Age Squared	0.000	(0.000)		-0.001	(0.000)	**
Incomplete Primary	-0.047	(0.055)		-0.283	(0.066)	***
Complete Primary	-0.088	(0.053)	*	-0.365	(0.061)	***
Secondary or higher	-0.304	(0.176)	*	-0.927	(0.149)	***
Head	-0.058	(0.077)		-0.052	(0.096)	
Spouse	-0.036	(0.067)		0.141	(0.085)	*
Non-labor Per Capita Income	-2.26E-06	(0.000)	**	-4.22E-06	(0.000)	***
Household Demographic Composition						
No of Children (0-3 Yrs)	0.014	(0.025)		-0.037	(0.033)	
No of Children (4-6 Yrs)	0.041	(0.025)	*	0.113	(0.035)	***
No of Girls (7-10 Yrs)	0.014	(0.030)		-0.024	(0.040)	
No of Girls (11-14 Yrs)	-0.014	(0.031)		0.109	(0.042)	***
No of Boys (7-10 Yrs)	0.013	(0.027)		0.050	(0.037)	
No of Boys (11-14 Yrs)	0.041	(0.030)		-0.013	(0.040)	
No of Women	0.004	(0.022)		-0.101	(0.027)	***
No of Men	0.021	(0.020)		-0.057	(0.026)	**
No of Elderly	0.134	(0.038)	***	-0.008	(0.051)	
Household Characteristics						
If Land Owner	-0.064	(0.038)	*	0.249	(0.050)	***
Value of Home Goods	1.33E-09	(0.000)		-2.93E-09	(0.000)	
Value of Enterprise Goods	-5.75E-09	(0.000)	*	-6.51E-09	(0.000)	*
Community Conditions						
Per Capita Income				-0.00001	(0.000)	***
Distance from Market				0.00009	(0.0007)	
Electricity Access				**-0.336**	**(0.069)**	***
Water Access				**-0.090**	**(0.074)**	
Distance from Water's Source	**0.232**	**(0.076)**	***	**0.177**	**(0.107)**	*
Distance from Water's Source Squared	**-0.014**	**(0.024)**		**-0.031**	**(0.029)**	
Number of Observation						
Censored Observation	4432		athrho	0.211	(0.112)	*
Uncensored)bservation	2375		lnsigma	-0.279	(0.020)	***
Wald chi2(29)	2057		rho	0.208	(0.107)	**
chi2(1)	217.55	***	sigma	0.756	(0.015)	

Table 3: Determinants of Worked Hours at Domestic Activities

	Hours of Domestic Work		
Variables	**Coefficient**	**Std. Error**	
Individual Characteristics			
Intercept	3.608	(0.232)	***
Age	-0.012	(0.012)	
Age Squared	-0.00003	(0.0001)	
Incomplete Primary	0.003	(0.034)	
Complete Primary	0.002	(0.030)	
Secondary or higher	-0.120	(0.049)	**
Head	0.161	(0.049)	***
Spouse	0.313	(0.043)	***
Non-labor Per Capita Income	-6.85E-07	(0.000)	**
Household Demographic Composition			
No of Children (0-3 Yrs)	0.201	(0.017)	***
No of Children (4-6 Yrs)	0.118	(0.017)	***
No of Girls (7-10 Yrs)	0.020	(0.020)	
No of Girls (11-14 Yrs)	0.018	(0.021)	
No of Boys (7-10 Yrs)	0.085	(0.019)	***
No of Boys (11-14 Yrs)	0.051	(0.012)	***
No of Women	-0.159	(0.013)	***
No of Men	0.016	(0.013)	
No of Elderly	0.057	(0.027)	**
Household Characteristics			
If Land Owner	-0.139	(0.027)	***
Value of Home Goods	1.24E-09	(0.000)	
Value of Enterprise Goods	-4.16E-11	(0.000)	
Community Conditions			
Per Capita Income	6.98E-07	(0.000)	
Distance from Market	0.0004	(0.0004)	
Electricity Access	**0.129**	**(0.038)**	***
Water Access	**-0.301**	**(0.040)**	***
Distance from Water's Source	**0.123**	**(0.060)**	**
Distance from Water's Source Squared	0.0004	**(0.016)**	
Number of observations	4270		
F(31, 4238)	47.17	***	
Adj R-squared	0.251		

Table 4: Determinants of Worked Hours at Market Activities

	Hours of Market Work			Prob. of Doing Market Work		
Variables	Coefficient	Std. Error		Coefficient	Std. Error	
Individual Characteristics						
Intercept	4.245	(0.237)	***	-1.173	(0.404)	***
Age	-0.025	(0.012)	**	0.074	(0.020)	***
Age Squared	0.000	(0.0001)		-0.001	(0.000)	***
Incomplete Primary	0.067	(0.035)	*	-0.025	(0.060)	
Complete Primary	0.080	(0.031)	***	0.037	(0.053)	
Secondary or higher	-0.033	(0.049)		0.152	(0.087)	*
Head	-0.054	(0.049)		0.420	(0.082)	***
Spouse	-0.094	(0.044)	**	0.286	(0.072)	***
Non-labor Per Capita Income	-6.50E-08	(0.000)		3.36E-06	(0.000)	***
Household Demographic Composition						
No of Children (0-3 Yrs)	0.044	(0.017)	**	-0.099	(0.030)	***
No of Children (4-6 Yrs)	-0.028	(0.018)		0.053	(0.031)	*
No of Girls (7-10 Yrs)	-0.018	(0.020)		0.067	(0.036)	*
No of Girls (11-14 Yrs)	-0.017	(0.021)		0.083	(0.037)	**
No of Boys (7-10 Yrs)	-0.009	(0.019)		0.127	(0.034)	***
No of Boys (11-14 Yrs)	-0.004	(0.020)		0.076	(0.037)	**
No of Women	-0.004	(0.013)		0.028	(0.023)	
No of Men	0.023	(0.013)	*	-0.031	(0.023)	
No of Elderly	0.030	(0.027)		-0.035	(0.046)	
Household Characteristics						
If Land Owner				0.027	(0.039)	
Value of Home Goods	8.68E-10	(0.000)		-2.53E-09	(0.000)	*
Value of Enterprise Goods	-1.36E-09	(0.000)	***	5.89E-09	(0.000)	**
Community Conditions						
Per Capita Income	4.88E-06	(0.00000)	***	-3.27E-06	(0.000)	***
Distance from Market				-0.002	(0.0005)	***
Electricity Access	**0.205**	**(0.035)**	***	**-0.167**	**(0.068)**	**
Water Access				**-0.080**	**(0.058)**	
Distance from Water's Source	**0.060**	**(0.054)**		**0.179**	**(0.105)**	*
Distance from Water's Source	**-0.006**	**(0.015)**		**-0.041**	**(0.027)**	
Number of Observation	4432		athrho	-1.706	(0.062)	***
Censored Observation	942		lnsigma	-0.337	(0.015)	***
Uncensored)bservation	3490		rho	-0.936	(0.008)	***
Wald chi2(29)	526.9	***	sigma	0.714	(0.011)	
chi2(1)	304.22	***	lambda	-0.668	(0.014)	***

Table 5: Determinants of Total Worked Hours

	Total Worked Hours		
Variables	Coefficient	Std. Error	
Individual Characteristics			
Intercept	3.434	(0.200)	***
Age	0.024	(0.010)	**
Age Squared	0.000	(0.000)	***
Incomplete Primary	-0.011	(0.030)	
Complete Primary	0.031	(0.026)	
Secondary or higher	-0.036	(0.042)	
Head	0.262	(0.042)	***
Spouse	0.265	(0.037)	***
Non-labor Per Capita Income	6.84E-07	(0.000)	***
Household Demographic Composition			
No of Children (0-3 Yrs)	0.118	(0.014)	***
No of Children (4-6 Yrs)	0.073	(0.015)	***
No of Girls (7-10 Yrs)	0.034	(0.017)	**
No of Girls (11-14 Yrs)	0.030	(0.018)	*
No of Boys (7-10 Yrs)	0.074	(0.016)	***
No of Boys (11-14 Yrs)	0.048	(0.017)	***
No of Women	-0.082	(0.011)	***
No of Men	0.013	(0.011)	
No of Elderly	0.045	(0.023)	**
Household Characteristics			
If Land Owner	-0.041	(0.023)	*
Value of Home Goods	-6.91E-11	(0.000)	
Value of Enterprise Goods	-2.23E-11	(0.000)	
Community Conditions			
Per Capita Income	1.28E-06	(0.000)	***
Distance from Market	0.000	(0.0003)	
Electricity Access	**0.074**	**(0.033)**	****
Water Access	**-0.182**	**(0.035)**	*****
Distance from Water's Source	**0.052**	**(0.051)**	
Distance from Water's Source Squared	**0.004**	**(0.014)**	
Number of observations	4337		
F(31, 4305)	18.03	***	
Adj R-squared	0.109		

7. Conclusions

- Water access:
  - Reduces hours fetching water
  - Reduces domestic hours worked
  - Does not affect hours worked at income generating activities
  - Reduces total hours worked

- Policy recommendations:
  - Improving the water access is an effective policy for reducing time poverty among women.
  - However, if we also want to reduce income poverty this infrastructure policy must also be accompanied by some policy that encourages women to dedicate themselves to market oriented activities.

- Electricity access:
  - Reduces hours fetching wood
  - Increases domestic hours worked
  - Increases hours worked at income generating activities for those women already working, but decreases the probability of women working at income generating activities
  - Increases total hours worked

- Policy recommendations:
  - Improving the electricity access is not an alternative policy for reducing time poverty among women. On the contrary, it also must be accompanied by some policy that decreases women's time dedicated to household chores.
  - It probably reduces income poverty for those households where women already dedicate themselves to market oriented activities, but not for those where women are not engaged in labor market. Therefore, it also must be accompanied by some policy that encourages women to enter income generating activities.

Thank you!