North vs South: the transition dilemma
Energy poverty and Social Justice

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Introduction

"Energy poverty is fundamentally a complex problem of distributive injustice"
(Walker and Day, 2012)

- The application of justice theories and principles to the understanding of energy systems is gaining increasing attraction, through the concept and frame of 'energy justice' (Jenkins, McCauley, Heffron, Stephan & Rehner, 2016).
  - The issue of energy poverty is a key dimension of the broader energy justice paradigm (Jenkins et al., 2016).
- Work that connects energy poverty with various concepts of justice has focused on inequalities between social groups, to the detriment of cross-countries comparisons (Bouzarowski 2018) and Global South and Global North analyses.

Introduction

"Energy poverty is fundamentally a complex problem of distributive injustice"
(Walker and Day, 2012)

- The failure to perceive the complex interdependency between energy and poverty under a common conceptual umbrella has prevented scientists and policymakers from seeing the causes of domestic energy deprivation in the energy transition trajectories.
- We provide a first integrated assessment of the entrenchment between energy poverty/vulnerability and development, by considering altogether: Bolivia, Ivory Coast and France

Beyond the methodological and case studies divides, we measure and analyze the drivers of energy poverty, with a special focus on the relationship between energy consumption and income distribution at different development stages

Multiple definitions of energy poverty: first divide

1. **<u>Single indicator</u>**:

   - based on whether the household consumes more or less than the threshold that defines the energy poor category.
   - That threshold can be defined in economic terms (relative to income) or in technical terms (kwh consumed, e.g.).
   - Mostly used in the **North**.
   - Most commonly used are: Fuel poverty defined as spending more than **10%** of income in energy (Broadman, 1991) and **Low-income-high-cost** (LIHC), that considers households spending more than the median and with a residual income lower than a threshold (Hills, 2012).

Multiple definitions of energy poverty: first divide

2. **Multidimensional measurement**:

- Based on measuring access to different type of services.
- The most commonly used is the Multidimensional Enegy Poverty Index (MEPI) that focuses on the deprivation of access to modern energy services such as cooking, lighting, cooling, entertainment and education, and communications (Nussbaumener et al.,2012)
- Mostly applied in **South** where the lack of harmonized data makes it useful to intersect several dimensions at the time in a qualitative way.

Multiple definitions of energy poverty: first divide

3. **<u>Dashboard indicator</u>**:

- focus at the same time on economic, environmental, social, technical and even institutional sustainability of energy access.
- OLADE, ECLAC, GTZ, 1997 performed a first investigation into dashboard indicators in developing countries including electricity access rates, consumption of useful residential energy, and indoor air pollution in the residential sector.
- Mostly for specific regions in the **South** using data collected specifically.

Case studies: second divide

1. **Lack of studies on developing countries:**

   - Only a handful of studies have attempted to review the measurements to potentially capture some of the dimensions of energy poverty in developing countries
   - Most of them apply different definitions of energy poverty, so lack of comparability

2. **Lack of North/South comparisons:**

   - Even fewer studies…so that there is limited understanding of the geographies of energy poverty, vulnerability and justice

   - Noticeable exceptions:
     - Grottera et al. (2018) on Brazil-France discuss how specific electricity requirements may vary across different deciles of living standard in Brazil and France.
     - Che et al., (2021) propose a integrated statistical approach to measure and monitor energy poverty form 2006 to 2016 at the world level.

Our contribution

1. We first study determinants of **access to energy** services in the Southern countries using a generalized logit (gologit) regression, contributing in line with the literature on multidimensional indicators and adding an econometric estimation of its determinants.

2. We then focus on the **affordability problem** of services once access to the infrastructure is already provided in the three countries. To this end we focus on the two main ways of looking at this problem with a single indicator: **10%** and **LIHC**. (To overcome Robinson´s critique of the LIHC, we consider as energy poor households spending more than the median and keeping less than the median income after energy expenditures).

3. We finally **analyze the patterns of energy poverty** in the three countries.

Empirical strategy

- Most of the litterature previously cited simply calculates different indicators of energy poverty according to the definition they intend convenient.

- Fewer papers actually tackle determinants of energy poverty.

  - **Mostly South**: These papers either look at percentages of households with mulitdimensional characteristics and, at the same time, having access to the infrastructure or to energy services.

  - **Mostly North**: Some use econometrics, usually a logit specification. Results then explain how different socioeconomic characteristics of households increase (or not) the probability of being energy poor.

Empirical strategy: adequacy with the comparison

- We combine the previous by:
  1. Considering access the multiple services provided by different appliances that use electricity and/or gas (in this sense we align with multidimensional studies)
  2. Use an econometric approach to undestand the probability of being energy poor as a function of different socioeconomic characteristics (logit and probit)

⇒ We use an original econometric tool that allows us to combine 1 & 2: **a generalized logistic regression** to estimate the importance of socioeconomic determinants in gaining access to an increasing number of energy services.

We consider this approach the best way of combining in the analysis North & South

The three countries at a glance

	Côte d'Ivoire	Bolivia	France
Population, total	27,053,629	11,832,936	67,499,343
Surface area (sq. km)	322,460	1,098,580	549,087
Population density (people per sq. km of land area)	85	11	123
Urban population growth (annual %) - 2021	3.44%	1.86%	0.50%
GNI per capita, Atlas method (current US$) - 2021	2,450	3,360	43,880
GDP (current US$) - 2021	69,764,827,467	40,408,208,524	2,937,472,757,953
GDP growth (annual %) - 2021	7.02%	6.11%	7.00%
Poverty headcount ratio at national poverty lines (% of population)	39.5% (2018)	39% (2020)	13.8% (2019)
Income share held by lowest 20%	7 (2018)	4.7 (2020)	8 (2018)
Life expectancy at birth, total (years) - 2020	58	72	82
Energy use (kg of oil equivalent per capita) - 2014	613	778	3,692
Electric power consumption (kWh per capita) - 2014	275	743	6,940
Access to electricity (% of population)	56.3%	91.5%	100%
Access to clean cooking (% of population)	17.8%	18.2%	86.0%
Energy poverty - LIHC (%) (inhabitants)	2.4% (761,433)	6.7% (2,631,773)	6.3% (5,032,032)
Energy poverty - Over 10 percent (%) (inhabitants)	14.3% (4,536,872)	6.5% (2,553,212)	13.6% (10,862,798)

Sources: WDI, 2022, Household Surveys. For France data is only metropolitan.

Results in terms of Access to energy services

- Ownership of an increasing number of appliances (TV, fridge, computer, cooker) providing energy services (**gologit model**)

- Main results:

  ✔ important macroeconomic differences but determinants of Access to energy services are similar among the three countries: family microstrucutre, education and dwelling characteristics

  ✔ dispersion among countries at the top (Access to all services) and at the bottom (Access to at least one energy service)

None are significant to gain the first Access in FRA.

Education, number of family members and ownership of the household significantly increase the need for energy services.

Education is by far the key determinant to have full Access in BOL and CIV.

	BOL	CIV	FRA
Access to at least one service			
Education (0=None, 1=Prim, 2=Secon, 3=Univ)	1.034***	0.299***	0.431
Head's age (0=[0-45], 1=+45)	0.081	0.072	1.249
log(Number of dependents)	1.621***	0.916***	43.111
Employed per Working-age pop.	-0.956***	0.249***	31.363
Sex of household head (0=Female, 1=Male)	-0.475***	0.520***	-0.035
Occupation status (1=Owner, 0=Other)	0.066	-0.055	1.973*
log(Income per CU)	0.745***	1.039***	0.059
Access to at least two services			
Education (0=None, 1=Prim, 2=Secon, 3=Univ)	1.011***	0.585***	-0.062
Head's age (0=[0-45], 1=+45)	0.500***	0.240***	0.048
log(Number of dependents)	0.933***	0.940***	2.371***
Employed per Working-age pop.	-0.731***	-0.031	2.190***
Sex of household head (0=Female, 1=Male)	-0.262***	-0.129	-0.295*
Occupation status (1=Owner, 0=Other)	0.348***	-0.150	1.173***
log(Income per CU)	0.705***	1.534***	0.345***
Access to at least three services			
Education (0=None, 1=Prim, 2=Secon, 3=Univ)	1.204***	0.939***	0.088***
Head's age (0=[0-45], 1=+45)	0.342***	0.428***	0.089
log(Number of dependents)	0.852***	1.000***	1.579***
Employed per Working-age pop.	-0.507***	-0.237	1.446***
Sex of household head (0=Female, 1=Male)	-0.093	-0.149	0.102**
Occupation status (1=Owner, 0=Other)	0.340***	-0.108	0.792***
log(Income per CU)	0.842***	1.870***	0.281***
Access to all the four services			
Education (0=None, 1=Prim, 2=Secon, 3=Univ)	3.062***	1.297***	-0.025
Head's age (0=[0-45], 1=+45)	0.917	0.256	0.465***
log(Number of dependents)	-1.893*	0.984***	1.967***
Employed per Working-age pop.	0.854	-0.248	1.977***
Sex of household head (0=Female, 1=Male)	0.442	-0.234	0.056
Occupation status (1=Owner, 0=Other)	-0.351	0.337	0.802***
log(Income per CU)	0.958***	2.198***	0.299***

Results in terms of affordability

- Main findings

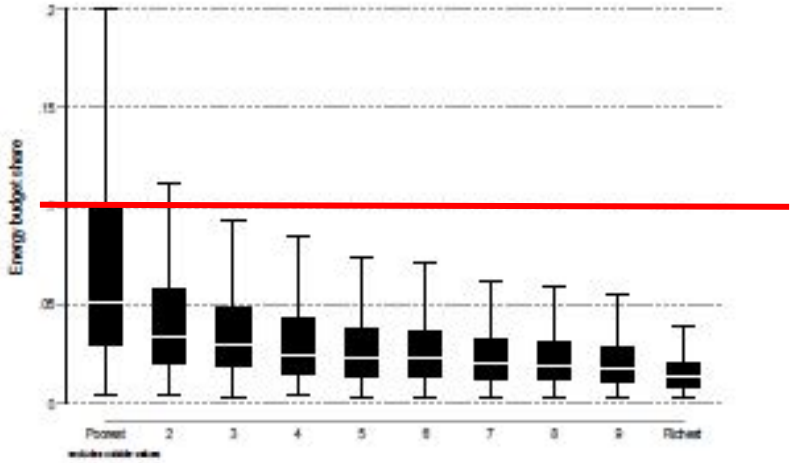
✔ The energy Budget share in Bolivia, where electricity access is almost universal, is low and with less geographical heterogeneity. This may be due to the extended social tariffs but we cannot disentangle that effect from soberty and self rationing.

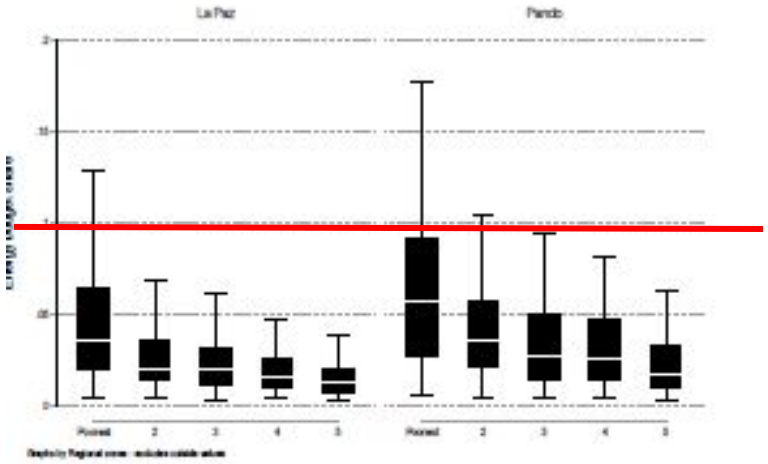
✔ CIV and France display similar patterns, despite the structural diversity of their economies and the difference in clean cooking access

✔ Big cities and rich regions are more vulnerable to energy poverty

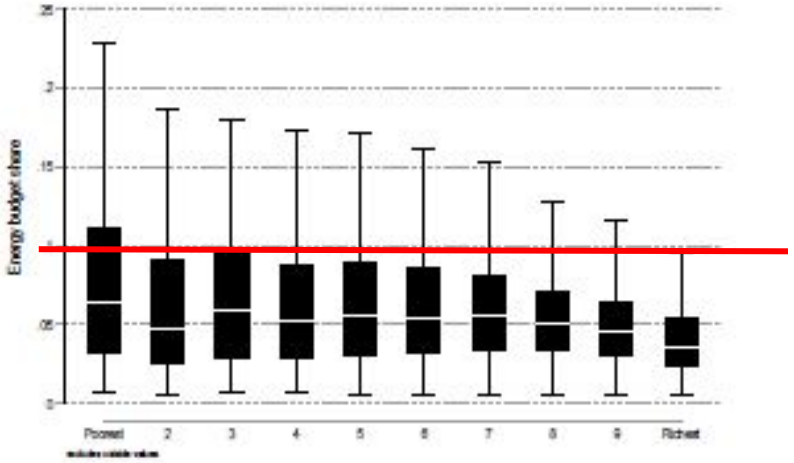
✔ **The marginal effects show that improvement in the income/total expenditure go with higher energy consumption**

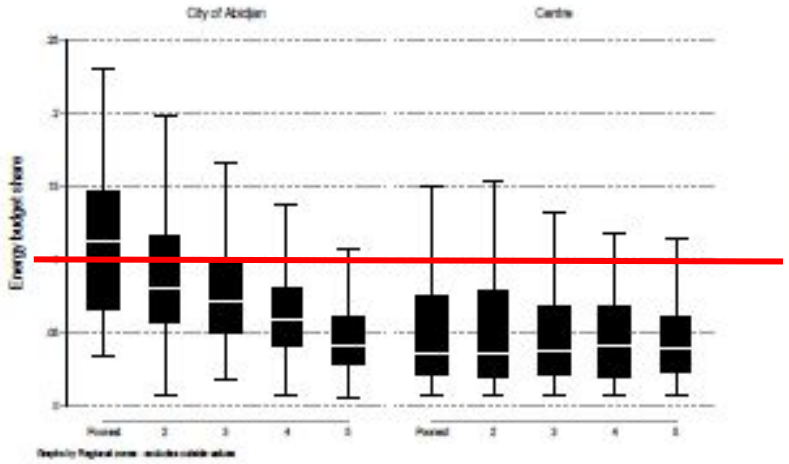
Bolivia



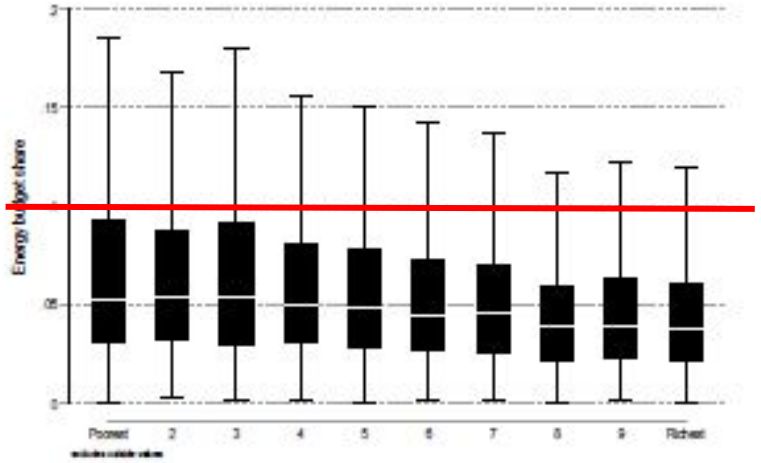


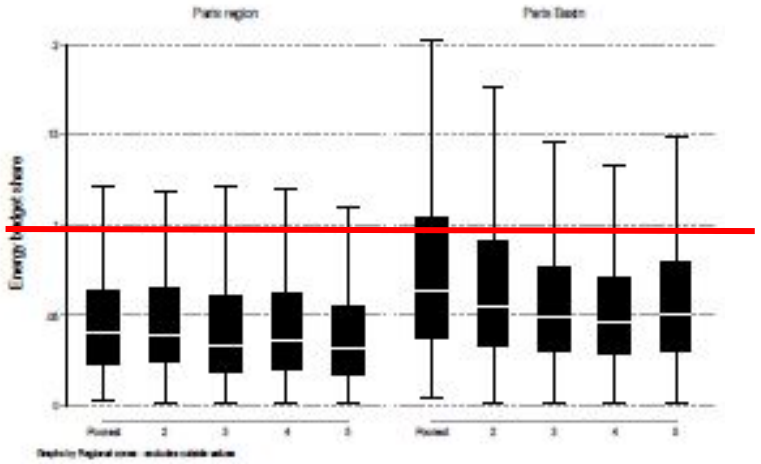
Côte d'Ivoire





France





— 10% Budget share line

Results in terms of energy poverty

- Main results (logit and probit)

- Aside from income, that decreases probability of being energy poor everywhere, there is a divide between North and South: further exploration of alternative definitions is needed.

- Robustness: the estimates do not change when accounting explicitely for climate (temperature and precipitation)

Determinants of being energy poor (LIHC, probit

	BOL	CIV	FRA
Education (0=None, 1=Prim, 2=Secon, 3=Univ)	0.023***	-0.005*	0.001
Head's age (0=[0-45], 1=+45)	0.012**	-0.012**	0.022***
log(Number of dependents)	-0.084***	-0.029***	0.096***
Employed per Working-age pop.	-0.024***	-0.005	0.111***
Sex of household head (0=Female, 1=Male)	-0.019***	-0.015***	0.000
Occupation status (1=Owner, 0=Other)	0.013***	-0.015***	0.073***
Quintiles of income per CU=2	-0.198***	-0.034***	-0.403***
Quintiles of income per CU=3	-0.214***	-0.055***	-0.442***
Quintiles of income per CU=4	-0.313***	-0.071***	-0.442***
Quintiles of income per CU=5	-0.313***	0.000	0.000

Family size, both parents working and age: increase dependency on energy in FRA. Instead but not in BOL (and even less so in CIV).

The importance of income shows that BOL is in between the two in terms of energy poverty.

Conclusions

- According to the 2030 Agenda for Sustainable Development, particularly SDG7 affordable, reliable, sustainable and modern energy for all), we must ensure universal energy access while implementing the energy transition, known as “leaving no one behind”.
- But universal energy access is not the unique goal of a just transition. Once access is granted, energy poverty can become a strong burden.
- For the South, leapfrogging without entering the energy poverty trap that characterizes the North requires targeted interventions during the process of accessing clean energy (i.e. retrofitting and improving the dwelling quality, and more generally fighting poverty and improving living standards).
- In a word of soaring energy prices, this is a priority **both** for the Global North and the Global South.

Ads: Special Issue in Energy Economics

edited by A. Creti, Z. Ftiti

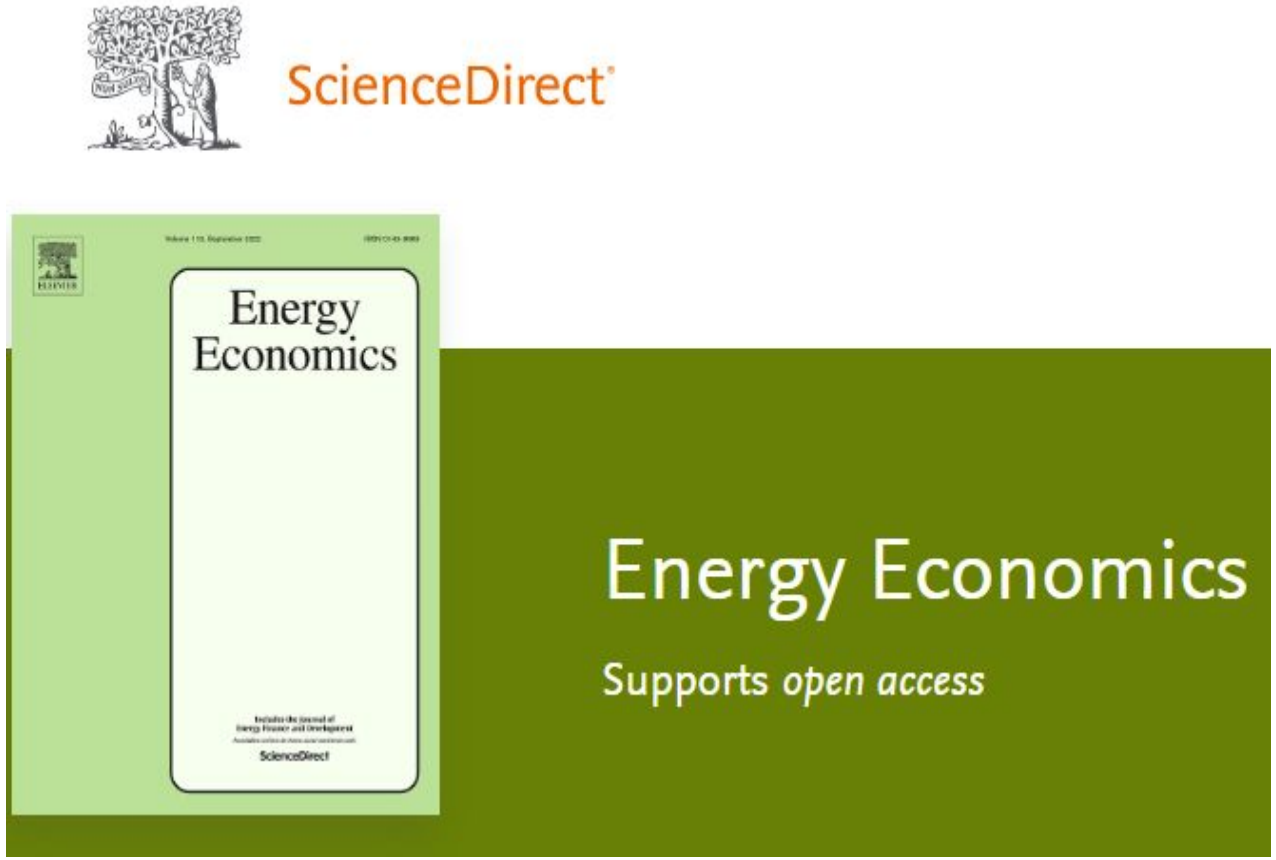
"Energy, Just Transition & Sustainability: What's New?".

"**VSI: Transition**" as the article type in the first step of the submission process.

Deadline:

Submission deadline (time by which all papers must be submitted): **December 15, 2022**

Editorial/Review deadline (the time by which all papers must have received a final decision): **April 6, 2023**



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