

Households' Choice of Drinking Water Sources in Malawi

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Introduction

- Safe drinking water is a basic human right essential to all.
 - Water is used in productive and consumptive activities;
 - Contributes to rural and urban livelihoods in many different ways.
- To facilitate monitoring of MDG on water, SSA was set to reach 75% water coverage target before 2015.
 - Although access to improved water supply in SSA steadily improved from 49% in 1990 to 60% in 2008, the region is not on track to meet the 75%
 - Huge differences in the proportion of people using improved drinking water sources in SSA countries.
 - For example, South Africa achieved 93% water coverage, Zimbabwe 77%, Zambia 65% and Malawi 90% in 2015 (UNICEF/WHO, 2015).

Motivation of the Study

- Although Malawi has surpassed the MDG on water of 75% coverage, the country is considered a water-stressed country (USAID, 2010; GoM, 2013; Chipofya, et al., 2012).
 - Fresh water per capita is < 1,700 m³ and is projected to fall to < 1,000 m³ by 2015.
- Major issues in Malawi relate to inadequate funds to extend services to large numbers of people and inadequate sustainable services which results in low quality services, low willingness to pay, and lack of maintenance requiring high levels of rehabilitation investments in the rural areas.
 - These block expansion of water services to areas that are not served with improved water points.
- Example: 79% of boreholes and 49% of gravity-fed schemes were non-functioning in rural areas in 2008 (Baumann and Danert, 2008).

Rationale of the Study

- The main objective of this study is to identify factors that affect households' choice of drinking water in Malawi.
 - Malawi's nationally representative cross-sectional data.
- Beyond this contribution, this study makes one additional contribution to the existing literature by explicitly testing validity of independence from the irrelevant alternatives (IIA) assumption in a Multinomial logit model (MNL) specification in household's choice of drinking water source.
 - IIA assumption stipulates that the ratio of the probabilities for two choices (piped water through a house connection and boreholes, for example) does not depend on what other alternatives are available (Hausman and McFadden, 1984).

Methodology

- This study developed a theoretical framework following a random utility model (RUM) from McFadden's (1974) proposition.
 - A random utility model describes a choice decision in which an individual i has a set of alternative water sources j from which to choose
 - It is assumed that each water source has its attributes which also influence individual's choice over another alternative.
- RUM helps us address how households make choices over alternative water sources.
 - The model is based on the notion that an individual chooses an alternative that maximizes their utility.

Methodology

- This study applied a multinomial logit model to identify factors that influence households' choice of the main source of drinking water.
 - Dependent variable, sources of drinking water, has more than two categories with no natural ordering, representing the different options households have in terms of access to drinking water.
 - The categories are mutually exclusive.
- Although it is simple to compute choice probabilities, main limitation of the MNL model is the IIA property.

Methodology

- The MNL model for water choice specifies probability of choosing j and the set of explanatory variables x_{ij} as

$$[1] \quad Prob(Y_i = j) = \frac{e^{\beta'_j x_i}}{\sum_{k=0}^J e^{\beta'_k x_i}}, j = 0, 1 \dots J$$

- Dependent var. is log of one alternative relative to the base alternative
- Borehole as primary drinking water source was set as the base case outcome.

Data Sources

- Malawi's nationally representative data from Third Integrated Household Survey (IHS3) which was conducted in 2010/11 by NSO.
 - 12,271 households
- A stratified two-stage sample design was used for the IHS3.
 - This survey collected information from the households and communities pertaining to their demographics; education; health; time use; labour and living conditions, including various sources of drinking water.

Empirical results

- To explore potential multicollinearity among the explanatory variables which can lead to imprecise parameter estimates, an OLS model was fitted
 - Multicollinearity was tested using the variance inflation factors (VIF).
 - The VIFs of all included variables were less than 10 indicating that multicollinearity is not a serious problem in the reduced-form model.
- Hausman test was applied to check for the validity of the IIA assumption (Hausman and McFadden, 1984)
 - The Hausman test with a Chi-square statistic of 3.21 and P-value of 0.9997 fails to reject the null hypothesis of independence of the household's choices of water sources under consideration, implying that the MNL specification was justified (StataCorp, 2009).

Variables: dependent variable is choice of particular water source	Piped into dwelling	Piped into yard/plot	Communal standpoint	Open well in yard/plot	Protected public well	Open public well	Protected well in yard/plot
Time taken in minutes	-0.1010 (0.0604)	-0.0753*** (0.0202)	-0.0062 (0.00322)	-0.0606** (0.0230)	-0.00320 (0.00468)	0.00868*** (0.00200)	-0.0619 (0.0391)
Sex of head, 1= female	0.761** (0.272)	0.301 (0.249)	0.157 (0.164)	-0.909* (0.396)	0.318 (0.252)	-0.342** (0.126)	-0.0823 (0.399)
Household size by composition							
<i>Children (<15)</i>	0.186** (0.0628)	-0.00917 (0.0475)	0.0450 (0.0307)	-0.0433 (0.0672)	-0.00653 (0.0522)	-0.0235 (0.0241)	0.186 (0.179)
<i>Male(15≤65)</i>	0.367*** (0.109)	0.145 (0.0851)	0.00707 (0.0692)	-0.135 (0.136)	-0.164 (0.102)	-0.117* (0.0525)	0.0422 (0.167)
<i>Female (15≤65)</i>	0.522*** (0.0908)	0.274*** (0.0760)	0.0761 (0.0569)	0.0109 (0.121)	0.0332 (0.0894)	-0.116* (0.0491)	-0.0622 (0.131)
<i>Elderly (>65)</i>	0.798*** (0.195)	0.0249 (0.166)	-0.134 (0.0893)	0.161 (0.171)	-0.199 (0.147)	-0.165* (0.0643)	0.397 (0.231)
Log of per capita annual expenditure	15.01*** (1.716)	6.348*** (1.576)	3.102* (1.351)	2.010 (2.385)	-4.826 (2.760)	-5.171*** (1.480)	8.336*** (2.390)
Acreage owned	-0.309*** (0.0861)	-0.361** (0.116)	-0.322*** (0.0700)	0.00165*** (0.000448)	-0.00119 (0.00150)	-0.00163 (0.00136)	-0.0207 (0.0892)
Log of farm income in Malawi Kwacha	-1.759 (1.635)	-0.0534 (0.203)	-0.756 (0.840)	-0.00590 (0.783)	0.229 (0.248)	-0.195 (0.616)	-1.519 (4.977)
Total number of livestock	-0.0150 (0.00988)	0.00583 (0.00666)	0.00522 (0.00526)	0.00905 (0.00556)	0.00967 (0.00673)	0.00880* (0.00400)	0.000551 (0.00776)
Marital status, 1=married	0.752** (0.272)	-0.0735 (0.245)	0.0372 (0.147)	-0.319 (0.335)	0.304 (0.251)	0.0447 (0.124)	0.525 (0.411)
Total number of years in school	0.0917*** (0.0184)	0.101*** (0.0121)	0.0233* (0.00992)	-0.0716** (0.0251)	-0.0239 (0.0210)	-0.0597*** (0.00927)	-0.0422 (0.0253)
Residence, 1=urban	2.520*** (0.469)	3.404*** (0.381)	2.685*** (0.371)	0.599 (0.389)	0.183 (0.425)	0.514 (0.439)	2.273*** (0.530)
Region (Base, Northern)							
<i>Central= 1</i>	-0.906* (0.386)	-0.696* (0.317)	0.126 (0.282)	1.506** (0.584)	0.883** (0.302)	0.550** (0.195)	1.976** (0.722)
<i>Southern=1</i>	0.171 (0.360)	-0.00702 (0.285)	0.461 (0.284)	0.627 (0.632)	0.144 (0.325)	0.000182 (0.199)	1.894** (0.699)
Constant	6.490*** (1.420)	2.525*** (0.820)	2.282*** (0.720)	2.128*** (0.620)	2.420*** (0.620)	0.975*** (0.320)	6.764*** (1.420)

Key messages

- An increase in time to collect water reduced the demand for piped water into yard/plot and open well in yard/plot compared to borehole.
- Households with more number of children were more likely to have piped water supplied on the premise compared to boreholes than households with less number of children.
- If the household head is female, probability of using drinking water from piped water through a house connection is high than borehole and that likelihood of choosing drinking water from open wells reduces.
- Educated household heads were more likely to choose drinking water from piped water supply and less likely to use water from open wells for drinking purposes.
- An increase in household income will increase the probability of choosing drinking water from piped water supply system and reduce the demand for open public wells declines.

Key messages

- Urban residents were more likely to have access to piped water and protected wells on premise relative to rural residents.
- Households in the Central region were less likely to choose drinking water from piped water supply system; but were more likely to drink water from wells than those in the Northern region.
- Households in the Southern region were more likely to drink water from protected wells in yard/plot than those in the Northern region.
- Households with more acres of land are less likely to choose drinking water from water piped supply system; but more likely to drill their own open well on plot/yard.
- Households with livestock are more likely to choose drinking water from unimproved sources than improved sources.

Conclusions

- This study applied multinomial logistic regression on nationally representative data from IHS3 to identify factors that influence households' choice of drinking water source in Malawi.
- The analysis showed that the more the time it takes to collect water from a particular source of drinking water, the lower the demand for that water source will be, except for open public well.
- The findings revealed that the probability of choosing improved drinking water from piped water supply systems was found to increase with
 - Household composition;
 - Married household heads and female-headed households;
 - With the years of education of the household heads, and
 - per capita annual household expenditure.
- Households located in the urban or semi-urban areas tend to be much more likely to have access to piped water as the provision of piped water tend to follow a pattern in which large cities are first served, followed by smaller cities and towns, and rural areas only much later (depending on their level of population dispersion).

Policy Recommendation

- In order to enhance access to improved drinking water at the household level, there is need to reduce the distance that households travel to access drinking water from improved water points in both urban and rural areas.
- The analysis has established that both female headed and married households have more access to piped water:
 - male-headed and unmarried household heads participation in projects and programs that increase household access to improved water sources needs to be promoted.
- There is also need to develop strategies that address the lack of financial capacity of poorer households to overcome lack of access to improved water sources in the rural areas.
- There is need for the government to increase investment in piped water supply system in Malawi, particularly in the Central and Southern regions as households in these regions are more likely to have access to drinking water from un piped water supply system than those in the Northern region.

Thank you!!!

