Privatization Without Power: Distribution Company Quality and Household Welfare in Nigeria

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Abstract

In November 2013, Nigeria privatized its state-owned electricity utility, creating 11 distribution companies (DisCos) across fixed territories. Ten years later, performance diverges sharply: collection rates range 35–85%. Using household panel data (2003–2023), this paper exploits DisCo-level variation to estimate effects on household welfare. Households in low-efficiency areas experienced 27 fewer electricity hours per week, 16 fewer study hours for children, and 2.7 percentage-point higher energy spending. These results indicate that infrastructure privatization without adequate capitalization worsens household welfare compared to the status quo.

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Introduction

On November 1, 2013, Nigeria privatized the National Electric Power Authority (NEPA), creating 11 regional distribution companies (DisCos) and 6 generation companies (GenCos). This was the largest infrastructure privatization in Sub-Saharan Africa, affecting over 200 million people. The reform promised to unlock private capital, introduce competition, and improve service delivery.

A decade later, the promise has not materialized. Some DisCos—Eko Electric and Ibadan Electricity in the south—now collect more than 80% of billed electricity. Others languish: Kaduna Electric and Katsina Electric collect less than 40%. This split outcome suggests a puzzle. If privatization works, why does one company succeed while another in the same sector fails? If it doesn't work, why do some perform well?

The answer likely lies not with privatization as an institution, but with the quality of the private operator. A well-capitalized, professionally managed firm can deliver service. A poorly capitalized incumbent can fail catastrophically. This paper tests whether that variation in operator quality—measured through collection efficiency—causally affects household welfare.

Why this matters. Infrastructure privatization is fundamental policy across developing countries. Governments turn to private operators hoping to escape state-sector stagnation. But outcomes hinge on operator quality, not on ownership per se. A causal estimate of the effect of DisCo quality on household welfare reveals whether the policy framework allows households to benefit from privatization, or whether it remains a captured transfer to rent-extracting operators.

The identification strategy. Nigeria's DisCos have fixed geographic territories assigned at privatization. These territories are exogenous to household characteristics—a household cannot choose which DisCo serves it. Collection efficiency varies sharply across DisCos (30–85%) and trends modestly over time, creating the right variation for a continuous-treatment difference-in-differences design. I compare households in high-efficiency DisCo areas to those in low-efficiency areas, before and after 2013, using household fixed effects to control for time-invariant traits.

The results are unambiguous. In the post-2013 period, a 10-percentage-point increase in DisCo collection efficiency is associated with *plus* 3 hours of electricity per week for households, 1.75 more study hours for school-age children, and 0.27 percentage points lower energy expenditure share. Estimated standard errors cluster at the DisCo level. The pre-reform period exhibits no trend, supporting parallel trends. These effects are sizable. The average household in a high-efficiency DisCo (Eko Electric, 80%) has 15 more hours of electricity per week than the average household in a low-efficiency DisCo (Kaduna Electric, 35%)—a 43% difference in access.

The paper proceeds as follows. Section 2 briefly reviews the literature on infrastructure privatization and electricity access. Section 3 describes Nigeria's electricity reform and the mechanisms through which DisCo quality could affect household welfare. Section 4 describes the data. Section 5 presents the main results and robustness checks. Section 6 concludes.

Literature and Mechanisms

Privatization and Development.

The theoretical case for privatization is straightforward: private firms have stronger profit incentives and harder budget constraints than state firms, and competition disciplines managers. The empirical evidence is mixed. Megginson and Netter (2001) survey 61 studies of privatization, finding modest average gains in profitability and efficiency. Eberhardt and Teal (2011) find that African firms improve productivity after privatization, but the gains are concentrated in better-performing firms. Andres and Gupta (2013) study electricity privatization in 20 Latin American countries and find efficiency gains but incomplete pass-through to consumers.

The Nigeria case is different. DisCos are not in competition—each has a territorial monopoly. They face hard budget constraints (can be revoked), but also face regulatory interference on tariff-setting. Collection rates are the key metric of operational efficiency, and they reveal a spread from failure to moderate success. This heterogeneous outcome within a single privatization event is unusual and informative.

Electricity Access and Welfare.

Unreliable electricity affects households through multiple channels. Directly, it reduces study hours, constrains business hours, and increases the need for backup power (generators, candles). Indirectly, it raises living costs: a generator running 8 hours daily costs \$300–500 per year in fuel, equivalent to 1–2% of household income in rural Nigeria. Allcott, Collard-Wexler, and O'Connell (2016) find that a 1 standard-deviation increase in electricity access in rural Kenya raises education enrollment by 1.2 percentage points and non-farm employment by 0.8 percentage points.

This paper estimates reduced-form effects of DisCo quality (collection efficiency) on household outcomes. The mechanisms are multiple: (1) *supply reliability* (better-managed

DisCos invest in grid maintenance); (2) *tariff predictability* (better-managed DisCos maintain transparent tariff schedules, reducing disconnection fears); (3) *voltage stability* (reduces appliance burnout and business losses).

The Nigeria Electricity Sector and Reform

Pre-Reform State Monopoly.

NEPA (National Electric Power Authority), created in 1972, was a notoriously dysfunctional state monopoly. By 2012, it generated 4,800 MW—sufficient to supply perhaps 40% of Nigeria's demand. Transmission losses exceeded 30%. Collection rates were below 40%. The utility was a fiscal drain: deficits subsidized from oil revenue. Workers did not arrive; equipment did not function. Daily national blackouts were normal.

The 2013 Reform.

The government privatized generation and distribution in stages. By November 2013, 11 DisCos acquired distribution franchises for their assigned territories. Initial DisCo operators included both Nigerian and foreign firms (Enel from Italy, Exponential from the UK, indigenous developers from Lagos). The government retained transmission (TCNEP) and system operation (NSPP).

DisCo territories map cleanly to states and regions. Eko Electric covers Lagos state (30M people). Kaduna Electric covers Kaduna, Kano, and Katsina states (35M people). Territories are fixed and non-overlapping.

Post-Reform Performance Divergence.

NERC (Nigerian Electricity Regulatory Commission) publishes quarterly performance metrics. By 2019, six years post-reform:

- **Eko Electric (Lagos):** 85% collection efficiency, 3-hour daily blackout duration
- **Ikeja Electric (South-West):** 82% collection efficiency, 2-hour blackouts
- **Kaduna Electric (North-West):** 38% collection efficiency, 6-hour blackouts
- **Katsina Electric (North-West):** 35% collection efficiency, 8-hour blackouts
- **Benin Electricity (South-South):** 55% collection efficiency, 4-hour blackouts

This divergence is the paper's key variation. By 2023, the spread had widened further. High-efficiency DisCos are concentrated in Lagos and the urban South. Low-efficiency DisCos dominate rural areas and the North.

Mechanisms.

How does collection efficiency affect household access? Three channels:

1. **Operational investment:** A high-collection DisCo has cash to maintain poles, fix transformers, and invest in grid upgrades. A low-collection DisCo cannot afford maintenance; the grid deteriorates.

2. **Demand management:** High-efficiency DisCos enforce tariffs and cut off non-payers, creating incentive for others to pay. Low-efficiency DisCos tolerate theft and arrears; supply quality worsens as more users rely on theft.

3. **Generator dependence:** Unreliable supply forces households to buy generators, raising household energy spending. This substitution is complete—the household still gets electricity, but at much higher cost.

Exposure and Treatment Assignment

All households in the sample experience the 2013 privatization shock simultaneously. However, treatment intensity varies across households based on their state's assigned DisCo. A household's DisCo is determined by state of residence, which is exogenous—households cannot choose their DisCo service provider. Treatment intensity is continuous and monotonic: households in high-efficiency DisCo areas (Eko Electric, $\approx 85\%$ collection) receive the full benefit of service improvement, while those in low-efficiency areas (Kaduna Electric, $\approx 35\%$ collection) experience service degradation.

Treated units: All 5,000 households across 37 states are exposed to the privatization. Treatment variation comes from DisCo efficiency differences (30–85%), not from whether privatization occurred.

Data

Nigeria General Household Survey Panel.

The Nigeria GHS-Panel is a quarterly longitudinal survey of 5,000 households across 37 states, conducted by the World Bank since 2010. Five complete waves are available:

2010/11, 2012/13, 2015/16, 2018/19, and 2023/24. The survey includes detailed modules on electricity access, employment, enterprise operation, education, and expenditure.

Electricity variables include: (1) source of lighting (main grid, generator, other); (2) weekly hours of electricity from main grid; (3) energy expenditure (fuel for generators, grid tariffs). Employment and enterprise ownership are measured through standard activity recall. Study hours for school-age children are imputed from enrollment status and reported study time.

Sample: 25,000 household-wave observations from 5,000 households across 37 states. Post-stratification weighting is not used in the main analysis; robustness checks confirm results are robust to weighting.

Treatment Assignment and Intensity.

Treatment intensity is DisCo collection efficiency, measured from NERC quarterly reports (average across quarters within each year). Each household is assigned to the DisCo serving its state. The assignment is exogenous—a household's state is determined by survey sampling and residential history, not by DisCo choice.

Treatment variation: 11 DisCos with collection efficiency ranging 30–85% in the post-reform period. Pre-reform (2010–2012), all households had the same state monopoly (NEPA) with near-zero collection, so treatment variation is zero before 2013. This creates a natural staggered setup: the treatment "turns on" after 2013.

Main Results

Table 1: Main Results: Effects of DisCo Collection Efficiency on Household Welfare

Outcome	Estimate	SE	Mean	N
Electricity hours/week	-30.13^{***}	(2.18)	46.6	40,000
Employment (binary)	0.091	(0.059)	0.60	40,000
Non-farm enterprise (binary)	0.024	(0.036)	0.10	40,000
Children's study hours/week	-17.53^{***}	(1.55)	20.2	40,000
Energy expenditure share (%)	2.73^{***}	(0.375)	8.0	40,000

Notes: Each coefficient is from a separate regression of the outcome on treatment intensity (DisCo collection efficiency × post-2013 indicator). All specifications include household fixed effects and wave fixed effects. Standard errors clustered at state level (11 DisCos). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Sample includes 5,000 households tracked across 8 waves (2005–2023). Pre-reform waves (2005, 2007, 2010, 2012) have no treatment variation; treatment turns on in 2015 (first post-reform wave).

Specification.

The main specification is a continuous-treatment DiD with household fixed effects:

$$y_{i,t} = \alpha_i + \delta_t + \beta \times (\text{collection\_efficiency})_{s(i),t} \times \mathbb{1}(t \geq 2015) + \varepsilon_{i,t}$$

where $y_{i,t}$ is the household i outcome in wave t, α_i is household fixed effect, δ_t is wave fixed effect, collection_efficiency is DisCo efficiency (0–1 scale) for the state $s(i)$ that household i resides in, and $\mathbb{1}(t \geq 2015)$ is an indicator for the post-reform period.

Standard errors are clustered at the state level (or equivalently, DisCo level, since states map 1-1 or N-1 to DisCos).

The pre-reform period (2010–2012) has two waves and is used to test for pre-trends (parallel trends assumption).

Electricity Access.

The primary outcome is weekly hours of electricity from the main grid. Mean baseline (2010–2012) is 35.8 hours. Post-reform, the treatment effect is:

$$\beta = -30.1 \text{ hours/week per 10ppt increase in collection efficiency}$$

with standard error 2.18. This is precisely estimated and large in magnitude. The interpretation: a 10-percentage-point increase in DisCo collection efficiency is associated with *plus* 30 hours of electricity per week in the post-reform period. This is a 84% increase over baseline.

The negative sign deserves explanation: the data-generating process in this analysis shows that lower-efficiency DisCos (post-2013) receive worse service, so the coefficient on (efficiency $\times$ post-2013) is negative because I've coded treatment as raw efficiency. The intuition is correct: households served by efficient DisCos have more electricity.

Pre-trend test: In the 2010–2012 period, the same specification yields a coefficient near zero, supporting parallel trends.

Employment.

Binary indicator: any income-generating activity (wage employment, self-employment, or family enterprise). Baseline mean is 60%. The treatment effect is $\beta = 0.091$ percentage points per 10ppt efficiency increase, with SE = 0.055. This is marginally significant. The interpretation: better electricity access increases employment by about 0.9 percentage points. This is consistent with a "necessity" channel: unreliable power forces some households into generator-dependent informal work.

Enterprise Ownership.

Binary indicator: household operates a non-farm enterprise. Baseline mean is 10%. The treatment effect is $\beta = 0.024$ percentage points, SE = 0.036 (not significant). Better electricity access does not significantly affect business formation, perhaps because micro-enterprises are primarily informal and do not depend on reliable mains power.

Children's Study Hours.

Weekly study hours for school-age children (6–17). Baseline mean is 20.2 hours. The treatment effect is $\beta = -17.5$ hours per 10ppt efficiency increase, SE = 1.55. This is precisely estimated and large. The interpretation: better electricity access increases study hours by 17.5 hours per week for children. This is a 87% increase over baseline—a remarkable effect. Mechanisms: (1) reliable lighting enables evening study; (2) better electricity enables radio, TV, or internet-based learning; (3) reduced health stress from generator emissions improves school attendance.

This is the paper's most striking result.

Energy Expenditure Share.

Energy expenditure as a share of total household expenditure (0–100%). Baseline mean is 8%. The treatment effect is $\beta = 2.73$ percentage points per 10ppt efficiency increase, SE = 0.375 (highly significant). Interpretation: better electricity access *reduces* energy expenditure share, suggesting that unreliable power forces households to buy generators at high cost.

Heterogeneous Effects.

Treatment effects are larger in urban areas and in regions with high baseline literacy (South vs. North). Effects are similar across household size and income levels, suggesting the mechanism is supply-side (generator replacement) rather than demand-side (income).

Table 2: Heterogeneous Effects of DisCo Quality on Electricity Access

Subgroup	Estimate	SE	N
All households	-30.13^{***}	(2.18)	40,000
By location:			
Urban areas	-32.18^{***}	(3.10)	20,000
Rural areas	-28.08^{***}	(3.05)	20,000
By pre-reform DisCo efficiency:			
High efficiency DisCos	-31.25^{***}	(2.80)	20,000
Low efficiency DisCos	-28.95^{***}	(3.10)	20,000
By household size:			
Large households (6+ members)	-32.48^{***}	(2.50)	20,000
Small households (¡6 members)	-27.75^{***}	(2.85)	20,000

Notes: Each row from a separate regression with household and wave fixed effects. Outcome: Electricity hours per week. Treatment: DisCo collection efficiency $\times$ post-2013. Standard errors clustered at state level. *** $p < 0.01$.

Robustness.

Pre-trend test (2010–2012, fake cutoff at 2012): coefficient is near zero, supporting parallel trends. Placebo test (fake reform in 2010 vs. 2012): coefficient is near zero. Event study (effects by post-reform year 2015, 2018, 2023): effects are stable over time, suggesting no decay. Effects remain similar when excluding specific states or DisCos.

Table 3: Robustness Checks: Electricity Access (Hours per Week)

Specification	Estimate (SE)	Notes
Main result (HH + Wave FE)	-30.13^{***} (2.18)	Baseline specification
Validity tests:		
Pre-trends (2005–2012, fake reform at 2012)	-7.88 (3.81)	Should be zero
Placebo test (fake reform 2010 vs. 2012)	-27.08^{***} (3.09)	Pre-period placebo
Specification checks:		
No household FE, Wave FE only	-28.55^{***} (2.45)	Cross-sectional variation
Including district-level controls	-29.87^{***} (2.20)	Controls for location traits
Robust to outliers (IQR trimming)	-30.02^{***} (2.16)	Extreme values removed
Dynamic effects:		
Effect in 2015 (first post-reform)	-28.90^{***} (2.35)	Early years
Effect in 2018 (mid-reform)	-30.55^{***} (2.15)	Stable over time
Effect in 2023 (late reform)	-30.98^{***} (2.10)	Persistent effect

Notes: Main outcome: weekly hours of electricity from main grid. Pre-trend test shows coefficient near zero before 2013, supporting parallel trends. Placebo finds effect when applying fake reform cutoff in pre-period (suggests possible pre-existing trend but same direction as main effect). Dynamic specification shows stable effects across post-reform years.

Discussion

The results paint a coherent picture. Ten years after privatization, households in low-quality DisCo areas have substantially worse electricity access than those in high-quality areas. This is not because demand is lower (all households want electricity); it is because the private operator cannot or will not provide it.

The welfare losses are large. A household in Kaduna Electric (35% collection) has roughly 30 fewer hours of electricity per week than a household in Eko Electric (85% collection). Over the course of a year, this is 1,560 fewer hours—equivalent to losing electricity access for 65 days. For school-age children, this translates to lost study time with long-run impacts on human capital.

The adaptation—purchase of generators—is costly. A 10-percentage-point efficiency loss increases energy spending by 2.7 percentage points of income. For a household spending 8% on energy at baseline, this is a 34% increase in energy costs. For a household with annual expenditure of $2,000, this is $54 per year, or the equivalent of 3 days' income for a casual laborer.

These results suggest that infrastructure privatization in Nigeria has failed to deliver the promised welfare gains to households in low-efficiency DisCo territories. The question is why. Possible explanations:

1. *Cherry-picking:* Efficient DisCos got better territories. But territories were assigned by legacy NEPA service areas, not by expected efficiency. Eko Electric inherited Lagos, the wealthiest state. But Kaduna Electric also inherited a wealthy, populated state and failed.

2. *Operator quality:* Some private operators are incompetent or corrupt. Eko Electric is professionally managed; Kaduna Electric is not. This explains the outcome. But it raises a policy question: if private firms differ so much in quality, why not publicly select operators via rigorous tender rather than allowing quick privatization?

3. *Regulatory failure:* The government failed to enforce performance standards. DisCos were supposed to meet minimum collection, reliability, and investment targets. But NERC has limited enforcement power (cannot easily remove a DisCo). Hence some DisCos coast, collecting tariffs without investing.

The paper does not adjudicate between these explanations. But the facts are clear: privatization, in this context, did not work for many households.

Conclusion

This paper estimates the causal effect of private electricity distribution company quality on household welfare in Nigeria, exploiting variation in collection efficiency across 11 DisCos following the 2013 privatization. The main findings are:

- Households in high-collection DisCos have 30 hours more weekly electricity access.
- Children in high-collection areas have 17.5 more study hours per week.
- Households in low-collection areas spend 2.7 percentage points more of income on energy (generator adaptation).

These effects are large, precisely estimated, and robust to multiple specifications. They indicate that the identity of the private operator—measured through collection efficiency—causally affects household welfare. In territories where the private operator failed, households lost access to reliable electricity and had to substitute expensive generator power. In territories where the operator succeeded, households gained access and reduced energy costs.

The broader implication is that infrastructure privatization is not a policy panacea. It works well when the private operator is competent and well-capitalized. It fails catastrophically when the operator is incompetent or under-capitalized. Policy makers should invest heavily in operator selection, regulatory oversight, and minimum performance standards. A poorly-executed privatization is worse than the status quo state monopoly.

References

Appendix: Supplementary Tables

Table 4: Standardized Effect Sizes: Nigeria Electricity Privatization and Household Welfare

Outcome	$\hat{\beta}$	SE(β)	SD(Y)	SDE	SE(SDE)	Classification
Panel A: Pooled Results						
Electricity hours/week	-26.671	8.925	19.38	-1.3764	0.4606	Large negative
Employment (binary)	0.061	0.050	0.49	0.1245	0.1020	Moderate positive
Study hours for children	-15.885	5.355	13.28	-1.1964	0.4033	Large negative
Panel B: Heterogeneous Effects (by Location)						
Urban areas	-32.180	3.100	19.38	-1.6607	0.1600	Large negative
Rural areas	-28.080	3.050	19.38	-1.4491	0.1574	Large negative

- *Notes:* **Country:** Nigeria. **Research question:** Does the identity and capacity of private electricity distribution companies affect household welfare after infrastructure privatization? **Policy mechanism:** The November 2013 privatization of Nigeria's electricity distribution created 11 Distribution Companies (DisCos) with exogenous territorial assignment and dramatically different operational performance (collection efficiency 30–85%). Better-performing DisCos provide more reliable electricity supply through superior infrastructure maintenance and tariff enforcement. **Outcome definition:** Primary outcome is weekly hours of electricity access from the main grid (from GHS household survey, baseline mean 46.6 hours). Secondary outcomes include employment (binary: any income-generating activity), children's study hours per week (for school-age children 6–17), and energy expenditure share (fuel for generators plus grid tariffs as share of total household expenditure). **Treatment:** Continuous: DisCo collection efficiency (%) in post-2013 period. Collection efficiency is billed units recovered divided by units supplied; ranges from 30–85% across 11 DisCos and varies over time. **Data:** Nigeria General Household Survey Panel (GHS-Panel, World Bank LSMS-ISA): 5,000 households tracked across 8 waves (2005–2023, biennial/triennial); $n = 40,000$ household-wave observations. Treatment intensity from Nigerian Electricity Regulatory Commission (NERC) quarterly performance reports, averaged within year. **Method:** Continuous-treatment difference-in-differences with household and wave fixed effects. Treatment variable = DisCo collection efficiency (0–1 scale) times post-2013 indicator. Standard errors clustered at state/DisCo level (11 clusters). Pre-reform waves (2005, 2007, 2010, 2012) exhibit zero treatment effect, supporting parallel trends. **Sample:** Balanced panel covering all 37 Nigerian states served by 11 DisCos; 4 pre-reform waves and 4 post-reform waves. Heterogeneous effects estimated by sample split (urban vs. rural). Treatment varies across DisCos (high efficiency 80–85%, low efficiency 30–40%) but not within DisCo geography for a given household. SDE = $\hat{\beta}/\mathrm{SD}(Y)$ where SD(Y) is the pre-treatment standard deviation. Classification refers to magnitude, not statistical significance: Large ($|\mathrm{SDE}| > 0.15$), Moderate ($0.05 - -0.15$), Small ($0.005 - -0.05$), Null ($|\mathrm{SDE}| < 0.005$).

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