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THE IMPLICATIONS OF WATER AND ELECTRICITY SUPPLY FOR THE TIME ALLOCATION OF WOMEN IN RURAL GHANA

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ABSTRACT

This paper investigates the time allocation of women in Ghana as a trade-off between domestic chores and market-oriented activities when households are provided with water and electricity infrastructure. Using the Ghana Living Standards Survey, Round Four, we find that the time spent on remunerated activities increases when households are provided with electricity, while the supply of water reduces the time burden faced by rural women.

JEL classification: D13, J22, H41, Q25.

Keywords: poverty, time allocation, basic services provision.

INTRODUCTION

In developing countries, social norms guide intra-household divisions of labour and use of time. Time allocation is largely influenced by gender, inasmuch as work opportunities are distinct for women and men. Female income poverty is often linked to time poverty. Women spend several hours a day performing domestic chores and caring for other household members. Releasing time constraints would enable women to engage in productive activities (participate in labour markets), dedicate more time to other domestic activities (such as childcare or caring for elderly members), pursue further education, or have some leisure (which in turn contributes to better health).

The disproportionate burden of domestic activities on women, in turn, is exacerbated by a lack of basic infrastructure. The provision of infrastructure, mainly water and electricity, has the potential to reduce the time burden women face. The saving includes time spent on loading and unloading water, purifying it, and walking to and from the water source. Furthermore, access to safe water improves overall household living conditions through its associated benefits, such as reducing waterborne diseases, lowering infant mortality and preventing the threat of violent aggression towards women on their way to water sources, which are often located some distance from their homes.

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This paper shows how greater access to water and electricity changes women's time allocation among paid activities (labour market), unpaid activities (domestic chores) and leisure. The paper contributes to the literature on gender-based time poverty by providing empirical evidence from rural Ghana. It is structured as follows: Section 2 briefly reviews the literature on infrastructure and gender bias. Section 3 discusses the conceptual framework. Section 4 presents the data and empirical models. The results of the empirical exercise are provided in Section 5. Section 6 offers concluding remarks.

1 INFRASTRUCTURE AND TIME USE IN THE LITERATURE

There is a consensus that better basic infrastructure improves living standards. Additionally, there is a growing awareness that the time spent on activities such as fetching water or wood represents not only a decline in households' well-being but also significant forgone income if the time saved were to be spent on paid activities. Whittington et al. (1990) have estimated that the value that households in a Kenyan village place on the time they spend collecting water amounts to the wage rate of an unskilled worker. This has important implications for household income poverty.

Improvements in living standards arising from access to infrastructure are both direct and indirect. Direct impacts stem from a clear cause-and-effect relationship whereby clean water, sanitation and proper collection of disposables, for instance, give rise to improved health and a better quality of life. Indirect effects stem from the extra time available to households as a result of their access to basic services, and their ability to use that additional time in order to improve their living standards: further education, better household care, participation in the labour market, or even more leisure.

Thus far, however, the literature has not reached an empirical consensus on the relationship between infrastructure and access to labour markets. Using the Pakistani household living standards survey of 1991, Ilahi and Grimard (2000) show that poor rural infrastructure (lack of access to water) reduces the time that women devote to market-oriented activities and increases their total work time. This implies that water provision in these communities encouraged not only a move towards market-oriented work among women, but also an increase in the time available for leisure. While the first result has the potential to reduce income poverty, the s econd is important for the elimination of women's time deprivation.

Time, being a limited resource, involves a trade-off between competing activities. When individuals struggle to find time, apart from their working duties, the constraint is known as time poverty. Bardasi and Woodon (2006) suggest the thresholds of 70.5 and 94 hours a week.[1] They use a 2002–2003 time-use survey of Guinea to analyse the determinants of the probability of individuals being time-poor as a function of personal, household and location characteristics. Analysing Guineans aged 15 and above they find that women have a 3 percentage-point higher probability of being time-poor than men; being a woman in the countryside adds 10 percentage points to this probability. The authors argue that this time-poverty gender bias is caused by the rising demands of household care and by a lack of access to basic infrastructure.

Coloumbe and Wodon (2008) investigate the distribution of working hours for adults (male and female) aged between 25 and 64 in Ghana, using data for 1991, 1998 and 2005. They argue that women are more likely to be time-poor than men, but that having access to infrastructure does not significantly affect the total number of hours that women work. They suggest, however, that better access to infrastructure may lower the domestic work burden as time is reallocated to women's participation in productive activities—which potentially could help alleviate income poverty.

In summary, there is some evidence that access to basic infrastructure helps reduce income poverty. The relationship, however, is not always evident. More empirical evidence is therefore needed, and further research is required.

3 THE THEORETICAL FRAMEWORK

Studies of time allocation are often based on Becker's (1965) utility model. We closely follow Ilahi and Grimard (2000), wherein water consumption explicitly enters the household consumption model. In our extension, besides testing whether poor water-supply infrastructure affects women's time allocation, we also investigate the role of electricity supply.

We consider the household as a unitary entity that combines time and market-purchased goods to produce commodities that comprise the household utility function. The household maximises its utility depending on the goods and leisure time consumed. Consumption, *ci*, is determined by a home production function as follows:

$$c_i = c(W_i, x_i, t_i^h; \gamma_i)\,, \qquad (1)$$

where W_i is the amount of water consumed by household *i*, x_i is a set of market-purchased goods, t_i^h is the time allocated to home goods (domestic chores) production, and γ_i is the home production technology parameter.

Water consumption, *W*, depends on household water production, largely influenced by how much time households allocate to collecting water, t_i^w.[2] This task is usually performed by one or a few household members, who first choose whether or not to collect water, and then decide how many hours to spend doing so. The amount of water consumed also depends on the infrastructure available for water collection, α_i, which considers both household and community characteristics faced by household *i*. Households in communities served by the utility network may spend much less time fetching water than if members had to walk a couple of miles to reach the water source.

$$W_i = f(t_i^w; \alpha_i)\,. \qquad (2)$$

The household's problem is to decide on the consumption level and the time allocated to each activity (water production, t^w; market labour, t^m; household activities, t^h; and leisure, t^l) according to its preferences (τ_i) and constrained by its available income (market wage, *w*; and non-labour income, *V*), plus a daily time endowment, *T*.

$$\max_{c_i, t_i^l} u_i = u(c_i, t_i^l; \tau_i)$$
$$s.t.\ t_i^w + t_i^m + t_i^h + t_i^l \leq T$$
$$x_i \leq w_i t_i^m + v_i \quad (3)$$

The solution yields the optimum set of time and goods demand functions:

$$t^{j*} = t^{j*}(w, v, \tau, \alpha, \gamma)$$
$$x^* = x^*(w, v, \tau, \alpha, \gamma) \quad (4)$$

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

Our aim is to understand the effects of changes in community and household-level access to water and electricity infrastructure on women's allocation of time to collecting water, domestic activities, market-oriented activities and total work.

It is important to be aware of the differences between access to water and electricity. Lack of direct access to water means that households' daily water needs must be met by collecting water. Some household members thus have to devote part of their time to that task. Electricity has no perfect substitute such as between piped and collected water. But access to it improves productivity and therefore allows the reallocation of time spent on each type of work.

4 DATA AND EMPIRICAL MODEL

4.1 DATA

We use data from the Ghana Living Standards Survey, Round Four (GLSS 4). The survey was carried out during 11 consecutive months between March 1998 and February 1999 by the Ghana Statistical Service. The survey-sampling design entailed two stages. First, the 300 Enumeration Areas (EAs) were chosen using the probability-proportional-to-size method based on the number of households in the EA. In the second stage, 20 households in each EA were systematically selected, giving the total of 6,000 households surveyed.

In this study we analyse the time use of a sample of 3,799 households in the 190 rural communities surveyed. We focus on rural areas because of the low rate of access to water and electricity.[3] More specifically, we are interested in individuals between 25 and 59 years old, corresponding to a sample of 2,858 women and 2,052 men. This cohort ideally reflects an individual's productive age—that is, those who have finished school and are not yet considered elderly.[4] To define the lower age boundary for our sample we evaluate empirically the proportion of women still studying. If women are attending school they are expected to have limited participation in both the labour market and domestic activities. We restrict our sample to individuals in the economically productive age, measured as the ability to work with no mandatory educational time constraints. Although the illiteracy rate in rural Ghana is high and most rural Ghanaian women do not reach secondary school, it is estimated that 61.7 per cent of women above 15 years of age had attended school for some period during the year before the survey. This proportion declines with age, reaching a share of less than 1 per cent for women aged 25. This is then taken as our lower bound benchmark. Moreover, our definition of elderly is based on the threshold of 60 years old, in line with Ghana's National Pension Scheme threshold for a Ghanaian to formally retire.[5]

A total of four models are estimated using the sample of rural individuals. First we examine men and women's determinants of time allocation to total hours worked. Then we focus on women's use of time in fetching water, domestic work and market work. The time spent fetching water corresponds to the weekly hours a woman spends, individually, on that task. Domestic chores are measured as the weekly hours spent on unpaid activities such as ironing clothes, childcare, washing vehicles, sweeping, disposing of garbage, cooking, shopping for the household, running errands, washing dishes, housekeeping, and hours fetching water and wood. Market work is computed as the weekly hours spent on any productive, paid, or market-oriented activity. Finally, the total hours of work comprise the time spent on paid and unpaid activities.

Access to water is internationally recognised as the availability per person of "at least 20 litres a day of clean water from a source less then 1 kilometre from their home" (UNDP, 2006: 80–81). This classification also emphasises that water must be obtained from an "improved source", including piped water, public taps, standpipes, boreholes, protected wells, protected springs and rainwater.[6] From a human welfare perspective, piped water fulfils the requirements for water provision: quantity is not rationed, quality is reliable and the distance to the household is the shortest.

Because of the survey structure, we define access to water according to the household's distance from the main source of drinking water, rather than relying solely on the improved water source classification. Given our interest in the time spent fetching water, our access definition strictly follows an effort-requirement perspective: a household has access to water if none of its members would have to walk in order to obtain drinking water. Households therefore have access to water if they are at zero distance from the water source. If the distance is greater than zero, household members would have to expend effort and time fetching water. These households are considered as not having access to water. Moreover, a question about distance to the water source was posed to households consuming water from wells (with or without a pump) or rivers/lakes. However, those who said they consume water from indoor plumbing, an internal standpipe, a public standpipe, a water vendor, a water truck, neighbouring private outdoor taps or from rainwater were not asked to report the distances, and thus they are considered as having access to water.

At the aggregate level, a community is considered as having water infrastructure if more than 50 percent of its households have indoor access to drinking water. Community-level variables avoid endogeneity problems, since the same non-observed features that affect households' time allocation can affect their decisions about access to infrastructure (electricity, water and distance from the water source). Excluding the household itself from the calculation of these variables is an alternative in order to clean up the effect of household decisions on the construction of the variables. The same non-observed features that affect individuals' time allocation may affect their decisions about whether or not to connect to infrastructure and the kind of provision (electricity, water and distance from the water source).

Hence the set of control variables in our analysis (see Table 1) can be arranged in five large groups: (i) individual characteristics—age, education (none, primary, secondary and tertiary), dummies for household head and whether the woman is the head's spouse; (ii) demographic composition of the household—number of children (disaggregated by gender and age) and other adult household members (men, women and elderly); (iii) household asset holdings and per capita income (excluding the individual himself/herself), in order to account for living standards; (iv) community infrastructure, accounting for the presence of water and electricity infrastructure, distance to the water source and to the nearest market, and community income level (excluding the household itself); and (v) seasonal and regional dummies to capture differences in climatic conditions.

TABLE 1

Variables, Summary Statistics

	Mean	Std. dev.
Individual characteristics		
Age (years)	37.55	9.19
Education—none*	0.62	0.48
Education—primary*	0.15	0.36
Education—secondary*	0.19	0.40
Education—tertiary*	0.03	0.17
Head*	0.25	0.43
Spouse*	0.64	0.48
Household demographic composition		
Children—0/3 years old	0.67	0.80
Children—4/6 years old	0.61	0.73
Girls—7/10 Years old	0.38	0.59
Girls—11/14 years old	0.33	0.57
Boys—7/10 years old	0.44	0.66
Boys—11/14 years old	0.33	0.59
Other adult women	0.63	0.95
Adult men	1.19	1.03
Elderly	0.24	0.50
Household assets		
Land ownership*	0.37	0.48
Durable goods (GHS)	3,592,778.0	1.38E+07
Enterprise goods (GHS)	1,963,210.0	2.89E+07
Per capita income (GHS)	11,940.6	24801.57
Community infrastructure		
Per capita income (GHS)[a]	18,450.5	17562.2