# Utility Services Poverty: Addressing the Problem of Household Resource Services Deprivation in Mayotte

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- Les habitats de fortune représente 33% du parc de logement
- 6 logements sur 10 n'ont pas d'installations sanitaires de base (toilettes, douche, accès à l'eau)
- 77% de la population vit sous le seuil de pauvreté

Le journal de Mayotte

Mayotte : la vie misérable à Kawéni. plus grand bidonville de France. L'OBS. 14/05/2018

/

Mayotte la 1ère. 01/07/2020

1/3 de la population n’a pas accès à l’eau.
20% n’ont pas accès à l ’électricité

A few days after the start of confinement, the regional health agency decided to facilitate access to standpipes for the most precarious populations, but also to install water distribution ramps.
Mayotte hebdo 2020

Le Monde, 2019

# Motivation

Goals for development (United Nations, PNUD)


**Goal 6 : Ensure availability and sustainable management of water and sanitation for all**

46% of individuals, 3,6 billions, lack safety management sanitation,
29% lack basic hygiene,
26% lack safely managed drinking water


**Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all**

One third of population use dangerous and ineficient cooking system
759 million people lack access to electricity, annuel energy efficiency improvement rate is equal to 3% and needs acceleration)

# Theoretical background

As Energy and water are essential needs ➔ relevant to broaden the concept of fuel and water poverty to also address the issue of access to basic utilities.

Generally fuel poverty and water poverty are treated independently.
While there is an abundant literature on fuel poverty since the 1980's the concept of water poverty is more recent and largely inspired by the definitions and measures of fuel poverty

- **Water poverty:** The concept of 'water poverty' has been developed in 2000 to consider both a lack of access to clean water and sanitation and the cost of consuming. (Salameh, 2000; Feitelson and Chenoweth , 2002)

- **Fuel and energy poverty:** The concept of fuel poverty refers to difficulties in satisfying a set of essential energy services in housing. While there is a large body of literature on measuring fuel poverty, there is no consensus on either a common definition or fuel poverty indicators

# Theoretical background

**Fuel and energy poverty:**

However, the recent academic literature has begun to highlight the need for a unified theoretical framework for analyzing fuel poverty based on Sen's work on *Capabilities*.

Day *et al. (2016*) defined Energy Poverty as ‘‘*an inability to realize essential capabilities as a direct or indirect result of insufficient access to affordable, reliable and safe energy services, and taking into account available reasonable alternative means of realizing these capabilities*”

**Fuel poverty and water poverty together?**

Few studies have treated fuel and water poverty together (Martin et al., 2019; Yoone *et al*., 2019; Fankhauser and Tepic, 2007; Browne *et al*., 2018, Laskari *et al*., 2016). Some of the studies addressed partially the fuel and water poverty focussing mainly on the affordability issue related to water and fuel poverty (Fankhauser and Tepic (2007).

*Finally, energy and water are essential utility services for a decent life. These services are extremely linked, why shouldn’t we treat them together?*

***In this paper we propose to enlarge the concept of fuel and water poverty to essential utility services poverty***.

# Objectives

**In this paper, we want to define and characterize the concept of utility services poverty in Mayotte**

Main objectives of the paper:

**DEFINE UTILITY SERVICE POVERTY AND IDENTIFY UTILITY SERVICES POOR HOUSEHOLDS**

1- A definiton of the new concept of utility services poverty

2- Identify utility services poor households ➔ Latent class Model

3- Propose a scale of vulnerability to better target policies (maybe it s not a binary phenomenon)

4- Provide evidence that utility services poors are not necessary monetary poors

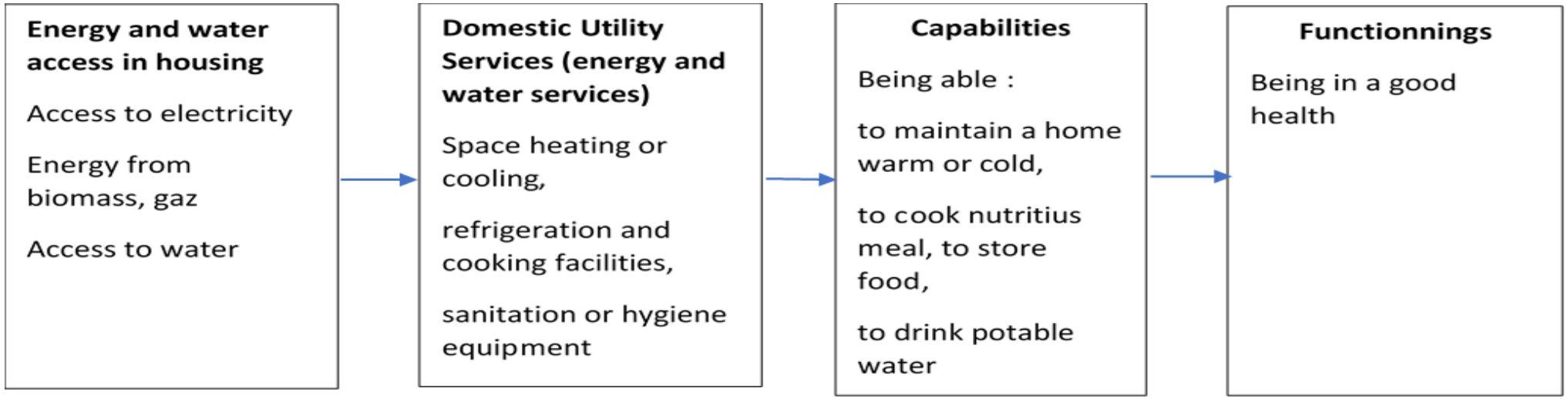
# Definition of utility services poverty

**We propose a definition of utility services poverty** based on the capabilities framework developed by Amartya Sen and Martha Nussbaum (Nussbaum, 2003; 2011; 1999; 2003; 2004; 2012; Nussbaumer, Bazilian, & Modi, 2012; Sen, 1979) and the work of Day *et al*. (2016)

The capability approach developed by Sen considers human life as a set of doings and beings termed **functionings.** The **capability** of a person is a derived notion that reflects the combination of functionings and the freedom to choose a way of life. **According to Sen, poverty can be seen as not having the capability to achieve crucial and valued functionings.**

The relevant literature on utility services access and affordability suggests that basic utility services, particularly potable water, improved sanitation and electricity, can impact human health, education, social interactions and women conditions (Njoh *et al.,* 2019; Martin *et al.,* 2019; Howarth *et al.,* 2001).

# Definition of utility services poverty




**Utility services poverty definition**

*"the inability to realise essential functionnings due to difficulties in satisfying a set of essential utility services in housing"*

# Data

« Enquête Logement Mayotte 2013 » - 2058 households

Module a little different from the one in the French metropole ➔ specific questions about housing conditions + materials for walls, roof and floors + access to electricity and water

To measure income poverty the local poverty rate at 60% of the median living standard

# Descriptive statistics

| | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| | | Utility Services | | | |
| Cooling system | 2058 | 0.169 | 0.375 | 0 | 1 |
| Water access | 2058 | 0.741 | 0.438 | 0 | 1 |
| Bathroom | 2058 | 0.436 | 0.496 | 0 | 1 |
| Electricity access | 2058 | 0.943 | 0.233 | 0 | 1 |
| Toilet | 2058 | 0.409 | 0.492 | 0 | 1 |
| Kitchen | 2058 | 0.713 | 0.452 | 0 | 1 |
| Energy for cooking: | | | | | |
| Coal & Wood | 2058 | 0.099 | 0.299 | 0 | 1 |
| Butane | 2058 | 0.746 | 0.435 | 0 | 1 |
| Electricity | 2058 | 0.124 | 0.33 | 0 | 1 |
| Oil | 2058 | 0.191 | 0.394 | 0 | 1 |
| | | Monetary Poverty | | | |
| Income | 2058 | 7050.982 | 9719.735 | 0 | 94125 |
| Monetary poor 60% | 2058 | 0.365 | 0.482 | 0 | 1 |
| Monetary poor 50% | 2058 | 0.325 | 0.468 | 0 | 1 |

# Descriptive statistics

Comparing utility services poverty and monetary poverty :

- Poor households also appear more satisfied with their housing conditions (**43,1% of poors** have a positive perceived situation of their dwelling condition **against 22,3% of non poors**).
- No differences between poors and no poors according to housing conditions

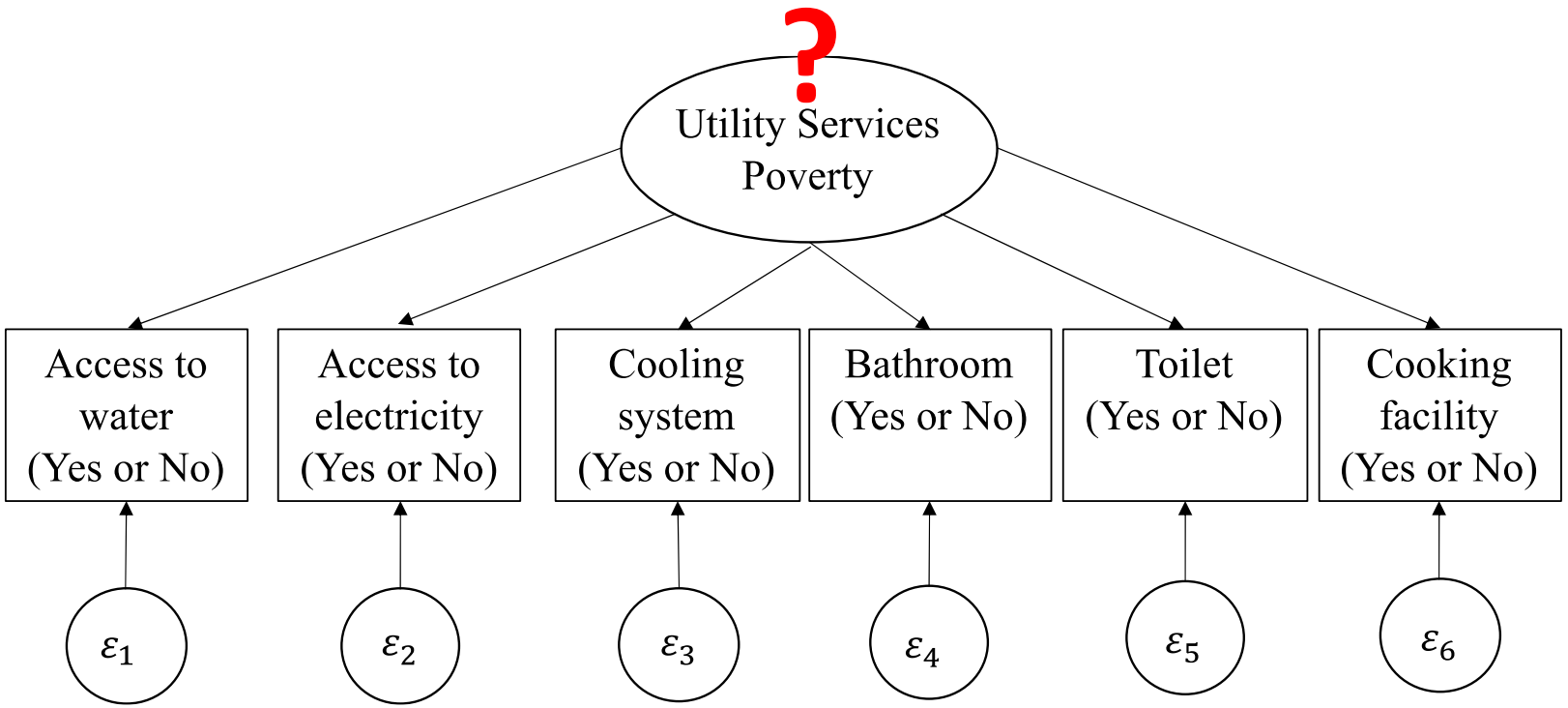
| | | Monetary poor 60% | | | |
|---|---|---|---|---|---|
| | Sample means (n=2058) | No Poor (n=1307) | | Poor (n=751) | |
| | % | % | Obs | % | Obs |
| | | | | Dwelling caracteristics | |
| **Humidity** | | | 1026 | | 334 |
| **Yes** | 24.5 | 25 | 256 | 23.1 | 77 |
| **No** | 75.5 | 75 | 770 | 77 | 257 |
| **Cooling system** | | | 1307 | | 751 |
| **Yes. entire dwelling** | 3.3 | 4.7 | 62 | 0.7 | 5 |
| **Yes. just a room** | 13.6 | 20.4 | 266 | 2.0 | 15 |
| **No** | 83.1 | 74.9 | 979 | 97.3 | 731 |

# Descriptive statistics

| | | Monetary poor 60% | | | |
|---|---|---|---|---|---|
| | Sample means (n=2058) | No Poor (n=1307) | | Poor (n=751) | |
| | | | | Cooking facilities | |
| **Having a place for cooking** | | | 1307 | | 751 |
| **Yes** | 71.3 | 49.7 | 1023 | 21.6 | 445 |
| **No** | 28.7 | 13.8 | 284 | 14.9 | 306 |
| **Energy for cooking** | | | 1307 | | 751 |
| **Butane, propane, tanker** | 74.6 | 85 | 1111 | 56.5 | 424 |
| **Oil** | 19.1 | 10.7 | 140 | 33.8 | 254 |
| **Electricity** | 12.4 | 15.1 | 197 | 7.7 | 58 |
| **Wood** | 7.4 | 2.8 | 36 | 15.6 | 117 |
| **Coal** | 2.9 | 3.3 | 43 | 2.1 | 16 |

| | | Monetary poor 60% | | | |
|---|---|---|---|---|---|
| | Sample means (n=2058) | No Poor (n=1307) | | Poor (n=751) | |
| | % | % | Obs | % | Obs |
| | **Access to water and sanitary facilities** | | | | |
| **Access to water** | | | 1307 | | 751 |
| **Yes** | 74.2 | 85.5 | 1117 | 54.5 | 409 |
| **No** | 25.8 | 14.5 | 190 | 45.5 | 342 |
| **The individual has a bathroom (shower, bath)** | | | 1307 | | 751 |
| **Yes** | 43.6 | 57.1 | 746 | 20.2 | 152 |
| **No** | 56.4 | 42.9 | 561 | 79.8 | 599 |
| **Household has a toilet in their home** | | | 1307 | | 751 |
| **Yes. inside** | 24.3 | 54.9 | 717 | 16.5 | 124 |
| **No. outside** | 16.6 | 31.5 | 412 | 53.7 | 403 |
| **No** | 39.6 | 13.6 | 178 | 29.8 | 224 |
| | **Access to electricity** | | | | |
| **Electricity access** | | | 1307 | | 751 |
| **Yes** | 74.3 | 83.1 | 836 | 64.6 | 485 |
| **Yes. connected to another home's meter** | 18.7 | 13.2 | 133 | 24.6 | 185 |
| **No** | 7.00 | 3.7 | 37 | 10.8 | 81 |

# Class latent model




Objective: to identify household profiles (Lazarsfeld and Henry, 1968). But, the dependent variable here, "utility poverty variable" assumed discrete and unobservable, and, the latent class methodology let to categorized observations into latent classes using observed variables or indicators (Goodman, 2002).

The Latent class model is estimated by the maximization of the log-likelihood through an expectation-maximization (EM) algorithm

# Models comparison

| | AIC | BIC | LL | df |
|---|---|---|---|---|
| 2 classes | 10219.24 | 10292.42 | -5096.619 | 13 |
| 3 classes | 10009.43 | 10110.76 | -4986.714 | 18 |
| 4 classes | 9981.925 | 10117.03 | -4966.962 | 24 |

3 is better to 2 classes model

3 or 4 ➔ meaning of adding an additional class?

Steps of analysis :

- Model with 2 classes (benchmark) to ensure the quality of the model
- Model with 3 classes ➔ Some vulnerable households ?
- Model with 4 classes ➔ Differentiated vulnerable household profiles in services utility ? Differentiated policies?

# Results – 2 Classes (benchmark)

| | Class 1 Utility services poor 43.4% | | | Class 2 Utility services -sufficient 56.6% | | |
|---|---|---|---|---|---|---|
| | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin |
| 0.No access to water | base outcome | | 0.4568 | base outcome | | 9.07e-12 |
| 1.Access to water | 0.173 | (0.068)** | 0.5432 | 25.426 | (0.965)*** | 1 |
| 0. No access to electricity | base outcome | | 0.1013 | base outcome | | 3.84e-08 |
| 1.Access to electricity | 2.183[a] | (0.100)*** | 0.8987 | 17.075 | (7.607)** | 1 |
| 0.No cooling system | base outcome | | 0 .9924 | base outcome | | .06204 |
| 1.Cooling system | -4.873 | (0.415)*** | 0.0076 | -0.491 | (0.076)*** | 0.3796 |
| 0.No bathroom | base outcome | | 0.9313 | base outcome | | 0.0843 |
| 1.Bathroom | -2.607 | (0.187)*** | 0.0687 | 2.384 | (0.144)*** | 0.9156 |
| 0.No toilet | base outcome | | 0.9678 | base outcome | | 0.1007 |
| 1.Toilet | -3.402 | (0.207)*** | 0.0322 | 2.190 | (0.186)*** | 0.8993 |
| 0.No kitchen facility | base outcome | | 0.4629 | base outcome | | 0.0569 |
| 1.Kitchen facilities | 0.149 | (0.060)*** | 0.5371 | 2.807 | (0.179)*** | 0.9430 |
| Observations | 2.058 | | | | | |

Robust standard errors are presented in parentheses; *** $p<0.01$. ** $p<0.05$. * $p<0.1$
Note: [a]The probability of being in Class 1 increases if households have electricity access compared with those without electricity access.

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| 0.No kitchen facility | base outcome | | 0.4629 | | | |
| 1.Kitchen facilities | 0.149 | (0.060)*** | 0.5371 | 2.807 | (0.179)*** | 0.9430 |
| Observations | 2.058 | | | | | |

Profile of fuel poors :

- Less access to water, electricity but main variables are :
- No Cooling system
- No Bathroom
- No Toilet

Robust standard errors are presented in parentheses; *** $p<0.01$. ** $p<0.05$. * $p<0.1$

Note: [a]The probability of being in Class 1 increases if households have electricity access compared with those without electricity access.

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| 1.Bathroom | -2.607 | (0.187)*** | 0.0687 | 2.384 | (0.144)*** | 0.9156 |
| 0.No toilet | | | | base outcome | | 0.1007 |
| 1.Toilet | -3.402 | (0.207)*** | 0.0322 | 2.190 | (0.186)*** | 0.8993 |
| 0.No kitchen facility | | | | base outcome | | 0.0569 |
| 1.Kitchen facilities | 0.149 | (0.060)*** | 0.5371 | 2.807 | (0.179)*** | 0.9430 |
| Observations | | | | | | |

**Profile of Fuel-sufficient** :

- Access to hot water
- Access to electricity
- More cooling system
- More bathroom
- More toilet
- More kitchen facilities

Robust standard errors are presented in parentheses; *** $p<0.01$. ** $p<0.05$. * $p<0.1$

Note: [a]The probability of being in Class 1 increases if households have electricity access compared with those without electricity access.

# Results – 3 classes

| | Class 1 Utility services poor 27,8 % | | | Class 2 Utility services vulnerable 32,4 % | | | Class 3 Utility services - sufficient 39,8 % | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin |
| 0.No access to water | base outcome | | 0.9143 | base outcome | | 0.0124 | base outcome | | 0.0013 |
| 1.Access to water | -2.368 | (1.345)* | 0.0857 | 4.377 | (0.717)*** | 0.9876 | 6.661 | (1.080)*** | 0.9987 |
| 0. No access to electricity | base outcome | | 0.1851 | base outcome | | 0.0165 | base outcome | | 0.0015 |
| 1.Access to electricity | 1.482 | (0.114)*** | 0.8149 | 4.088 | (1.269)*** | 0.9835 | 6.511 | (2.833)** | 0.9985 |
| 0.No cooling system | base outcome | | 1 | base outcome | | 0.9711 | base outcome | | 0.5992 |
| 1.Cooling system | | | 0 | -3.516 | (0.302)*** | 0.0289 | -0.402 | (0.100)*** | 0.4008 |
| 0.No bathroom | base outcome | | 1 | base outcome | | 0.7759 | base outcome | | 0.0872 |
| 1.Bathroom | | | 0 | -1.242 | (0.152)*** | 0.2241 | 2.348 | (0.269)*** | 0.9128 |
| 0.No toilet | base outcome | | 0.9632 | base outcome | | 0.9811 | base outcome | | 0.0158 |
| 1.Toilet | -3.264 | (0.235)*** | 0.0368 | -3.949 | (2.400) | 0.0189 | 4.133 | (.690)*** | 0.9842 |
| 0.No kitchen facilities | base outcome | | 0.4507 | base outcome | | 0.4422 | base outcome | | 0.0461 |
| 1.Kitchen facilities | 0 .198 | (0.094)** | 0.5493 | 0.232 | (0.092)** | 0.5578 | 3.030 | (0.307)*** | 0.9539 |
| Observations | 2,058 | | | | | | | | |

Opening a third class gives us a better understanding of the poorest's profile

# Results – 3 classes

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|---|---|---|---|
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| 0.No access to water | base outcome | | 0.9143 |
| 1.Access to water | -2.368 | (1.345)* | 0.0857 |
| 0. No access to electricity | base outcome | | 0.1851 |
| 1.Access to electricity | 1.482 | (0.114)*** | 0.8149 |
| 0.No cooling system | base outcome | | 1 |
| 1.Cooling system | / | / | 0 |
| 0.No bathroom | base outcome | | 1 |
| 1.Bathroom | / | / | 0 |
| 0.No toilet | base outcome | | 0.9632 |
| 1.Toilet | -3.264 | (0.235)*** | 0.0368 |
| 0.No kitchen facilities | base outcome | | 0.4507 |
| 1.Kitchen facilities | 0 .198 | (0.094)** | 0.5493 |
| Observations | 2,058 | | |

Profile of fuel poors :

- **No access to water**
- No Cooling system
- No Bathroom
- Less Toilet

Vulnerable individuals are our poor in the 2-class model and the richest are pretty the same

Access to water is more discriminating than access to electricity in defining utility services poverty ➔
What if we open one last class?

# Results – 4 classes

| | Class 1 Utility services poor 20,1 % | | | Class 2 Utility services vulnerable 1 13 % | | | Class 3 Utility services vulnerable 2 27,3 % | | | Class 4 Utility services -sufficient 39,6 % | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin |
| 0.No access to water | base outcome | | 0.8744 | base outcome | | .6344 | base outcome | | 0 | base outcome | | 0 |
| 1.Access to water | -1.940 | (0.491)*** | 0.1256 | -0.551 | (4.266) | .3656 | 30.936 | (0.494)*** | 1 | 31.973 | (0.278)*** | 1 |
| 0. No access to electricity | base outcome | | 0.2495 | base outcome | | .0272 | base outcome | | .0101 | base outcome | | .0022 |
| 1.Access to electricity | 1.101 | (0.602)* | 0.7505 | 3.577 | (3.448) | .9728 | 4.584 | (0.899)*** | .9899 | 6.120 | (1.108)*** | .9978 |
| 0.No cooling system | base outcome | | 1 | base outcome | | .9830 | base outcome | | .9734 | base outcome | | .5966 |
| 1.Cooling system | - | - | 0 | -4.055 | (1.548)*** | .0170 | -3.602 | (0.365)*** | .0266 | -0.391 | (0.120)*** | .4034 |
| 0.No bathroom | base outcome | | 1 | base outcome | | 1 | base outcome | | .74289 | base outcome | | .0746 |
| 1.Bathroom | - | - | 0 | -17.730 | (1.704)*** | 0 | -1.061 | (0.443)** | .2571 | 2.518 | (1.011)** | .9254 |
| 0.No toilet | base outcome | | 1 | base outcome | | .8621 | base outcome | | .9906 | base outcome | | .0193 |
| 1.Toilet | - | - | 0 | -1.833 | (2.256) | .1379 | -4.659 | (4.877) | .0094 | 3.931 | (1.133)*** | .9807 |
| 0.No kitchen facilities | base outcome | | 0.6187 | base outcome | | .0905 | base outcome | | .4809 | base outcome | | .0487 |
| 1.Kitchen facilities | -0.484 | (1.266) | 0.3813 | 2.308 | (1.465) | .9095 | 0.076 | (0.748) | .5191 | 2.971 | ( 0.296)*** | .9513 |
| Observations | 2,058 | | | | | | | | | | | |

# Results – 4 classes

It is mainly the vulnerable who are divided into 2 categories: scale of vulnerability?

| | Class 2 Utility services vulnerable 1 13 % | | | Class 3 Utility services vulnerable 1 27,3 % | | |
|---|---|---|---|---|---|---|
| | Coeff. | Std. Err. | Margin | Coeff. | Std. Err. | Margin |
| 0.No access to water | base outcome | | .6344 | base outcome | | 0 |
| 1.Access to water | -0.551 | (4.266) | .3656 | 30.936 | (0.494)*** | 1 |
| 0. No access to electricity | base outcome | | .0272 | base outcome | | .0101 |
| 1.Access to electricity | 3.577 | (3.448) | .9728 | 4.584 | (0.899)*** | .9899 |
| 0.No cooling system | base outcome | | .9830 | base outcome | | .9734 |
| 1.Cooling system | -4.055 | (1.548)*** | .0170 | -3.602 | (0.365)*** | .0266 |
| 0.No bathroom | base outcome | | 1 | base outcome | | .74289 |
| 1.Bathroom | -17.730 | (1.704)*** | 0 | -1.061 | (0.443)** | .2571 |
| 0.No toilet | base outcome | | .8621 | base outcome | | .9906 |
| 1.Toilet | -1.833 | (2.256) | .1379 | -4.659 | (4.877) | .0094 |
| 0.No kitchen facilities | base outcome | | .0905 | base outcome | | .4809 |
| 1.Kitchen facilities | 2.308 | (1.465) | .9095 | 0.076 | (0.748) | .5191 |
| Observations | | | | | | |

Class Fuel vulnerable 1 :

- No access to water + No Cooling system
- No Bathroom
- No Toilet

Class 2 are poorest that Class 3

➔ **Access to water**

# Results – comparisons utility poors and monetary poors (4 classes model)

| | Monetary poor 60% | | | | Income | Total |
|---|---|---|---|---|---|---|
| | No | | Yes | | Euros | |
| | | % | | % | | |
| **Class1 – Utility services poor 1** | 96 | 33.2 | 193 | 66.7 | 2657 | 289 |
| **Class2 – Vulnerable 1** | 98 | 37.6 | 162 | 62.3 | 2690 | 260 |
| **Class3 – Vulnerable 2** | 405 | 61.5 | 280 | 42.5 | 4197 | 658 |
| **Class 4 – No poor 4** | 708 | 85.9 | 116 | 14.0 | 12340 | 824 |
| **Total** | 1307 | | 751 | | | 2058 |

Scale of utility services poverty confirmed by the income average but, utility services poors are not necessary monetary poors

➔ public policies that aim to support only the monetary poors do not solve all the problems of access to utility services

# Conclusion

Policy recommendations:

Policies could be implemented into 2 steps :
1/ To fight utility services poverty, priority to water access and sanitary facilities (fight disease to waste or stagnant water)
2/ Provide an electricity access for everyone

**Policies should not be distributed according to income but to facilities access and living conditions**

This methodology could be implemented in other countries

Thank you for your attention