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Household Electrification and Education Outcomes: Panel evidence from Uganda

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Household Electrification and Education Outcomes: Panel evidence from Uganda

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Abstract:

We investigate the impact of household electrification on educational outcomes in Uganda using household panel data and employ a probit model. The findings indicate that electrification increases school enrolment at all education cycles. Also, education level of household head, marital status, gender and good housing increase education outcomes. Our results provide insights on the existing gaps in designing supportive policies for increased access to electricity for rural households where there are high disproportionately poor education outcomes. The results suggest that policies to eliminate all barriers to access to electricity will greatly enhance educational outcomes in Uganda.

Key words: Household electrification, education outcomes, gender, panel data; Uganda

1. INTRODUCTION

Despite the great strides the government of Uganda has made in its attempt to meet the targets set in the National Development Plan and the Millennium Development Goals by 2030 (Republic of Uganda, 2015), huge challenges in terms of social-economic indicators still remain. A remarkably low national electrification rate of 9% in the country means that biomass continue to be the primary source of energy to the population. While electrification has reached almost 43% of the urban households, there is a substantial rural-urban gap in household electrification in the country with only about 7% of the rural household having access to electricity (UBOS, 2017, ERA, 2016). This greatly disadvantages a large proportion of the population in terms of the benefits of having access to electricity (Bernard, 2012). Thus, Uganda's low rural electrification rates is a reflection of the observed urban-rural bias in developing countries (Bernard, 2012; UBoS, 2017). Also, there are noticeable regional disparities in access to electricity in Uganda, with the electrification rate ranging as low as 13% in the North, 34% in the East, and 45% in the West and over 78% in the Central region (UBOS, 2017). Still, within regions richer household have a better access to electricity and greater consumption levels relative to their poor counterparts (UBOS, 2017). With these existing inequalities, many nationals are likely to be denied the potential benefits of access to electricity including better education outcomes, good health and employment benefits.

The world over, there is consensus that access to affordable and reliable clean energy is an integral component of social and economic development, as it leads to a better use of the available resources and to realize potential development both at individual and societal levels, reduces poverty, and promotes human health and independence (Khandker et al., 2013; Daka & Ballet, 2011). Clean energy with electricity in particular is one of the most important means to improve the quality of life (Martins, 2003; Khandker et al., 2013). Furthermore, electricity creates opportunities for people in terms of employment, education, reduces the twin burdens of poverty and diseases, and gives a strong incentive to individuals and government for long term investments (Republic of Uganda, 2015; Barnerjee et al., 2011). It is widely recognised that clean energy and specifically electricity in developing countries has a profound impact on educational outcomes and overall human development (Khandker et al., 2013; Daka & Ballet, 2011; Kanagawa & Nakata, 2008).

Uganda's socioeconomic progress appears to be mixed when one considers development indicators other than the rate of economic growth (UBOS, 2017). Uganda's annual per capita

GDP growth rate rose from 1.4% in 2006 to 6% in 2017 and peaked at 8.3% in 2007. Also, there has been a significant decline of the population living under poverty from 59% in 2000 to as low as 19.2% in 2015 and again peaked at 28.3% in 2017 (UBOS, 2005/6, 2015, 2017). Inequality levels in Uganda have persisted for the last three decades despite universal access to primary education introduced in 1992 and secondary education (USE, 2007), all aimed at increasing access to quality education in the country, a rural-urban gap in education still exists whereby primary enrolment increased from 45% and 75% in 2006 to 89% and 99% in 2017 for rural and urban areas, respectively (UBOS, 2006, 2017). In addition, there is a noticeable rural-urban gap in the on-time school completion rate that is attributed to fewer school hours, inadequate learning materials, low teacher quality and motivation (UBOS, 2017, Nannyonjo, 2007).

Although electricity is considered to be an important instrument that affects educational outcomes, it is necessary to know how this effect differs across boys and girls at the different education cycles and its relative importance in Uganda. Thus, a full understanding of the electricity-educational outcome relationship is important for national social and development planning since electrification can be directly and indirectly influenced by government policy. In Uganda, low household electrification is considered an obstacle to both individual and national development. Therefore, detailed knowledge of the household electrification-educational outcome relationship would doubtlessly facilitate social and economic development. Thus, both individual and policy makers require a better understanding of the circumstances in which household electrification is likely to promote the desired educational outcomes for a quality and productive labour force.

In Uganda, the official primary school entrance age is 6. The system is structured so that the primary school cycle lasts 7 years, lower secondary lasts 4 years, and upper secondary lasts 2 years, and 3 to 5 years of post-secondary education. Therefore, this study analyses the impact of household electrification on education outcomes for the school going children at different education cycles- primary level (6-12 years), secondary (‘O’ and ‘A’ levels, 13-18 years), taking into account the gender of the children. This is because, it is important to understand the size and distribution of the school going age population in order to inform policy formulation and implementation processes in the education sector at all levels.

Thus, this article provides answers to the following pertinent questions. First, controlling for the household characteristics and individual-child, does household electrification affect educational outcomes in Uganda? If so, how does it affect enrolment at the different education cycles? This implies that understanding the effect of household electrification per se on educational outcomes is not enough, the differential effect at various educational cycles can provide more meaningful insights. Second, does household electrification affect educational outcomes for male and female-children differently at the different education cycles? We hypothesize that household electrification positively influences educational outcomes in terms of enrolment for female and male children.

The results of this article not only contribute to the body of knowledge considering the changing nature of the social-economic environment but also inform policy makers and other stakeholders on the different effects of household electrification on educational outcomes at different education cycles. This study extends the earlier works on determinants of education outcomes by examining the factors that influence educational outcomes at different education cycles in a gender perspective. Previous studies (Nishimura, 2008; Nannyonjo, 2007) used cross sectional data and simple descriptive analysis and estimation of OLS that could not solve the omitted variable bias problem which commonly affect OLS results (Wooldridge, 2002). This study improves on the previous work on Uganda by employing panel data econometrics, which provides more power to infer the direction of causality, and also to solve the bias due to omitted variable problem (Wooldridge, 2002; Angrist & Pischke, 2009). In addition, the present study undertook a gender disaggregation to ascertain whether there are any discernible differences in the effect of household electrification on education outcomes at the different education cycles. The results show that household electrification has a large effect on education outcomes and explains a large part of educational outcomes across the different education cycles, such that children are more likely to be enrolled in school both boys and girls with electricity. The effect of background factors such age of the child and gender, education level of household head, sex, residence and household ownership and marital status have strong effect of enrolment of female and male children.

Section two reviews the selected literature. The data and empirical strategy are described in section three. Section four presents and discusses the study findings, while section five presents the concluding remarks.

2. SELECTED LITERATURE

There is a large body of theoretical and empirical evidence on the impact of household electrification on education outcomes. Evidence shows that household electrification improve household time allocation, lighting, ease of doing domestic chores like cooking, ironing and washing, which consequently increase children's reading time, watch education programs on TV, better children's health, household incomes plus low fertility rates, which affect the overall educational outcomes (Geske et al., 2006; Kanagawa & Nakata, 2008; IEG, 2008; Peters & Vance, 2011; Glick & Sahn, 2000). In addition, household characteristics such as education level of household head/parents, sex of the parent, residence, age, marital status, source of household water, and type of toilets influence educational outcomes (Grant & Behrman, 2010; Konstantopoulos & Borman, 2011; Khandker et al., 2013; Daka & Ballet, 2011). Also, the age of the child, sex and physical disabilities and owing to a complex interplay of household and community factors have a great effect on education outcomes (Daka & Ballet, 2011; Burke & Beegle, 2004; Anderson, 2000). Other factors that affect education outcomes are distance to school, type of school and school facilities (Konstantopoulos & Borman, 2011; Khan & Kiefer, 2007; Bowman & Anderson, 1980).

3. DATA AND EMPIRICAL STRATEGY

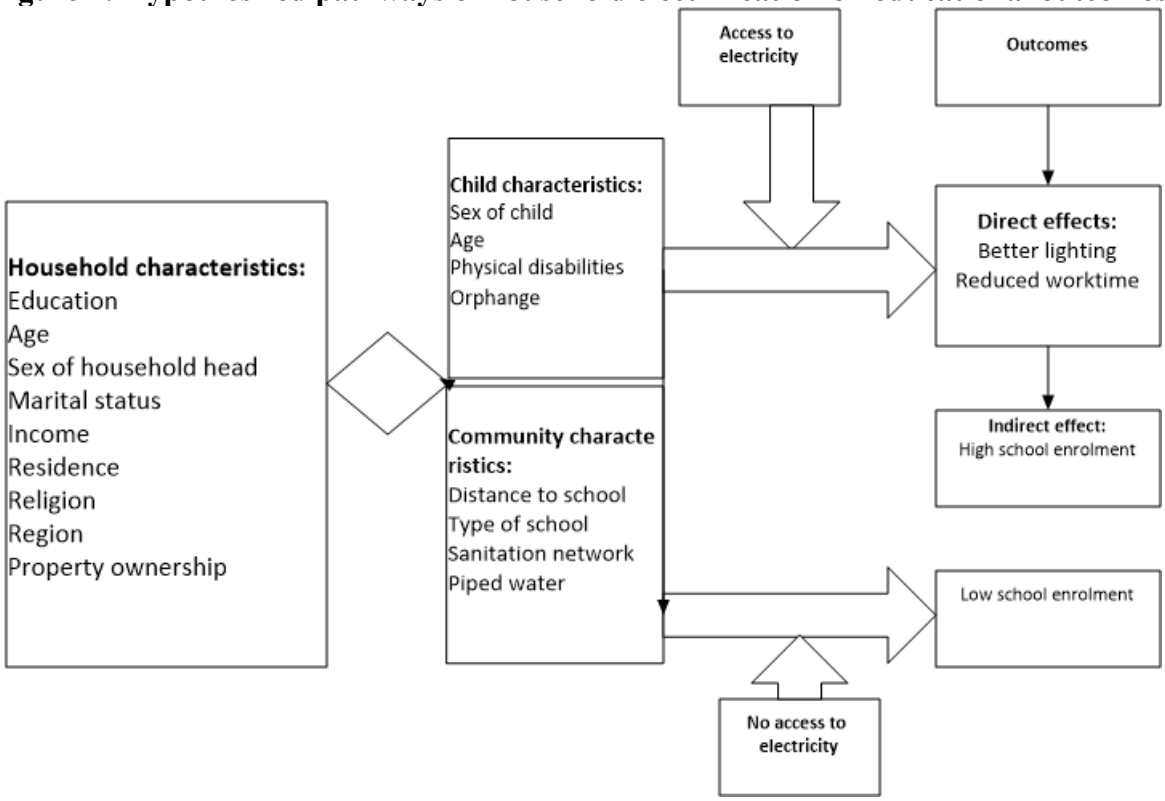
3.1 Data

Our analysis draws on education history of the children in the school going ages (age 6-18) to examine the effect of household electrification on school enrolment in Uganda. The data for our empirical application is drawn from five waves (2005/6, 2009/10, 2010/11, 2012/13, 2015/16) of the Uganda National panel Survey (UNPS), which provide information at the individual, household, and community levels (UBOS, 2017). The UNPS collects information on household composition (household size, age of each household member, sex and relationship to the household head), level of education, economic indicators (assets, poverty status, income and expenditure) and energy use. Also, it collects information on time use. Specifically, one is able to identify whether a household has electricity or not, gender of the child, children of school going age are enrolled in school or not, complete on-time or not a given grade, and whether household's residence is urban or rural. This sample is large enough to provide reliable estimates at individual-child level and by gender.

3.2 Empirical strategy

Figure 1 presents a conceptual framework that we put forward to explore the pathways for household electrification on educational outcomes. The development of this framework is based on the results from the reviewed literature. Our main assumption is that the change of electricity connection status for a specific household will affect the household itself in terms of lighting and time allocation and, potentially, the school outcomes of the child indirectly. This implies the existence of direct, indirect and total marginal effects. Also, household electrification may provide non-educational benefits such as good health or exposure, or reduced fertility, child's engagement in labour market to supplement low parental wages (Basu & Van, 1998). Our hypothesized causal pathway show that household electrification may influence educational outcomes through increased children's reading time or provide educative TV programs or enough time to rest due to reduced domestic work (Kanagawa & Nakata, 2008). Our conceptual framework takes into account not only household background characteristics but also individual-child and community characteristics as key factor that ultimately affect educational outcomes (Kanagawa & Nakata, 2008; IEG, 2008; Peters & Vance, 2011).

Figure 1: Hypothesized pathways of household electrification on educational outcomes



Source: Authors construction from reviewed studies

The households decision whether to get connected or not on national grid does not entirely depend on household income status but on government policy and thus household electrification cannot unequivocally be conceptualised as a household or community level infrastructure characteristic. Thus, rich households may not have access to electricity if they are located in a remote area where there is no electricity grid connection. Conversely, poor households may have access to electricity if they are located in a community with universal access to electricity grid connection. Unlike the theory of reasoned action, this model does not have behaviour as its end point but outcomes with regard to school enrolment.

This conceptual model is based on the argument that electricity consumption explicitly enters the household consumption and affects overall welfare of the household members (Ilahi & Grimard, 2000). Thus, to have a deeper understanding of the direct and indirect effects of electricity on the child's education outcomes, we undertake a rigorous analysis by estimating the following empirical model:

$$Edoutcome_{ijt=\beta HE_{ij}+\delta HC_{jt}+\theta CC_{ijt}+\pi Z_{jt}+T+\varphi_i+e_{ijt}} \quad (1)$$

In our model specification, i indexes children, j indexes households and t indexes time. The educational outcome is a binary dependent variables taking the value of '1' if a child i from household j is enrolled in school at time t, and '0' otherwise. HC is a vector of household characteristics (age of household head, sex, education level, residence, income level, household ownership, region, type of toilet, and marital status), CC is a vector of individual-child characteristics (age of the child, sex, and orphanage), Z is a vector of household infrastructures (type of school ownership, water sources), "HE" is a dummy equals "1" if the household has electricity and "0" otherwise, φ are household fixed effects and T are year fixed time effects and e is an error term.

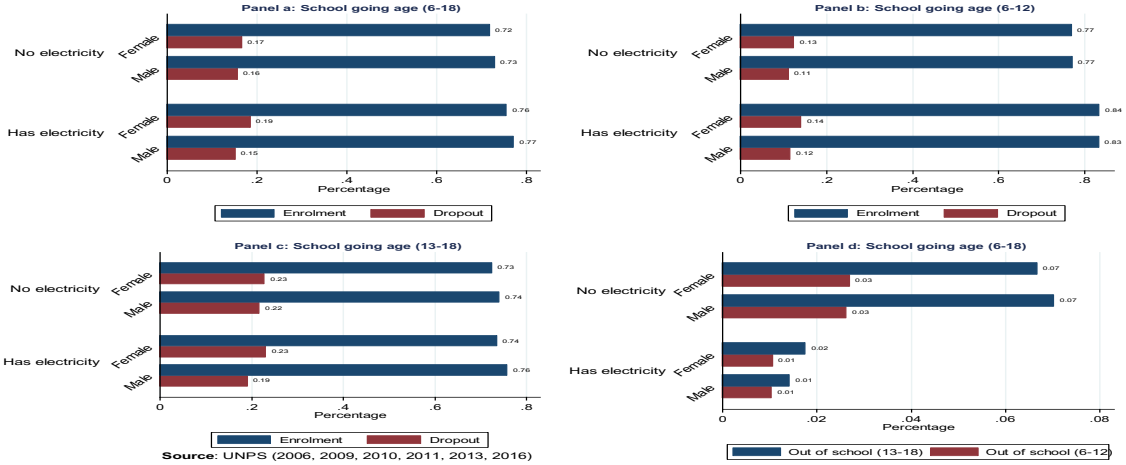
4. RESULTS

4.1 Descriptive results

Figure 2 shows the overall school enrolment, dropout and out of school of children of school going age in Uganda. Notably, households with electricity for all categories of school going have a high male and female enrolment of 77% and 76%, 83% and 84%, and 76% and 74% for ages 6-18, 6-12 and 13-18 respectively compared their counterparts with no electricity

connection. Also, we observe low male school dropout in households with and with no electricity for all age categories of school going than their female counterparts. Panel d of Figure 2 shows that households with electricity have the lowest proportion of children out of school for school going ages.

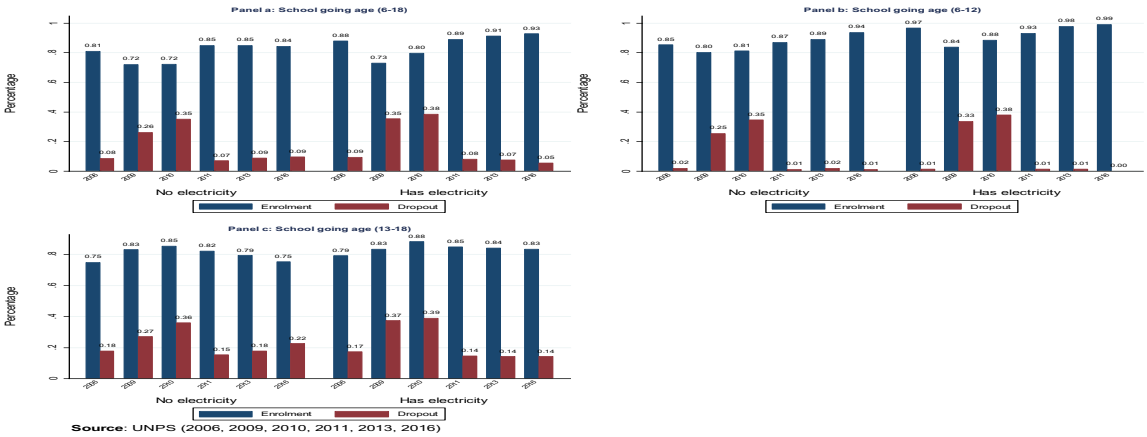
Fig 2: Enrolment, dropout and out of school by sex and household electrification ages (%)



Source: UNPS (2006, 2009, 2010, 2011, 2013, 2016)

Figure 3 presents rates of school enrolment and dropout over the study period. We observe that the trend of enrolment has remained high over the years that reflect the UPE and USE programs being implemented in the country. Figure 3 shows that 14% of boys of primary school age are out of school compared to 13% of girls of the same age. For children of primary school age in Uganda, the biggest disparity can be seen between households with electricity and those with no electricity.

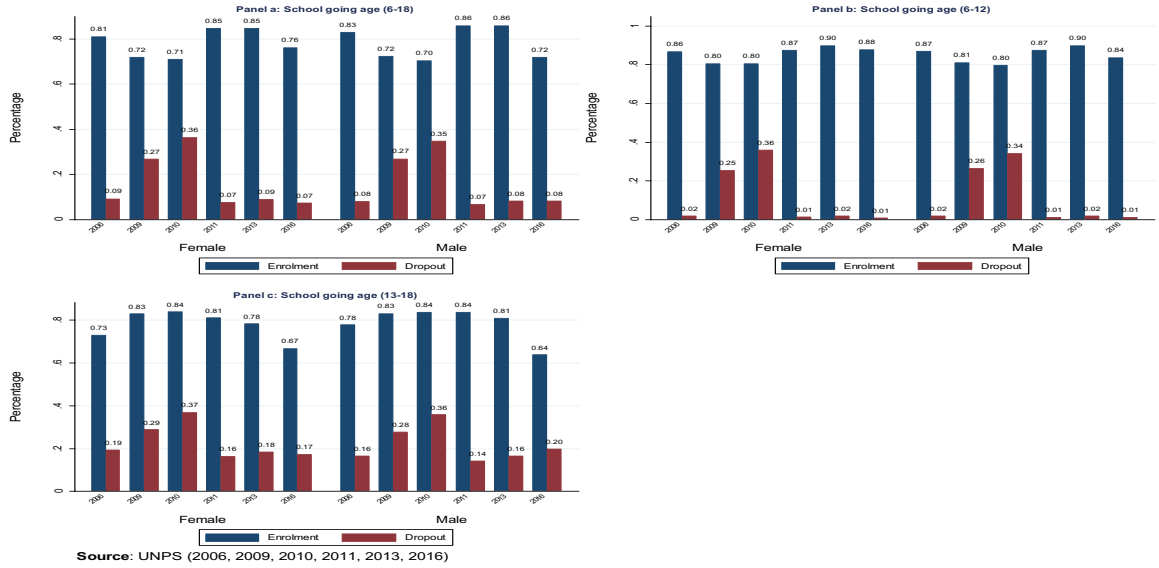
Fig 3: Enrolment and dropout by household electrification for school going ages (%)



Source: UNPS (2006, 2009, 2010, 2011, 2013, 2016)

Figure 4 looks at the percentage of secondary school ages that are enrolled and that have dropped out of school by sex. At age 6-12, no noticeable difference in enrolment and dropout between male and female. However, we note a big difference for ages 13-18 where a big disparity can be seen in school dropout between male and female.

Fig 4: Enrolment and dropout for school going ages by gender of child (%)



Source: UNPS (2006, 2009, 2010, 2011, 2013, 2016)

In addition, Table 1 presents descriptive evidence of sub-sample mean comparison test for variables between households with no and with electricity as a foundation for the quantitative analysis on the factors that affect school enrolment in Uganda. We find a difference between households with and without electricity in terms of both children and household characteristics significant at conventional levels. Also, in terms of school enrolment, we find a statistical difference between households with no and with electricity.

Table 1: Comparison of variables means between households with and with no electricity

Variables	No electricity	Mean 1	Electricity	Mean 2	Mean Difference
Enrolment (6-18)	33429	0.744	4298	0.793	-0.049***
Enrolment (6-12)	20755	0.785	2426	0.857	-0.072***
Enrolment (13-18)	15844	0.741	2326	0.767	-0.026***
Child age	33429	11.64	4298	12.19	-0.552***
Female child	33429	0.493	4298	0.512	-0.019**
Male child	33429	0.507	4298	0.488	0.019**
Non-orphan	28433	0.835	3583	0.810	0.024***
Orphan	28433	0.165	3583	0.190	-0.024***
No education	31832	0.192	4199	0.0560	0.136***
Primary	31832	0.575	4199	0.269	0.306***
Secondary	31832	0.183	4199	0.376	-0.193***
Postsecondary	31832	0.0500	4199	0.298	-0.248***
Female head	32081	0.300	4258	0.287	0.013*
Male head	32081	0.700	4258	0.713	-0.013*
Age of head	32133	47.23	4263	46.14	1.092***
Household size	32399	16.64	4247	16.66	-0.0300
Given free house	33050	0.0380	4298	0.121	-0.082***
Owned house	33050	0.908	4298	0.661	0.247***
Rented	33050	0.0540	4298	0.218	-0.165***
Never married	31091	0.253	4089	0.310	-0.057***
Married	31091	0.590	4089	0.547	0.043***
Divorced/separated	31091	0.0560	4089	0.0590	-0.00300
Widow/widower	31091	0.102	4089	0.0850	0.017***
Household expenditure	27814	370,000	3761	750,000	-385,000***
No piped water	33361	0.898	4286	0.383	0.515***
Piped water	33361	0.102	4286	0.617	-0.515***
Bush/uncovered toilet	32954	0.0930	4282	0.00500	0.088***
Covered	32954	0.763	4282	0.976	-0.214***
Flush/VIP	32954	0.144	4282	0.0190	0.125***
Nongovernment school	28034	0.225	3605	0.566	-0.342***
Government school	28034	0.775	3605	0.434	0.342***
Rural area	33387	0.852	4298	0.272	0.580***
Urban area	33387	0.148	4298	0.728	-0.580***
Central	33387	0.225	4298	0.700	-0.475***
Eastern	33387	0.274	4298	0.143	0.132***
Northern	33387	0.271	4298	0.0480	0.224***
Western	33387	0.229	4298	0.110	0.119***

***Indicates that the difference between the means is greater than zero at the significance level of 1%
Source: Authors' calculation based on UNPS (2006, 2009, 2010, 2011, 2013, 2016)

4.2 Empirical results

Table 2 presents findings from the educational outcomes model. Our findings articulate the importance of household electrification in influencing the probability of school enrolment and repetition in both urban and rural areas. Results show that access to electricity increases chances of enrolment by 11% for all children aged (6-18) and by 10% for children aged (6-12) and (13-18). Also, child age influences children's likelihood to be enrolled in school. The

marginal effect show that one additional year increases chances of child enrolment by 7% for children aged (6-18) and by 1% for children aged (6-12), and by 13% for children aged (13-18). For the nonlinear effect of age, the results show that after a certain age, one additional year reduces the likelihood of enrolment by 3% for children aged (6-18) and (13-18). In addition, being male increases the chances of enrolment by 1% for children aged (13-18). As expected, being an orphan reduces the likelihood of enrolment by 2% and 3% for children aged (6-18) and (6-12), respectively. These finding are consistent with findings of previous authors (Konstantopoulos & Borman, 2011; Khandker et al., 2013; Daka & Ballet, 2011).

As expected, education attainment of household head increases the probability of enrolment for all school age children. Estimated marginal effect show that having primary education increases enrolment by 3% for children aged (6-18) and (6-12) and by 4% for age (13-18). Household head with secondary and postsecondary education increases the probability of enrolment by 4% for all categories of school going age compared to the no education category. Male household head are associated with decreasing chances of enrolment of 1% for children aged (6-18) and (6-12) compared to their female counterparts. Also, young parents are associated with a deceasing likelihood of enrolment by 1% for ages (6-18) and (6-12), while mature household increases the probability of enrolment by 1% for ages (6-18) and (6-12).

Surprisingly, large households are associated with an increasing probability of enrolment by 1% for all school going age categories. The marginal effects of type of house ownership reveal that individuals in owned houses increases chances of enrolment by 5% and 6% for ages (6-18) and (6-12) and by 4% for ages (6-18) and (6-12) for rented houses. Furthermore, marital status of household head influences the likelihood of enrolment. Being married increases enrolment by 30% for age (6-18), 27% for age (6-12) and by 32% for age (13-18). Also, being divorced/separated increases enrolment by 9% for age (6-18), 7% for age (6-12) and by 11% for age (13-18), while being a widow increases enrolment by 11% for age (6-18), by 8% for age (6-12) and by 13% for age (13-18). These finding are consistent with findings of previous authors (Sackey, 2007; Van de Walle et al., 2013; Khandker et al., 2013; Daka & Ballet, 2011).

Table 2: Estimated Marginal Effects of access to electricity on School enrollment in Uganda

Variables	School enrolment age (6-18)	School enrolment age (6-18)	School enrolment age (6-18)
Electricity	0.107***	0.095***	0.103***
	(0.000)	(0.000)	(0.000)
Child age	0.071***	0.014*	-0.133***
	(0.000)	(0.090)	(0.000)
Child age squared	-0.032***	-0.001	0.033***
	(0.000)	(0.966)	(0.004)
Male child	0.005	-0.001	0.014*
	(0.248)	(0.910)	(0.068)
orphanage	-0.018**	-0.028***	0.000
	(0.011)	(0.002)	(0.994)
Education (RC: No education)			
Primary	0.033***	0.028***	0.039***
	(0.000)	(0.000)	(0.000)
Secondary	0.044***	0.040***	0.043***
	(0.000)	(0.000)	(0.000)
Postsecondary	0.038***	0.035***	0.038***
	(0.000)	(0.000)	(0.006)
Male household head	-0.009	-0.014**	-0.001
	(0.102)	(0.031)	(0.917)
Household age	-0.008***	-0.011***	-0.003
	(0.000)	(0.000)	(0.156)
Household age squared	0.007***	0.010***	0.002
	(0.000)	(0.000)	(0.349)
Household size	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.001)
House ownership (RC: Given free)			
Owned	0.050***	0.062***	0.029
	(0.001)	(0.000)	(0.213)
Rented	0.040***	0.040***	0.031
	(0.000)	(0.000)	(0.116)
Marital status (RC: Never Married)			
Married	0.300***	0.272***	0.322***
	(0.000)	(0.000)	(0.000)
Divorced/separated	0.090***	0.070***	0.109***
	(0.000)	(0.000)	(0.000)
Widow/widower	0.105***	0.082***	0.127***
	(0.000)	(0.000)	(0.000)
Household expenditure	0.022***	0.013***	0.031***
	(0.000)	(0.004)	(0.000)
Piped water	0.007	0.008	0.003
	(0.372)	(0.362)	(0.826)
Type of toilets (RC: Bush/uncovered)			
Flush/VIP	0.074***	0.087***	0.038**
	(0.000)	(0.000)	(0.017)
Covered	0.049***	0.050***	0.026*
	(0.000)	(0.000)	(0.055)
Government	-0.017***	-0.017**	-0.014
	(0.004)	(0.015)	(0.161)
Urban area	0.016**	0.012*	0.025**
	(0.013)	(0.092)	(0.017)
Regions (RC: Central)			
Eastern	-0.008	-0.016*	0.005
	(0.245)	(0.054)	(0.644)
Northern	-0.068***	-0.076***	-0.045***
	(0.000)	(0.000)	(0.001)
Western	0.005	-0.002	0.016
	(0.485)	(0.839)	(0.148)
Observations	15,754	9,683	6,358
Log likelihood	4388.03	2514.55	1891.27
LR test	8.91(0.004)	3.72(0.001)	2.40(0.006)
Wald chi^2	3367 (0.000)	770.2 (0.000)	396.4 (0.000)

Robust pval in parentheses *** p<0.01, ** p<0.05, * p<0.1

Analysis of household facilities reveal that having Flush and covered toilets compared to counterparts using Bush/uncovered toilets increases the chances of enrolment by 7% and 5% for children aged (6-18), 9% and 5% for age (6-12) and by 4% and 3% for age (13-18).

Residing in urban areas increases the enrolment by 2%, 1% and 3% for children age (6-18), (6-12) and (13-18), respectively. The marginal effect of residing in the Eastern and Northern regions are negative. This show that residing in the Eastern region reduces the chances of enrolment by 2% for children aged (6-12), while residing in the Northern region reduces probability of being enrolled in school by 7%, 8% and 5% for children aged (6-18), (6-12) and (13-18), respectively compared to their counterparts in the Central region.

The results for the enrolment by gender are presented in Table 3. The results for the six models show that access to electricity has a positive and significant effect on enrolment for male and female children. Results show that access to electricity increases enrolment probability for all age categories (6-18), (6-12) and (13-18). Also, child age influences children's likelihood to be enrolled in school. Also, age of the both female and male children has an inverse effect on chances of enrolment for all school going age children. Also, orphanage of a child compared their counterparts with parents reduces the probability of enrolment for female aged (6-18), and for female and male aged (6-12). The results indicate when one becomes of age, he/she can maneuver his/her being in school. These finding are consistent with findings of previous authors (Bernard, 2012; Martins, 2005; Glick & Sahn, 2000).

Also, education attainments (primary, secondary and postsecondary) of household head compared to counterparts with no education increases the probability of enrolment for female and male of school going age. Also, male household heads reduce the chances of enrolment for male aged (6-12), while age linearly reduces the probability of enrolment and the age squared increases the probability of enrolment for both female and male of all school going age. In addition, household size increases the probability of enrolment for all school going age categories. The marginal effects shows that staying in owned house and rented house increases chances of enrolment for ages (6-18) and (6-12). Furthermore, being married, divorced/separated or widow/widower compared to counterparts that have never been married increases enrolment for both female and male children. These finding are consistent with findings of previous authors (Konstantopoulos & Borman, 2011; Khandker et al., 2013; Daka & Ballet, 2011).

Table 3: Marginal Effects of having access to electricity on school enrollment by gender in Uganda

	School enrolment age (6-18)		School enrolment age (6-18)		School enrolment age (6-18)	
Variables	Female	Male	Female	Male	Female	Male
Electricity	0.096***	0.118***	0.084***	0.107***	0.094***	0.109***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child age	0.070***	0.073***	0.016	0.013	-0.140***	-0.126***
	(0.000)	(0.000)	(0.174)	(0.252)	(0.007)	(0.007)
Child age squared	-0.032***	-0.033***	-0.002	0.001	0.036**	0.031**
	(0.000)	(0.000)	(0.759)	(0.932)	(0.042)	(0.048)
Orphanage	-0.011	-0.027**	-0.024**	-0.034**	0.008	-0.010
	(0.253)	(0.010)	(0.050)	(0.015)	(0.569)	(0.494)
Education (RC: No education)						
Primary	0.037***	0.027***	0.031***	0.024**	0.050***	0.029**
	(0.000)	(0.003)	(0.003)	(0.021)	(0.003)	(0.049)
Secondary	0.047***	0.040***	0.036***	0.043***	0.061***	0.025
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.130)
Postsecondary	0.035***	0.041***	0.035***	0.035***	0.034*	0.047**
	(0.002)	(0.000)	(0.002)	(0.005)	(0.083)	(0.011)
Male household head	-0.005	-0.013	-0.008	-0.020**	0.002	-0.003
	(0.527)	(0.113)	(0.382)	(0.024)	(0.882)	(0.838)
Household age	-0.006***	-0.009***	-0.009***	-0.012***	-0.001	-0.004*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.763)	(0.097)
Household age squared	0.005***	0.008***	0.008***	0.011***	-0.000	0.003
	(0.001)	(0.000)	(0.000)	(0.000)	(0.962)	(0.176)
Household size	0.001***	0.001***	0.001***	0.001***	0.001	0.001***
	(0.000)	(0.000)	(0.002)	(0.000)	(0.113)	(0.002)
House ownership (RC: Given free)						
Owned	0.028	0.078***	0.047**	0.081***	-0.007	0.075*
	(0.126)	(0.001)	(0.036)	(0.003)	(0.812)	(0.056)
Rented	0.030**	0.049***	0.029**	0.050***	0.030	0.038
	(0.033)	(0.000)	(0.032)	(0.000)	(0.288)	(0.106)
Marital status (RC: Never Married)						
Married	0.302***	0.297***	0.272***	0.270***	0.328***	0.318***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Divorced/separated	0.087***	0.090***	0.066***	0.072***	0.109***	0.107***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Widow/widower	0.101***	0.106***	0.078***	0.084***	0.126***	0.125***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household expenditure	0.021***	0.020***	0.013**	0.012*	0.029***	0.030***
	(0.000)	(0.000)	(0.036)	(0.052)	(0.001)	(0.001)
Piped water	0.012	0.005	0.011	0.006	0.008	-0.001
	(0.258)	(0.682)	(0.371)	(0.638)	(0.633)	(0.965)
Type of toilets (RC: Bush/uncovered)						
Flush/VIP	0.074***	0.073***	0.083***	0.087***	0.021	0.050**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.357)	(0.022)
Covered	0.044***	0.053***	0.050***	0.049***	-0.009	0.048***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.707)	(0.001)
Government	-0.022***	-0.012	-0.023**	-0.009	-0.016	-0.013
	(0.007)	(0.159)	(0.012)	(0.358)	(0.260)	(0.389)
Urban area	0.012	0.019**	0.015	0.007	0.011	0.036**
	(0.190)	(0.036)	(0.121)	(0.496)	(0.480)	(0.010)
Regions (RC: Central)						
Eastern	-0.001	-0.017	-0.004	-0.030**	0.001	0.007
	(0.947)	(0.109)	(0.748)	(0.023)	(0.960)	(0.647)
Northern	-0.073***	-0.062***	-0.068***	-0.080***	-0.075***	-0.019
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.282)
Western	0.002	0.006	0.003	-0.007	0.001	0.028*
	(0.820)	(0.535)	(0.803)	(0.584)	(0.952)	(0.059)
Observations	7,615	8,139	4,761	4,922	2,983	3,375
Log-likelihood	2071.29	2300.93	1204.82	1297.96	866.46	1006.29
LR test	4.34(0.044)	4.37(0.018)	2.96(0.043)	6.44(0.000	2.79(0.047)	6.34 (0.006)
Wald chi^2	1650 (0.000)	654.2 (0.000)	238.1 (0.000)	304.9 (0.000)	114.9 (0.000)	149.7 (0.000)

p-values in parentheses $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Gender based results show having flush and covered toilets compared to counterparts using Bush/uncovered toilets increases the chances of enrolment for female and male of all school going age. Surprisingly, residing in urban areas increases the enrolment only for male aged (6-18) and (13-18). Also, residing in the Eastern region reduces the chances of enrolment of boys (6-12), while residing in the Northern region reduces the chances of enrolment for female and male aged (6-12) and (6-12), and only girls aged (13-18).

5. CONCLUDING REMARKS

This article analyses the impact of household electrification on education outcomes in Uganda taking into account the gender perspective using data drawn from 6 waves of the UNPS and employ panel probit. The results reveal that children from electrified households have better school outcomes in terms of high school enrolment. Interestingly, electricity connection to household significantly affects female's education than their male counterparts. Also, urban location significantly increases school enrolment rates compared to the rural counterparts. The northern region stands out in reducing school enrolment compared to the central region.

A number of policy lesson emerge from the study findings. First, government and other stakeholders should undertake measures aimed at increasing household electrification efforts to enable all household get electricity connections and benefits accrued. Second, government should ensure that all schools are connected to electricity across the country. Also, there need for government to continue clean water connection to schools given their impact on school enrolment. Also, our study findings point out the need for the energy sector interventions to be designed in such a way as to benefit the most vulnerable in society both from the perspective of social equity and for the reforms to be acceptable and hence ultimate sustainability of the reforms. This will go a long way in promoting school enrolment.

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