A Drop in the Bucket? Explaining Government Responsiveness for Rural Water Provision in Tanzania

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Abstract

Access to clean and safe water presents a serious challenge for most citizens of Tanzania. Despite massive funding increases in recent years, the proportion of Tanzanians with access to a clean and safe source of drinking water has hovered at just over 50% for the past 20 years. I investigate the extent to which the Tanzanian government's failure to improve access to clean water reflects the politically motivated allocation of public resources. I test three main hypotheses corresponding to different mechanisms of politicized distribution. The first posits that government investment in water is concentrated in electorally competitive places, the second that government effort is reduced in political units that have defected to the opposition, and the third that ruling party strongholds are favored with higher levels of government effort compared to political units that demonstrate less loyalty. I test my hypotheses on a comprehensive dataset of all 75,000 public water points serving rural Tanzanians, using novel estimation techniques that take population distribution into account.

1 Introduction

As in many African countries, access to basic public services presents a serious challenge to most citizens of Tanzania. In particular, access to clean and safe water is consistently identified by Tanzanians in public opinion surveys as a major problem that they want government to address. Such subjective expressions of dissatisfaction reflect a dismal objective reality. Since comparable statistics first began to be collected, access to clean water

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in Tanzania has largely stagnated – hovering between 54% and 53% between 1990 and 2011.[1] Furthermore, the World Health Organization estimates that Tanzania loses the equivalent of one million life years in productivity every year due to water, sanitation and hygiene related diseases (World Health Organization, 2009).[2]

While Tanzania is a poor country, the government's failure to improve access to clean water cannot be explained by a lack of resources. A recent quadrupling of funding for the water sector put Tanzania ahead of its peers (African Ministers Council on Water, 2010). However, Figure 1 illustrates that such substantial increases have not made a dent to improve access to clean and safe water.

[Figure 1 about here.]

Tanzania's failure to improve access to clean water is also not simply a question of geography, since other countries with similar climates (e.g. Kenya and Uganda) have seen improvements in recent decades. As a result, access to clean and safe water in Tanzania is "worse than in any country that is neither water-scarce nor war-torn" (Taylor, 2012).

This paper suggests that the Tanzanian government's failure to improve access to clean water reflects the fact that public resources have been allocated in part to maximize political gains rather than efficiency. I use spatial analysis techniques to study a comprehensive dataset of all 75,000 public water points serving rural Tanzanians to test hypotheses corresponding to different mechanisms of politicized distribution.

In the sections that follow I present the series of hypotheses that this paper tests, describe my data, and explain the methods I use to test the hypotheses that I advance. My analysis is still in progress and thus I report only preliminary results.

2 Hypotheses

2.1 Relation to the Literature

I present a series of hypotheses that relate generally to the nature of public goods provision in Tanzania, taking clean water to be a representative public good.[3] I ground these hypotheses in two main literatures – the literature on distributive politics in developing democracies[4] and the literature on hegemonic party regimes. My reliance on these two literatures reflects Tanzania's indeterminate status with respect to regime type. Multi-party

[1] Data from the UNICEF/ World Health Organization Joint Monitoring Programme (`http://www.wssinfo.org/data-estimates/table/`

[2] The World Health Organization estimates that Tanzania loses 27 Disability Adjusted Life Years (DALYs) per 1,000 people each year. Applying this proportion to Tanzania's population of 47.8 million yields 1.29 million life years.

[3] Kramon and Posner (2013) caution that patterns of distribution can vary across public goods, making it difficult to generalize the phenomenon. In other parts of my dissertation I consider government effort with respect to education to get a sense of how well my findings for water travel across sectors.

[4] See Golden and Min (2013) for a comprehensive review.

politics have been legal in the country for over 20 years and elections are held regularly and are increasingly viewed to be free and fair, with candidates at all levels of government respecting term limits and transferring power peacefully. On the other hand, the country's ruling Chama Cha Mapinduzi (CCM) party has maintained a hegemonic position since Tanzania achieved independence in 1961,[5] garnering significant margins of victory in presidential contests and controlling nearly two-thirds of all legislative seats. In light of this, scholars have alternately classified the country as a dominant party democracy (Lindberg and Jones, 2010), a "hybrid" regime (Ekman, 2009), or a stable "competitive authoritarian" government (Levitsky and Way, 2010).

In addition to considering the relevant literature when developing my hypotheses, I also draw on my experience conducting fieldwork in Tanzania over a period of six months (July-December 2013).[6] During that time I not only collected administrative data (including the water point data I test in this paper) but also gathered information through interviews, focus group discussions and observational studies of a range of key actors, including Ministry of Water officials, foreign aid donors, local government politicians and bureaucrats, and rural water users.

2.2 Hypotheses to Test

This paper will test three related hypotheses that reflect different strategies employed by the Tanzanian government to maintain power.

Theories of democratic accountability hold that competitive elections create a relationship of formal accountability between policymakers and citizens, with the latter group using their vote to sanction or reward the former on election day (Ashworth, 2012). This suggests that when competition is absent, elections have considerably less utility as a means of sanctioning or rewarding elected officials. Such a lack of competition characterizes much of Tanzania. Many Tanzanian voters lack credible alternatives to the ruling party and so cannot sanction politicians who fail to deliver clean water. Numerous interviewees that I spoke with as part of my fieldwork suggested that there is more pressure for improving service delivery in areas where the opposition has made inroads. This is thought to stem both from ruling party politicians responding to perceived threats and from opposition politicians who are already in power trying to prove they can do better than the ruling party. This suggests the following:

> *Competition Hypothesis:* Higher levels of electoral competition will generate a greater degree of government effort with respect to water provision.

[5] Tanzania's ruling party at independence was called the Tanganyika African National Union (TANU); in 1977 TANU merged with the ruling party in Zanzibar to form the current CCM party.

[6] In addition to my recent fieldwork experience, I lived in Tanzania from 2006 to 2008, working with a prominent local non-governmental organization in Dar es Salaam.

Diaz-Cayeros, Estevez, and Magaloni (2012) note that in settings characterized by limited political competition, "voters... are forced to support the incumbent party even when it fails to deliver any collective benefits, because they are likely to be punished and removed from the government's spoils system if they defect to the opposition" (p. 235). My fieldwork suggests that a punishment regime may be in effect in at least some parts of Tanzania, with the Tanzanian government withholding resources in areas that vote for the opposition, leading to the following hypothesis:

> *Punishment Hypothesis:* Government effort will be reduced in political units that defect to the opposition.

In addition to punishing voters who defect to the opposition, CCM is thought to disproportionately favor those who stay in the fold. This behavior relates to the concepts of 'core' vs. 'swing' voters, which is one of the most precisely articulated concerns in the literature on distributive politics. Dixit and Londregan (1996) present the basic theoretical model, which predicts that if parties are equally effective in delivering transfers to any group they will target swing voters, whereas if they are more effective in delivering transfers to core supporters they will deliver to core voters (i.e. machine party politics).[7] CCM may be arguably understood as a machine-type party, with the party's longevity attributed in part to its ability to distribute patronage within the its extensive clientele networks (Whitehead, 2012: p. 16). This suggests the following hypothesis:

> *Favoritism Hypothesis:* Ruling party strongholds are favored with higher levels of government effort compared to political units that demonstrate less loyalty.

3 Data

I test the hypotheses presented above by analyzing an extensive new dataset resulting from a recent water point mapping (WPM) exercise conducted by the World Bank and the Tanzanian Ministry of Water.[8] This dataset includes observations of all 74,289 public 'water points'[9] serving rural communities in mainland Tanzania, with information on their

[7] It is important to note that given data limitations, most tests of the swing-core model have examined targeting across swing and core *constituencies* rather than swing and core *voters*. While my analysis is subject to this limitation to an extent, I do consider the distribution of voters within the political units I analyze.

[8] The WPM exercise was completed in February 2013. For more information, see `http://wpm.maji.go.tz/`

[9] Over half of all water points in Tanzania are communal standpipes; the next most common type of water point is the hand pump. Other types of water points include improved springs, dams and cattle troughs.

year of installation, source type, management scheme, functionality status and precise geographical location. It should be noted that the water point mapping exercise covered rural and 'mixed' wards only, reflecting the fact that most of Tanzania's urban dwellers have water piped into their homes or buy water from local vendors rather than relying on communal water points. I use this data to construct proxies for government effort with respect to water provision – looking at how water point coverage varies across Tanzania's Parliamentary constituencies.[10]

I also consider variation at a more finely grained level. This is relevant given Tanzania's decentralized framework for public goods provision, which devolves a significant amount of resources and responsibility for allocation decisions to the district level.[11] District councils are then supposed to allocate resources to projects in specific rural communities within their jurisdiction, based on a combination of need, as demonstrated by current levels of access, and demand, as demonstrated through the bottom-up planning process (African Ministers Council on Water, 2010). District councils are composed of councillors elected from each of the 10-25 wards within a given district.[12] I have data on election outcomes at the ward level, so I can also consider how coverage varies across wards within each district.

My analysis improves significantly upon conventional methods for estimating coverage. Typically, coverage estimates are calculated by taking the number of water points and dividing by the population of the relevant political unit (Parliamentary constituency or ward, in this case). However, such estimates do not take population distribution into account. Hence, there is a risk of under- or over-counting the number of people served by a given water point. As I show in Section 5, this risk is rather severe, with water points tending to be bunched together in certain areas or along the main roads, and hence not distributed well within political units.

In order to avoid the pitfalls associated with conventional methods, I employ the following strategy: first, I use QGIS[13] to draw 400-meter radii[14] around each water point,

[10]In another part of my dissertation, I compare government effort in the water sector with government effort in the education sector. I test a *visibility hypothesis*, where visibility refers to how easy or difficult it is for citizens to assess government competence based on observed outcomes. As Mani and Mukand (2007) explain, differences in visibility arise because the outcomes associated with some public goods are intrinsically harder to directly observe or measure (such as teacher quality compared to school construction). In addition, some public goods are more "complex," in that many factors apart from government competence affect outcomes. Given that water users bear significant responsibility for operations and maintenance of their communal water sources, water may be considered a less 'visible' public good than education.

[11]As of the most recent (2010) election, Tanzania was divided into 142 districts. District boundaries are contiguous with Parliamentary constituencies; each district contains one to two constituencies.

[12]The district council also includes MPs representing constituencies within the district, woman representatives, and other MPs whose nomination originated from organs of political parties within the district council jurisdiction (Venugopal and Yilmaz, 2010).

[13]QGIS (previously known as "Quantum GIS") is the geographic information systems (GIS) application I use for data viewing, editing, and analysis.

[14]This corresponds to the Tanzanian government's official access guideline as articulated in the 2002 National Water Policy.

dissolve the overlapping circles to identify 'catchment areas.' I then and derive an estimate of the number of people residing within all catchment areas of a given ward or Parliamentary constituency (the 'served' population). Next, I calculate the percent served by dividing the 'served' population by total population for each ward and Parliamentary constituency, using high-resolution data on population distributions for Tanzania from the WorldPop database.[15]

To illustrate this technique, consider the Parliamentary constituency of Peramiho in Songea district in Southwestern Tanzania. Peramiho has 731 water points to serve a population of 186,882 people. According to the Ministry of Water's guidelines, one water point can be expected to serve up to 250 people. If we use conventional methods to estimate coverage, Peramiho's coverage rate would therefore be 98% - almost full coverage.[16] However, this estimate assumes the water points are evenly distributed across Peramiho's residents. A closer examination suggests this is not the case.

Figure 2 depicts the distribution of Peramiho's water points. We can see that a number of them are bunched together. In order to avoid overcounting the number of people served by these proximate water points, I draw 400-meter radii around each points and dissolve the overlapping regions to identify catchment areas. Figure 3 illustrates this process for a subset of water points in southeastern Peramiho.

[Figure 2 about here.]

[Figure 3 about here.]

Figure 4 then depicts the catchment areas layered on top of a population 'heat map,' with darker regions representing higher population density. We see that a large number of Peramiho's residents do not in fact live within reasonable distance of the constituency's water points. Rather, only about 11,934 people out of the constiuency's 186,882 residents live inside a catchment area of one of the water points - or only 6.5% of the population.

[Figure 4 about here.]

I will use the technique described above to calculate service rates for all Parliamentary constituencies and wards. I also consider service rates that only consider functional water points (i.e. population living within the catchment area of a functional water point). While maintaining functionality is partly the responsibility of water users, it is not implausible that politicians might contribute more for repairs in areas where they have more of an electoral interest in doing so.

Finally, I look at where new construction is concentrated. Although the WPM data is cross-sectional, providing what is effectively a snapshot of coverage at the time the mapping

[15] For more information, see `http://www.worldpop.org.uk/`

[16] I divide 186,882 residents by 250, then divide 731 into the resulting figure.

exercise was conducted, it includes information on each water point's date of installation. While the data on installation dates is based on water users' recall, local experts with whom I have consulted maintain that it is fairly reliable. I will use this information to create measures of the number of water points in a given constituency/ward as of 2005 and as of 2010 – corresponding to the two most recent elections. This will allow me to create a new variable indicating new construction between 2005 and 2010, as well as a variable indicating new construction since 2010.

4 Empirical Strategy

This section describes the methods I will employ to test the hypotheses outlined in Section 2.

In order to test the *Competition Hypothesis* I will examine whether wards and constituencies that are more electorally competitive, or which have become more competitive between the two most recent elections, benefit from higher levels of coverage. I employ two measures of competition, reflecting the dominant approaches in the literature. These include the incumbent party's margin of victory - where a lower margin indicates a more competitive race - as well as the 'effective number of candidates' (ENC) in a given race. The ENC is calculated by taking the the inverse of the Herfindahl-Hirschman Index (HHI), which accounts for two dimensions of competition: the number of candidates in a race and the distribution of vote shares. The HHI is calculated by squaring each candidate's vote share, and then summing the resulting numbers:

$$HHI = \sum_{i=1}^{n} (s_i)^2$$

where s_i represents the vote share of the ith candidate (out of n candidates in the race). The HHI statistic can range from close to 0 (perfect competition) to 1 (zero competition). In an uncontested race, one candidate would capture 100 percent of the vote, meaning that the HHI statistic of the race would be 1^2, or 1. Conversely, if an infinite number of candidates evenly split the vote, then they would each have nearly 0 percent vote share, producing an HHI statistic of 0 (Malhotra, 2008).

An extension of the *Competition Hypothesis* is that new construction has been concentrated in more competitive wards and constituencies. Related to the notion that improved service delivery is a function of competitive elections, I will also look for evidence of *electoral cycles* – both generally (more water points being built in years just prior to an election), and in more competitive areas.

In order to test the *Punishment Hypothesis* I will look to see if wards/constituencies that turned over to the opposition in 2010 were subsequently disfavored in terms of new

investments. That is, I would expect fewer water points to be built since 2005 in these areas than in wards and constituencies that stayed loyal to the ruling party.

In order to test the *Favoritism Hypothesis*, I will look at whether Parliamentary constituencies and wards that voted for CCM in Tanzania's two most recent (2005 and 2010) elections exhibit higher levels of coverage than those political units that went to an opposition party. Given the limited degree of variation in political party control (78% of all directly elected seats in Parliament went to the ruling party in 2010, as did 84% of all wards), I will conduct a similar analysis with ruling party stronghold defined as political units where ruling party support was in the 50th percentile or higher. I will also test two extensions of the *Favoritism Hypothesis*. The first posits that coverage should be higher in ruling party MPs' home wards; the second that new construction will be concentrated in ruling party strongholds.

In testing all of my hypotheses I will incorporate additional spatial data into my analysis to serve as control variables that might influence water provision and lead to spurious correlation if omitted. These include data on the location of natural water sources and roads.[17] I will also incorporate data on baseline coverage and poverty to see if and how need affects government effort.

5 Preliminary Results

This section presents preliminary results based on an exploratory analysis of water point distribution across Parliamentary constituencies. This analysis covers 183 out of Tanzania's 189 mainland constituencies, reflecting the fact that the mapping exercise did not cover urban areas.

Before looking into the determinants of variation in coverage, it is interesting to consider some general trends. Namely, there is evidence of a substantial discrepancy between traditional coverage estimates and estimates that take population distribution into account - as suggested in the above examination of Peramiho constituency. National coverage, using conventional estimation techniques appears to be 51%.[18] However, if we define catchment areas in the manner described above, we see that only 12.4% of the rural population lives within 400 meters of a public water point. This discrepancy is apparent in the majority of constituencies, as shown in Figure 5.

[Figure 5 about here.]

[17] It seems reasonable to assume that water points may tend to be built along the main roads, which are easier to access by engineers and construction companies.

[18] According to the WorldPop estimates, Tanzania's total population is 42,208,076. In 2002, 86.4% of the population lived in rural or mixed wards; I apply this to percentage to get a total population estimate of 36,472,738, which I then divide by 250. I divide the total number of water points - 74,289 - into the resulting figure for a coverage estimate of 50.9%.

Next, I conduct preliminary tests of my three hypotheses. I find tentative support for the *Competition Hypothesis*, no evidence for the *Punishment Hypothesis*, and suggestive evidence *against* the *Favoritism Hypothesis*.

If we look at the correlates of traditional coverage estimates, we see that higher levels of coverage are associated with *lower* levels of competition - whether measured by the effective number of candidates or the incumbent's margin of victory. This is depicted in the scatterplots in Figure 6. We see that by either measure, coverage appears to be higher in *less* competitive areas.

[Figure 6 about here.]

However, if we examine the correlates of coverage estimates that take population distribution into account (from now on, 'percent served') we find the opposite pattern, as shown in Figure 7. Now, it appears that more competitive districts have higher levels of service.

[Figure 7 about here.]

I also find suggestive evidence of electoral cycles. Figure 8 depicts construction by year for the multiparty era. There appear to be spikes close to a number of election years (especially 1995, 2000, and 2010). However, it should be noted that since the year of construction is based on water users' recall, round numbers ending in 5 or 0 may simply be more likely to be given.

[Figure 8 about here.]

I do not find that constituencies which have become more competitive between the 2005 and 2010 elections have been targeted with new construction (as measured by the change in number of water points constructed as of 2005, with the number constructed as of 2010).

Moving on to the *Punishment Hypothesis*, I find no evidence to suggest that constituencies that turned over to the opposition in 2010 were subsequently disfavored in terms of new investments. This may be due to the limitations of my data to test this hypothesis, since the vast majority of the water points in the sample (96%) were constructed prior to 2010.

Finally, I find suggestive evidence *against* the *Favoritism Hypothesis*. Whether support for the ruling party is measured in terms of a constituency having elected a ruling party MP, or the share of voters in a given constituency that voted for the ruling party candidate for President in 2010, ruling party strongholds appear to have *lower* levels of service, as depicted in Figure 9.

[Figure 9 about here.]

6 Next Steps

Given the preliminary nature of the analysis presented on the preceding pages, I have identified a number of next steps, corresponding to the empirical strategy outlined in Section 4. The first will be to expand my analysis to cover variation across wards. I will then introduce relevant control variables into my analysis to see if the relationships that hold in the pairwise correlations are robust to the inclusion of other potential predictors of water point distribution. I may also extend my time series by bringing in information from the 2000 elections. This might allow for a better test of the *Punishment Hypothesis*, since, as noted above, the vast majority of water points in the WPM database were constructed prior to 2010. There is much more movement between 2005 and 2010, however - with 13,605 water points, or 18% of the sample, being constructed during that period.

Beyond fleshing out my analysis of the Tanzanian water point data, I may consider conducting similar analyses for other African countries that have recently completed water point mapping exercises and made the data publicly available. These include Liberia, Sierra Leone, and Uganda. Like Tanzania, all three of these countries have experienced features of both democracy and autocracy in recent years, making it interesting to see whether and how politics have played a role in determining government effort with respect to water provision.

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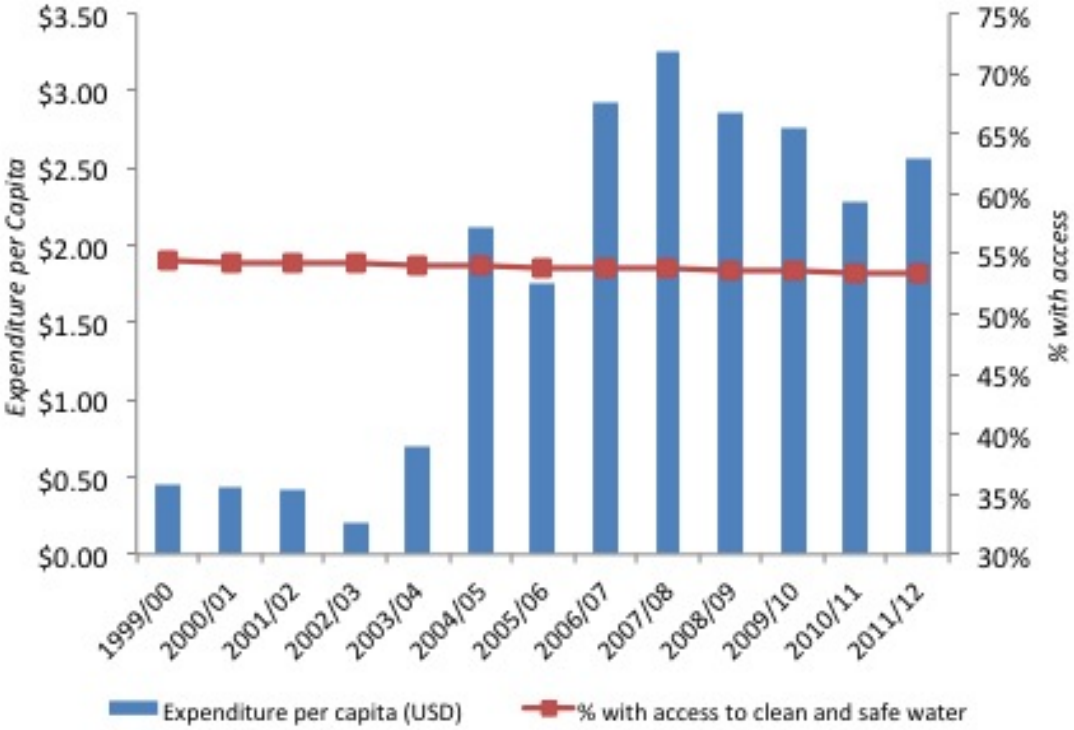
Figure 1: Spending on Water vs. Access



Note: Budget data from the Tanzania Public Expenditure Review (PER) of the Water Sector, 2009; Tanzania PER 2010; 2013 ODI Rapid Budget Analysis of the Water Sector in Tanzania; National Accounts of Tanzania Mainland 2011. Access data from the World Health Organization/UNICEF Joint Monitoring Programme

Figure 2: Water Points in Peramiho Constituency

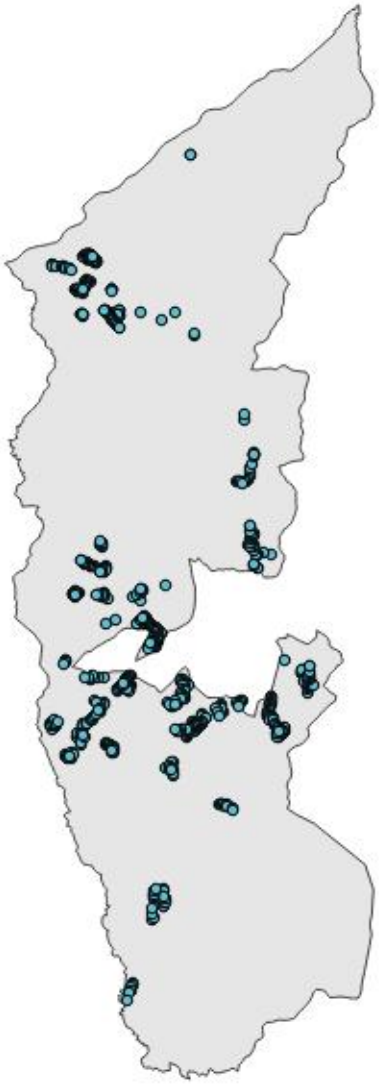
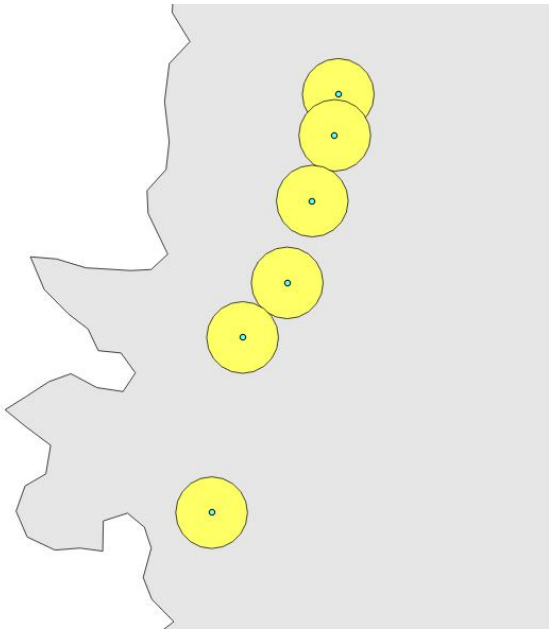
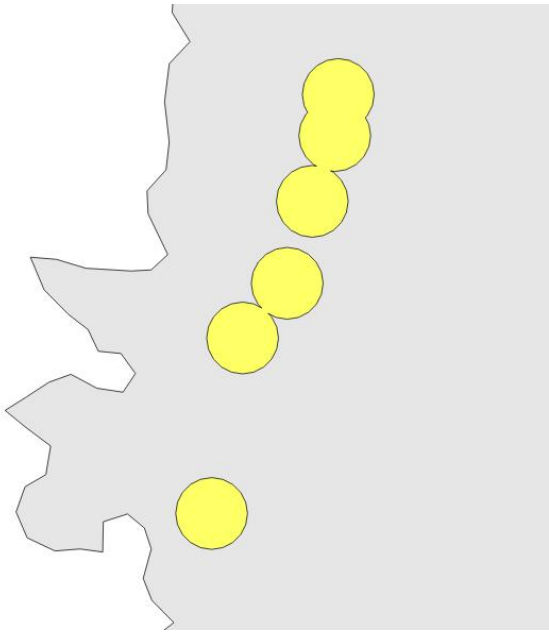


Figure 3: Defining Catchment Areas



(a) Water Points with 400-meter buffers



(b) Catchment Areas

Figure 4: Catchment Areas and Population Distribution, Peramiho Constituency

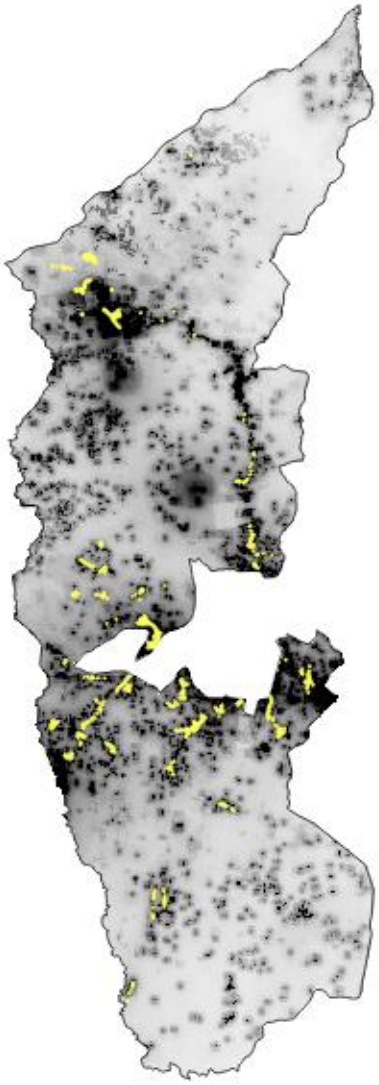
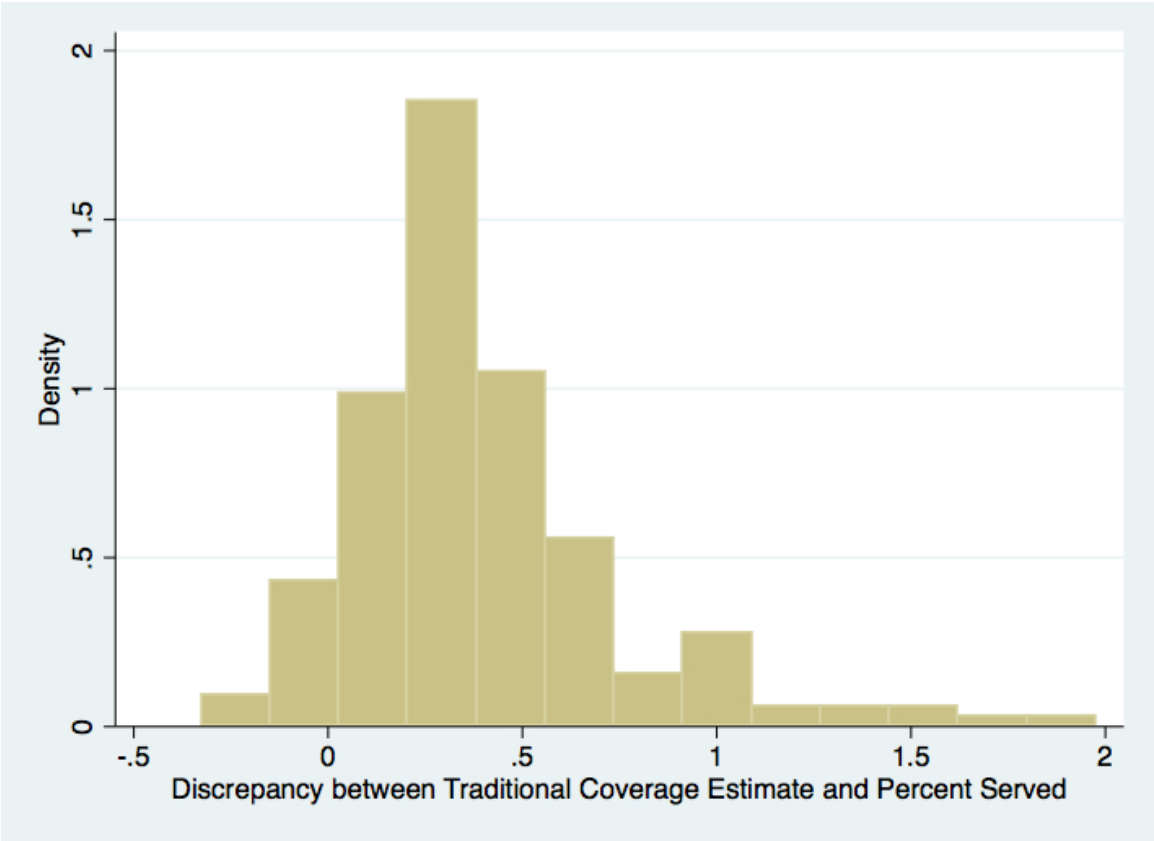


Figure 5


Density
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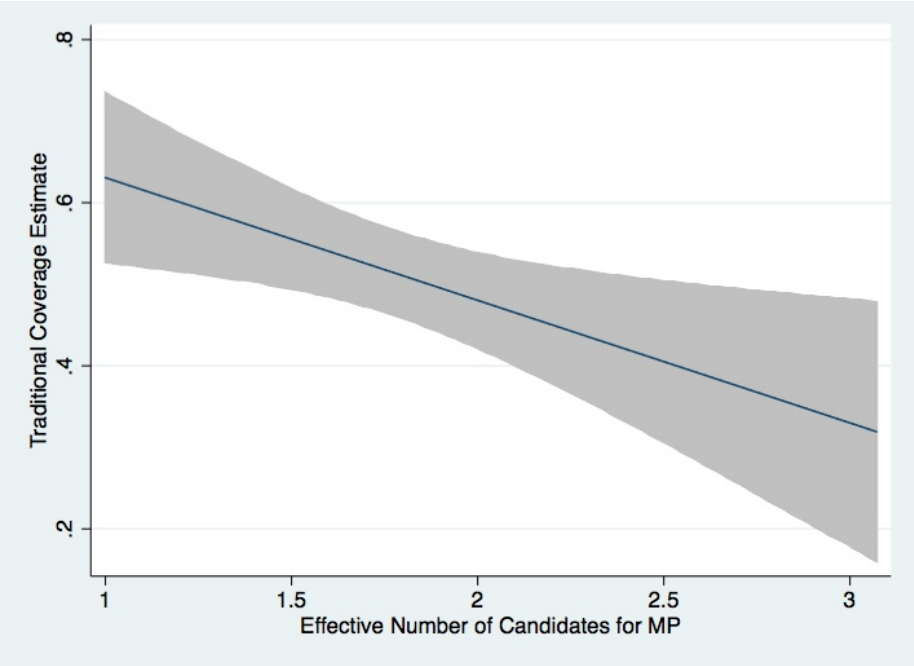
Discrepancy between Traditional Coverage Estimate and Percent Served

Figure 6: Traditional Estimates of Coverage and Competition



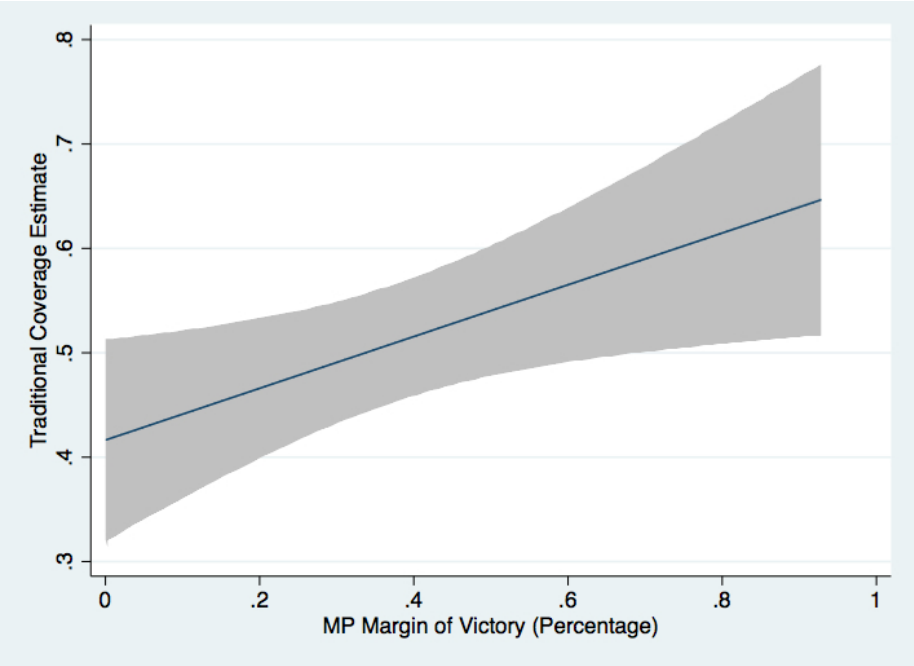
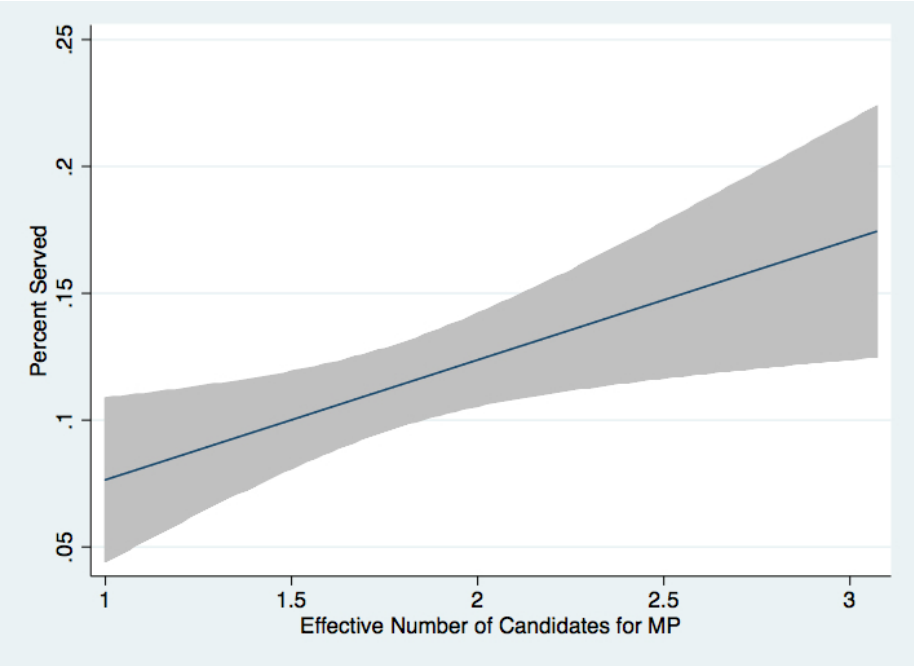


Figure 7: Percent Served and Competition



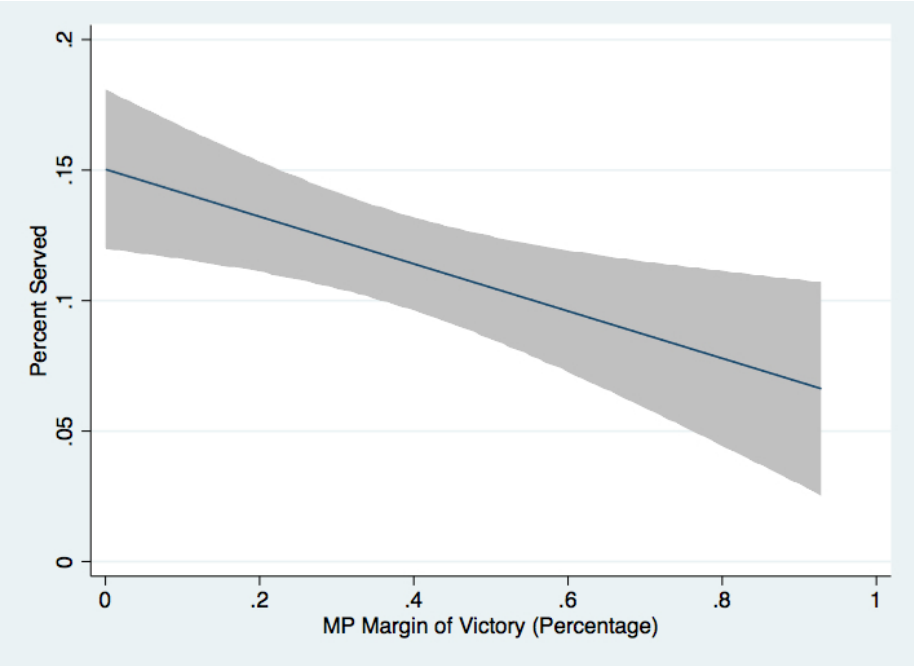


Figure 8: Water Point Construction by Year

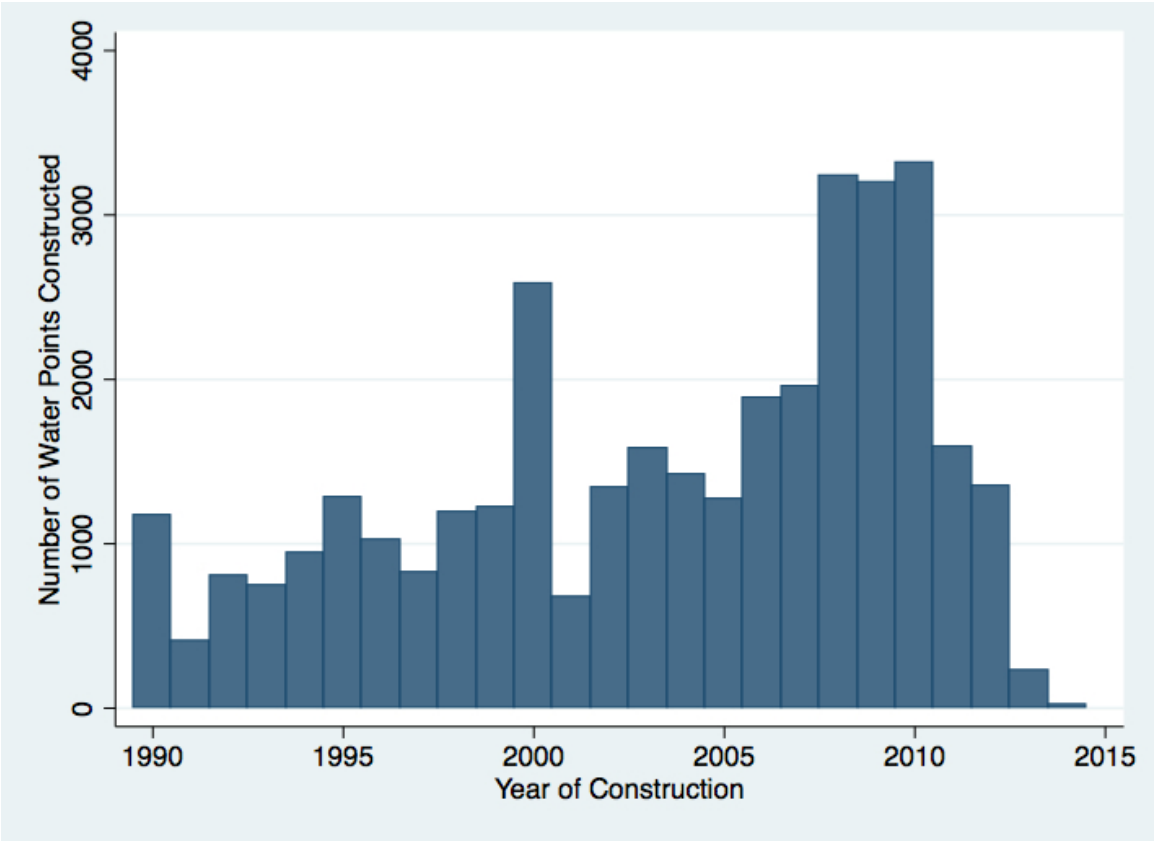


Figure 9: Percent Served and Ruling Party Strongholds