Electricity Provision and Tax Mobilization in Africa

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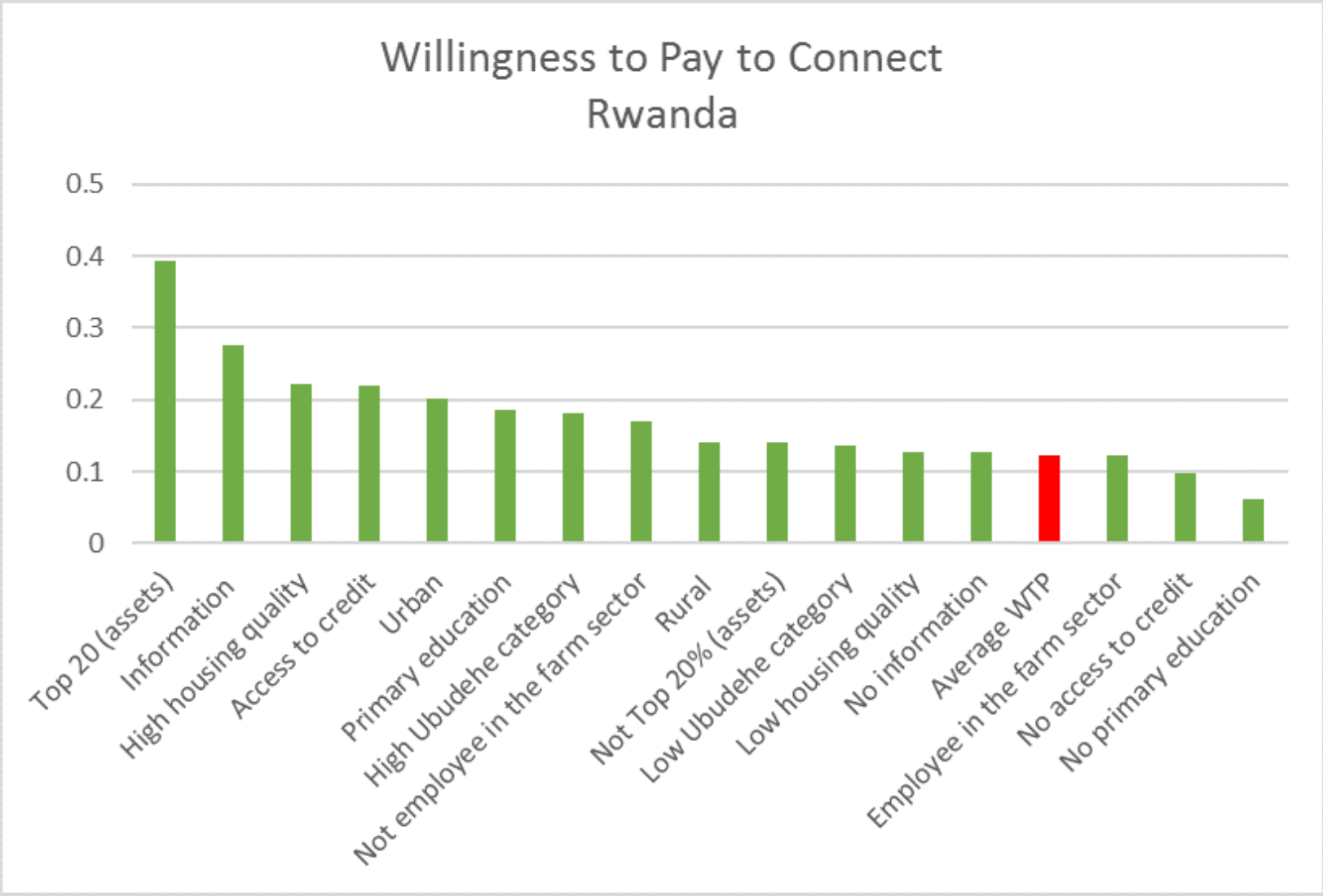
Motivation

- Electricity sector in many SSA countries characterized by:
  - Low access, low consumption, poor quality of service, major financial viability issues
  - High prices relative to other regions, despite the subsidies
  - Major affordability issues for a large share of the population
- The financial gap in the sector requires both private and public investments
  - Need to attract private investments
  - Need also more public funding, especially for economically viable but perhaps financially non-viable projects
- *Research Question:* Would the provision of electricity induce feedback into public finance for future investments?

Affordability, WTP, and the rational of public funding



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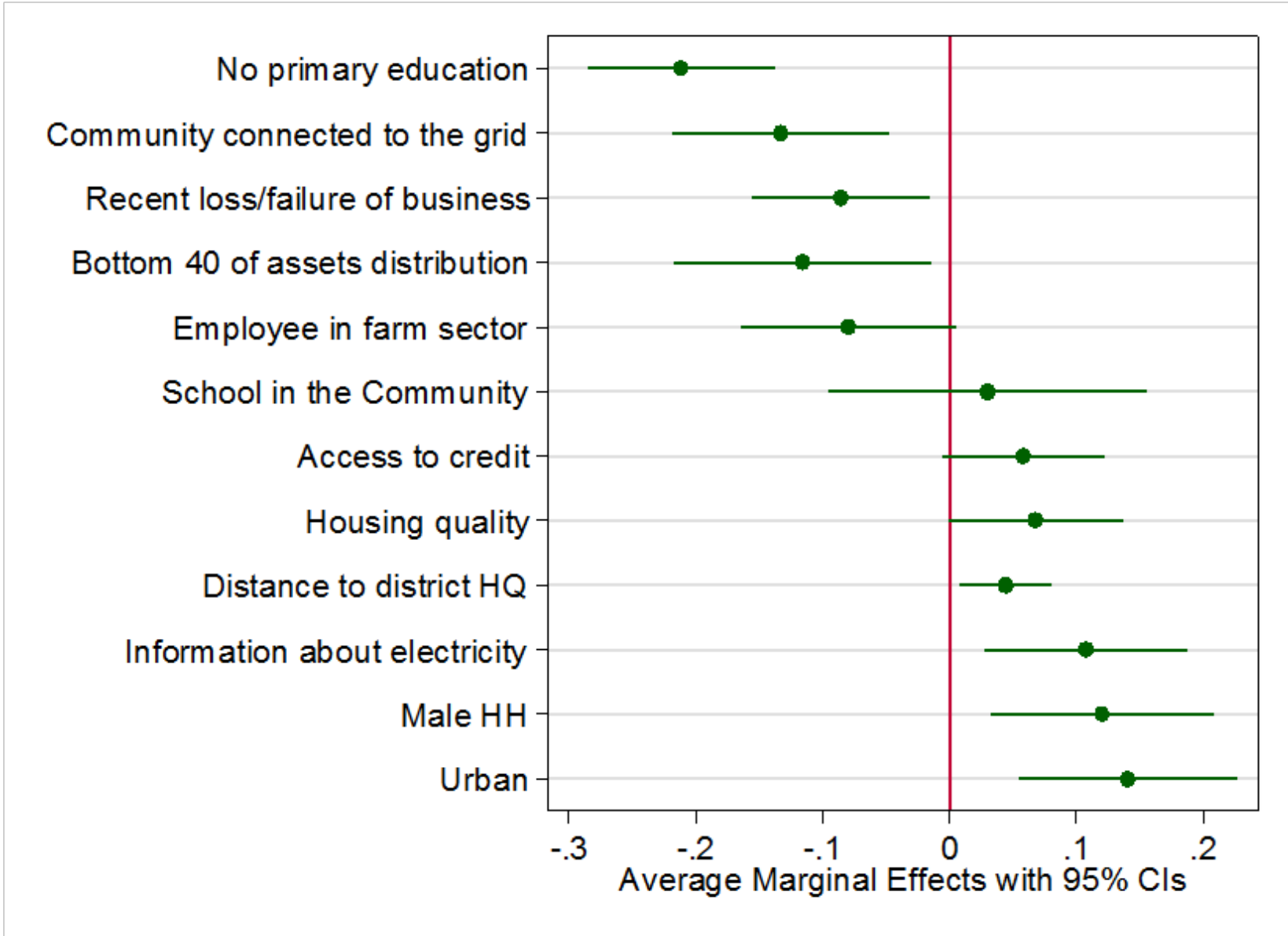


This Paper

- We examine the effects of electricity access and reliability on tax compliance attitudes of individuals in SSA.
- Estimate the potential tax revenue gains to governments from improving reliability in electricity provision.
- Specific questions
  - Does access to electricity increase individuals' reported levels of tax compliance and willingness top pay taxes?
  - Does the variation in the quality of supply matter?
  - What are the potential fiscal implications of improving reliability in supply of electricity?

Summary of Findings

- Electricity access and reliability exert strong and positive impact on attitudes towards taxes
- Strong Spillovers: Grid extension to a community improves the WTP taxes even for unconnected HHs
- Simulation: Potential tax revenue gains from reliable supply of electricity amount to over $9.5 billion (4.3% of total tax revenue) per annum in 35 SSA countries.

Data

- Electricity and attitude toward paying taxes
  - Afrobarometer Survey (Round 6: 2014-2015) for 31 SSA countries - Geo-coded at the community level.
  - African Infrastructure Transmission Diagnostic database - Geo-coded data of transmission lines
- Simulation of forgone tax revenues:
  - Enterprise Survey Data (latest round for each country) for 35 SSA countries (2006-2015)
  - Complementary data sources: WDI, IIAG, IMF's Worldwide Government Revenue Database
- Individual tax estimates (To be added)

Methodology-Electricity Provision and Tax Compliance

- Empirical Model

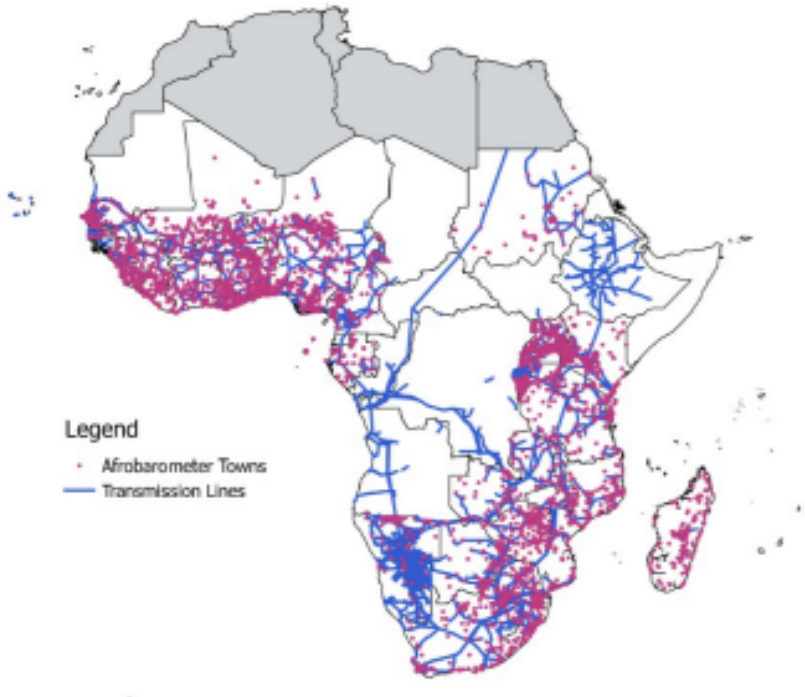
$$y_{icdj} = \alpha + \beta E_{ijdc} + \delta X_{jdc} + \gamma Z_c + \epsilon_{ijdc} \tag{1}$$

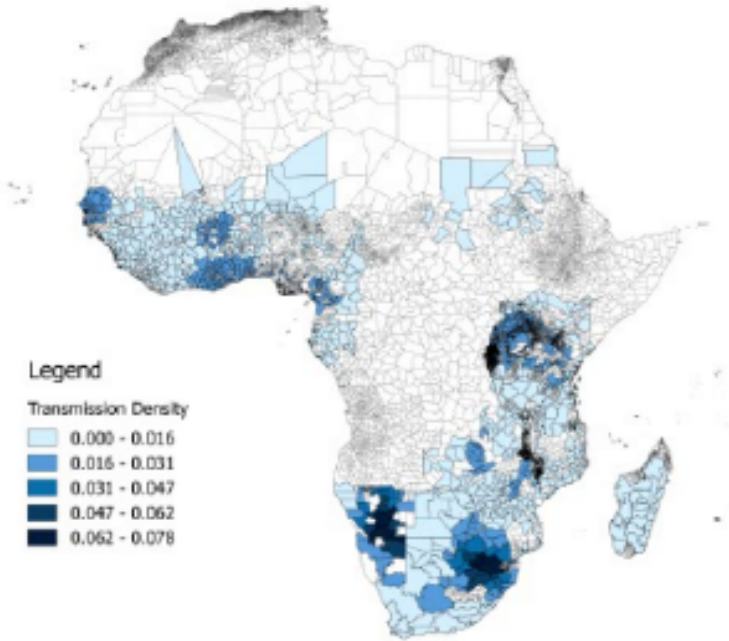
  - where y_{ijdc} is the outcome variable(s) including indices of tax compliance and national identity of individual i living in community j, district d and country c; E is a measure of electricity access and/or degree of reliability of supply; while X and Z are vectors of community and country characteristics; with ϵ_{ijc} as the error term.

Methodology-Identification Strategy

- We use density of electricity transmission network as an instrument for electricity access and reliability (Brown and Sedano, 2004; Chakravorty et al., 2014)
  - Endogenous placement of Transmission lines? Plausibly Not!
  - Placement of transmission lines between the generation plant and endpoint of the lines follow a least cost approach which are largely determined by the topography of the landscape.
  - Construction of transmission network is capital intensive, and the cost increases with elevation.
  - In the African context, many of these transmission lines extend beyond national boundaries as part of the subregional power pools.

Variations in Electricity Transmission Density





Electricity Access and Tax Compliance

Positive and Significant Correlation Between reliability and attitude toward paying taxes

VARIABLES	(1) All	(2) Urban	(3) Rural
Frequency of electricity availability			
Level 1	-0.018**	0.009	-0.023**
	(0.008)	(0.016)	(0.010)
Level 2	0.014*	0.028**	0.004
	(0.007)	(0.011)	(0.011)
Level 3	0.017**	0.022*	0.022
	(0.008)	(0.012)	(0.014)
Level 4	0.027***	0.036***	0.026***
	(0.006)	(0.010)	(0.009)
Level 5	0.033***	0.053***	0.010
	(0.007)	(0.011)	(0.011)
Constant	0.192***	0.198***	0.172***
	(0.035)	(0.055)	(0.045)
Observations	43,560	16,365	26,603
R-squared	0.037	0.043	0.039

Robust standard errors in parenthesis and clustered at the primary sampling unit level. Estimations are done using OLS. The survey sampled across 7,137 communities/towns, 4,435 of which in the rural area and 2,702 in the urban area. The independent variable of interest is the availability and the reliability of electricity for those who are connected. The responses ranged from 1 to 5, where 5 represent the highest level of availability. The

Electricity Access and Tax Compliance - IV estimates

	(1)	(2)	(3)	(4)
	IV Regression			
Electricity Access in Town	0.346*			
	(0.18)			
Household Connected to Grid		0.216**		
		(0.09)		
Reliable Electricity in Town			0.169**	
			(0.07)	
Household has Reliable Electricity				0.287***
				(0.09)
F Stat	8.708	37.651	63.836	26.473
Observations	33423	33338	33419	23323

Notes: Robust standard errors in parentheses are clustered at Primary Sampling Unit(PSU) level. Fstat is the IV First Stage F test of instrument strength. All the regressions in the table control for individual/household, community, and country level variables. The individual/household level variables include the respondent's gender, age, education, quality of housing, employment status, the size of the household, and the ownership of TV or a mobile phone. The community level variables include the presence of piped water systems, paved roads, schools, and hospitals. The country level variables include the total population, the GDP ppp, the share of urban population, the population density, the value added of agriculture and service as a share of GDP, the total natural resources rents (% of GDP), the Mo Ibrahim index on governance, and the Ethno-Linguistic Fragmentation Score.

* Significant at 10 percent level

** Significant at 5 percent level

*** Significant at 1 percent level

Electricity Access and Tax Compliance: Externalities

	(1)	(2)	(3)	(4)
	Conditioned on			
	No HH Access to Elec		No HH Access to Pipe-borne Water	
	IV Regression			
Electricity Access in Town	0.901*		0.372***	
	(0.539)		(0.139)	
Piped Water in Town	-0.209	-0.454	-0.098***	-0.076**
	(0.128)	(0.587)	(0.037)	(0.033)
F Stat	2.893	0.581	14.721	7.825
Observations	16626	16626	19736	19734

Notes: Robust standard errors in parentheses are clustered at Primary Sampling Unit(PSU) level. Fstat is the IV First Stage F test of instrument strength. All the regressions in the table control for individual/household, community, and country level variables. The individual/household level variables include the respondent's gender, age, education, quality of housing, employment status, the size of the household, and the ownership of TV or a mobile phone. The community level variables include the presence of piped water systems, paved roads, schools, and hospitals. The country level variables include the total population, the GDP ppp, the share of urban population, the population density, the value added of agriculture and service as a share of GDP, the total natural resources rents (% of GDP), the Mo Ibrahim index on governance, and the Ethno-Linguistic Fragmentation Score.

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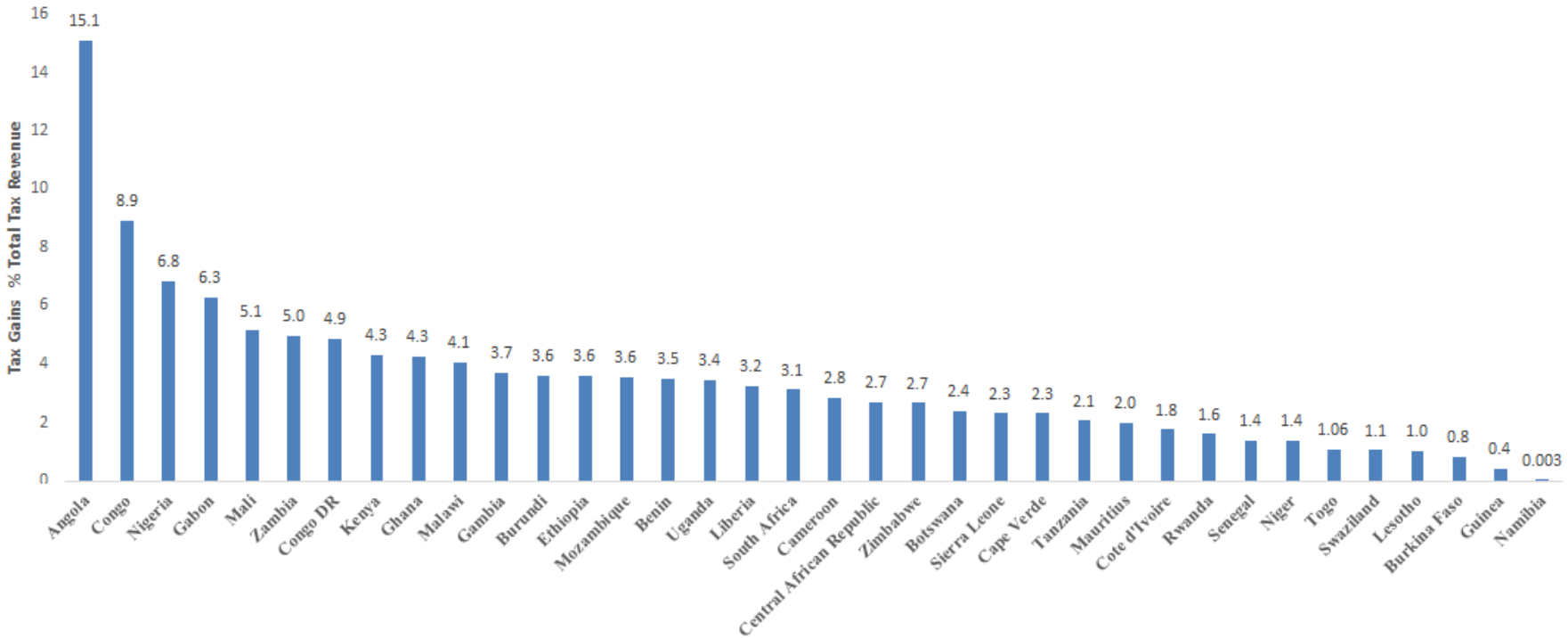
Simulated Tax Revenue Gains/Losses



Concluding Remarks

- Public financing of electrification will require better internal revenue mobilization in African countries
- Provision of reliable electricity has a reinforcing effect on people's attitude toward paying tax.
- The forgone tax revenue stemming from just the unreliability of electricity could fill much of the public financing gap.