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Power to which people? Explaining how electrification targets voters across party rotations in Ghana

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ABSTRACT

In countries with low household electrification rates, who gets electricity is an urgent political question. I examine the location and timing of 3,515 electrification projects in democratic Ghana over two decades, during which time the party in power rotated twice while the fraction of the population with electricity doubled. I show that party rotations cause large shifts in the location of new electrification projects, with each party following a different canonical voter targeting strategy. I propose that the parties choose different strategies because electrification projects can influence not only the voters that receive a transfer, but also voters that merely learn about a transfer. I develop a theory of how such information externalities influence how parties target resources and I show that political elites in Ghana think about resource allocation in ways that are consistent with the existence of information externalities. This analysis thus demonstrates that politics can strongly condition who receives electricity and when they receive it.

As of 2016, thirteen percent of the global population and nearly sixty percent of the population of sub-Saharan Africa lacked access to electricity (World Bank, 2018a). Sustainable Development Goal 7 aims to ensure that these people can access affordable, reliable, sustainable, and modern energy. The motivation for this goal comes in part from a body of evidence showing that receiving electricity has been associated with a range of positive economic and social outcomes (Dinkelman, 2011; Khandker, Barnes, & Samad, 2013; Grogan & Sadanand, 2013; Rud, 2012; Lipscomb, Mobarak, & Barham, 2013). In order to expand access to electricity, it is important to consider not only economic and technical constraints, but also the incentives facing the politicians who make choices about resource allocations.

Unsurprisingly, electricity is a highly valued good and so governments in democratic countries feel pressure to provide electricity to places where it is scarce. This pressure has upsides, as the extension of the franchise seems to encourage governments in democracies to provide more electricity to residential consumers —and especially the rural poor —than they otherwise would (Brown & Mobarak, 2009; Ahlborg, Boräng, Jagers, & Söderholm, 2015; Min, 2015; Kroth, Larcinese, & Wehner, 2016; Trotter, 2016). This matches a general trend where democracies are found to often provide higher levels of mass public services than non-democracies (Lake & Baum, 2001; Kaufman & Segura-Ubiergo, 2001; Stasavage, 2005), though who ultimately benefits from these public services remains an open question (Ross, 2006).

However, democratic demand for electricity can also create perverse incentives. For example, electricity distribution (Sareen, 2018) or transmission can be politicized (Min & Golden, 2014; Baskaran, Min, & Uppal, 2015; Aidoo & Briggs, 2018). Governments facing electoral pressures may target electricity or other spatially targetable goods in an effort to increase their vote share. They could do this by targeting core supporters in an attempt to boost turnout (Cox & McCubbins, 1986). Examples of core voter targeting exist in the United States (Levitt & Snyder, 1995), Kenya (Briggs, 2014; Jablonski, 2014), Albania (Case, 2001), and Argentina (Nichter, 2008), among others. Governments may also target goods to swing voters in an attempt to switch their vote (Lindbeck & Weibull, 1987; Dixit & Londregan, 1996).[1] Examples of swing voter targeting are similarly common (Dahlberg & Johansson, 2002; Cole, 2009; Banful, 2011).[2]

Core and swing voter models thus have mixed empirical support, suggesting that we need broader models that help explain when incumbents decide to use core or swing targeting strategies. This is especially useful as governments seem to target core and swing areas with different kinds of goods at different points in time

[1] Dixit and Londregan (1996) present a general model capable of producing either core or swing voter targeting. However, their definition of a core-voter—one who is cheaper for the government to influence with transfers—maps badly onto common usage, which is generally based on intrinsic political preferences.

[2] For an overview of research on distributive politics, see Golden and Min (2013).

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(Kramon & Posner, 2013). Some research has moved in this direction. For example, Albertus (2012) has shown that parties may take the nature of a good into consideration when choosing to target core or swing voters, with core voters receiving goods that last longer than one election and swing voters receiving more quickly consumed transfers. Other recent research has examined how bureaucrats can resist efforts to politically target resources like solar panels (Brass, Schon, Baldwin, & MacLean, 2020).

The present analysis examines the political allocation of electrification projects that connect villages to the national grid. I examine the location and timing of 3,515 projects built in southern Ghana between 1992 to 2011. Ghana provides a good test case for the influence of politics on electricity allocation because on the eve of Ghana's democratization in 1992, about 30% of Ghana's population had electricity (World Bank, 2018b). Almost all of this 30% lived in a few major cities, as only 3% of rural Ghanaians had electricity during this time (World Bank, 2018c). However, from 1992 to 2012 access to electricity roughly doubled and an intense rural electrification program caused a more than ten-fold increase in electricity access in rural areas (World Bank, 2018b, 2018c). During this time, Ghana democratized and then experienced two turnovers of power, first in January 2001 after the incumbent National Democratic Congress (NDC) lost to the opposition New Patriotic Party (NPP) and then again in January 2009 after the NDC won back the presidency.

I show that changing the party in power leads to large changes in which parts of the country receive new electrification projects. Both parties target electrification in response to voting patterns in past elections, though they follow different targeting strategies. While these targeting strategies are likely driven by past voting patterns, the ethnic politics of Ghana means that voter targeting strategies look quite similar to ethnic targeting. This is because each of Ghana's two major parties is associated with a spatially concentrated ethnic group. The NDC receives strong and consistent support from the Ewe ethnic group in Volta region and the NPP receives strong support from the Asante ethnic group in Ashanti (Fridy, 2007, 2012; Lindberg, 2013). I show that the NDC consistently targets electrification projects to its core voters, while the NPP targets swing voters to the detriment of its core supporters and to the detriment of the NDC's core supporters.

This paper adds to prior research by demonstrating cross-party differences in the allocation *of the same good in the same institutional context*. The results confound prior theory, as one party targets its base while the other targets swing areas and skews against its base. I propose that this cross-party difference in voter targeting strategies may be due to the fact that resource transfers can influence not only the voters that receive the transfer, but also voters that merely learn about the transfer. I develop a theory of how such information externalities influence how parties target resources and I use elite interviews to offer a suggestive test of the theory. I show that party officials think about resource allocation in ways that are consistent with the existence of information externalities.

In sum, this paper shows that while domestic politics can be an important factor in explaining who receives electrification in low-income countries, the way that politics influences resource transfers is not necessarily straightforward. The Ghanaian case highlights a puzzle, for which I offer a tentative explanation and preliminary tests.

1. Case selection

In order to examine cross-party differences in distributional political strategies, this paper investigates the spatial distribution of village electrification projects in Ghana from the start of the current democratic period until the end of 2011. Electrification projects in Ghana provide an ideal case examining party-level differences in distributive strategies for three reasons.

First, Ghana has a heavily presidential political system where the president is elected via a majoritarian election in a single national constituency, with a two-party runoff if no party secures more than half of the valid votes cast in the first round. This pushes Ghana's parties to maximize their total vote count regardless of where voters are located, and it simplifies efforts to understand the logic of distributive politics within the country. The presidency is the major political prize, and so in each election both parties aim to maximize their total number of votes across the country.

Second, Ghana has only two major parties and the presidency has rotated between them twice since democratization, shifting from the NDC to the NPP in 2000 and then back to the NDC in 2008.[3] These sharp party changes allow one to plausibly identify the effect of changing the party in power on the spatial distribution of resources. They also allow one to examine the durability of the NDC strategy over two time periods that are eight years apart.

Third, each of Ghana's two major parties is associated with a spatially concentrated and spatially distinct ethnic group of roughly the same size, though ultimately both parties also appeal to a wide variety of Ghanaians (Hoffman & Long, 2013). The NDC is associated with the Ewe in southern Volta, though they are also viewed as a social democratic party that represents Northern and rural interests (Fridy, 2007). The NPP is associated with the Asante[4] (and more broadly the Akan). The NPP's base is primarily located around Kumasi in Ashanti region, and the NPP is also viewed as a more capitalist and urban party (Fridy, 2007). Both parties' core ethnic groups (the Ewe and Asante) strongly support their party (Lindberg, 2013, p. 951).[5] However, both ethnic groups are fairly small and together make up less than 30% of the electorate (Fridy, 2007). This means that "the outcomes of [Ghana's] elections tend to be determined largely by so-called swing ethno-regional groups" (Abdulai & Hickey, 2016, p. 52). Additionally, Ghana's electoral geography has fairly clear dividing lines between each party's core ethnic group and Ghana's unaligned, swing voters. Each party's core group is geographically concentrated within one of Ghana's regions, with the Asante in Ashanti region and the Ewe in the south of Volta. The remaining regions, such as Central or Western, hold many non-Asante speaking Akans and other ethnic groups and move back and forth between the parties (Fridy, 2012). The concentration of core and swing voters into specific places means that the concern that swing *districts* may not be filled with swing *voters* but rather with two evenly sized groups of core voters (e.g. Golden & Min, 2013) is much less of a concern in the case of Ghana.

In sum, Ghana has a highly presidential system where the president is elected via a simple majority and the presidency has rotated twice during the period under study. This, combined with the fact that Ghana's core and swing voters have been stable over time and live in different places, enables a relatively clean test of differences in party-level distributive strategies.

2. Testing for voter targeting strategies

This section shows that Ghana's parties use different strategies when allocating the same good in the same institutional context. I

[3] See Jeffries and Thomas (1993) for an overview of the 1992 election and see Jeffries (1998) for the 1996 election. Gyimah-Boadi (2001) has a very good account of Ghana's peaceful turnover in 2000. Jockers, Kohnert, and Nugent (2010) has a summary of the time period and a pessimistic take on Ghana's second turnover in 2008.

[4] For clarity, throughout the text I will use "Asante" to refer to the ethnic group and "Ashanti" to refer to the administrative region of Ghana.

[5] Fridy (2012, p. 110) writes: "There are certain givens in Ghanaian elections. The NDC will dominate in the Volta Region and the NPP in the Ashanti Region."

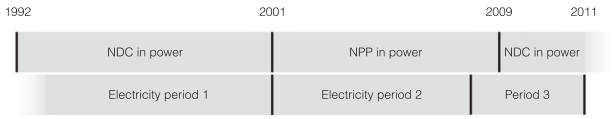

Fig. 1. Time line showing the overlap between the time periods in the electrification data and parties in power in Ghana.

introduce the data under analysis, discuss the empirical approach, and then present the results.

2.1. Data and empirical strategy

Data on electrification projects come from the Electricity Company of Ghana (ECG) and in their original form consist of a list of 3515 towns that received projects.[6] The ECG is responsible for electrification in the South of Ghana only, and so the analysis is restricted to the South of Ghana.[7] The ECG list includes the region in which the village is located, the broader electrification project under which the village received power, and a rough division into three time periods (pre-2001, 2001–2008, 2008–June 2011).[8] While these temporal groupings are crude, they align well with party turnovers in Ghana. The overlap between party turnovers and the electrification periods is shown in Fig. 1.

The dataset provided by the ECG contains village names and the region in which the village is located, but it does not list the village's district or geographic coordinates. For some of the following analyses it is useful to have more precise information on the location of the projects. To create this information, I matched a large and as-if random sample of the full ECG list to geographic coordinates by using textual fuzzy matching to link village names in the ECG list to village names in a gazetteer.[9]

In the following analyses, the dependent variable is the count of projects per region-time period or district-time period. The count of projects exhibits wide variation over both space and time. The key independent variables, however, vary either over space or time. Specifically, the measures of political affiliation—whether based on regions or vote margins—are either constant over time or show little variation over time. The party in power variable varies over time, but is constant over space. Accordingly, the key variable of interest is the *interaction* between the party in power and a measure of political affiliation, which reveals how switching the party in power changes the relationship between a district's political affiliation and its number of electrification projects.

The most critical assumption of the paper is that party changes are related to future shifts in the spatial allocation of electricity projects only through a mechanism whereby members of the new party influence the allocation of electricity projects. There is evidence that parties exercise this kind of influence over electricity utilities in Ghana. For example, the government in power has strong control over the composition of the ECG board and typically about half of board members are replaced when the party in power changes.[10] More importantly, decisions about where to build projects are made at the Ministry level and are politicized.[11] When asked to explain the patterns in electricity provision found in this paper, a senior manager at the ECG deferred and stated that "timing and location decisions [for electrification projects] are made purely by the politicians."[12]

The plausibility of the identification of the causal effect of party changes on the spatial distribution of electricity is aided by the fact that Ghana experienced two party changes during this period, shifting from the NDC to the NPP and then back to the NDC. Thus, in order for an omitted variable to confound the estimated effect of party changes on the spatial distribution of electrification it must not only covary with a measure of political affiliation over space, but it also must change with party rotations over time. This seems unlikely, and so the analysis can be read as showing if party changes cause changes in who receives electricity.

2.2. Results

I examine the data at three levels of analysis and using three different methods. First, I use the full dataset and show that party changes lead to large changes in regional project shares. Using the full dataset allows for an analysis that includes all projects, but I am limited to using region-level information on project location. Second, I map the subset of projects that were matched to geographic coordinates and graphically show how the spatial distribution of projects changes across parties. This approach aggregates projects into consistent spatial units rather than administrative units, and in doing so avoids the zoning portion of the modifiable areal unit problem (Wong, 2009). Finally, I present panel regressions explaining the count of projects per district-time period.[13] This approach allows for the use of control variables and enables a formal test of differences in electrification allocation strategies over parties. The results are consistent across all of the ways of aggregating and analyzing the data.

2.2.1. Basic analysis

The regional data are summarized in Table 1, where the bottom of the table shows two relevant electrification statistics from the period 1999/2000.[14] The first is the fraction of the population in each region without electricity. The second is the fraction of all southerners without electricity that reside in each region. This second figure is important because it is a good approximation of an optimal distribution of projects across regions when all people lacking power are considered to be equally important.

[6] An obvious alternative source of data would be the measurement of light at night. However, a drawback of the use of satellite imagery is that it primarily picks up light from streetlights. If one is using satellite imagery to track electrification, then one will tend to classify electrified villages with fewer than 20 streetlights as unelectrified (Min, Gaba, Sarr, & Agalassou, 2013). This not only means that many villages that receive power from the ECG will thus be marked as unelectrified, it also means that smaller towns with fewer streetlights will be more likely to be marked as unelectrified than larger towns, potentially creating bias if one thinks that one political party favors allocating electricity to more rural areas.

[7] The Northern Electricity Department is responsible for electrification in the North of Ghana. See Briggs (2012) for an analysis of electrification in the North of Ghana.

[8] I am not certain of the precise start date of the pre-2001 category. Some projects in this category were part of Ghana's National Electrification Scheme, which was started in 1989. It is also clear that at least one project finished in 1993, so the start date is somewhere between 1989 and 1993. The list includes all electrification projects in the south of Ghana excluding the Self Help Electrification Projects Phase III and above, as these latter projects were run through the Ministry of Energy and not the ECG.

[9] To reduce the probability and gravity of incorrect matches, I ensured that all searches of the gazetteer are within each project's known region. A complete description of the matching technique can be found in Appendix A.

[10] One technical report on the electricity sector in Ghana noted "Governmental control of the electricity industry is evident in the functions of the ECG and the composition of the governing board of ECG. [...] The Principal Secretaries or holders of the most senior civil service positions ...constituted an overbearing government presence on the utility's board" (Resource Center For Energy Economics & Regulation, 2005, p. 27).

[11] For more information on the energy sector in Ghana broadly, see Eshun and Amoako-Tuffour (2016) and Kumi (2017). On the challenges of universal electrification in Ghana, see Kemausuor and Ackom (2017).

[12] Interview in Accra, Ghana. July 27, 2016.

[13] In 1992, Ghana had 110 districts (73 in the regions under study) but the country added new districts in later time periods. For the analysis, all districts are aggregated back into their original configuration.

[14] Electrification rates and population figures come from Ghana's 2000 census.

Table 1
Fraction of electricity projects per region across parties.

	Ashanti	Central	Eastern	Accra	Western	Volta
Pre-2001 (NDC)	19.8	15.2	16.2	3.1	16.7	29.0
2001–2008 (NPP)	11.7	16.8	27.7	12.7	22.1	9.0
2008–2011 (NDC)	21.2	12.3	6.9	11.3	12.5	35.9
% of region without power	49.6	61.6	68.0	23.3	59.1	74.0
% of all residents of Southern Ghana without power	24.8	13.6	19.8	9.4	15.7	16.7

Ghana's regions hold very different numbers of people, so these two measures of electricity gaps can diverge. For example, only half of the residents in the populous Ashanti region lack electricity, but Ashanti holds 25% of southern Ghana's unelectrified population. Poorer and less populated Volta region only holds 17% of southern Ghana's unelectrified population, even though 74% of Volta's residents lack power.

Table 1 reveals that party changes coincide with large changes in the provision of electricity projects across regions. When the NDC was in power, about one-third of electrification projects were targeted to Volta region. This is consistent with the notion that the NDC targets electricity to their core supporters and is inconsistent with swing voter targeting. The NDC's allocation of electrification projects across regions was generally consistent across their two periods of rule, with the exception that Accra received more projects post-2008 and Eastern received more pre-2001. Ashanti, Central, and Western were treated fairly, as their share of projects was about equal to their share of southerners without power. When the NPP gains power, they direct resources away from both the stronghold of their party (Ashanti) and the stronghold of the NDC (Volta). Rather than targeting core supporters, they instead build a large share of projects in Central, Eastern, and Western regions. These regions are notable for their large shares of swing voters, though the NPP has reliable supporters in parts of Eastern region. Western region saw the discovery of oil resources during this time, which was plausibly a factor in extending the network towards Western.

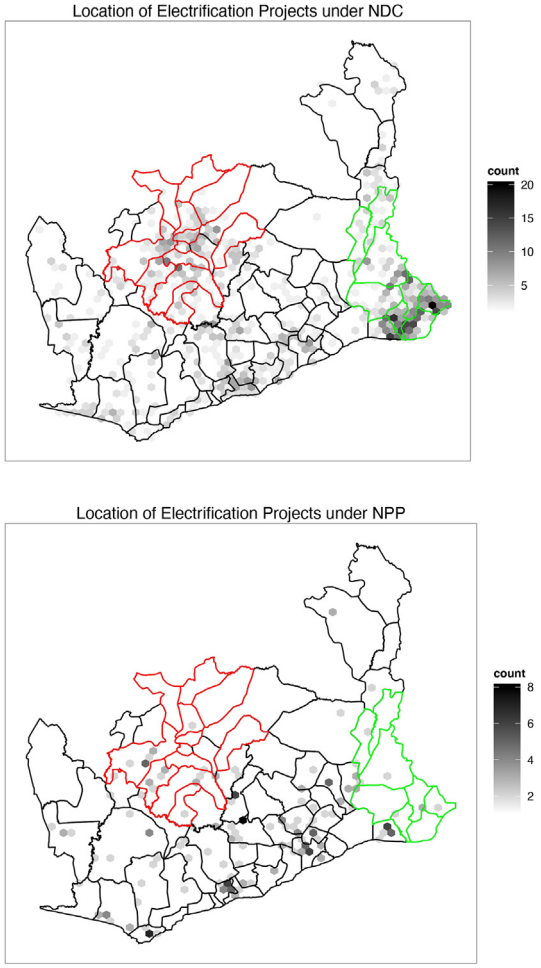

Fig. 2. The location of electrification projects. Ewe majority areas are outlined in green and Asante majority areas are outlined in red. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Fig. 2 shows that a similar pattern is present in the subset of the data that was geocoded.[15] Here the projects are not aggregated into regions or districts but rather into equally sized hexagons that are tiled across a map of southern Ghana. White areas contained no projects and the hexagons grow darker as they contain more projects. This approach allows one to visually note areas with a high density of electrification projects without aggregating the counts to units that are defined by official borders. As a basic way of marking core support areas, districts with Ewe majorities are drawn in green and districts with Asante majorities are drawn in red.

The maps show that the NDC is favoring the southern portion of Volta region, which holds their base, rather than Volta region in general.[16] The NPP builds fewer projects overall and their projects skew away from both their base of Ashanti and away from the NDC base in south Volta. As with Table 1, the NPP is building more electrification projects in swing areas. One may worry that the patterns apparent in the maps or Table 1 are due to omitted variables like population density, but note that the NPP held power for eight years in the middle of two periods of NDC rule. As such, the *differences* in targeting between the two maps cannot be caused by variables that either change slowly or linearly over time. The remaining analyses simply reinforce the results that are apparent in Table 1 and Fig. 2.

2.2.2. Regression analysis

This section more formally examines how switching the party in power changes the spatial allocation of electrification projects. As above, the NDC targets its base while the NPP targets swing voters. This pattern holds if I identify core and swing areas using the vote margin between parties, the absolute difference in votes between parties, or the share of party-aligned ethnic groups in each district.

Table 2 presents results where core and swing voters are identified by vote margins in the period-dividing (and party-switching) elections of 1992, 2000, and 2008. The district-level vote margin is measured as the NDC's fraction of votes in the district minus the NPP's fraction of votes. Working broadly within the framework set by Dixit and Londregan (1996) and Banful (2011) has shown that if voters within a district have symmetric and single-peaked preferences over parties, then the margin of victory can be used to identify the proportion of swing voters in the district. Similarly,

[15] See Appendix A for information on the geocoding procedure.
[16] Both periods of NDC rule are merged in the map.

Table 2
Voter targeting results.

	1	2	3	4	5	6
NDC in Power	0.08	0.06	0.05	0.06	0.25	0.23
	(0.13)	(0.13)	(0.14)	(0.14)	(0.16)	(0.19)
NDC Win Margin	0.10	0.10	0.13	0.22	0.19	0.17
	(0.34)	(0.33)	(0.33)	(0.31)	(0.28)	(0.28)
NDC Win Margin^2	−1.52***	−1.62***	−1.63***	−1.85***	−2.00***	−2.10***
	(0.57)	(0.53)	(0.54)	(0.50)	(0.46)	(0.47)
NDC in Power × NDC Win Margin	−0.22	−0.19	−0.19	−0.22	0.18	0.16
	(0.27)	(0.27)	(0.27)	(0.28)	(0.29)	(0.35)
NDC in Power × NDC Win Margin^2	2.94***	3.03***	3.04***	3.13***	3.45***	3.84***
	(0.50)	(0.51)	(0.52)	(0.53)	(0.53)	(0.65)
ln(Area)		0.32***	0.32***	0.13	0.02	0.01
		(0.11)	(0.11)	(0.12)	(0.15)	(0.13)
ln(Population)			0.11	0.46**	0.68***	0.53***
			(0.19)	(0.22)	(0.21)	(0.17)
Percent Rural				1.42***	0.75	0.33
				(0.43)	(0.58)	(0.51)
% With Electricity					−2.05**	−2.09**
					(0.99)	(0.89)
Electricity Projects$_{t-1}$						0.03***
						(0.01)
Constant	2.24***	−0.02	−1.34	−5.09**	−5.81**	−3.83*
	(0.14)	(0.82)	(2.23)	(2.54)	(2.48)	(1.99)
Districts	73	73	73	73	73	73
Observations	219	219	219	219	146	146

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable is the count of electrification projects per district-period. Robust standard errors clustered on districts in parentheses.

the margin of victory can serve as a proxy for the "cutpoint" density in a district, which marks the density of voters that are 'on the line' between parties and so can have their vote shifted by a transfer (Dahlberg & Johansson, 2002; Banful, 2011). Parties trying to persuade voters with resources will want to target such resources to districts with higher cutpoint densities. Alternatively, a core voter model such as that of Cox and McCubbins (1986) predicts that incumbents will direct more resources to the places that support them more heavily.

The dependent variable in all models is the number of electrification projects per district per time period. This is an overdispersed count variable and so the following analyses use a negative binomial model. In order to test for core or swing voter targeting strategies and changes in strategies over parties in a single model, I use a specification that includes the lower order terms of vote margin, vote margin squared, and a dummy variable that marks if the NDC is in power, as well as interactions between the NDC in power dummy and both vote margin variables. If a party is targeting core voters, then electrification projects should increasingly flow to places with larger vote margins in favor of the party. If a party is targeting swing voters, then their electrification project allocations should peak on districts that have vote margins near zero.[17] The results from the minimal model are shown in model 1 of Table 2. I then sequentially add controls for each district's area, population, the share of its population that is rural, the share of population with electricity in 2000, and the number of electrification projects in the preceding period.[18] All models cluster standard errors on districts.

The key result from Table 2 is that the NDC targets more electricity to its base and that the relationship between vote margins and NPP targeting has the expected concave shape. The table shows that the differences between parties is substantively and statistically significant, and the findings are stable as controls are added. However, it is difficult to interpret tabular output from models with squared terms and interactions and so the results are also presented graphically in Fig. 3.

Fig. 3 is built from model 4 in Table 2 and shows how the predicted count of electrification projects varies across parties and over vote margins.[19] The NDC favors the areas that support it most heavily, consistent with it using a core voter targeting strategy. The NPP favors areas with vote margins near zero. Given the electoral geography of Ghana, with spatially distinct and concentrated groups of core and swing voters, this implies that the NPP is targeting districts with more swing voters. This pattern accords well with the region level results in Table 1 and the maps in Fig. 2.

While the use of vote margins is appropriate for measuring swing voters, it is not an ideal measure for core voter targeting because it ignores turnout. Ghana's presidential elections are contests to reach a country-wide 50% + 1 vote share, and so core areas are best understood not as districts with very high vote margins in favor of one party but rather as places with very large numbers of voters in favor of one party. Accordingly, I re-ran the model that was used to produce Fig. 3 but replaced the vote margin and its squared term with a count of the number of NDC votes minus the number of NPP votes per district per period. This measure is equivalent to using the vote margin when both are zero, but it diverges in district population and turnout as the margin moves away from zero. The results are shown in Fig. 4.[20]

When measured as raw voter advantage, the NDC favoritism towards its stronghold in Volta is even more pronounced. Notably, every one of the 16 observations in which the NDC vote was at least 38,000 votes more than the NPP vote was located in Volta region. Volta also held two-thirds of the 44 observations that gave the NDC at least 20,000 votes more than the NPP. This high level of

[17] One may be concerned about the imposition of a quadratic functional form on the results. In fact, a quadratic shape is quite clear in the raw data, as is shown in Appendix C. Also, the inclusion of the quadratic term is required in order to test for swing targeting, and so is theoretically motivated.

[18] The latter two models drop the first time period.

[19] The range of vote margins (from the NPP winning by 60 points to the NDC winning by nearly 100 points) reflects the underlying range of values in the district-level data. Note that the y-axes differ across the panels. The figure is shown with the control variables (area, population, percent rural) held at their means. The dotted line is a 95% confidence interval.

[20] The range of the x-values is such that two outlying observations in the far left tail of the distribution are dropped. If they are included, the figure becomes more difficult to read and the uncertainty around these outlying observations is very large. The dotted line is a 95% confidence interval.

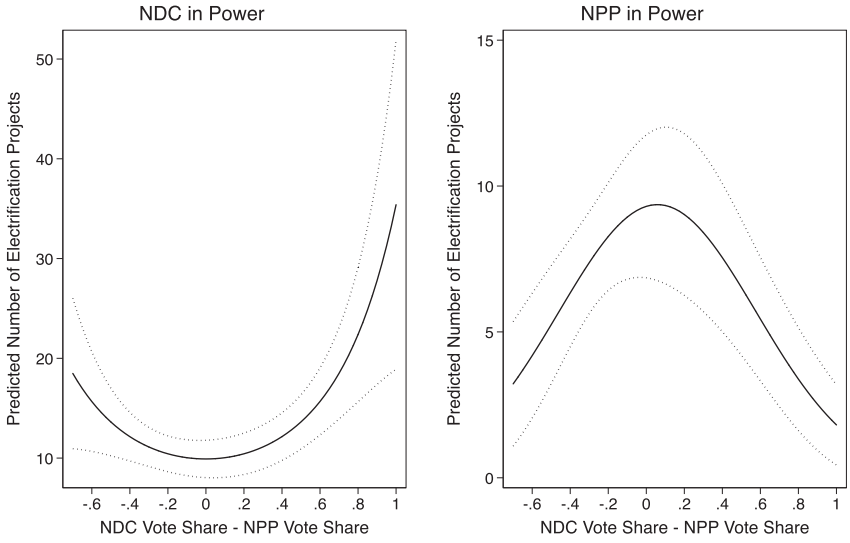

Fig. 3. How electrification targeting varies across vote margins.

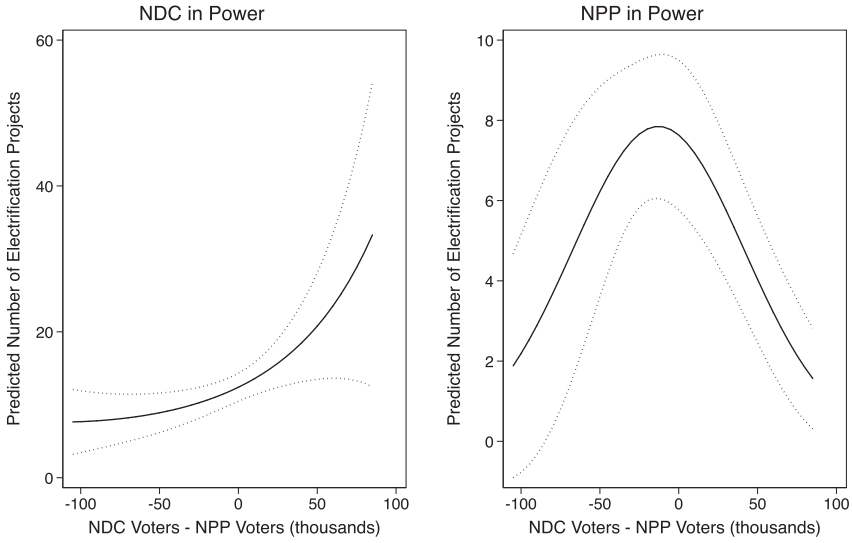

Fig. 4. How electrification targeting varies across vote counts.

support is why the NDC refers to Volta as its 'World Bank of votes.'[21]

2.2.3. Robustness

The results are robust to a number of modifications of the underlying variables and specifications.[22] First, I recoded the dependent variable so that it represented not the count of projects per district per period, but rather each districts' share of all projects per period. This recoded dependent variable is bound at 0 and 1 and so I analyze the data using a generalized linear model with a logistic link function. Using this new variable and model, I reproduce Figs. 3 and 4. The results are substantively very similar, with the NDC targeting core and Ewe areas and the NPP targeting districts with vote margins near zero. This confirms that use of a count dependent variable and associated negative binomial model is not driving the results.

Second, the strategy for matching villages names to geographic coordinates, which is necessary for the creation of the maps in Fig. 2 and for the creation of the dependent variable used in the regressions, involved minimizing the number of characters that had to be changed, dropped, or added in order to match a village name from the ECG list to a village name in a geographic gazetteer.[23] With very small edit distances, the likelihood of a mis-

[21] Volta's nickname of the NDC's 'World Bank of votes' occurs regularly in the literature and came up in one of my interviews with an NDC party official. Andbo (2001) claims that Rawlings first used the term after the 1992 election.

[22] These robustness tests are reported in Appendix B.

[23] The matching of the ECG village list and the gazetteer was restricted so that all matches always shared the same region. More information on the creation of the DV is in Appendix A. Full output from the robustness checks in available in Appendix B.

match is very small but the number of matched villages is relatively low. As edit distance increases, the probability of a mismatch increases but a much larger share of the overall list is matched to coordinates. This matching strategy likely did not introduce much bias because the full, regional-level dataset shows similar cross-regional and cross-party patterns as the georeferenced sample. However, to more closely examine the robustness of the results to the matching strategy, I reproduced Figs. 3 and 4 using datasets formed from all edit distances from zero to five (inclusive). The results are very similar across edit distances.

3. Information externalities

The above results present a puzzle, as Ghana's parties use different but equally political strategies for distributing exactly the same good in the same institutional context. This pattern holds as a large number of control variables are added to the models, including controls for different districts being more or less large, populous, rural, or electrified. The fact that the NPP targets swing voters while the NDC targets core voters also confounds a political settlements approach (e.g. Abdulai & Hickey, 2016) or any other approach to resource allocation that predicts that resource allocations will track the distribution of political power within ruling coalitions, as the NPP did not do this when allocating electricity.

The puzzle of cross-party differences in voter targeting strategies can be resolved if one expands the ways that transfers influence voters. In standard models of distributive politics, transfers only influence the voters that receive the transfers. However, it is also possible, and in some situations likely, that transfers to select voters create information that reaches and influences other voters. In other words, when a transfer is made, voters that do not receive the transfer may learn about the transfer and then update their voting preferences in response to that information. Voters may update their voting preferences in at least two ways. First, voters may use information on which groups benefited from the transfer to update their beliefs about which groups will benefit if the party wins the election. Second, if voters find a transfer to be unfair, then they may punish the incumbent simply for making an unfair transfer. I next explain these general responses in more detail and then apply the model to electricity allocation in Ghana's Fourth Republic.

First, a large literature in African politics suggests that voters vote along ethnic lines not due to expressive factors, but rather because ethnicity provides a convenient rule of thumb for understanding who parties will favor when in office (e.g. Posner, 2005; Ferree, 2006; Bratton, Bhavnani, & Chen, 2012; Conroy-Krutz, 2012; Carlson, 2015). In this case, information externalities may provide voters with additional information about a party's distributive preferences. Put simply, incumbents signal who they favor when they make transfers. The effect of such information is likely to be especially important when parties make transfers that map on to clearly understood political groupings, such as when a party targets its core group. When a good is politically salient, there is always a chance that information about a transfer will reach voters who did not receive the transfer and alter their perceptions about who parties favor. The more a transfer clearly favors a distinct group, the more voters will update their understanding of the targeting preferences of the party making the transfer. Anticipating the possibility of information externalities, parties may decide not to target relatively small groups with highly politically salient goods.

Second, humans in general have a profound dislike of unfair activity. This dislike extends quite far, including the willingness of neutral third parties to pay to sanction people that make unfair transfers in a dictator game (Fehr & Fischbacher, 2004; Henrich et al., 2006). I propose that if a party makes a transfer that a voter sees as unfair, then that voter is less likely to vote for that party. In this way, a voter that is not part of a transfer can still be influenced by the transfer. If the group watching an unfair transfer is large relative to the group planned to receive the unfair transfer, then parties may fear an overall loss of votes from the unfair transfer and subsequently shift to a strategy where they make a transfer that is more likely to be seen as fair.

In general, parties will be less sensitive to these concerns the less that a given transfer is expected to produce information. They will be more sensitive to information externalities as the population of the watching group grows relative to the receiving group. They will also be more sensitive the more that the watching group is influenced by the information relative to the degree that the receiving group is influenced by the actual transfer. I next apply this model to Ghana and examine if Ghanaian political elites actually think about information externalities.

3.1. Do information externalities matter in Ghana?

In order for information externalities to explain different voter targeting strategies across parties, two conditions must hold. First, the parties must believe that the good being targeted produces information that has a good chance of both reaching and influencing voters that will not receive the transfer. Second, the parties must have different beliefs about how damaging it would be for voters who are not part of the transfer to see them as targeting core versus swing voters.[24] Drawing on elite interviews conducted in Accra, I show that both conditions hold in Ghana. The interviews were conducted after the information externality explanation was created and were intentionally designed to offer preliminary, qualitative tests of the two conditions noted above.

First, members of the NDC and NPP believe that the distribution of electricity in Ghana creates information externalities. This is because electricity is a highly visible and politically salient good in Ghana. An NDC party official described the importance of electricity to Ghanaian voters with the phrase: "electricity is key."[25] The NDC has campaigned on providing goods like electricity to voters. Their 1996 campaign featured billboards showing villages with electric poles with the slogan "Always for people, always for development" (Roberts, 1996). Another NDC campaign slogan from the same election was "Let there be light for rural people, for they are Ghanaians too!" (Adedeji, 2001, p. 18). The NPP is equally aware that people care about electricity. For example, an NPP MP from a relatively deprived part of Ashanti region noted that "[His constituents] are passionate to have electricity."[26] The parties also are aware that allocating electricity to one region can potentially cause problems in other regions, as one NDC official put it, "When you concentrate on your stronghold, other regions see."[27] Electricity has been a major political issue in Ghana since independence,[28] and so parties are aware that their decisions around electricity have a real chance of making news and reaching voters.

Second, Ghana's parties' choice of voter targeting strategies is differently constrained by information externalities. This owes primarily to the fact that Ghana's swing voters see the Asante and the Ewe very differently. Thus, while no party wants to be seen as a

[24] In a process tracing framework, one can view these two conditions as hoop tests as they are necessary but not sufficient for an information externality explanation for cross-party differences in voter targeting to be correct (George & Bennett, 2005).

[25] Interview in Accra, Ghana. July 18, 2016.

[26] Interview in Accra, Ghana. July 21, 2016.

[27] Interview in Accra, Ghana. July 18, 2016.

[28] From the Volta River project under Nkrumah, to Rawlings' plan to electrify all of Ghana's district capitals, to the contemporary issue of load shedding (known locally as *dumsor*, or "off/on" in Twi), the politics of electricity has consistently been a major issue in Ghana.

party of its core ethnic group (Fridy, 2007), the NPP is much more afraid of voters making this link than the NDC. A junior NPP party official noted that when it came to avoiding affiliation with their core ethnic group "we are more cautious [than the NDC]."[29] A senior NPP party official said that the view that the NPP is an Asante party "is quite damaging" while "[the NDC] don't worry."[30] Some of this fear on the part of the NPP is due, in the words of a senior NPP party official, to "historical antecedent."[31] This reference, which came up a number of times, is an oblique nod to the fact that in pre-colonial times the Asante had a wealthy, strong state that often had a tense relationship with neighboring groups. In particular, the Asante state's "expansionist ambition of conquest and domination over the majority of their southern counterparts brought them into open confrontation with some of the states in the coast…" (Asante & Gyimah-Boadi, 2004, p. 13–14). Aside from expansion, "slaves were […] of crucial importance to the Asante economy" (Wilks, 1990, p. 176), with these slaves coming from surrounding ethnic groups. This history makes the NPP uniquely fearful of being seen as an Asante party. While Ghana's parties rarely make overt statements claiming that the opposition is 'being tribal,' this history lives in the background of Ghana's politics and is brought up in private. For example, when asked about the connection between the Asante and the NPP, an NDC party official told me in hushed tones that the NPP was an Asante party and that "[The Asante] see themselves as the rulers of Ghana."[32]

Aside from 'historical antecedent', the Asante are presently also seen by most Ghanaians as wealthy and so undeserving of government transfers. The high average level of infrastructure in Ashanti can be seen in Table 1, where the region has a relatively high electrification rate in 2000. The region holds Ghana's second city and is an economic hub based around cash crops and mining.[33] These economic differences are noticed by regular Ghanaians and compound the history noted above. In the words of a senior NPP party official, the Asante "are resourceful" and this has created "hatred and antagonism [towards the Asante] because of wealth differences."[34] In the words of an NPP MP from Ashanti region, "People have a notion that everyone in Ashanti is rich. That is the notion in the whole country. […] People expect the government to do more in poor regions, not Ashanti."[35]

The above concerns mean that the NPP loathes to be seen as allocating resources to Ashanti region. This is both because they are afraid of (non-Asante) voters punishing them for making unfair transfers and because they are afraid that if (non-Asante) voters see them as an Asante party then they will believe that the NPP will not favor their group post-election. In response to these fears, after the 2000 election that brought the NPP to power "The President decided to spread, to ignore the stronghold. […] They decided to go out and get votes."[36] When I asked an NPP official why the NPP was giving more electricity to Central, Eastern, and Western, his response was "The idea there is votes. We wanted to increase the margins."[37] In this way, fear of information externalities constrain the NPP's voter targeting options when allocating politically salient goods like electricity. The result is that they target swing voters rather than their base.[38]

As noted above, the NDC is not similarly afraid of having voters interpret their resource allocations in ethnic terms. This partially owes to the fact that the Ewe do not have the contentious history of the Asante within Ghana. They also are viewed as very poor. This is again reflected in the regional electrification statistics in Table 1, where 74% of Volta (but only 50% of Ashanti) lacked power in 2000.

Aside from lacking a contentious history and being seen as more deserving, the NDC also runs on a platform that is heavily based on the provision of services to poor and rural Ghanaians. This means that while targeting Volta could be seen in ethnic terms, it is also possible that many Ghanaians would simply see it as the NDC following their platform and targeting the poor. This logic can be seen in the statements of a senior NDC party official who explained that they were not as afraid of people seeing their targeting in ethnic terms as the NPP was because "the ideology [between the parties] is different" and because "we are a rural party."[39] The fact that the Ewe are seen as very poor and deserving of transfers, combined with the fact that the NDC runs on a platform of providing such transfers, reduces the fear that information externalities arising from electricity allocation will hurt the NDC at the polls. The NDC is also very aware of the importance of high turnout and very large margins of victory in Volta for them winning the presidency, and this desire to protect and rally the base was given as their reason for consistently favoring the region with electricity. A senior NDC party official told me, "You cannot have a 'World Bank' with nothing to show."[40]

In sum, parties know that when they allocate a politically salient good they may influence not only the voters that receive the good, but also voters that find out about the transfer. If those external voters see the transfer as unfair, they may punish the party making the transfer. The external voters may also use the information about who is favored by the transfer to update their understanding of who a party will favor after the election. Parties know this, and so they are strategic in their allocation of goods that have a high risk of creating large information externalities.

Ghana's two major parties have similarly sized core ethnic groups that collectively make up about 30% of the population. For the NPP, being seen as favoring their core group is very damaging because their group is relatively wealthy and is viewed somewhat warily by many Ghanaians. This means that it is riskier for the NPP to target core voters rather than targeting swing voters with politically salient goods. The NDC does not face such a stark decision. Their core group is viewed as poor and deserving and does not have a history of dominating over Ghana's other groups. Further, the NDC platform emphasizes that their goal is to target resources to rural and disadvantaged areas of Ghana. They feel that if voters find out about them targeting Volta, it may well be interpreted as the NDC targeting the poor rather than the NDC targeting the Ewe. Thus, the NDC is not particularly worried that targeting south Volta will hurt them in the eyes of Ghana's swing voters. This lack of worry, combined with the fact that the NDC sees itself as highly reliant on both high turnout and large margins of victory in Volta, explains why the NDC's strategy is to favor core voters with electricity.

In sum, elites in both political parties seem to be aware that resource distributions influence voters and that they consider both the direct influence of a transfer on the voters that receive the transfer and also the influence of information about transfers on voters that do not receive the transfer. Additionally, the interviews

[29] Interview in Accra, Ghana. July 25, 2016.
[30] Interview in Accra, Ghana. July 26, 2016.
[31] Interview in Accra, Ghana. July 26, 2016.
[32] Interview in Accra, Ghana. July 18, 2016.
[33] The welfare differences between Ashanti and Volta region, for example, extend beyond electricity and can be see in regional poverty profiles (World Bank, 2015).
[34] Interview in Accra, Ghana. July 26, 2016.
[35] Interview in Accra, Ghana. July 26, 2016.
[36] Told to me by an NPP MP from Ashanti region when I asked him why his constituents were neglected by the NPP in 2000–2008. Interview in Accra, Ghana. July 26, 2016.
[37] He then explained the targeting to Western region differently, saying that NPP's targeting (of village electrification) there was due to the demands of oil exploration. I did not push for clarification on this point. Interview in Accra, Ghana. July 25, 2016.
[38] One additional implication of the theory is that when the NPP targets resources to Ashanti region, they will use resources that are 'harder to see.'
[39] Interview in Accra, Ghana. July 18, 2016.
[40] The NDC official also explained targeting to Volta by referring to how poor it is. Interview in Accra, Ghana. July 18, 2016.

confirmed that when elites in Ghana's parties weigh these direct and external effects and decide on an allocation of transfers, they feel differently constrained by their party's ethnic connotation. The elite interviews above were conducted after the information externality theory was created and offer a preliminary test of the mechanisms in the theory. The evidence from the interviews, as well as less formal discussions with members of Ghanaian civil society, is supportive of the theory. Future work could do more to test the implications of the theory using qualitative and quantitative methods.

4. Discussion

This paper highlighted, and then proposed a resolution to, the puzzle of why political parties sometimes use different strategies when allocating the same good in the same context. This cross-party variation cannot be explained by current voter targeting models, but is well explained by incorporating information externalities into voter targeting calculations. While the information externality theory was applied to Ghana in the present paper, it seems likely that information externalities exist in most cases where governments target politically salient goods to clearly defined groups. These groups do not need to be defined geographically. For example, if most people in a state view professors as having a high level of economic comfort, then a government that considers influencing the 'public university professor vote' by increasing salaries (one can dream) will likely realize that while such a transfer may sway professors, it also creates information that may anger the much larger group of non-professors. Therefore, the downside of being seen making an unfair transfer likely outweighs the upside of a gain in the professor vote and so the transfer will not be made. There likely exist many more such cases.

The second contribution of the paper is on the expected effects of democracy on resource distribution in Africa. The paper showed that electoral pressures sometimes lead governments to target resources away from their core ethnic group and towards swing voters, a finding that is in line with research by Horowitz (2015). This is a rather optimistic finding, as it suggests that democratization can push governments away from ethnic favoritism. However, this optimistic finding is tempered by the fact that it only applied to one of Ghana's parties and that the pressure the NPP faced to not target the Asante with electricity owed to an interaction of a number of specific contextual factors. It seems likely that the effect of information externalities on resource allocation will typically depend on an interaction between country, time, good, and party specific factors. This suggests that the influence of information externalities on the ethnic targeting of resources in democracies is unlikely to yield simple and general predictions.

The third contribution pertains to our understanding of the politics of electricity. Brown and Mobarak (2009) have shown that poorer democracies provide relatively more electricity to households relative to industry than do poorer autocracies. Their explanation for this finding is that voting renders democracies more beholden to the mass interests of households relative to the concentrated financial interests of industry. This result is reinforced in Min (2015), who examines light at night data and finds that democracies provide electricity to a larger share of their populations than autocracies and that democracies are also more likely to provide electricity to the rural poor. In a similar vein, Kroth et al. (2016) examine South Africa and show that when apartheid ended, electrification increased most dramatically in places that had the largest number of newly enfranchised voters. They also find that the African National Congress favored places with more core voters when it had control over electrification. This paper complements this work by examining cross-party changes in electricity allocation strategies. Consistent with the work above, Ghana's parties targeted electricity to areas of Ghana that were more rural or had lower rates of electrification. However, the parties also used party-specific distributive strategies that are best explained by the presence of information externalities in allocating electricity. Finally, the finding that the NDC targets its core supporters is consistent with the constituency-level evidence in prior work that examined electricity allocation in the north of Ghana (Briggs, 2012).[41]

The present paper also has a number of limitations. First, the analysis of cross-party differences in resource allocations looks only at electrification projects, and so if governments treat other resources as political substitutes for electrification projects then this partial picture may be misleading (Kramon & Posner, 2013). Throughout this period, electrification rates where not high, so this issue may be less threatening than in other contexts. Second, the information externality theory was created in response to the quantitative results and was only tested via a small number of elite interviews. Future work could do much more to examine if or when this theory is able to explain resource allocations better than other models. Third, this paper examined electrification in one region of one country over about 20 years. Future work could examine other regions, countries, or time periods. Fourth, the dataset in the paper had information only on towns that received electrification projects but lacked any measure of the size of each projects (e.g. budget or number of customers connected). Where possible, future work could examine if or how conclusions about voter targeting change when one adds additional information on project size.

5. Conclusion

On the eve of democratization, about 30% of Ghana's population had electricity (World Bank, 2018b). Almost all of this 30% lived in a few major cities, as only 3% of Ghana's rural majority had electricity during this time (World Bank, 2018c). However, from 1992 to 2012 access to electricity roughly doubled across the country and an intense rural electrification program caused a more than ten-fold increase in electricity access in rural areas (World Bank, 2018b, 2018c). While the grid was being built across the country, Ghana democratized and then experienced two turnovers of power, first in 2000 when the NDC lost to the opposition NPP and then again in 2008 when the NDC won back the presidency.

This paper has demonstrated that these rotations of power caused pronounced changes in where electrification projects were built in Ghana. The NDC had a consistent strategy across both of its periods in power, and it targeted its base regardless of whether its base is identified using regions or vote margins. The NPP followed a different but equally political strategy, as it targeted swing areas and was biased against both its base in Ashanti and the NDC's base in Volta.

The finding that Ghana's parties used different strategies to target the same good in the same institutional context cannot be explained by existing theories. In response to this puzzle, this paper presented a theory of information externalities in distributive politics. Plainly, it points out that when a party makes a transfer to voters it creates information that can influence voters that were not party to the transfer. In Ghana's case, the NPP does not want to be seen as an Asante party and it felt that it did not have the ideological cover that would be necessary to explain why it was allocating a highly desired good like electrification projects to its base. Accordingly, it targeted swing areas. The NDC was less

[41] However, the evidence from the present paper is not consistent with the (weaker, $n = 10$) cross-regional evidence in Briggs (2012).

worried about being seen as an Ewe party and felt that if voters found out that they were favoring south Volta then many voters would simply read this as the NDC following its platform of serving the rural poor. The success of the NDC's presidential bids is also reliant on high turnout and large margins of victory in south Volta, and so the NDC chose to target its base.

When parties allocate politically salient resources, they can influence the voters that receive the resources as well as those that learn about them. Politicians are aware of the possibility of information externalities and may plan resource allocations with them in mind. In Ghana, information externalities offer a good explanation for why the major political parties target politically salient goods differently. While both of Ghana's parties are trying to target resources to maximize their number of votes, the presence of information externalities encourages Ghana's parties to act in different ways. Ghana's politicians and party officials are aware of these dynamics and self-consciously choose these strategies. While information externalities offer a good explanation for the allocation of electricity in Ghana, there is nothing Ghanaian or African about the idea that resource transfers produce information that can influence voters who did not receive the transfer. Thus, it seems likely that information externalities matter elsewhere.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.worlddev.2021.105391.

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