The Distribution of Power: Decentralization and Favoritism in Energy Infrastructure

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Abstract

Electrification is central to green growth, but state-owned utilities dominate many countries' electricity sectors. This paper studies political favoritism in Kenyan electrification after constitutional decentralization reforms to empower subnational governments. Relative to the pre-existing legislative formula guiding implementation, pro-government areas received 35-42% more household and village electrification. National offices drove favoritism, we detect no favoritism among subnational officials, and counties' share of public energy spending was less than a fifth that of other sectors. Despite successful decentralization reforms across many sectors and countries, the continued centralization of the grid may expose the energy transition to political capture.

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1 Introduction

Electrification is a primary decarbonization tool and an urgent global policy priority, consisting of the replacement of technologies as diverse as steel production, gasoline vehicles, and charcoal cookstoves with electric substitutes. Ambitious electrification and decarbonization goals drive trillions of dollars of investment into electric grids across the world each year (IEA, 2024).

Who spends this money? In high-income countries, multiple private sector companies often operate across the generation, transmission, and distribution segments of the grid: in the U.S., more than 250 companies own transmission lines serving over 4,000 distribution utilities (NAICS, 2024).[1] In contrast, over 80% of African countries have a single electric utility, more than 90% of which are government-owned. While centralized ownership can have efficiency benefits, parastatals can be more vulnerable to political favoritism, threatening mistargeting and state capture of public resources (Briggs, 2021; Min, 2019; Mahadevan, 2024). Such interference by leaders to direct resources towards their political supporters, particularly as the spoils of an election victory, is often captured by the phrase "it's our turn to eat" (Wrong, 2010).

In the past half-century, dozens of countries have sought to broadly constrain favoritism and advance democratization through decentralization: the re-allocation of political and fiscal power away from the central executive. Such reforms often involve creating and empowering subnational governments such as districts and counties, or ratifying new constitutions that remove key powers from the central executive, in the hope of improving outcomes for groups currently out of power. Across countries as diverse as India, Indonesia, Mexico, and Nigeria, researchers have documented a host of possible benefits to decentralization, including reduced intrastate conflict, lower corruption, and improved quality of public goods provision.[2]

Yet it remains an open question whether decentralization can constrain political favoritism in the energy sector, which in many countries is dominated by monopoly parastatals. We study this in Kenya, a regional leader in electrification and decarbonization. Kenya Power (the public electricity distribution monopoly) grew rapidly from having fewer than 1 million residential customers in 2008 to 8.7 million by 2023 (Kenya Power, 2013, 2023). Many were connected through the Last Mile Connectivity Project (LMCP), an ambitious initiative launched in 2016 to connect all households to electricity—and, at \$788 million, one of Kenya's largest public works programs.[3] Kenya Power operates a grid that is 89% powered by hydropower, geothermal, and wind, and has furthermore spurred the adoption of electric cooking and compact fluorescent lamps, placing Kenya at the 20th percentile in terms of CO_2 emitted per dollar of GDP (Kenya Power, 2023; World Bank, 2016).

Kenya has also experienced major political decentralization reforms. After independence, Kenya

[1] 71.4% of U.S. electricity customers get their electricity from one of 168 investor-owned utilities (with an average of 655,000 customers each). The rest get their power from cooperatives or publicly-owned utilities.

[2] Ostrom, Tiebout, and Warren (1961), Prud'homme (1995), Fisman and Gatti (2002), Brancati (2008), Fedelino and Ter-Minassian (2010), Alatas et al. (2012), Opalo (2014), Mookherjee (2015), Savage and Lumbasi (2016), Rodríguez (2018), Opalo (2020), Hassan (2020b), Hassan (2020a), Hamidi and Puspita (2021), Rajasekhar (2021), and Faguet and Pal (2023).

[3] For comparison, Nairobi's expressway was projected to cost \$504 million (KNHA, 2022) and Kenyan government expenditure on secondary education in FY2021/2022 was \$521 million (GoK, 2021).

saw decades of control of public resources by the central executive, leading to significant political favoritism in the allocation of public investment (Burgess et al., 2015). In the early 2000s, Kenya underwent the "biggest political transformation since independence" (Cheeseman, Lynch, and Willis, 2016). This included the 2003 Constituency Development Fund (CDF) Act, which allocated 2.5% of national revenue to constituencies according to a transparent and largely equitable CDF formula. In 2010 citizens subsequently ratified a new constitution through a referendum, which created 47 new popularly elected county governments and strengthened the legislature. Counties and constituencies now spend 23% of total Kenyan public expenditures (GoK, 2019, 2019). These decentralization reforms created "arguably Africa's strongest parliament" (Opalo, 2014), and helped make it one of Africa's most democratic countries (Figure A1 compares its democracy score to other countries).

This paper evaluates favoritism in the allocation of rural electrification investments in the wake of these major decentralization reforms. Importantly for the study's identification, Kenya Power and Kenya's Ministry of Energy publicly announced that they were allocating electrification investments across constituencies according to the existing CDF formula, which specified that allocations should be 75% uniform and 25% based on each constituency's poverty index. This formula had been agreed upon by opposing political parties more than a decade before the launch of the LMCP, and was thus viewed as a nonpartisan legal benchmark. This allows for the estimation of political bias in rural electrification without having to assume the government's underlying policy objectives.

To evaluate the role of decentralization, we estimate marginal favoritism across four distinct stages of the electrification program, which were influenced by different levels of government. First, between 2008 and 2016, national parastatals constructed thousands of electrical transformers in rural areas. Second, in 2016 Kenya Power selected a subset of transformers to be included in the LMCP, working with constituency-elected members of parliament (MPs) to allocate LMCP projects within constituencies. On-the-ground construction was contracted out in geographic clusters to dozens of private contractors, who worked with regional Kenya Power offices (Wolfram et al., 2023). Finally, the regional Kenya Power offices activated the newly connected household meters.

The analysis uses rich administrative data, including the universe of Kenya Power's 7.4 million electricity meters and 62,271 transformers, as well as village-level panel data on LMCP construction progress. We pool these by geographic ward (an administrative unit) to match them with electoral data on presidential and parliamentary results from Kenya's 2013 and 2017 elections. To quantify decentralization in the energy sector, we collect ministerial and county-level sectoral expenditures.

This paper has two main empirical findings. First, constituencies that voted pro-government in the preceding election received significantly more LMCP sites than their CDF share, while opposition constituencies received significantly fewer. As a result, by 2019 pro-government wards had 35% more new electricity meters per capita. These results are robust to a wide range of specifications and controls, including census data and measures of private sector economic activity. Furthermore, even if the government deviated from their stated goal of using the CDF formula for legitimate reasons related to unobservable policy goals or social welfare preferences, a deviation from the stated policy is still noteworthy from the perspective of promoting transparency in public policymaking.

Favoritism is strongest in core support wards (where the government received at least 75% of the vote share), but of similar magnitude in swing wards, regardless of whether they eventually voted for the government or the opposition. While the levels of favoritism we find are lower than those estimated for other Kenyan public investments in previous decades (for instance, for roads, Burgess et al., 2015), decentralization did not eliminate favoritism in this context.

How was political favoritism able to persist in Kenya despite major constitutional decentralization reforms? A leading possibility is that subnational government representatives leveraged their increased fiscal and political power to allocate resources clientelistically, perpetuating biases that had previously been exerted by the national government. Yet we find no evidence of favoritism aligned with subnational politicians: within a constituency, wards that voted for the MP see similar levels of LMCP construction as wards that voted for a losing candidate, and a close-election regression discontinuity design additionally finds that alignment of a constituency's MP with the winning presidential coalition does not affect electrification outcomes. In line with the lack of local influence, we document that county governments were responsible for only 1.1% of public expenditures in the energy sector, and we develop a novel measure to quantify decentralization to show that counties' share of public spending in the energy sector was less than one fifth that in other sectors, suggesting Kenya's reforms had not in practice significantly decentralized the energy sector.

Instead, the paper's second main finding is that aggregate pro-government favoritism was enacted by representatives in the national government, which oversaw the first two stages of rural electrification. We do not detect favoritism during final local network construction and meter activation, which were implemented and managed by geographically dispersed contractors and local utility employees. Rather, we estimate a significant 17% higher initial construction of transformers in pro-government areas, which was planned and executed centrally by Kenya Power and the Rural Electrification Authority between 2008 and 2016. Kenya Power's subsequent selection of LMCP sites from among the set of transformers expanded the gap between pro-government and opposition constituencies, generating an overall 42% difference in the number of LMCP sites. MPs were not involved in this process: their input was requested only to allocate funding within—not across—constituencies. Taken together, these results indicate that pro-government favoritism was exerted primarily by national officials.

These results highlight the critical role of institutional design in effective decentralization. In many low-capacity states, subnational government capacity lags significantly behind the national government's (Hassan, 2020a). In interviews with stakeholders from Kenya Power, the Rural Electrificatin Authority, and the Kenyan government, Volkert and Klagge (2022) note widespread agreement that "a lack of skills, knowledge and experience of the county governments, their staff and possibly also the MPs... is the main challenge for a devolved electrification governance." That is, compared with long-established central government power sector organizations such as utilities and ministries, county governments lack the technical expertise to construct and operate power grids. At the legislative level, the high turnover of Kenyan MPs inhibits the development of specialized expertise, causing parliament to defer to the executive on technical matters (Opalo, 2022b). This paper joins a growing body of work studying the political influences on electric utilities in both higher and lower income countries,[4] as well as the large inter-disciplinary literature on political favoritism and the provision of public goods in Africa, including Kenya.[5]

Strong public policymaking bodies are critical in the global energy transition (Shapiro, 2023). The technical and coordination complexities of operating a grid imply that centrally managed grids might more efficiently expand transmission networks as well as locate and deploy generation (Welton, 2024; Cicala, 2022; Botterud et al., 2024). In the U.S., decentralized management of transmission has created significant bottlenecks connecting renewables to the grid (Kavulla, 2021; Cicala, 2021; Klass et al., 2022). In contrast, a recent remote wind generation project that expanded Kenya's generation capacity by 17% did not face subnational interconnection issues as it only had to connect bilaterally with Kenya's monopoly transmission company.

These efficiency gains may be critical in low- and middle-income contexts. Recently, only two of Africa's 52 utilities recovered their costs (Kojima and Trimble, 2016). Many face additional pressure to provide affordable, universal access to electricity and to improve service quality through continued investment (Burgess et al., 2020; Blimpo and Cosgrove-Davies, 2019). Centralized management of the electricity sector may therefore be a sensible economic decision in purely technocratic terms. At the same time, as shown in this paper, continued centralized management may increase the energy sector's vulnerability to political capture. Thus while political decentralization has successfully limited favoritism across many sectors, it may be less suitable for accountability in the electricity sector. The resulting distortions in public resource allocation may undermine countries' ability to to successfully manage the ongoing energy transition.

2 Electrification and decentralization in Kenya

In 2009, only 23% of Kenyan households, and 5% of rural households, had access to grid electricity.[6] The Government of Kenya (GoK) has since directed significant funding towards universal electrification. After the Rural Electrification Authority launched a program in 2008 to electrify thousands of public facilities, in 2015 the GoK announced the Last Mile Connectivity Project (LMCP), which would connect millions of rural Kenyans to the grid between 2016–2022 at a cost of $788 million (REA, 2015; Kenya Power, 2018). These programs, which raised grid access to more than 50% by 2019, took place largely after major decentralization reforms had taken place between 2003 and 2010. This section discusses these political and economic factors in more detail.

2.1 Kenya's Decentralization and the Constituency Development Fund

Decentralization has been a major feature of Kenyan democratization, and has helped make Kenya's democratic institutions among the strongest in Sub-Saharan Africa (Figure A1). A key milestone

[4] MacLean et al. (2016), Min (2019), Briggs (2021), Mahadevan (2024), and Hausman (2024).

[5] Barkan and Chege (1989), Miguel and Gugerty (2005), Franck and Rainer (2012), Francois, Rainer, and Trebbi (2015), and Marx (2018).

[6] Figure A2 shows the number of meters per household by wards per Kenya Power's residential meter data.

in the reform process was the 2003 Constituency Development Fund (CDF) Act, enacted after President Arap Moi's 24-year rule came to an end in 2002 when Kenya's main opposition party—led by Mwai Kibaki—had won the presidential and parliamentary elections.

The 2003 CDF Act aimed to disburse resources across Kenya's constituencies according to a transparent and equitable formula (GoK, 2010). The formula reflected bipartisan government objectives for equality and equity: 75% of CDF funding would be allocated in equal shares across all constituencies (regardless of population or other features) and 25% according to that constituency's share of national poverty (GoK, 2003).[7] It was designed and supported by members of both the government and opposition parties—including Raila Odinga, the leader of the opposition in the 2007, 2013, and 2017 national elections—with the goal of constraining future favoritism, and continues to be viewed as a nonpartisan way to disburse funds across constituencies (Bagaka, 2010; UNODC, 2022). Indeed, after controlling for basic census variables, allocations are uncorrelated with political affiliation, while without controls, they lean very slightly towards pro-opposition areas, which tend to be somewhat poorer (Table B1).

A second milestone of decentralization was the adoption of the 2010 Constitution after a national referendum. Among other reforms, it created an entirely new layer of government: 47 'counties' with significant political and fiscal independence. This included popularly elected governors for the first time, as well as county assemblies elected across 1,450 newly created electoral wards. The new constitution also increased the number of constituencies from 210 to 290. These legislative and constitutional changes devolved resources and power toward local politicians, with the intent to "diffuse, if not eliminate altogether, the ethnic tensions fueled by perceptions of marginalization and exclusion" in national politics (Akech, 2010). The 2010 Constitution explicitly assigned responsibility for setting electricity policies to both county governments and the national government (Government of Kenya, 2010a). Observers have argued that these overlapping constitutional mandates have created ambiguity and left open the extent to which national as opposed to local officials would set and implement energy policies (The World Bank, 2017).

2.2 Kenya's political backdrop

Uhuru Kenyatta, the son of Kenya's independence leader Jomo Kenyatta, was the incumbent president during the launch of the LMCP in 2015. As background, he had earlier joined Kibaki's winning coalition in the 2007 election, which saw widespread violence after a disputed result: an estimated 1,500 Kenyans were killed (Leonard, Owuor, and George, 2009; Cheeseman, 2008). In the aftermath, key figures—including Kenyatta and William Ruto, who had previously been on opposite sides but joined forces in the subsequent 2013 national election—were charged with crimes against humanity by the International Criminal Court. Their political alliance strengthened in the years after, forming what became known as the "coalition of the accused" (Shilaho, 2016; The Economist, 2013).

[7] In early 2016, the legislature amended the allocation: each constituency would now receive an equal share (GoK, 2016). In practice, this change in the formula was both economically and statistically small.

This paper's main explanatory variable is voting outcomes from the 2013 presidential election, which preceded the selection of LMCP sites. Uhuru Kenyatta won the March 2013 presidential election with an electoral coalition similar to Kibaki's in 2002 and 2007, drawing significant support from central Kenya, as reflected in the electoral map shown in Panel B of Figure 3. Kenyatta's partnership with Ruto also gained him significant support in the central Rift Valley region, where Ruto's main political base resides. Raila Odinga led Kenya's opposition with support located primarily in western regions of Kenya and some urban centers.

Kenya's rural electrification investments started with a program of transformer construction in 2008 under President Mwai Kibaki. Kenyatta subsequently expanded Kibaki's program, leveraging the growing network of transformers to target universal household electricity access. Despite increasing scrutiny surrounding ethnicity within public sector appointments (Amaya, 2016; Simson, 2018), both Kenya Power managing directors appointed under Kenyatta in 2013 and in 2017 were politically aligned with and coethnics of Ruto (Figure A3 provides an overview of appointments). Electrification efforts accelerated in the year before the August 2017 presidential election, with more than a million new residential electricity meters installed over this period. In a March 2017 State of the Nation address, Kenyatta stated:

> "To begin the walk towards industrialisation, we needed to drastically improve and expand our infrastructure, and to increase access to electricity... In 2013, we promised to provide access to electricity for 70% of all households by the end of 2017. Today, we have connected an additional 3.7 million new homes to electricity. We have more than doubled the total number of connections made since independence." (Kenyatta, 2017)

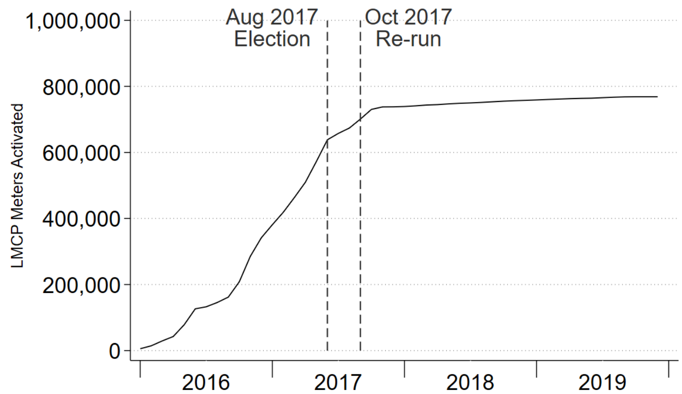
Kenyatta won the August 2017 election but Kenya's Supreme Court annulled the results due to alleged irregularities, confirming both the strengths of Kenya's democracy (as the judiciary was able to force an election re-run) but also its limitations (the lack of fully transparent polls). After winning the November 2017 re-run, Kenyatta was sworn in to his second term on November 28, 2017.[8] Kenyatta's Jubilee Party won 140 out of 290 MP seats in the National Assembly, while Odinga's Orange Democratic Movement won 62.

This paper's main analyses study the relationship between electrification project placement and the 2013 election results, rather than the 2017 results, for two main reasons. First, the 2017 results might be endogenous to the placement of electricity infrastructure if those investments influenced voting. Second, the spatial distribution of electoral support in Kenya is highly persistent over time: the 2013 and 2017 elections are correlated with an R^2 of 0.89 (Figure D1 provides a scatter plot). The 2013 election results thus reflect the contemporaneous political landscape at play during the 2016–2017 rural electrification program.

Figure 1 plots the cumulative number of activated LMCP meters based on their activation dates provided by Kenya Power. Between the start of LMCP in 2016 and the October 2017 presidential election re-run, there was rapid progress in construction, with over 30,000 meters activated per

[8] The October 2017 re-run was boycotted by the opposition. The August 2017 results, while also imperfect, thus better reflect the contours of regional electoral support and we use these in the analysis.

Figure 1: LMCP household electricity meters



Count of LMCP meters (Section 3 defines an 'LMCP meter') over time. The vertical lines denote the August 2017 and October 2017 presidential elections. Figure A4 disaggregates construction per capita by political affiliation.

month. However, after the August election and the October re-run there was a sudden plateau in the pace of construction for at least two years. These patterns help motivate our investigation into the political drivers of electrification. In particular, the ramp-up in the lead-up to the election is consistent with ex ante strategic politician behavior designed to incentivize voting rather than solely a system of ex post rewards for areas that had recently voted for the winning party (Golden and Min, 2013).

2.3 Rural electrification in Kenya

In 2008, Kenya's electricity grid had around 30,000 electrical transformers, which convert medium voltage electricity down to low voltage (LV), which can be used by households and businesses. Between 2008–2015, thousands more transformers were constructed across the country. This greatly reduced the marginal cost of household connections, and motivated the launch of the LMCP. In 2016, several thousand of these transformers were selected for the LMCP (termed 'LMCP transformers' or 'LMCP sites'). The LMCP's goal was to leverage economies of scale and connect all households within 600 meters of a transformer in a single process referred to as 'transformer maximization', where most LMCP sites contained between 20 to 100 unconnected households. This section describes the four stages of this process in more detail.

Stage 1: The construction of new transformers

The first major hurdle to increasing rural electricity access was the lack of transformers in rural areas. In its 2008 Strategic Plan, the Rural Electrification Authority (REA) announced that it would construct thousands of transformers across the country with the goal of connecting secondary schools, trading centers, and health and water centers to electricity (REA, 2008; Berkouwer, Lee, and Walker, 2018). In part as a result, the number of distribution transformers nationally more than doubled: installed capacity of 11/0.415kV and 33/0.415kV distribution transformers increased from 3,515 MVA in June 2007 to 7,276 MVA in June 2017 (Kenya Power, 2012; 2017).

Stage 2: The selection of LMCP sites from among the nationwide set of transformers
Based on private correspondence that we reviewed, Kenya Power first determined a target budget for each constituency. Kenya Power then reached out to each constituency's member of parliament and exchanged a series of letters to jointly select which transformers in that constituency would be maximized under LMCP. A total of 13,840 transformers were selected for maximization, and the list of these LMCP villages was shared publicly (Kenya Power, 2017; Kenya Power, 2015).

Stage 3: The construction of low voltage network expansions at LMCP transformers
Construction at villages selected for the LMCP was outsourced to private contractors. Staff at Kenya Power's Nairobi headquarters implemented auctions and administered dozens of contracts. The selected contractors—a mix of domestic and international firms—were responsible for designing low-voltage network expansions, procuring materials (such as poles and conductors), and installing them. Installation consisted of three steps: erecting poles, stringing (wiring) poles, and connecting a drop cable from a pole to each customer.

Importantly, implementation contracts were segregated geographically, with each contract assigning responsibility for LMCP sites in at most a handful of geographically clustered counties.[9] As a result, contractors often had staff based in smaller cities, who interacted primarily with local Kenya Power offices. This becomes a notable detail later when we discuss the role of decentralization.

Stage 4: Household electricity meter activation at sites with construction
A crucial program feature that enabled LMCP to reach so many households was that recipients were not required to pay an upfront deposit: per Kenya Power, "all the beneficiaries under this scheme will be connected whether they have paid the contribution or not" (Kenya Power, 2016). Households connected under the LMCP could pay the the KES 15,000 ($\sim$USD 150) connection fee—significantly lower than the standard KES 35,000 ($\sim$USD 350) fee, thanks to government and donor financing—in up to 36 monthly installments of around USD 4 each.[10]

Connecting a household to the grid requires installing and activating an electricity meter. While contractors were responsible for the physical connection and meter installation, Kenya Power was responsible for meter activation.

Cumulative favoritism
The marginal impacts across the four stages jointly determine the number of LMCP household electricity meters per 100,000 households. Equation 1 formalizes this cumulative measure of favoritism:

[9] Both the African Development Bank (AfDB) and World Bank (WB) were major donors. The contracts funded by the AfDB and the WB were spatially interspersed and both nationally representative and this difference thus does not affect the political analysis (Wolfram et al., 2023). The results in the paper are similar when considering only AfDB sites or only WB sites.

[10] The monthly payments were supposed to have been automatically posted to households' electricity meters, but in practice, connection fees for many customers were never or only partly recovered (Alushula, 2018). This structure was later changed to a 20% upfront payment, with the balance recouped by dedicating 50% of households' monthly electricity expenditures to repaying the connection fee (AfDB, 2022).

$$
\begin{aligned}
\frac{\#\text{ LMCP household electricity meters}}{100{,}000\text{ households}} = & \left(\frac{\text{Total }\#\text{ transformers}}{100{,}000\text{ households}}\right) \\
& \cdot \left(\frac{\#\text{ LMCP transformer}}{\text{Total }\#\text{ transformers}}\right) \\
& \cdot \left(\frac{\#\text{ LMCP transformers with LV construction}}{\#\text{ LMCP transformers}}\right) \\
& \cdot \left(\frac{\#\text{ LMCP household electricity meters}}{\#\text{ LMCP transformers with LV construction}}\right) \qquad (1)
\end{aligned}
$$

2.4 Electricity grid investments would follow the CDF formula

A central contribution of this paper is estimating favoritism against an objective benchmark, which avoids the researcher having to assume the government's policy objective function. Specifically, electrification expenditures were to follow the Constituency Development Fund (CDF) formula, which had been agreed upon by opposing political parties well before the launch of the REA and LMCP electrification programs (in 2008 and 2015). The government announced that it would follow the CDF to allocate electrification expenditures on numerous occasions, through numerous platforms—we present a subset here.

In a parliamentary session in Nairobi in 2010, a representative of the Ministry for Energy and Petroleum stated that the construction of transformers was to be allocated across constituencies according to the CDF formula. Consider the following exchange:

> Evans Bulimo Akula, Opposition Member of Parliament for Khwisero:
> *Mr. Speaker, Sir, how many projects is the Ministry supposed to do in every constituency per year? For the last eight years, they have done only 11 projects.*
> [...]
> Charles Keter, Assistant Minister for Energy and Petroleum:
> [...] *we are using the CDF formula. The hon. Member will realise that in this financial year, he will get over Kshs15 million and we are doing about five projects. In the last financial year, he also got the same amount of money, that is, Kshs15 million which did three projects. Right now, the Ministry of Energy allocates funds using the CDF formula.*
>
> Kenyan parliamentary debates, 25 March 2010 (Hansard, 2010).

In a parliamentary session in Nairobi in 2016, an opposition member of the senate asked "why the Government is discriminating against sections of the public in terms of the allocation," in response to which a member of government provided the following statement:

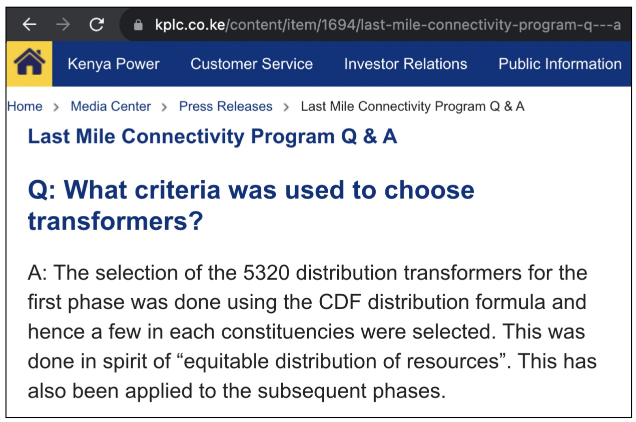
> Senator Mwakulegwa, Vice-Chairperson in the Standing Committee on Energy:
> *The company is not discriminating against any section of the public in terms of their*

location... The company has ensured that the ongoing projects are supported by donors and the Government and are spread throughout the constituencies and counties using the Constituencies Development Fund (CDF) distribution formula.

Kenyan parliamentary debates, 14 June 2016 (Hansard, 2016).

Throughout this period, Kenya Power's public materials also all stated that it would allocate LMCP sites to constituencies according to the CDF formula. Kenya Power's 'Electrification Project' web page states that "selection of the distribution transformers for the Last Mile project was based on the Government Constituency Development Fund criteria for resource allocation" (Kenya Power, 2024). Figure 2 shows the "Last Mile Connectivity Program Q&A" section on Kenya Power's website, similarly describing the allocation of sites across constituencies using the CDF formula.

Figure 2: Kenya power website announcement



Note: The Kenya Power website announced that LMCP transformers would be allocated to constituencies according to the Constituency Development Fund (CDF) formula. Source: Kenya Power (2016).

3 Data

A key feature of this paper is the granularity of the data on both grid infrastructure (provided by Kenya Power) and construction progress over time (provided by LMCP project contractors). We combine this with detailed ward-level electoral data as well as county- and national-level expenditures in the energy sector. Together, these data provide a detailed understanding of Kenya's rural electrification activities, electoral outcomes, and public expenditures between 2008-2019.

3.1 Grid infrastructure and LMCP construction data

The grid infrastructure data provided by Kenya Power include the universe of Kenya's 7.4 million electricity meters and the 62,271 transformers that they were connected to as of December 2019, with geo-spatial coordinates and network connections for each meter and transformer. Meters and transformers span Kenya's 290 constituencies and 1,450 wards (Table B2 provides summary statistics). Since the LMCP was a program of transformer maximization, it deprioritized sparsely populated regions and urban regions, and we exclude these from the analyses.[11] The main analyses thus focus on a sample of 911 rural wards that were the main focus of the LMCP (Figure A5). These 911 wards contain 42,135 transformers—including 9,284 out of the 11,934 transformers that were selected for the LMCP (78%)—and 948,063 household meters that are indicated as having been connected via a government electrification program since 2016.[12] For the remainder of the paper, we refer to these 911 wards as 'LMCP wards', the 9,284 transformers as 'LMCP sites', and these 948,063 electricity meters as 'LMCP meters'.

More than 99% of LMCP construction by 2019 was part of one of three programs co-financed by a major international funder: African Development Bank (AfDB) Phase I, AfDB Phase II, and World Bank (WB). The construction progress panel data consist of monthly transformer-level construction progress reports—which contractors were mandated to send to Kenya Power—for all LMCP sites that were financed through either AfDB Phase I or WB.[13] The data contain four markers of progress: the start of construction, pole installation, stringing of electrical cables, and meter installation. Panel A of Figure 3 shows two snapshots of these data. The activation of household meters—when electricity actually begins to flow to households—is completed by Kenya Power and thus not included in the contractor progress reports. Instead, we construct a panel dataset of meter activation using the activation dates from the Kenya Power data; Appendix C provides additional detail on data construction.

The various data sources generally align well. As an example, the meter activation database shows around 3 to 5 active electricity meters connected to each LMCP transformer prior to construction (Kenya Power officials confirmed that, prior to the LMCP, up to a handful of high-income households would often be connected to a rural transformers by paying the standard connection fee). The meter activation data, which are from an entirely separate data source, indicate a sharp rise of around 25–30 in the number of active meters in the weeks around when a contractor independently reports completion of construction at a site (Figure A8). This is in line with Kenya Power's ex ante expectations around the likely number of unconnected households at each site.

3.2 Electoral and demographic data

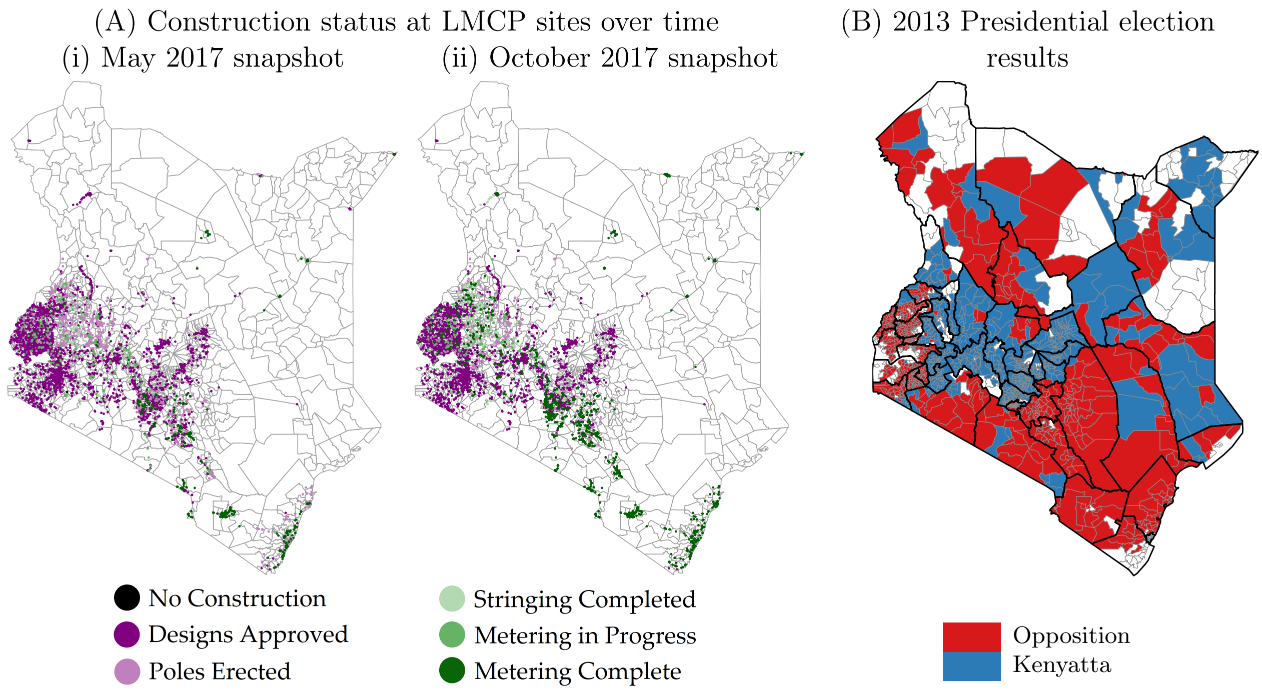
Panel B of Figure 3 displays ward-level results for Kenya's 2013 presidential election, obtained from the Independent Electoral and Boundaries Commission website. Blue wards are those where Kenyatta won over 50% of the vote, while red wards are those where the opposition won over

[11] We label counties targeted by REA's Kenya Off-Grid Solar Access Project as sparsely populated. In these remote areas, very few households lived within 600 meters of a transformer. We label wards in Nairobi or Mombasa, or with similar population density, as urban. By 2016, 84% of urban Kenya households were connected to electricity (WB, 2018). Figure D2 presents a specification curve with 63 variations of sample definitions. Results are not qualitatively sensitive to the sample definition.

[12] In line with Kenya Power explanations, we define this as having a pre-paid residential meter that was activated after 2015 as part of a government-funded scheme. Appendix C describes data construction in detail.

[13] We observe locations for all meters as of December 2019, but we only observe construction activity and activation dates for meters that had been activated by December 2017 or earlier as part of AfDB Phase I and WB. This limitation does not affect the main econometric analysis below.

Figure 3: Nationwide distribution of LMCP construction and 2013 election vote shares



Panel A shows two snapshots from monthly construction data, showing the status of construction at each LMCP transformer site. The full monthly panel data set spans from April 2017 to June 2019. Panel B shows 2013 presidential election results at the ward level, with county borders in thick black lines. Blue (red) wards had vote shares of over (under) 50% for Kenyatta. White wards are missing election data. Figure A6 presents the full distribution of vote shares and separates interior and border regions of support. Figure A7 maps the distribution of LMCP sites across pro-Kenyatta and opposition border areas.

50%.[14] Votes for Kenyatta's government were concentrated in central Kenya, the ethnic home areas of Kenyatta and Ruto, respectively, as discussed in Subsection 2.2. Electoral coalitions and geographic patterns in vote shares were stable between 2013 and 2017 (Figure D1).

As a robustness check, we restrict the sample to wards bordering at least one ward that voted for the opposing candidate in the 2013 presidential election, thus comparing only wards with relatively similar geographic and socioeconomic characteristics. This also accounts for baseline differences in the extent of the national grid, which can affect the cost and feasibility of local network extensions. This results in a sample of 451 adjacent wards (mapped in Figure A6).

3.3 Public expenditure data

We collect three types of public expenditure data, at the constituency, county, and national levels of government. Panel A of Figure A9 shows the share of the Constituency Development Fund (CDF) that was allocated to each county in 2015 (Government of Kenya, 2015). This reflects the allocation rule that was in place between 2003 and 2016, which was that 75% of the funds would be allocated

[14] 2013 election data are missing for 185 out of 1,450 wards (13%), shown in white in Figure 3. These are primarily located in remote northern regions of the country with relatively small populations and fewer LMCP sites.

on an equal basis and the remaining 25% would be allocated according to a national poverty index consisting of population, dependency, housing quality, and education variables that was intended to proxy for the number of people living in poverty in each constituency. Then between 2016 and 2021, 100% of constituency funds were allocated on an equal basis.

At the county level we collect sector-level expenditures. Panel B of Figure A9 shows total county government expenditures (Kenya's Office of the Controller of Budget, 2022) while Panel C shows the portion of county government expenditures that were spent in the energy sector, primarily on rural electrification and street lighting. Finally, at the national level we collect data on 2021–2022 ministerial expenditures by six key ministries: health, agriculture and livestock, education, water and sanitation, roads and transport, and energy (GoK, 2022).

3.4 Additional data

We draw socio-economic controls from the 2009 Kenya Population and Housing Census, which was the most recent census before the launch of LMCP (GoK, 2009). These include population density, baseline unconnected electricity rates, and household asset proxies. In addition to these socio-economic controls, we include geographic controls for land gradient and land area, as opposition wards have slightly less rugged terrain (as measured by a satellite-based gradient index) and larger land area, which could potentially affect construction costs.

While Kenya Power was planning and rolling out the LMCP, the private firm Safaricom was heavily expanding its network of M-PESA agents across the country. We therefore supplement the census data with geo-tagged data on the roll-out of M-PESA mobile money agents between 2013–2015. We interpret these data as an indicator of private sector economic activity and investment.

4 Favoritism in the rural electrification program

How much did Kenya's household electrification program favor areas that voted for Kenyatta, the winner of the previous presidential election? We first document the overall difference in household electrification using a selection-on-observables approach. Then, to distinguish favoritism from other possible government objectives, we evaluate realized allocations relative to the CDF formula.

4.1 Selection-on-observables estimation

We first estimate the difference in electricity meters per 100,000 households between pro-government wards and opposition wards, as follows:

$$y_i \quad = \quad \beta_0 + \beta_1 ProGovernment_i + \boldsymbol{\gamma}\mathbf{X_i} + \varepsilon_i \tag{2}$$

where y_i is the number of government-subsidized household electricity meters per 100,000 households activated in ward i as of December 2019. (For scale, Kenyan constituencies outside the major cities have an average population of around 27,000 households.) $ProGovernment_i$ equals 1 if ward i voted pro-Kenyatta in the 2013 presidential elections—as discussed in Subsection 2.2, the 2013 presidential elections result is the preferred explanatory variable (rather than 2017). $\mathbf{X_i}$ is a vector of covariates that varies across regressions.

Column 1 of Table 1 presents results first without any socio-economic or geographic controls. Wards that voted pro-Kenyatta in the 2013 election saw more than 3,000 more active electricity meters per 100,000 households compared to wards that voted for the opposition. Relative to the 14,500 meters activated in opposition wards, this is a sizable 22% partisan gap. In other words, wards that voted pro-Kenyatta appear to have been significantly favored in the deployment of household electricity connections.

Of course, this initial regression may not accurately identify political favoritism if there are systematic differences between pro-Kenyatta and opposition areas. If, say, pro-Kenyatta areas are on average richer, and the economic returns of electrification increase with wealth, targeting pro-Kenyatta areas may be economically sensible. Gaps in electrification rates that are correlated with political affiliation could in that case be justified by a welfare-maximizing social planner.

To begin to address this, Column 2 of Table 1 adds a large set of socio-economic and geographic controls (detailed in the table note). This does not substantially move the coefficient β_1. Similarly, Column 3 shows that using LASSO to flexibly select from the quadratic and cubic transformations and double and triple interactions of these controls does not meaningfully alter the coefficient estimate. It moves the point estimate slightly (since government support is correlated with socio-economic outcomes) but the magnitude remains similar.

The main finding persists: electoral wards that voted pro-Kenyatta in 2013 saw substantially more electricity metering than opposition-voting wards, on the order of between 21–25%. The stability of the coefficients even when introducing a wide range of controls suggests that the observed political gaps do not merely reflect observed socio-economic or geographic differences. Results are qualitatively similar across a wide set of robustness checks.[15]

Even though favoritism does not appear to be correlated with contemporaneous economic outcomes, it could still be driven by other factors, such as expected growth: the government may have used private information about the potential for economic growth, not captured in the census data, to allocate electrification projects. To assess for this, we conduct a placebo test using data on the penetration of M-PESA mobile money agents—which are widely used for financial transactions in Kenya—as a proxy for expected growth in local economic activity. M-PESA expansion should reflect private sector expectations about regional growth trajectories. If electrification was targeted based on economic growth potential, we would thus expect to see similar pro-Kenyatta bias in the allocation of mobile money agents across space.

We repeat the analyses in Table 1 but replace the dependent variable with the change in M-PESA mobile money agents between 2013 and 2015. In contrast to the results for electricity connections, M-PESA expansions do not appear to favor pro-Kenyatta areas (Table B5). Similarly, the allocation

[15] For instance, Column 2 is identical to Column 7 of Table 3, and similar to Column 1 of Table B3 (using panel data) and Column 7 in Table D6 (without population weighting), Table D7 (among only adjacent wards), and Table D8 (per capita—not per household). Figure D2 presents a specification plot with 63 different specifications varying sample and controls.

Table 1: Political favoritism in household electricity connections per 100,000 households

	In absolute terms			Relative to CDF Allocation		
	(1)	(2)	(3)	(4)	(5)	(6)
Voted pro-govt in 2013	3188***	3092***	3613***	5639**	5285**	5045***
	(1008)	(1159)	(805)	(2062)	(2364)	(1609)
Observations	911	911	911	196	196	196
Opposition Mean	14444	14444	14444	16299	16299	16299
Effect Size (%)	22	21	25	35	32	31
Controls	None	SES	LASSO	None	SES	LASSO
Sample	Wards	Wards	Wards	Consts	Consts	Consts

In Columns 1–3, i is a ward and y_i is the number of government-subsidized household electricity meters per 100,000 households, with standard errors clustered by constituency. In Column 4–6, i is a constituency, and y_i is that same number minus the hypothetical number had meters been allocated according to the CDF formula. Columns 2 and 5 control for land gradient, population density, baseline unconnected households, share adults with primary or secondary education, share adults who work for pay, dependency ratio, share households with an iron roof, population density, household size, mobile money agents as of 2013 per capita, and change in mobile money agents between 2013 and 2015 per capita. Column 3 uses post-double selection LASSO (Belloni, Chernozhukov, and C. Hansen, 2013; Ahrens, C. B. Hansen, and Schaffer, 2020) to flexibly select from a subset of quadratic and cubic terms and interactions between this same set of variables. Table B4 presents the same analysis for LMCP sites per 100,000 households. Figure D2 and Figure D3 present specification plots with 63 different specifications varying sample and controls. $^{*} \leq 0.10,^{**} \leq .05,^{***} \leq .01$.

of LMCP sites shows a pro-Kenyatta bias even when measured relative to the share of mobile money agents, or against the 2013-2015 growth in the number of mobile money agents (Figure A10). Taken together, these results suggest that the pro-Kenyatta bias in LMCP sites is unlikely to simply be the result of underlying local differences in the levels or growth of economic activity.

4.2 Leveraging the CDF allocation to identify favoritism

The results above indicate a strong bias towards pro-Kenyatta areas in Kenya's nationwide rural electrification program, even after controlling flexibly for a host of socio-economic and geographic characteristics. Still, a well-known limitation of using selection-on-observables approaches is that other unobserved factors could have driven the observed favoritism. For example, if the government has an idiosyncratic objective function that is unobserved by the researcher, and this objective happens to partially correlate spatially with political affiliation, then differences that align with political affiliation may not reflect partisan favoritism. Distinguishing favoritism from unobserved social welfare optimization (or other legitimate public policy goals) is important when studying political favoritism in the allocation of public investment.

This paper addresses this common identification concern by leveraging a unique feature of the setting: a transparent, equitable, and well-known benchmark against which to measure favoritism. As discussed in Subsection 2.1 and Subsection 2.4, officials from the Ministry of Energy and Kenya Power publicly announced that the well-known Constituency Development Fund (CDF) formula was to determine the allocation of transformer construction and LMCP sites across constituencies.

LMCP sites were selected in 2015, when the original 2003 CDF formula was in effect, which as noted above stated that 75% of CDF funding was to be allocated in equal shares across all constituencies with the remaining 25% based on each constituency's share of national poverty (GoK, 2003). We use this rule to construct outcome variables that measure levels of construction relative to the CDF formula. Deviations from this CDF rule that are correlated with political affiliation are natural to interpret as evidence of political favoritism.

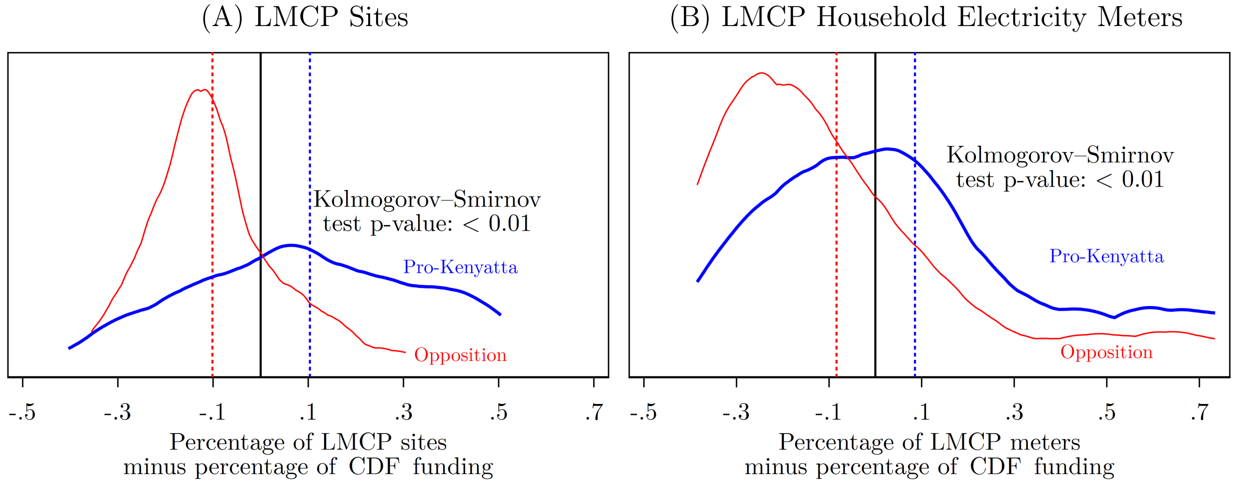
Columns 4, 5, and 6 of Table 1 measure the gap in electricity meters between constituencies that voted pro-Kenyatta in 2013 and constituencies that voted for the opposition, relative to the share of public funds each constituency was allocated per the CDF formula (that is, the number of household electricity meters per 100,000 households minus the hypothetical number had meters been allocated according to the CDF formula). Since constituency allocations are (by definition) only available at the constituency level, these estimates have fewer observations and the coefficient estimates are less precise. Still, Column 4 shows that constituencies that voted pro-Kenyatta in 2013 had over 5,500 more household electricity meters per 100,000 households relative to their CDF allocation than constituencies that voted for the opposition—a 35% gap compared to the opposition mean of around 16,000 meters per 100,000 households. This coefficient is stable after introducing the same set of socio-economic controls as for the wards (Column 5) and LASSO-selected quadratic and cubic transformations and triple-interactions of these controls (Column 6). Taken together, these results show that the allocation of electrification deviated meaningfully from its publicly stated benchmark, in favor of pro-Kenyatta areas.

We next document that this difference is not driven by a small number of outlier constituencies, but rather is found across the entire distribution. For each constituency, we compute an "allocation deviation": the share of LMCP sites a constituency was awarded minus its share of CDF funding. Had sites been allocated exactly according to the CDF formula, allocation deviations would be concentrated at zero; positive values mean that the constituency was allocated more LMCP sites or meters than its CDF share, and negative ones that constituencies were under-allocated.

Figure 4 compares the distributions of allocation deviations between constituencies that voted pro-Kenyatta (blue) and opposition (red) in the 2013 presidential election. Panel A shows that pro-Kenyatta constituencies were disproportionately allocated more LMCP sites—on average, 110% of the allocation they would have received under the CDF rule—while constituencies that voted for the opposition received on average only 90% of their allocation. Similarly, Panel B shows that pro-Kenyatta constituencies saw significantly more active household electricity meters than opposition constituencies, relative to their CDF allocations. For both outcomes, t-tests under the null that the means are equal and Kolmogorov-Smirnov tests under the null that the distributions are equal are rejected with p-value < 0.01. Plotting the residuals after controlling for socio-economic characteristics shows a slightly narrower distribution but an almost identical difference (Figure A11). These results persist when comparing allocations to population (Panel A of Figure D4), land area (Panel B of Figure D4), or when using all wards nationwide instead of just LMCP wards (Figure A12).

Columns 4, 5, and 6 of Table 1 and Figure 4 provide evidence that the government deviated from this allocation formula, selecting significantly more LMCP sites and activating significantly

Figure 4: Constituency LMCP shares relative to CDF shares by 2013 election result



A constituency's share of nationwide LMCP outcomes minus its share of CDF funding, by whether constituencies voted pro-Kenyatta in the 2013 presidential election, bottom- (top-) coded at the 5th (95th) percentile. Panel A shows LMCP sites selected. Panel B shows LMCP household meters activated. Vertical lines indicate sample means. Shares are normalized according to the same sample as in Table 1. These patterns hold when plotting residuals after controlling for the same socio-economic controls as Column 2 of Table 1 (Figure A11). Figure D5 presents a scatter plot version.

more household electricity meters in pro-Kenyatta wards. Taken together, these results indicate that there was substantial pro-Kenyatta favoritism in the allocation of household electrification in Kenya, on the order of 20% to 35%.

While the favoritism we identify is economically and statistically meaningful, the estimates are significantly lower than those pertaining to favoritism between the 1970s through the early 2000s identified in Burgess et al. (2015) and Barkan and Chege (1989) (see Figure A13). This points to an encouraging continuing downward trend over time in the magnitude of political favoritism, coinciding with major reforms that have strengthened democratic institutions and decentralized government functions.

4.3 Targeting core versus swing supporters

Political favoritism can operate through different approaches to electoral targeting. In 'swing' electoral areas, where the margins between political parties are relatively small, parties may allocate public goods in the belief that they can sway which party voters will support. In 'core' electoral areas, where a clear majority of voters supports one party, the objective may be to drum up electoral turn-out among committed partisans rather than swaying voters, or may be a way to reward them for past support.

Was political favoritism in electrification targeted towards core or swing areas? We define swing regions to be wards where one party won 50–75% of the vote in the 2013 presidential elections, and core support regions as wards where a party won between 75–100% of the vote.[16] We estimate

[16] Note that, even with this generous definition, swing areas are relatively scarce in this polarized political envi-

Table 2: Electricity meters per 100,000 households in core and swing regions

	In absolute terms		
	(1)	(2)	(3)
Pro-Government Core (δ_1)	3609***	4013***	4543***
	(1098)	(1235)	(928)
Pro-Government Swing (δ_2)	4315**	2845	2928*
	(1963)	(2272)	(1613)
Pro-Opposition Swing (δ_3)	2686*	2889**	2538**
	(1530)	(1401)	(1258)
Observations	911	911	911
Pro-Opposition Core Mean	14095	14095	14095
p-val $\delta_1 = \delta_2 = \delta_3$	.73	.74	.28
p-val $\delta_1 = \delta_2$	.72	.62	.34
Controls	None	SES	LASSO
Sample	Wards	Wards	Wards

Results from Equation 3. Samples and specifications are identical to those presented in Columns 1–3 of Table 1. Pro-Kenyatta Core are wards where the government received >75% of the presidential vote in the 2013 elections (414 wards). Pro-Kenyatta Swing: government received 50–75% (44 wards). Pro-Opposition Swing: opposition received 50–75% (81 wards). Omitted: Pro-Opposition Core (372 wards). SE clustered by constituency in parentheses. $^{*} \leq 0.10,^{**} \leq .05,^{***} \leq .01$.

how electrification allocations differ between these areas using the following equation, such that coefficient estimates are relative to core opposition wards:

$$y_i = \delta_0 + \delta_1 ProGov_i \times Core_i + \delta_2 ProGov_i \times Swing_i + \delta_3 Opp_i \times Swing_i + \boldsymbol{\gamma}\mathbf{X_i} + \varepsilon_i \quad (3)$$

Table 2 indicates that pro-Kenyatta core areas received the largest number of electrification connections, at 32%. That said, pro-Kenyatta swing areas and opposition swing areas also see higher levels of household electrification than core opposition areas, on the order of 18%–21% higher, and we cannot reject that the three areas all benefited from similar levels of electrification. The pattern also broadly persists when comparing against the CDF benchmark formula, although the estimates are noisier because the sample sizes become smaller when running regressions by constituency instead of by ward (Columns 4–6 of Table D1, Table D2 and Table D3).

5 National and subnational favoritism

We next examine the role of decentralization in the pro-Kenyatta favoritism identified in the previous section. The findings presented above are consistent with two broad hypotheses. One possibility is that decentralization successfully empowered local officials but these actors continued to enable or enact pro-Kenyatta favoritism. Another possibility is that decentralization did not empower local politicians sufficiently for them to be able to alter the centrally preferred allocation, and that power

ronment, comprising only 14% of wards in our analysis sample (23% nationally). Results are qualitatively robust to defining 'core' as having >60% or >80% of the presidential vote (Columns 1–3 of Table D2 and Table D3).

and resources remained concentrated *de facto* with national leaders.

We evaluate the roles of national and subnational officials in two ways. First, we evaluate marginal favoritism across the four stages of rural electrification, which were implemented by different levels of government. Second, we assess how MPs shaped implementation.

5.1 Favoritism across the four stages of electrification

As discussed in Subsection 2.3, rural electrification consisted of four stages, which together determine the aggregate number of household electricity meters activated: transformer construction, LMCP site selection, construction, and household meter activation. Understanding how political favoritism differed across these stages can shed light on the underlying mechanisms.

Crucially, national-level authorities had tight control over the first two stages of rural electrification: initial transformer construction and the selection of LMCP sites. These activities were implemented by Kenya Power and the Rural Electrification Authority, which are both parastatals controlled by the national government. As a result, these stages may have been more subject to political pressure by the central executive.

Conversely, the final two stages—construction and meter activation—were implemented by local officials who were one or more steps removed from the president's administration. LMCP site construction was implemented by private contractors, each of which was responsible for LMCP sites in a specific set of counties (Wolfram et al., 2023). After contracts had been awarded and administered, contractors interacted primarily with regional Kenya Power offices located in their geographic area of responsibility for the duration of the implementation period. Meter activation was completed by local Kenya Power offices. As a result, these latter stages may have been less easily influenced by the central government, and subject to stronger influence by local politicians.

To examine where aggregate favoritism originated, we decompose the cumulative effect into the marginal impacts during each stage, conditional on attaining the previous stage. Table 3 presents the results. Column 1 indicates a 17% pro-Kenyatta bias in the placement of transformers between 2008-2016, prior to the start of the LMCP. Column 2 indicates that the selection of LMCP sites from among the set of transformers further exacerbated this difference by 21%, for a cumulative difference of 42% in the number of LMCP sites. The bulk of cumulative favoritism thus is driven by the pre-LMCP stock of transformers (Column 1) and LMCP site selection (Column 2). Columns 4 and 6 show little evidence of additional favoritism in local network construction and the activation of household meters, with the marginal impacts if anything attenuating the overall difference slightly. Still, the favoritism exerted in the initial stages leads to significant favoritism in all stages of the program. The order of magnitude of favoritism is robust to a wide range of specifications.[17] Estimating the effects in columns 1, 3, 5, and 7 relative to the CDF formula shows quantitatively

[17] Specifically, results are qualitatively similar when dropping socio-economic controls (Table D4), using LASSO to select socio-economic controls (Table D5), not weighting by population (Table D6), only comparing adjacent wards (Table D7), and using per capita rather than per household (Table D8). Adding constituency fixed effects dampens the effects, indicating the results are driven by across-constituency rather than within-constituency targeting (Table D9). This makes sense since political affiliation correlates strongly across wards in the same constituency.

Table 3: Cumulative and marginal favoritism across the stages of electrification

	Pre-existing Transformers	LMCP					
		Site Selection		Construction		Meters	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Voted pro-govt in 2013	108***	.0539***	62.6***	-.0428	27.1***	-5.34	3092***
	(41.3)	(.0178)	(11.2)	(.0415)	(10.2)	(11.1)	(1159)
Observations	911	910	911	587	587	882	911
Opposition Mean	644.3	0.3	148.7	0.5	83.1	125.1	14443.6
Treatment Effect (%)	16.8	21.2	42.1	-8.0	32.6	-4.3	21.4
Analysis		Marg.	Cumul.	Marg.	Cumul.	Marg.	Cumul.

All regressions at the ward level, weighted by ward population, with same socioeconomic controls as in Table 1 and standard errors clustered by constituency. For Column 1, y_i is number of transformers per 100,000 households. For Columns 2, 4, and 6, the regressions isolate the marginal impact of that particular stage. In Column 2, y_i is proportion of transformers selected for LMCP; in Column 4, y_i is LMCP sites completed per LMCP transformer; in Column 6, y_i is LMCP meters per LMCP transformer. For Columns 3, 5, and 7, the regressions are cumulative across stages of construction. In Column 3, y_i is LMCP transformers; in Column 5, y_i is LMCP sites completed; in Column 7, y_i is LMCP meters; all per 100,000 households. Results persist across a range of sample and regression specifications (Table D4 through Table D8). Table D9 adds constituency fixed effects. $^{*} \leq 0.10, ^{**} \leq .05, ^{***} \leq .01$.

and qualitatively similar (and if anything slightly larger) effects, with similar patterns of statistical significance (Table D10).[18]

Taken together, aggregate political favoritism in Kenyan electrification at the household level appears entirely driven by stages that were largely controlled by the central government, namely, the initial stock of pre-LMCP transformers and LMCP site selection.

5.2 Members of parliament

We next consider elected members of parliament (MPs), who represent a given constituency. Volkert and Klagge (2022) observe that, based on interviews conducted in February 2020, Kenya Power and REA[19] officials often expressed a preference for working with local MPs over county governments. MPs furthermore have some control over local public spending: Harris and Posner (2019) and Opalo (2022a) both note how MPs largely determine how CDF funds are used within their constituencies. Despite the fact that MPs are technically national-level officials and spend much of the year in Nairobi, many interviewees stated that MPs are seen as "representative of the people." MPs are one of the few locally elected offices that predate the devolution reforms discussed above, and unlike other local officials (i.e., senators or members of the county assembly), MPs often have close formal and informal links to Kenya Power and REA. Early in the LMCP, Kenya Power and each constituency's MP also exchanged a series of letters to jointly select the locations of transformers within each constituency, giving MPs the ability to directly exert influence on the process.

[18] We focus on the ward-level regressions, rather than the constituency-level regressions relative to the CDF formula because—for the marginal effects—it is mathematically nonsensical to estimate favoritism relative to both the CDF and the previous stage simultaneously.

[19] The 2019 Energy Act created the Rural Electrification and Energy Corporation (REREC) as a successor of REA.

MP favoritism may have taken at least two forms. While neither can fully account for the aggregate levels of favoritism we observe, these are the most likely channels through which local politicians could have exerted political influence. First, MPs may have exerted bias when allocating LMCP sites to specific wards within their constituencies to favor those wards that had voted for them in constituency elections. The Kenya Power and REA employees interviewed by Volkert and Klagge (2022) reported that MPs decisions about where to implement REA projects were "influenced by political intentions, especially the desire for re-election". While these would not contribute to the cross-constituency results we estimate in Columns 4, 5, and 6 of Table 1, they could have contributed partly to the ward-level regression results in Table 3 and in Columns 1, 2, and 3 of Table 1. Second, across constituencies, MPs aligned with the pro-Kenyatta ruling party at the national level may have been able to channel more resources to their constituencies relative to MPs aligned with the opposition coalition. We discuss these two hypotheses in turn.

5.2.1 Within-constituency MP favoritism

Do MPs favor the wards in their constituencies that voted for them in constituency-level MP elections with more LMCP projects? For wards indexed by i, we estimate the following equation:

$$y_{ic} = \theta_0 + \theta_1 ProGovernment_{ic} + \theta_2 ProMP_{ic} + \gamma X_{ic} + \gamma_c + \varepsilon_i \quad (4)$$

where $ProGovernment_i$ equals 1 if ward i voted pro-Kenyatta in the 2013 presidential elections (paralleling the analysis above) and $ProMP_i$ equals 1 if the MP candidate with the most votes in ward i also won the overall constituency election. γ_c is a constituency fixed effect.

Table 4 presents the estimates of Equation 4, with the new MP coefficient θ_2 in the second row. Three of the four stages show no evidence that a ward having voted for the overall winning MP affects that ward's electrification outcomes. Column 2 shows marginally significant pro-MP favoritism in the selection of LMCP sites within a constituency: this is in line with Kenya Power and the MPs being jointly responsible for site selection (as discussed in Subsection 2.3). Still, the point estimate is considerably smaller than the presidential vote effect, and there is little evidence that areas that voted for their MP were favored in the final program outcome, the activation of household electricity meters (columns 6 and 7). Taken together, these results indicate that the main results presented above are not driven by MPs rewarding wards that voted for them in the 2013 election with more electrification projects (the results slightly noisier due to the inclusion of constituency fixed effects). Results are similar in specifications that drop socioeconomic controls (Table D11), select controls using a LASSO procedure (Table D12), drop population weights (Table D13), use the adjacent wards sample (Table D14), use per-capita as opposed to per-household outcome measures (Table D15), or dropping constituency fixed effects (Table D16).

5.2.2 Across-constituency MP favoritism

Was there increased electrification in constituencies that elected an MP aligned with the national government (i.e., the President)? To study this question, we use a close election regression dis-

Table 4: Effects of MP alignment on stage outcomes (with constituency fixed effects)

	Pre-existing Transformers	LMCP: Site Selection		LMCP: Construction		LMCP: Meters	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Voted pro-govt in 2013	143	-.022	13.5	-.0908	-17.5	-17.8	1205
	(111)	(.0376)	(26.6)	(.0633)	(17)	(27.6)	(1700)
Voted pro-MP in 2013	-42.3	.0237*	1.43	.00613	.49	-6.39	-150
	(31.3)	(.0142)	(8.78)	(.0326)	(8.63)	(10.2)	(777)
Observations	731	730	731	478	478	706	731
Opposition Mean	644.3	0.3	148.7	0.5	83.1	125.1	14443.6
Treatment Effect (%)	22.2	-8.7	9.0	-16.9	-21.1	-14.2	8.3
MP Effect (%)	-6.6	9.3	1.0	1.1	0.6	-5.1	-1.0
Analysis		Marg.	Cumul.	Marg.	Cumul.	Marg.	Cumul.

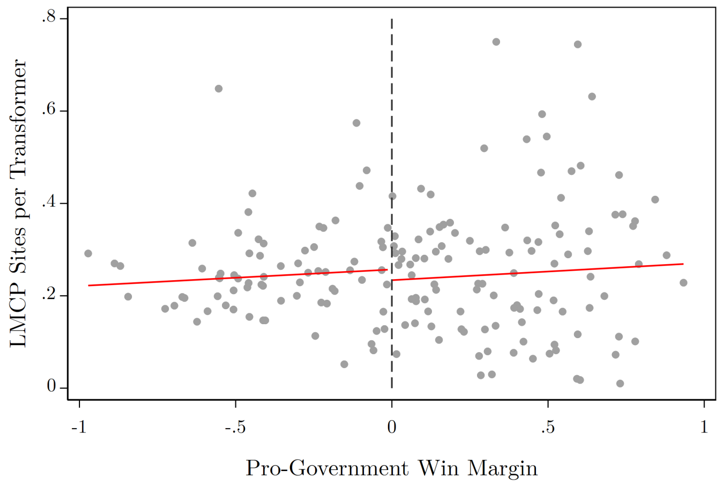
All regressions are at the ward level, weighted by ward population. Socioeconomic control variables are same as in Table 1, with the addition of constituency fixed effects to estimate impacts within constituencies. 'Voted pro-MP in 2013'=1 if the ward voted for the winning MP in the 2013 constituency-level National Assembly elections. For column 1, y_i is number of transformers per 100,000 households. For columns 2, 4, and 6, the regressions isolate the marginal impact of that particular stage. In column 2, y_i is proportion of transformers selected for LMCP; in column 4, y_i is LMCP sites completed per LMCP transformer; in column 6, y_i is LMCP meters per LMCP transformer. For columns 3, 5, and 7, the regressions are cumulative across stages. In column 3, y_i is LMCP transformers; in column 5, y_i is LMCP sites completed; in column 7, y_i is LMCP meters; all per 100,000 households. SE clustered by constituency are in parentheses.

continuity design. The running variable is the gap in vote share between the best-performing pro-Kenyatta (Jubilee) coalition candidate and the best-performing non-Jubilee candidate in the 2013 MP elections. We observe if there is a discontinuity around 0 in the share of that constituency's transformers that were selected for the LMCP. Win margins in this context have a relatively smooth distribution, with little evidence of bunching and a notable mass of electoral outcomes near zero (Figure D6).

Figure 5 does not show a meaningful discontinuity ("jump") at zero, indicating that electing an MP who was aligned with the central government did not meaningfully increase a constituency's share of transformers selected for LMCP. A robust regression discontinuity in the style of Calonico, Cattaneo, and Titiunik (2014) with linear trends fails to reject the absence of discontinuity with a p-value of 0.44. This departs from existing research on local politicians in the U.S. (Alesina, Baqir, and Easterly, 1999; Ferejohn, 1974), but is in line with Harris and Posner (2019) who study MPs in Kenya (see Figure A13 for a comparison). We similarly find no effects when using the same regression discontinuity strategy with each of the four stages as the outcome (Figure A14).

It is worth noting that, by design, discontinuity estimates are identified off of constituencies where the electoral result was near the margin. MP alignment could increase a constituency's share of LMCP sites in core pro-government areas far from the discontinuity, which could contribute to the results presented in Section 4. However, given the high degree of overlap between MP and presidential voting, we are unable to readily disentangle these alternatives.

Figure 5: Share of constituency's transformers selected for LMCP



The running variable—pro-government win margin—represents the difference between the vote share of the best performing pro-Kenyatta coalition (Jubilee) candidate and the best-performing candidate not in the pro-Kenyatta coalition in the 2013 parliamentary elections. Linear trends on either side of the 0-margin line are weighted by constituency population. Figure A14 similarly shows no results for individual stages. A sharp discontinuity test yields a coefficient of 0.03 which fails to reject (*s.e.*=0.04).

6 Decentralization of electricity networks and other sectors

Section 4 and Section 5 find that national government officials effected significant favoritism in the placement and progress of rural electrification projects. This is despite major constitutional reforms enacting political and fiscal decentralization in Kenya, with subnational levels of government that had been awarded significant legal authority, including county governments with an explicit mandate to oversee energy policy (World Bank, 2017). How did favoritism persist in the electricity sector despite these reforms? To answer this question, we evaluate the role of decentralization in different sectors, both across countries and as implemented in Kenya in the early 2000s.

6.1 In which sectors does decentralization work best?

Dozens of countries have implemented constitutional reforms to enact political and fiscal decentralization in recent decades, including India (Rajasekhar, 2021), Indonesia (Hamidi and Puspita, 2021), and Mexico (Rodríguez, 2018). For instance, in China, Indonesia, and Nigeria, subnational governments now spend more than 40 percent of public expenditures (Fedelino and Ter-Minassian, 2010). However, decentralization has been implemented differently and had heterogeneous impacts across sectors. Prud'homme (1995) hypothesizes that sectors with complex networks, pure public goods, or high demand for technical skills (what Prud'homme calls 'technicity') —such as highways, railroads, and energy—might be less suitable for decentralization. This may also be the case for sectors with significant cross-unit externalities, economies of scale, or high human capital requirements, or in countries where where local governments lack institutional capacity or are more vulnerable to political capture. This includes, for example, environmental regulation, anti-trust, national security, transportation networks, or communications (such as internet and mobile phone access).[20] Conversely, most service sectors (which cannot transport outputs), or sectors that benefit from local adaptation (including to demographic, religious, linguistic, geographic, or topological diversity) may be better suited to decentralization. This may include health, agriculture, sanitation, and education, or the targeting of cash or resource transfers: indeed, these sectors are the focus of many of the papers that find benefits to decentralization.[21]

How well-suited is the electricity sector to decentralization? Electricity distribution companies are a textbook example of a natural monopoly (e.g., Mankiw, 2011), and may benefit substantially from centralized planning and management. Generation and transmission could leverage economies of scale by pooling generation sources to minimize costs in wholesale electricity markets (Cicala, 2022) or coordinating the nationwide procurement of materials needed to expand electricity networks (Wolfram et al., 2023). The operation of technologically complex electricity networks also requires significant institutional capacity and human capital: countries low in these dimensions may benefit from pooling these resources nationally.

These issues are important for the global energy transition (Klass et al., 2022; Klass and Wilson, 2019; Martinot, 2016). In the U.S., state-controlled transmission networks have generated bottlenecks in connecting renewables to the grid, with experts now advocating for increased federal regulation and coordination (Kavulla, 2021; Cicala, 2021; Welton, 2024; Botterud et al., 2024). The expansion of renewables will likely increase the importance of centrally managed generation and transmission networks. In East Africa, generation is dominated by hydropower, geothermal, and wind, which are geographically constrained and are therefore often sited far from demand centers—unlike fossil fuel plants, which face fewer locational constraints. Consider Kenya's Lake Turkana Wind Power project, inaugurated in 2019 with operating capacity of 310MW, which increased the country's generation capacity by 17%. The project was sited in the far north of the country, where wind speeds are high, and thus required the construction of 438 kilometers in high-voltage transmission lines. The ministry's coordination of Kenya's public electricity networks may have helped bring this project on-line more quickly compared with a more decentralized transmission sector.

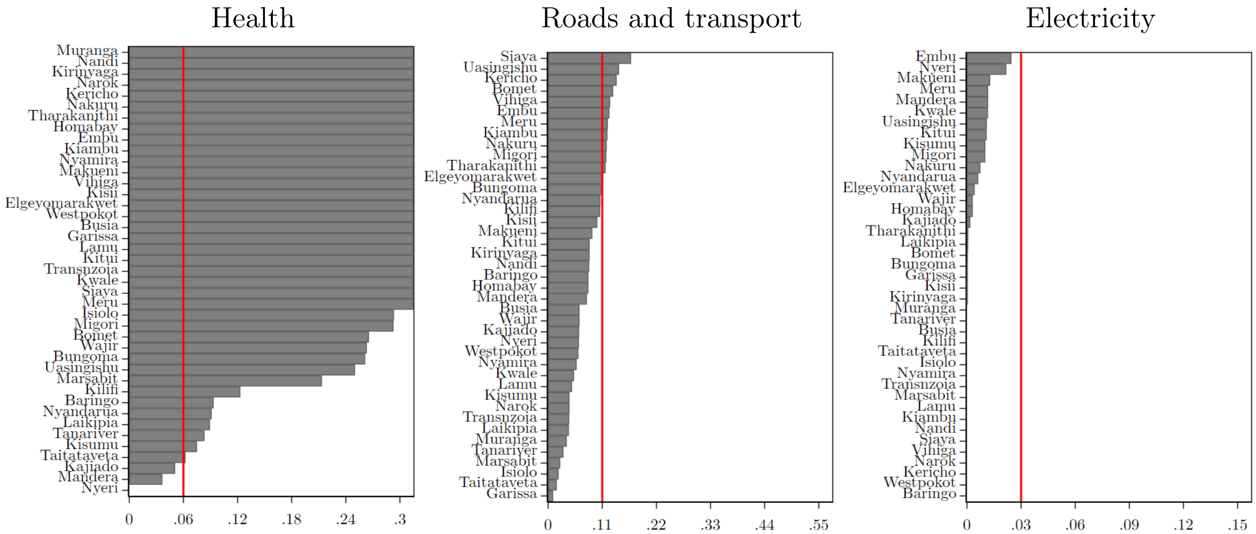
6.2 Decentralization in Kenya by sector

As noted above, Kenya's 2010 constitution created 47 counties that were empowered fiscally and politically. Decentralizing a sector's expenditures can be an effective constraint on aggregate favoritism: as an example, even if the ministry of health exerted some favoritism in their assignment of resources across counties (say 20% more to pro-government areas), if 50% of health expenditures were disbursed by county governments directly then this would only constitute 10% favoritism in the aggregate distribution of health resources. The health sector in Kenya is in fact fairly decentralized: of total public health expenditures, approximately 45% is spent by county governments and 55%

[20] Lipscomb and Mobarak (2016), He, Wang, and Zhang (2020), Nguyen (2024), and Rios (2015).

[21] Fisman and Gatti (2002), Brancati (2008), Opalo (2014), Opalo (2020), Savage and Lumbasi (2016), Faguet and Pal (2023), Hassan (2020b), Alatas et al. (2012), and Haushofer et al. (2022).

Figure 6: Fraction of county and ministerial spending spent on each sector



The red line indicates the fraction of total ministerial spending spent by that sector's ministry (Kenya Treasury, 2022). For comparability, the x-axis is normalized to be five times the ministerial average. The gray bars indicate the fraction county spending assigned to that sector, top-coded at 33% (Kenya Office of the Controller of Budget, 2022). 'Roads and transport' spending primarily funds road construction and maintenance, but occasionally includes public transportation, railways, or ports. County energy spending is primarily household electrification and streetlight construction.

by the national health ministry. Compare this with the energy sector, where only 1.1% of total spending is disbursed by county governments, with 98.9% by the Ministry of Energy.[22]

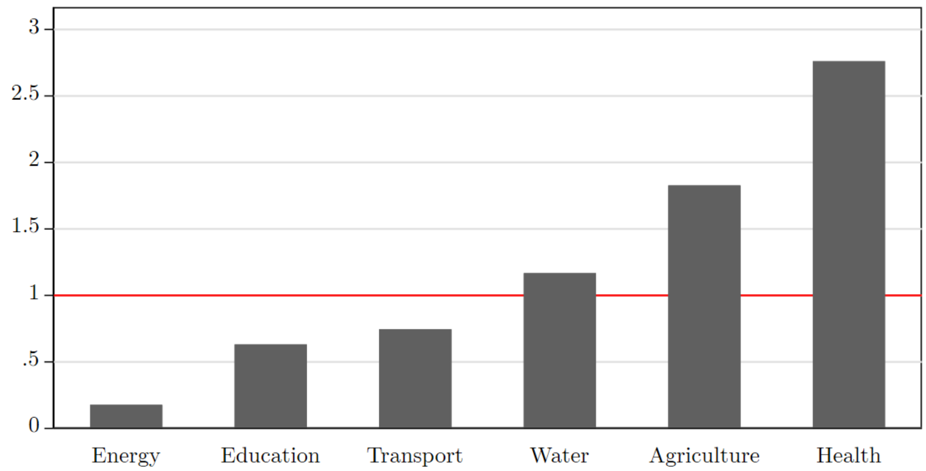
Figure 6 compares each county's expenditures in a given sector with the national government's expenditures in that same sector (through the corresponding ministry). The gray bars plot the fraction of its public expenditures that each of the 47 counties spends on health, roads and transport, and energy (top-coded at 33%).[23] For comparison, the vertical red line shows the fraction of total ministerial budget that is spent by the ministry responsible for that sector.

The average Kenyan county spends 30% of its budget on health expenditures, whereas the ministry of health's budget constitutes only 6% of total spending by Kenya's national ministries. In other words, counties proportionally spend far more on health than the national government, but as shown in the right-hand panel, they proportionally spend far less on energy than the national government does. To formalize this intuition we develop a measure capturing the degree of decentralization in each sector. Total county-level expenditures constitute the sum of expenditures by all counties i and each sector s (c_{is}): $C = \sum_i \sum_s c_{is}$. Total ministerial spending is the sum of ministerial spending across each sector (m_s): $M = \sum_s m_s$. Define the degree of decentralization in sector s as

[22]The mandate of the Ministry of Energy in Kenya is to operate the electricity grid (including generation, transmission, and distribution), and to provide off-grid electricity. Oil and gas operations were overseen by the Ministry of Petroleum and Mining, whose expenditures consisted largely of fuel subsidies. In 2023 these two ministries merged to form the Ministry of Energy and Petroleum.

[23]Muranga spends 49.7% of its budget on health; Kericho, Narok, Kirinyaga and Nandi all spend between 40-42%.

Figure 7: Decentralization across sectors



The degree of decentralization in each sector as defined in Equation 5: the ratio of the share of subnational spending on sector s to the share of national government spending on sector s. Sources: Kenya Treasury (2022) and Kenya Office of the Controller of Budget (2022).

follows:

$$\delta_s = \frac{\sum_i c_{is}}{C} \bigg/ \frac{m_s}{M} \tag{5}$$

That is, δ_s reflects the ratio of the share of subnational spending in sector s to the share of national spending in sector s: $\delta_s > 1$ indicates that the sector is more decentralized than average, while $\delta_s < 1$ indicates less decentralization than other sectors on average.

Figure 7 plots δ_s for six large sectors: health, transportation, electricity, agriculture, water, and education. These six sectors together constitute 35% of the national government's ministerial budget, and between 36%–64% of county budgets (interquartile range). Under this measure, the health sector is 15.5 more decentralized than the energy sector, and agriculture is 10.3 times more decentralized than energy. When factoring all ministerial and county spending across all sectors (not just these six), the energy sector is less than a fifth as decentralized as the average.

How did this continued centralized management of the power sector unfold? First, the 2010 constitution assigned responsibility for energy policy to both the national and the new county governments (GoK, 2010), as noted above. These overlapping constitutional mandates created ambiguity about whether energy policy would be set and implemented nationally or subnationally (World Bank, 2017). As a result, the central executive was able to retain significant political power in the electricity sector. As discussed in Subsection 2.2, recent appointees at top management positions of Kenya Power came from the political coalition of the incumbent president, reflecting the continued dominance of the executive in appointments. Kenya Power—the country's electric utility, which is majority-owned by the Government of Kenya—was responsible for the implementation of the LMCP, and left county governments with little control over implementation. Hassan (2020a) observes that, in many African countries, devolution has often had limited effects when legal mechanisms allow the national government to claim functions that fall under a local government's mandate, as in the case of the Kenyan energy sector.

The expansion and management of infrastructure furthermore requires significant technical capacity. At the parliamentary level, the high turnover of MPs in Kenyan elections often inhibits the development of specialized expertise (Opalo, 2022b). Thus, despite its strong legal powers, in practice the legislature often defers to the executive branch on technical matters (Opalo, 2022b). Even with their constitutional mandate, county governments similarly lack technical expertise to implement electricity projects. In interviews with stakeholders from Kenya Power, the Rural Electrification Authority, and the Kenyan government, Volkert and Klagge (2022) note widespread agreement that "a lack of skills, knowledge and experience of the county governments, their staff and possibly also the MPs... is the main challenge for a devolved electrification governance."

These legal and technical motivations for retaining executive control of the electricity sector reveal the vulnerability of large parastatals to political capture. Incentivized by electoral pressures (or financially motivated corruption in some cases), national leaders can exploit this concentration of power to direct resources towards their political supporters, as appears to have been the case with the Kenya LMCP.

6.3 Electric utilities in low- and middle-income countries

These dynamics are unfolding across a wide range of countries. To begin, Kenya's centralized management of its electricity sector is typical for most African countries. Of the 46 African countries we evaluate, 42 (91%) have a single nationwide transmission company and 38 (83%) have a single nationwide distribution company. More than 90% of these monopolies are majority government-owned (Table B6 lists all public generation, transmission, and distribution companies in Africa).

Global electrification and decarbonization goals will introduce seismic shifts in the energy sector. Hundreds of millions of households that currently lack a connection are expected to join the grid, and connected households are expected to replace appliances with electric substitutes (i.e., charcoal stoves to electric stoves), both of which will likely rapidly increase demand. Low-and middle-income countries (LMICs) are expected to drive the majority of growth in energy demand in the coming decades (EIA, 2023). Utilities will need to manage massive investments to extend electricity access while improving reliability and power quality. Electric utilities in LMICs will therefore also play a crucial role in the clean energy transition (World Bank, 2024). Meanwhile, decarbonizing heavy industries and manufacturing will rely, in many cases, on electrification, so the pressure to maintain a well-maintained grid, will only grow.

Utilities in LMICs face a key trade-off, especially given their tight budgets: 50 out of 52 utilities in Africa are facing severe financial constraints (Blimpo and Cosgrove-Davies, 2019; Kojima and Trimble, 2016), and these are expected to worsen as government-owned utilities face increased pressure to provide low-cost, universal access to electricity and to improve service quality by investing in grid maintenance and upgrading (Burgess et al., 2020). On the one hand, the efficiency gains from centralization could therefore be important in enabling the enormous energy transitions expected in the coming decades. On the other, as we show, continued centralized management of the electricity sector may make it more vulnerable to political capture and favoritism.

6.4 Accountability in the electricity sector

The estimates of favoritism in this paper range between 35 to 42%. While substantial in magnitude, this level of bias is substantially smaller than what Kenya experienced between 1964–2002, when Kenya was largely under autocratic rule. Burgess et al. (2015) estimate 100-300% pro-government favoritism in nationwide road construction during this period, and Barkan and Chege (1989) estimate 153% favoritism in road construction and 172% bias in healthcare investment around this time (Figure A13). Given the lack of de facto fiscal or political decentralization in the energy sector (as discussed in Subsection 6.2), this reduction is unlikely to have resulted from decentralization itself. This section considers several potential explanations for this stark contrast between earlier and current periods, regarding other ways (beyond decentralization) to improve accountability in the electricity sector.

A leading explanation is that Kenya's democratic progress in the 2000s and 2010s likely helped constrain political favoritism. Multiparty elections decreased the incidence of unilateral executive actions, offering evidence of increased legislative checks on executive authority (Opalo, 2020). The Polity IV measure of democracy increased from 4 in 2001 ('anocracy') to 9 in 2013 ('consolidated democracy'), placing Kenya far ahead of its peers (Figure A1).

International donors may also have helped constrain favoritism. The transformer construction program was launched in 2008 with apparently very little involvement from international donors.[24] The LMCP on the other hand was funded by the World Bank and the African Development Bank, and as a result faced significant donor oversight (Wolfram et al., 2023). The 2016 Kenya Power press release informing the public of the LMCP—clarifying, for example, household eligibility and connection fees—describes donor contracting processes and timelines in detail. Both donors *"established detailed procedures..., [and the] laws, regulations, policies, and implementing rules must promote fairness and thus discourage discrimination and favoritism"* (World Bank 2007).

Media scrutiny may also have played a role in generating accountability and reducing favoritism. Site selection was a visible process, with sites publicly announced in national and local news, and the entire LMCP project was highly publicized as a national government endeavor. Kenya has a relatively free press, consistently ranking at around the 65th percentile among lower-middle income countries in terms of press freedom (World Press Index, 2022). An extensive literature studying sources of accountability in politics indicate media can be a strong driver of democratization (Strömberg, 2015; Egorov and Sonin, 2024 provide reviews). However, we are unable to readily quantify the impact of media scrutiny on favoritism in this context.

Thus, the glass is half-full: the levels of political favoritism documented in this study are far below those documented in earlier large-scale public programs in Kenya (Burgess et al., 2015) and

[24] The REA Strategic Plan 2008-2012 (2008) lists "development partners" as "stakeholders" providing "financial support," but mentions no specific donors or processes.

less than many observers of Kenyan politics might predict (Figure A13). While decentralization may not be a suitable tool in the energy sector, there appear to be many other factors that can constrain favoritism, at least partially, in contemporary Kenya.

7 Conclusion

In the years leading up to the launch of a $788 million national electrification project, Kenya enacted major constitutional reforms to decentralize power away from the central executive and towards locally elected members of parliament and county governments. These constitutional reforms were called the "biggest political transformation since independence" (Cheeseman, Lynch, and Willis, 2016) and created "arguably Africa's strongest parliament" (Opalo, 2014).

To objectively quantify favoritism, we leverage a unique institutional feature: the existence of an objective and transparent formula—the Constituency Development Fund (CDF) allocation rule—that had been agreed upon by the incumbent government as well as the opposition. Even in this relatively democratic context, we find that, relative to the official allocation that the government had committed to, constituencies that had earlier voted for the president received around 35% more household electricity connections than constituencies that voted for the opposition.

Why does favoritism persist despite extensive decentralization in one of Africa's strongest democracies? First, a decomposition of the various stages of rural electrification shows that favoritism was driven by the two stages that were implemented by the national government, and that there was no sign of favoritism in stages that were implemented locally. While locally elected MPs were consulted in the planning process, there is little evidence that they allocated electrification programs in a clientelistic way: areas won by government-aligned MPs in close elections do not appear to benefit from more investment, and MPs did not appear to apply their influence to reward wards within their constituencies that voted for them.

A novel metric of decentralization indicates that county governments are responsible for spending a significantly smaller portion of total public expenditures in the energy sector than, for instance, in the health, agriculture, and water sectors. Despite county and national governments having competing mandates for electricity planning in the 2010 constitution, the national government de facto implemented LMCP while county governments had no formal role in the program.

In the coming decades, decarbonization efforts will require trillions of dollars in new investments globally to accommodate growing demand for electrical power and expanded renewable energy generation. In the majority of African countries, the electric grid is managed by national parastatals. Our findings—drawn from a setting with notable advantages in structures for political accountability—underscore potential difficulties in managing these investments and highlight the limitations of decentralization for constraining favoritism in the clean energy transition.

Of course, the risks and costs of an increased concentration of political power must be weighed against the potential technical, economic, and operational benefits of centralization. Renewable resources such as solar, wind, hydropower, and geothermal often have spatially heterogeneous generation costs: unlike grids with independent regional ownership or management structures, nationally managed grids enable cost minimization by siting generation cost-effectively, optimizing transmission networks, and pooling generation resources. Economies of scale may furthermore generate natural monopolies, for example by avoiding duplicate management structures or in the international procurement of materials. Decentralized energy technologies such as solar home systems and micro grids can deliver important benefits for some communities but they cannot power the large-scale economic growth required to lift billions out of poverty (Lee, Miguel, and Wolfram, 2020). The clean energy transition also depends heavily on institutional and technical capacity (Shapiro, 2023). Yet in many LMICs, subnational government capacity lags significantly behind the national government's (Hassan, 2020a). Related lessons may apply to sectors with similar attributes like transportation and telecommunications.

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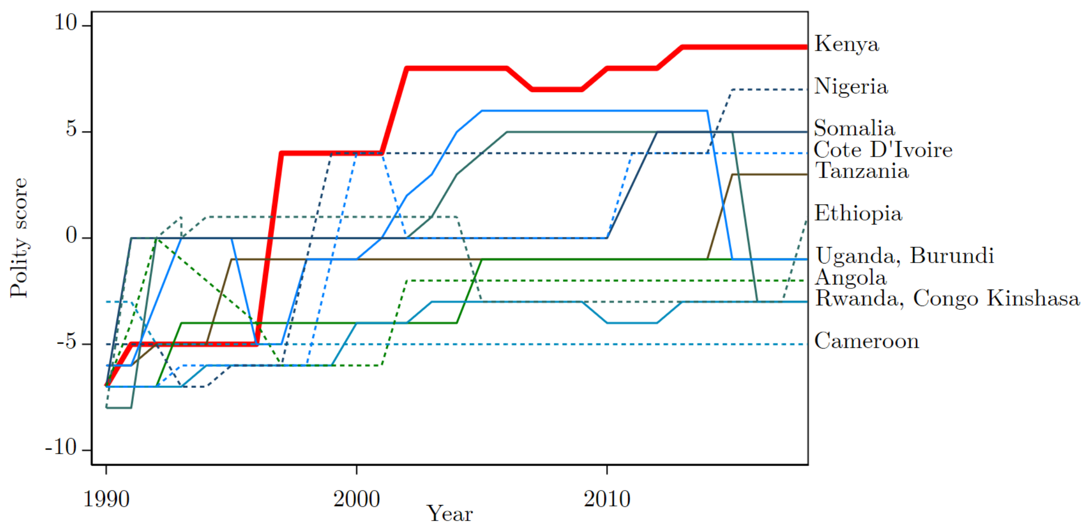
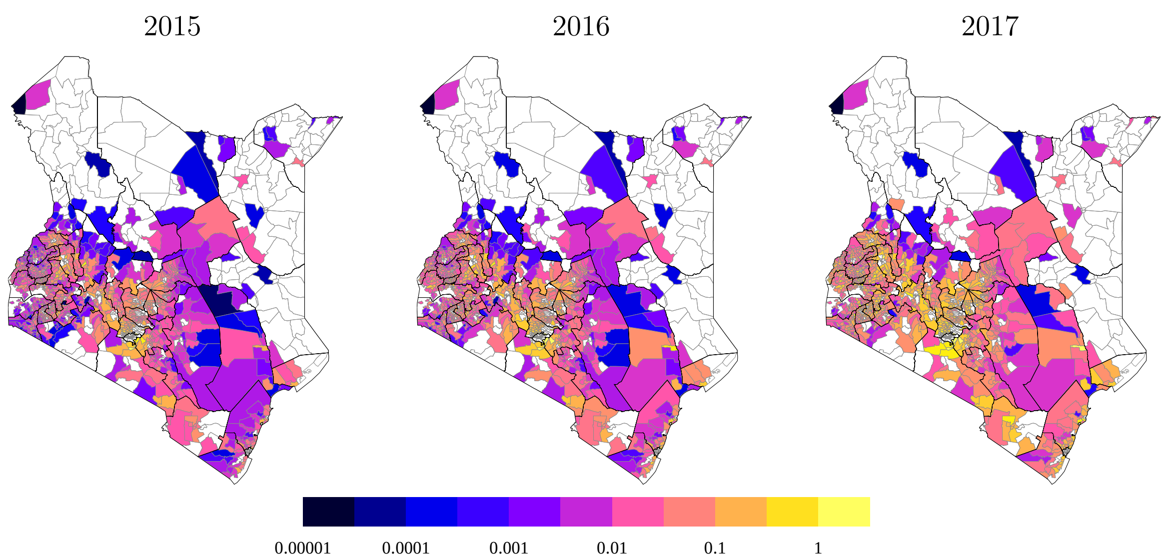
A Appendix Figures

Figure A1: Polity democracy scores among countries in Africa



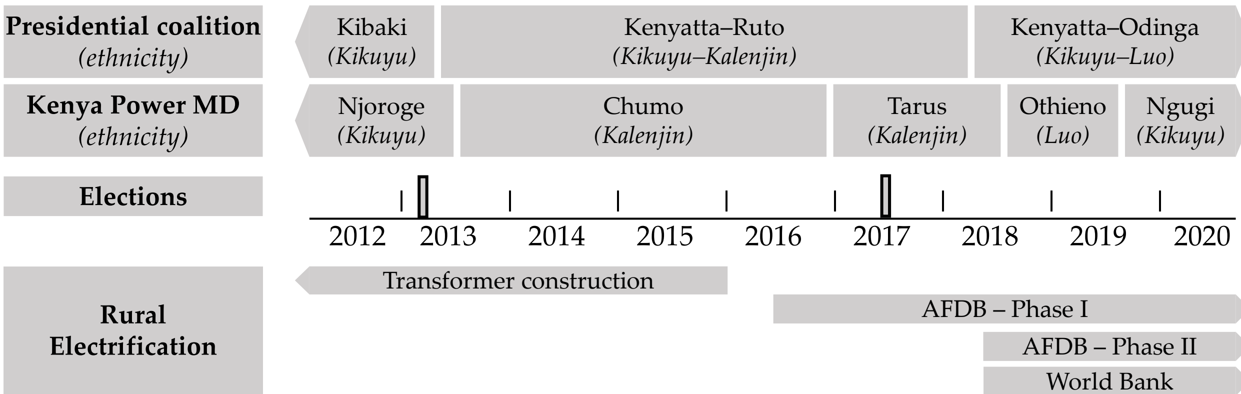
Polity democracy scores for countries in Africa. Solid lines represent countries in the East African Community. Dashed lines are other countries in Africa with GDP per capita similar to Kenya. Source: Marshall and Gurr (2020).

Figure A2: Residential meters per household by ward (log)



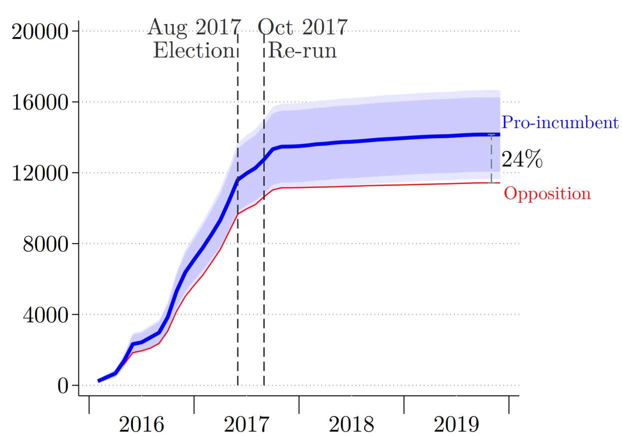
Ward-level population comes from the 2009 census after applying a uniform growth rate based on country-level population growth from UN WPP (UN, 2022). Units are residential meters per household, with shading following a log10 scale. White wards contain no residential meters in our dataset or are missing 2009 population data.

Figure A3: Timeline of political and Kenya Power events, 2013-2022



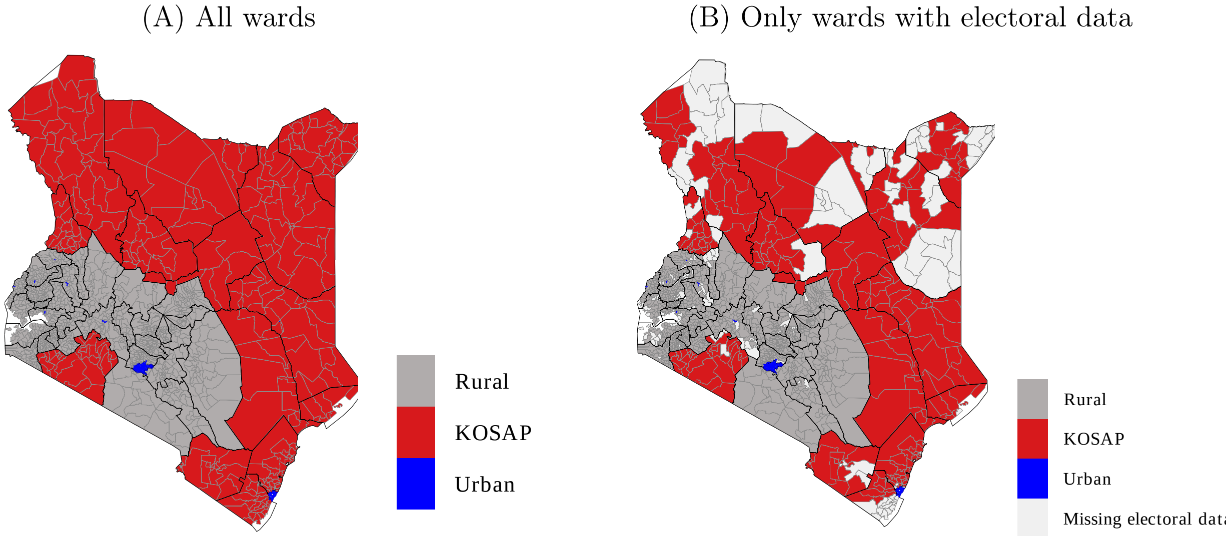
Timeline of Kenyan presidential terms, Kenya Power managing director appointments (MD), elections, and rural electrification. Kenyatta was inaugurated on April 9th, 2013 and again on November 28th, 2017. The 'Handshake' between Kenyatta and Odinga took place on March 9th, 2018.

Figure A4: Number of meters activated in or after 2016 at LMCP sites per 100,000 households



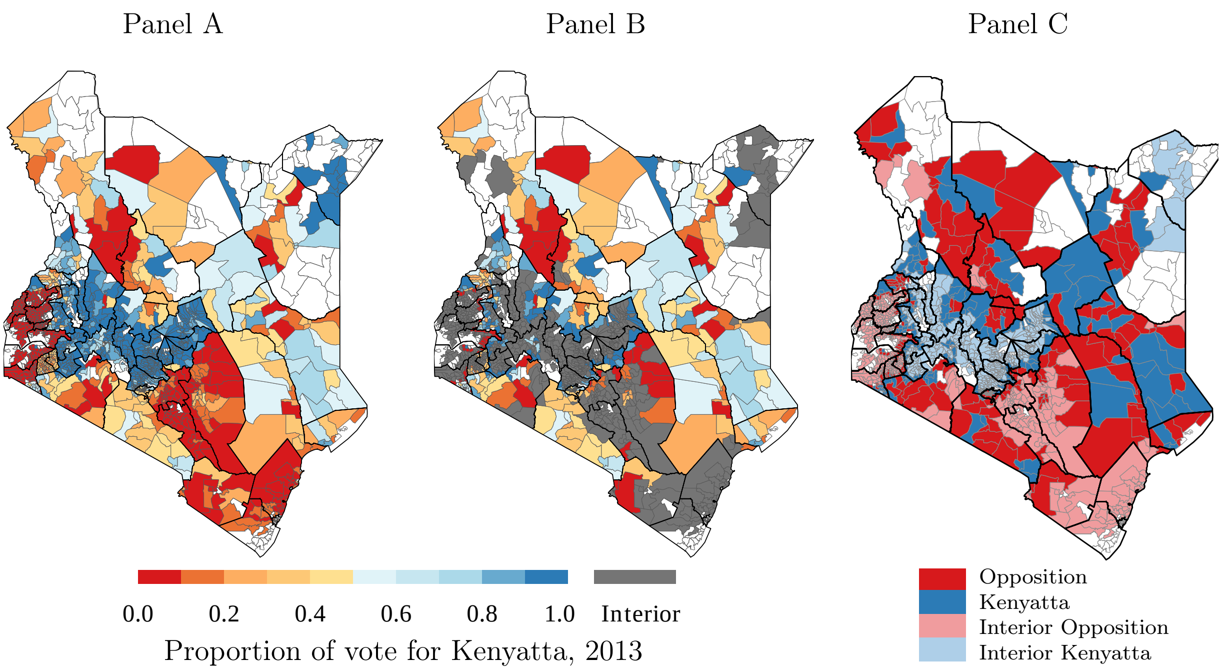
Results from the following regression: $y_{it} = \sum_{k=1}^{118} \gamma_k D_{it}^k + \sum_{k=1}^{118} \beta_k D_{it}^k * ProGovernment_i + \epsilon_{it}$ (no socio-economic controls). The red line plots the γ_k's while the blue line plots $\gamma_k + \beta_k$. The gap between the blue and red lines represents the difference between opposition and pro-government wards (β_k's). The darker (lighter) blue is the 90% (95%) confidence interval of the β_k's. The vertical line denotes the August 2017 Presidential election. Figure 1 shows a version without political breakdown in absolute terms. Figure D7 provides versions with controls, per capita, and per CDF allocation. Figure D9 and Figure D8 provide versions for construction progress. Table B3 presents equivalent regression results.

Figure A5: Main sample specification: omitted urban and sparse areas



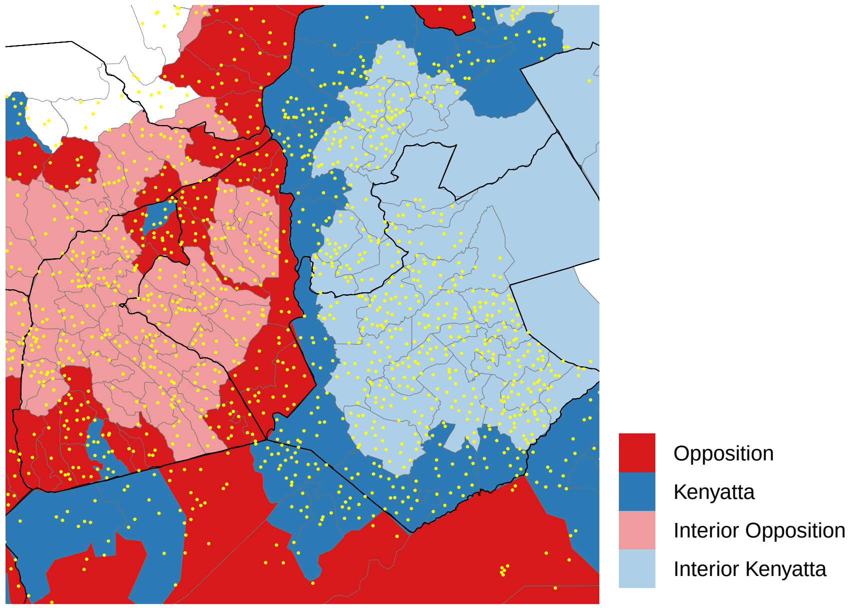
Wards labelled “rural” (in gray) form the main sample of LMCP wards (see Section 3 for a detailed description of sample construction). Wards shaded red are in counties targeted by KOSAP, an off-grid solar electrification project. Wards shaded blue are within Nairobi and Mombasa counties or are in a ward with an equal or greater population density (3,513 population per square km). Wards shaded white in Panel B are missing 2013 election data.

Figure A6: 2013 Kenya presidential election results



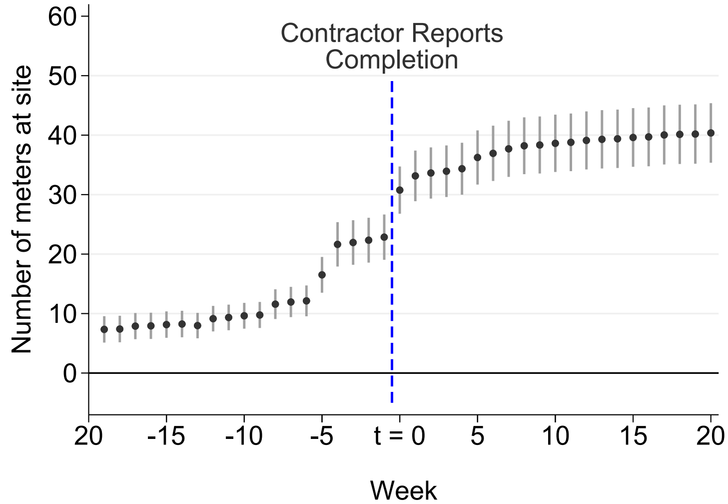
Blue wards had vote shares of over 50% for Kenyatta. Red wards had vote shares under 50% for Kenyatta. White wards are missing election data. Panel A shows 2013 presidential election results at the ward level. Panel B shows the same, but ‘interior’ wards—which only border similarly aligned wards—are greyed out. Panel C shows a binary version, with adjacent wards shown in dark.

Figure A7: Adjacent wards with LMCP sites (example area)



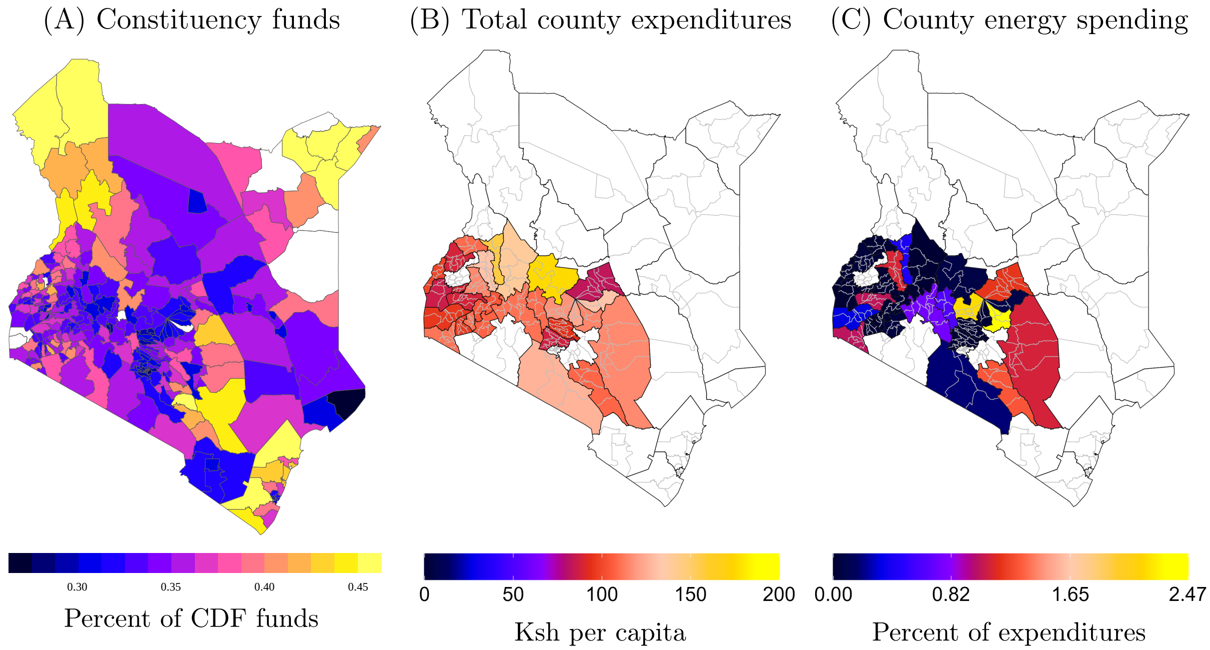
Region mapped contains primarily Bomet, Kisii, Nyamira, Kericho counties. Blue (red) wards had vote shares of over (under) 50% for Kenyatta. White wards are missing election data. Darker (lighter) wards represent adjacent (interior) wards. Yellow dots show the locations of transformers which were selected for maximization under LMCP.

Figure A8: Meters activated in Kenya Power infrastructure database relative to when contractors report construction completion



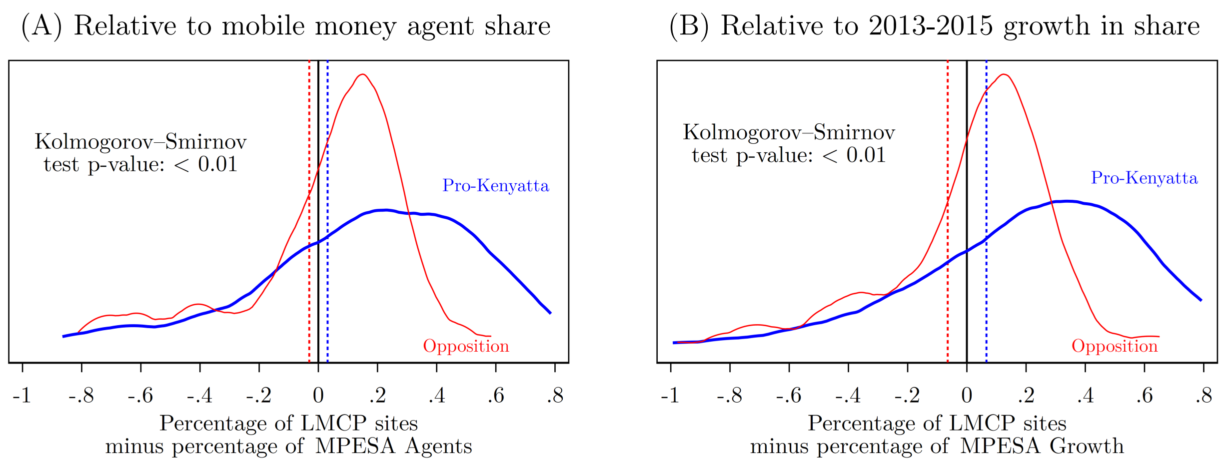
This figure combines Kenya Power's meter data with construction progress data at the transformer level provided by independent contractors. In the weeks after a contractor reports construction at a particular transformer to have been complete, the number of meters that Kenya Power identifies as going on-line increases sharply up to on average 40, in line with estimates of the number of unconnected households living within 600 meters of each LMCP transformer (as discussed in Subsection 2.3). Point estimates and standard errors from a stacked difference-in-differences estimates of the number of meters installed in the 20 weeks before and after a contractor reports construction completion, relative to sites that were not yet completed during that period (Deshpande and Li, 2019; Cengiz et al., 2019; Goodman-Bacon, 2021).

Figure A9: County and constituency expenditures in 2015



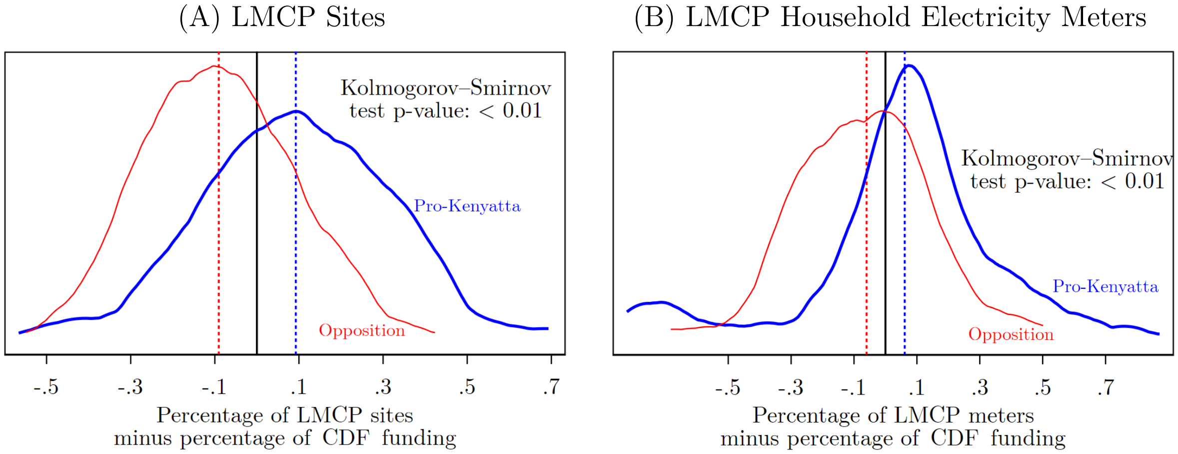
Panels B and C omit urban and sparsely populated counties (see Subsection 3.1 for more detail) and Machakos and Kakamega because of incomplete reporting (Kenya's Office of the Controller of Budget, 2022)

Figure A10: Constituency LMCP site shares relative to mobile money shares by 2013 election result



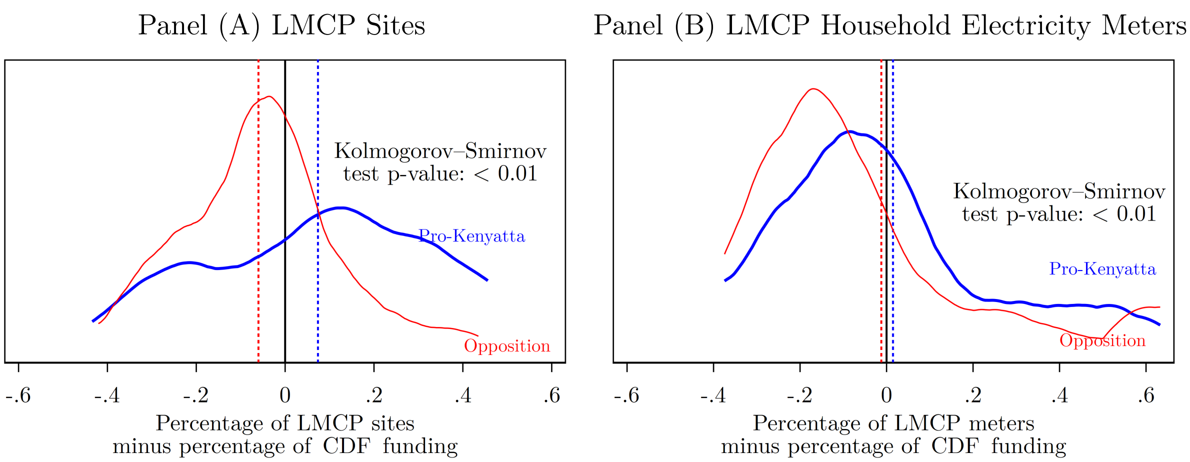
Differences between a constituency's percentage of LMCP sites minus its share of mobile money agents (panel A) or its share of new mobile money agents in 2014/2015 (panel B), by whether constituencies voted pro-government in the 2013 presidential election, bottom- (top-) coded at the 5th (95th) percentile. Both panels include only rural constituencies. Vertical dashed lines present the sample means.

Figure A11: Residuals of constituency LMCP shares relative to CDF shares by 2013 election result



The residual of constituency's share of nationwide LMCP outcomes after controlling for socio-economic variables (as in Column 2 of Table 1) minus its share of CDF funding, by whether constituencies voted pro-Kenyatta in the 2013 presidential election. Panel A shows LMCP sites selected. Panel B shows LMCP household meters activated. Vertical lines indicate sample means. Shares are normalized according to the same sample as in Table 1. Figure 4 presents a version with raw data. Figure D5 presents a scatter plot version.

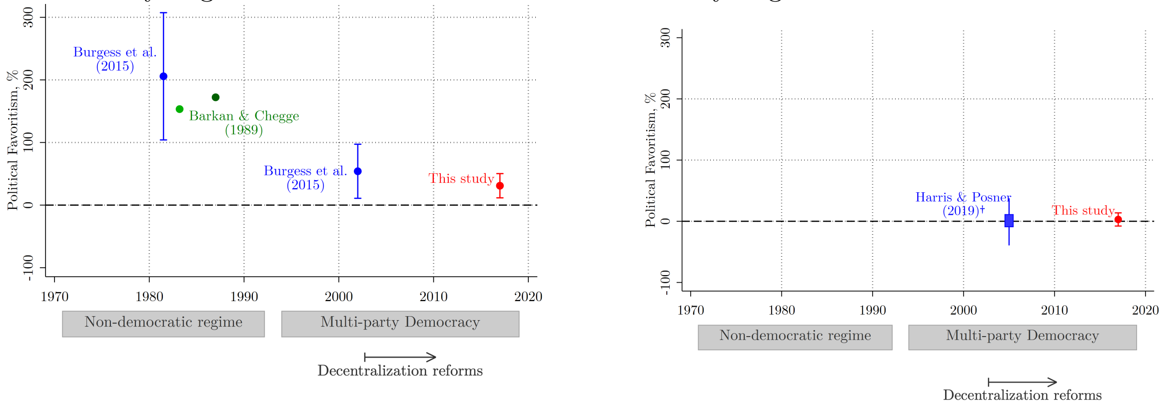
Figure A12: LMCP outcomes relative to CDF shares by 2013 election result (nationwide sample)



This figure shows the same as Figure 4 but for all wards nationwide. A constituency's percentage of LMCP sites minus its share of CDF funding, by whether constituencies voted pro-government in the 2013 presidential election, bottom- (top-) coded at the 5th (95th) percentile. Vertical lines indicate sample means.

Figure A13: Estimates of favoritism

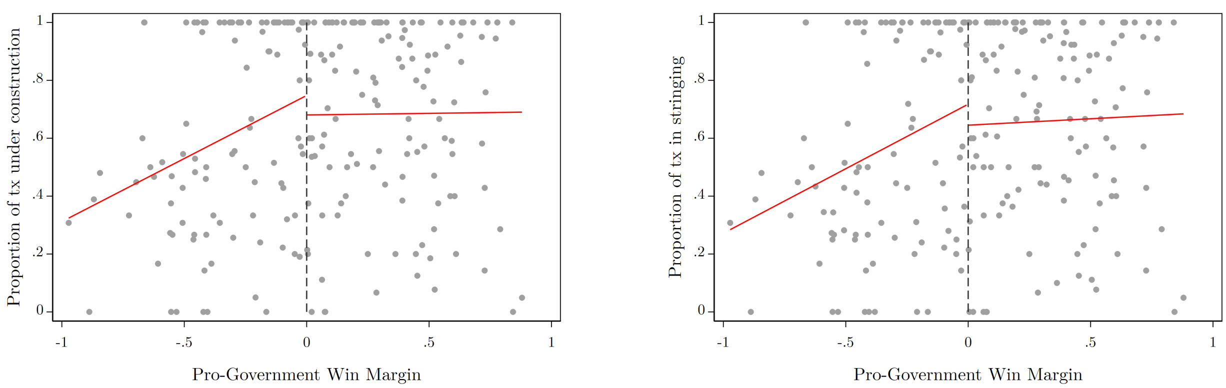
Panel A: By alignment with the President — Panel B: By alignment with Member of Parliament



Panel A: Estimate for "this study" from Table 1. Estimates for Burgess et al. (2015) use results in Table 1 (Column 4, Panel B) on road expenditures per capita. Estimates for Barkan and Chege (1989) are on road expenditure (light green) and health expenditure (dark green). *Panel B:* Estimates for this study taken from Column 7 of Table 4. †: Box and whisker plot based on estimates of favoritism in each constituency, as reported in Harris and Posner (2019).

Figure A14: Share of constituency's LMCP transformers with construction progress

Panel A: Share of LMCP Transformers in a Constituency With Construction Started — Panel B: Share of LMCP Transformers in a Constituency With Stringing



Note: Similar to Figure 5 but using two main construction outcomes as the main outcome variables. Panel A shows the fraction of a constituency's LMCP transformers where construction started. Panel B shows the fraction of a constituency's LMCP transformers where stringing had been completed.

B Appendix Tables

Table B1: Determinants of Constituency Development Fund allocations to constituencies over time

	2003–2015			2016–2021		2022–	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	9.29***	8.48***	6.83***	9.36	9.36	10.01***	7.64***
	(0.10)	(0.21)	(0.41)	(.)	(.)	(0.05)	(0.00)
2013 Kenyatta voteshare (%)	-0.50***	-0.01	-0.22	0.00	0.00	0.01	-0.00
	(0.17)	(0.11)	(0.18)	(.)	(.)	(0.09)	(0.00)
Poverty index (2009)		0.36***			0.00		0.00***
		(0.03)			(.)		(0.00)
Poverty index (2005)			1.47***				
			(0.29)				
Population		0.54***	0.03		0.00		-0.00
		(0.08)	(0.13)		(.)		(0.00)
Ward count		0.11**	0.32***		0.00		0.47***
		(0.04)	(0.07)		(.)		(0.00)
Observations	290	286	229	290	286	289	285
Mean	9.1	9.1	9.1	9.4	9.4	10.0	10.0
R2	0.03	0.71	0.28	.	.	0.00	1.00

Columns 1–3, 4–5, and 6–7 use the allocations (hundred thousands 2016 USD) from 2013, 2017, and 2022, respectively, but allocations were proportional in each period. Ward counts are from 2013 administrative boundaries, consistent with those used by the 2023-24 NG-CDF Committee (GoK, 2023). The R^2 in Columns (2) and (3) of do not equal 1 because the exact constituency poverty index formula is not public. We approximate it using 2005 and 2009 Census Data. For Column (7), the regression is not perfectly collinear because of minor rounding in the allocations. $^{*} \leq 0.10,^{**} \leq .05,^{***} \leq .01$.

Table B2: Summary statistics

	2009	2019
Wards	n/a[c]	1,450
Constituencies	210[d]	290
Counties	n/a[c]	47
Population (millions)[a]	38.6	47.6
Households using grid electricity as main lighting source[a]	22.7%	50.4%
Households using solar panels as main lighting source[a]	1.6%	19.3%
Electricity meters (millions)[b]	1.3	7.1
Residential electricity meters (millions)[b]	1.0	6.7
Electrical transformers[b]	30,000[e]	62,271

[a]Source: Kenyan Census (2009; 2019). [b]Source: Kenya Power annual reports (2012; 2022). [c]Counties were created in the 2010 Constitution. [d]The number of constituencies changed from 210 to 290 in the 2010 Constitution. [e]Authors' calculation based on capacity growth rates.

Table B3: Favoritism in LMCP (meter panel data)

	(1)
Pro-Govt Effect, Dec 2016	1359.35**
	(641.52)
Pro-Govt Effect, Dec 2017	2325.01*
	(1228.72)
Pro-Govt Effect, Dec 2018	2622.13**
	(1255.64)
Pro-Govt Effect, Dec 2019	2728.60**
	(1268.26)
Observations	42624
Opposition Mean, Dec 2016	5022.30
Opposition Mean, Dec 2017	11154.30
Opposition Mean, Dec 2018	11304.63
Opposition Mean, Dec 2019	11428.82

Results from the following regression: $y_{it} = \sum_{k=1}^{118} \gamma_k D_{it}^k + \sum_{k=1}^{118} \beta_k D_{it}^k * ProGovernment_i + \epsilon_{it}$. Listed coefficients are estimated β_k values; listed opposition means are estimated γ_k values. The estimates in this table correspond to Figure A4. Estimates are in units of meters per 100,000 households.

Table B4: Political favoritism in LMCP sites per 100,000 households

	In absolute terms			Relative to CDF Allocation		
	(1)	(2)	(3)	(4)	(5)	(6)
Voted pro-govt in 2013	50.6***	62.6***	58.7***	69.4***	63.7***	63.4***
	(10.6)	(11.2)	(8.13)	(18.4)	(19.4)	(12.1)
Observations	911	911	911	196	196	196
Opposition Mean	149	149	149	151	151	151
Effect Size (%)	34	42	39	46	42	42
Controls	None	SES	LASSO	None	SES	LASSO
Sample	Wards	Wards	Wards	Consts	Consts	Consts

In Columns 1–3, y_i is the number of LMCP sites per 100,000 households. In Column 4–6, y_i is the same but minus the hypothetical number had meters been allocated according to the CDF. Columns 2 and 5 controls for land gradient, population density, baseline unconnected households, share adults with primary or secondary education, share adults who work for pay, dependency ratio, share households with an iron roof, population density, household size, mobile money agents as of 2013 per capita, and change in mobile money agents between 2013 and 2015 per capita. Column 3 uses post-double selection LASSO (Belloni, Chernozhukov, and C. Hansen, 2013; Ahrens, C. B. Hansen, and Schaffer, 2020) to flexibly select from a subset of quadratic and cubic interactions between this same set of variables. Table 1 presents the same analysis for LMCP meters per 100k households. $^{*} \leq 0.10, ^{**} \leq .05, ^{***} \leq .01$.

Table B5: Placebo Test: Political Favoritism in Rollout of New M-Pesa Agents (2013-2015)

	In absolute terms			Relative to CDF Allocation		
	(1)	(2)	(3)	(4)	(5)	(6)
Voted pro-govt in 2013	16.3	-75.4	-83.5	54.9	-50	-11.4
	(37.6)	(58.8)	(58.5)	(48.5)	(58.3)	(52.9)
Observations	911	911	911	196	196	196
Opposition Mean	291	291	291	319	319	319
Effect Size (%)	5.6	-26	-29	17	-16	-3.6
Controls	None	SES	LASSO	None	SES	LASSO
Sample	Wards	Wards	Wards	Consts	Consts	Consts

In Columns 1–3, y_i is the number of new M-PESA agents added in 2013-2015 per 100,000 households. In Column 4, y_i is the same but minus the hypothetical number had agents been allocated according to the CDF. Sample in all regressions excludes urban wards and KOSAP wards. Columns 2 controls for land gradient, population density, baseline unconnected households, share adults with primary or secondary education, share adults who work for pay, dependency ratio, share households with an iron roof, population density, household size, mobile money agents as of 2013 per capita, and change in mobile money agents between 2013 and 2015 per capita. Column 3 uses LASSO to flexibly select from a subset of quadratic and triple interactions between this same set of variables. Column 4 does not include socio-economic controls. $^{*} \leq 0.10,^{**} \leq .05,^{***} \leq .01$.

Table B6: Electricity market structure across Africa

	Generation	Transmission	Distribution
Algeria	Sonelgaz, Private	Sonelgaz	Sonelgaz
Angola	PROTEL	RNT	ENDE
Benin	BEPC	SBEE	SBEE
Botswana	BPC, Private	BPC	BPC
Burkina Faso	SONABEL, PPAs	SONABEL	SONABEL
Burundi	REGIDSO, Private	REGIDSO	REGIDSO, Private
Cameroon	Private	SONATREL	ENEO (Private)
Cape Verde	ELECTRA , Private	ELECTRA	ELECTRA
CAR	ENERCA, Private	ENERCA	ENERCA
Chad	SNE, Private	SNE	SNE
Comoros	SONELEC	SONELEC	SONELEC
Cote d'Ivoire	CI-Energies, Private	CI-E (Private)	CI-E (Private)
DRC	SNEL, Private	SNEL	SNEL
Egypt	EEHC, Private	EETC	EEHC
Equatorial Guinea	SEGESA	SEGESA	SEGESA
Eritrea	EEC	EEC	EEC
Ethiopia	EEP, Private	EEP	EEU
Gabon	SEEG, Private	SEEG	SEEG
Ghana	VRA, BPA, Private	GRIDCo	ECG, NEDco, private
Guinea	EDG, Private	EDG	EDG
Guinea-Bissau	EAGB, Private	EAGB	EAGB
Kenya	KenGen, Private	KETRACO, Private	KPLC
Liberia	LEC	LEC	LEC
Lybia	GECOL, Private	GECOL	GECOL
Malawi	EGENCO, Private	ESCOM	ESCOM
Mali	EDM, Private	EDM, Private	EDM, Private
Mauritania	SOMELEC, Private	SOMELEC	SOMELEC
Morocco	ONEE, Private	ONEE	ONEE, Public, Private
Mozambique	EDM, Private	EDM	EDM
Namibia	NamPower, Private	NamPower	NamPower, Private
Niger	NIGELEC, Private	NIGELEC	NIGELEC
Nigeria	Gencos	TCN	Discos
Republic of the Congo	Private	Private	Private
Rwanda	REG, Private	REG	REG
Senegal	SENELEC, Private	SENELEC	SENELEC
Seychelles	PUC, Private	PUC	PUC
Sierra Leone	EGTC, Private	EGTC	EDSA
Somalia	Private	Private	Private
South Africa	Eskom, Private	Eskom, Municipalities	NTCSA
South Sudan	SSEC, Private	SSEC	SSEC
Tanzania	TANESCO, Private	TANESCO	TANESCO
The Gambia	NAWEC, Private	NAWEC	NAWEC
Tunisia	STEG, Private	STEG	STEG
Uganda	Public, Private	UETC	Private
Zambia	ZESCO, Private	ZESCO, Private	ZESCO, Private
Zimbabwe	ZPC, Private	ZETDC	ZETDC