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April, 2013

# Sitting on the fence: Pork-barrels and democratization under threat of conflict.

The case of Ghana, 1996 - 2004\*

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April 29, 2013

## Abstract

This paper studies political competition in the case of a democratization process. We present an illustrative model describing political competition when the opposition threatens the stability of the country. In some cases, our model predicts the government should invest in opposition districts to avoid political agitation. This contrasts with existing literature on established democracies, where public funds usually target ruling party supporters or electorally tight districts.

We empirically observe the first democratic changeover in Ghana in 2000. Implementing a diff-in-diff strategy, we find that districts with a leading political party member appear to receive slightly more public funds when their party is not in charge. This phenomenon is found in urban areas and in areas that vote the most for this leading member's party. Hence it occurs in places with the potential for political agitation.

Keywords: Public goods, Elections, Politics, Ghana.

JEL classification codes: D72, O55, R53.

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# 1 Introduction

A growing number of African countries have held elections since the 1990s, with varying levels of transparency. Governments' political motivations in imperfect democracies may be more complex than in fully accomplished democracies or full dictatorships.

In fully accomplished democracies, a government seeking re-election probably has partially inefficient incentives. It has incentives to target two groups of people in theory:<sup>1</sup> the incumbent government's "core support" group, and/or the "swing voters". Theoretically, Dixit and Londregan (1996) show the first outcome occurs when the government is more efficient at providing public funds to its "core support" group. Many papers identify such a mechanism on a geographical basis: governments of developed countries (e.g. Levitt and Snyder, 1995 and Joanis, 2011) and developing countries (Diaz-Cayeros, 2008; Schady, 2000; Moser, 2008; Case, 2001) are found to invest more in their core support regions.

Dixit and Londregan (1996) argue that the government targets "swing voters" when other voters have strong preferences for one of the political parties: public funds target voters who might vote for either party. Levitt and Snyder (1997) present a version of the swing voter model for indirect elections. Indeed, MPs may make more of an effort in districts where electoral competition is tight, such that government spending is higher in these districts. A number of empirical papers have found the governments invest more in electorally tight districts (like Dahlberg and Johansson, 2002; Diaz-Cayeros, 2008; Cole, 2009 and Banful, 2010 respectively in Sweden, USA, India and Ghana).

This literature provides relevant insights into political life in established democracies. However, most African countries have much weaker political institutions. In these countries, (at least) two other considerations may emerge.

Firstly, electoral fraud is plausible. The literature shows this is possible in African countries (Collier and Vicente, 2012) and in particular in Ghana (Ichino and Schündeln, 2012). This is not, however, the focus of our paper.

Secondly, when a democracy might conceivably be broken up, a government's behavior is likely to be affected by this threat. Two recent books emphasize that democratization is driven by balances of power among different social groups. Acemoglu and Robinson (2006) explain that democracy is preferred by the majority of citizens, but opposed by elites. Democracy is a way for the elite to peacefully commit to redistribution to the poor. North et al. (2009a,

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<sup>1</sup>Earlier theoretical studies (including Downs, 1957 and Bowen, 1943) are summarized and extended by Dixit and Londregan (1996).

2009b) focus on competition within the elite. In their framework, the organization of the relationship among elite groups competing for leadership is meant to avoid violence. So the rights of the elites depend on their military power. North et al. (2009a) theorize that the transition to an “open-access order” (concept close to full democracy) is consistent with this, and corresponds to the will of the elites. For example, institutional development is a way to secure the rights of some elite groups threatened by competition with the rest of the elite.

These frameworks point up that conflict management is a crucial aspect of the democratization process. Dictatorship and rebellion are potential alternatives for the incumbent government and its opponent(s) at this stage. A common feature of the framework proposed by North and his co-authors and by the dictatorial political economic models (Esteban and Sákovics, 2008; Hirshleifer, 2001; Azam, 2006) is that balances of power between elite groups are central to understanding economic outcomes.

Ellman and Wantchekon (2000) model the consequences of these balances of power in a democracy. They model electoral competition with a threat of unrest from the “strong” party. This party prefers social unrest to democracy if the political platform implemented after the elections is too far removed from its ideological preferences. Hence electoral platforms are sometimes biased towards the “strong” party’s preferences in order to avoid social unrest.

In this paper, we develop an illustrative model of electoral and non-electoral competition between an incumbent government and the opposition whereby the opposition can threaten the stability of the country. Similarly to Ellman and Wantchekon (2000), the political platforms are biased towards the party threatening democracy. In our model, we assume instability is credible when opposition leaders’ districts have a strong preference for the opposition. Consequently, the government can discourage social unrest by pork-barreling in the opposition leaders’ districts. The result is that the government’s platform favors the opposition districts.

We use the first democratic changeover in Ghana in 2000 to observe the political mechanisms described in our model. First, we predict the government may invest more than the opposition would invest in the opposition leaders’ districts. Second, this should be especially true when the threat of a coup is credible, i.e. when these districts radically prefer the opponent. We find that political party leaders’ districts apparently receive more public funds when their party is not in charge. This is true especially when district preferences are strongly biased towards this party, and also in urban areas. Both kinds of district probably have a greater likelihood of political agitation.

This paper is structured as follows. In section 2, the Ghanaian political environment is

presented. The theoretical model is described in section 3. Sections 4 and 5 present the data and empirical strategy, while section 6 gives concluding remarks.

## 2 Ghana's Political History

At the end of the 20th century, Ghana was an emerging democracy. Regular presidential and general elections were held, even though former dictator Jerry Rawlings was still in charge. Ghana had moreover seen political instability prior to Jerry Rawlings' rule, so the threat of political instability was credible.

Ghana gained independence in 1957 before embarking upon a period of alternating dictatorships and democracies through to 1992. Between 1966 and 1981, Ghana was particularly unstable with six different coups occurring during this period alone. The Ghanaian economy was strongly affected by this instability.

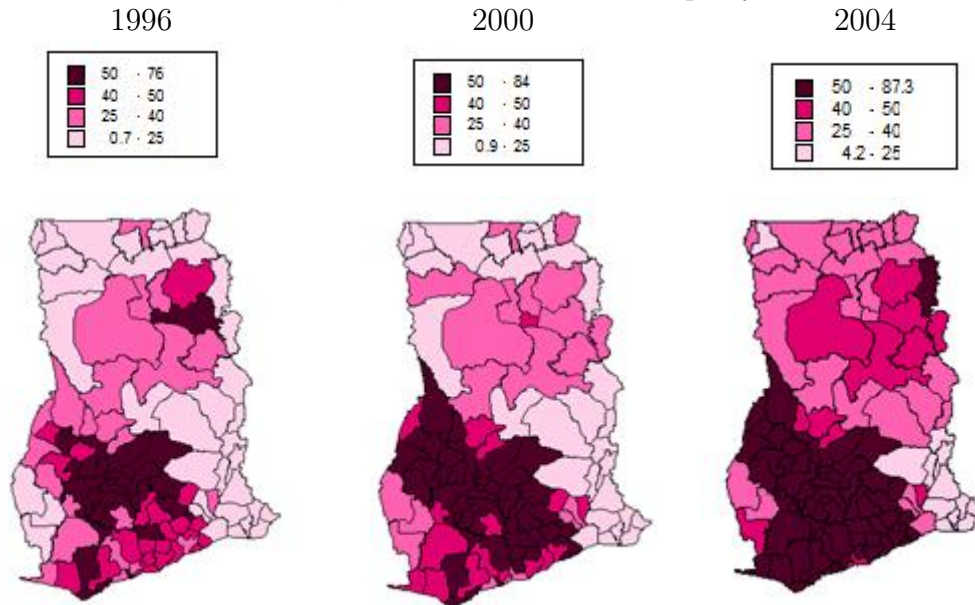
The foremost political leader of Ghana in recent times is Jerry Rawlings, who led a coup and took power when he was Flight Lieutenant in 1981. Rawlings' government made the country's economic stability a priority right from the beginning of the 1980s. Since 1984, Rawlings' government and successors have posted stable growth.

Under both international and domestic pressure, Rawlings' government ushered in democracy with the first parliamentary and presidential elections in 1992. Rawlings stood for his own succession as candidate for the National Democratic Congress (NDC). One candidate represented the right wing, on behalf of the New Patriotic Party (NPP). Three candidates represented the Nkrumah tradition (left wing). However, Rawlings successfully moved into their traditional political arena: like Kwame Nkrumah, Rawlings was a charismatic leader and presented a populist platform (see Morrison, 2004).

Presidential and parliamentary elections have been held every four years since 1992. Both elections are held simultaneously at the end of the calendar year. The president is appointed in January of the following year. The presidential elections are direct. The general elections are by constituency.

The NDC (left wing) and the NPP (right wing) have been the two main political parties in Ghana since 1992. Each of these parties has its ethnic leanings. The NPP is largely supported by the Ashanti and has its geographic strongholds in the Ashanti region. Conversely, the Volta region is inhabited by Ewe, Rawlings' ethnic group, and is the stronghold of the NDC. The poorest Northern regions also tend to vote for the NDC (see Bossuroy, 2008). These geographic patterns have been constant since 1992 (see Figure 1).

Figure 1: Presidential elections, % of votes for the NPP party in 1996, 2000 and 2004



Sources: Official election results, authors' calculations

In 1996, the NDC won both the presidential (Jerry Rawlings) and parliamentary elections.

Yet the 2000 elections were very different. First, Jerry Rawlings was constitutionally prevented from running for a third presidential term. He is one of the rare African presidents to have honored this constitutional obligation. Instead, the NDC candidate was John Atta Mills, who was seen as less charismatic and was less well-known at the time. In addition, the NDC's campaign was perceived by some as arrogant and the economic situation had taken a downturn (Boafo-Arthur, 2008). The elections were won by John Kufuor for the NPP, which also won the parliamentary elections.

In 2004, the NPP (led by Kufuor) won the presidential and parliamentary elections, but their electoral mandate remained fragile. The second democratic shift in Ghanaian history took place in 2008. John Atta Mills (NDC) won the presidential elections with 50.23% in the second round, and the NDC took 114 of the 228 seats (107 for the NPP).<sup>2</sup> In 2012, John Atta Mills died and John Mahama (NDC) won the elections with 50.7%.<sup>3</sup>

<sup>2</sup>Nana Akufo-Addo was the NPP's presidential candidate.

<sup>3</sup>Nana Akufo-Addo (NPP) lost with 47.7%.

### 3 A model of political competition with the threat of coups

Theoretical and empirical political models usually assert that, in a democratic environment, the incumbent government will be inclined to reward its districts with preferential public transfers. In this section, we present a model describing the contrary: in some cases, the government invests more in the opposition leaders' districts in order to avoid coups.

Our model describes the behavior of an incumbent government  $I$  competing with its challenger  $C$  for power. Both compete for power with the threat of coups. The threat represented by the opposition may take various forms: demonstrations, political violence, etc. To simplify, we model them all as coups.

There are two techniques for the transmission of power (elections and coups d'état) and two groups of people in the country (people living in the pro-incumbent districts,  $P_I$ , and those living in the pro-challenger districts,  $P_C$ ). The challenger needs a moderate preference from the whole population in order to win the democratic game. Yet when the challenger's districts prefer him/her very strongly, these districts may want to engage in conflict against the government. So the challenger needs a radical preference among his/her districts to win a coup. This gives the president an incentive to swing the preferences of opposition districts away from the opposition using targeted funds, so as to mitigate the probability of an attempted coup.

#### 3.1 The model

The timing of the game is as follows:

1. The incumbent and the challenger make electoral promises to districts  $P_I$  and/or  $P_C$ , with full commitment. The budget is normalized to 1. We call  $x_I$  and  $x_C$  the amount promised respectively by players  $I$  and  $C$  to  $P_I$ . Hence they promise  $1 - x_I$  and  $1 - x_C$  to  $P_C$ .
2. The challenger chooses whether it will lead a coup or not. If it leads a coup, elections are canceled.
3. The option chosen by the challenger (elections or coup attempt) takes place.



## Elections

When elections are held, the expected numbers of votes for the incumbent in  $P_I$  and  $P_C$  are respectively  $E_{PI}$  and  $E_{PC}$ :

$$\begin{aligned} E_{PI} &= S_{PI} + \mu_I \sqrt{x_I} - \sqrt{x_C} \\ E_{PC} &= S_{PC} + \sqrt{1 - x_I} - \mu_C \sqrt{1 - x_C} \end{aligned} \quad (1)$$

Districts  $P_I$  and  $P_C$  are characterized by their ideological preference for player  $I$  (relative to  $C$ ),  $S_{PI}$  and  $S_{PC}$ . In addition to ideological preferences, the election result is a function of electoral promises.  $x_I$  and  $x_C$ , the promises of  $I$  and  $C$ , change the expected number of votes in  $P_I$  through the functions  $\mu_I \sqrt{x_I}$  and  $\sqrt{x_C}$ : there are decreasing returns to promises.  $I$ 's promises are more efficient for his/her districts, with  $\mu_I > 1$ .<sup>4</sup> Symmetrically, investments  $1 - x_I$  and  $1 - x_C$  in districts  $P_C$  have decreasing returns, and  $\mu_C > 1$ .

The incumbent's probability of winning the election is a function of the sum of the total number of votes:

$$\Psi = F(E_{PI} + E_{PC}) \quad (2)$$

$F$  is a cumulative distribution function, and can be micro-founded by probabilistic voting models: the probability of  $I$  winning the election increases with the argument of  $F$ . We assume  $F$  is weakly concave over its support. When density functions have a single mode, the cumulative distribution is concave on the right-hand side of this mode. This would mean the probability of  $I$  winning is always above the probability at the mode. This broadly means that the incumbent is always the most likely to win, which seems intuitive in an African context.<sup>5</sup>

## Coups

When there is a coup attempt, we assume the probabilities of victory are a function of the number of radical opponents in the challengers' districts  $P_C$ , which is a function of  $E_{PC}$ . The probability that the government will win a coup is then:

$$\Phi = F[\beta(E_{PC} + \alpha)] \quad (3)$$

We assume equations (2) and (3) have the same functional form  $F$ . This ensures the

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<sup>4</sup>Which is not that different from Dixit and Londregan (1996).

<sup>5</sup>This simplifies the solution of the mixed strategy equilibrium.

model has a closed form solution. Coefficients  $\alpha$  and  $\beta$  make this assumption less restrictive.  $\alpha$  can be interpreted as the relative efficiency of the incumbent's military technology and  $\beta$  is the effect of group  $P_C$ 's preferences on the probability of winning coups. We assume  $\beta > 1$ , which implies that  $\Phi$  is more elastic than  $\Psi$  to the number of votes in group  $P_C$ ,  $E_{P_C}$ . Given that the result of coup attempts only depends on  $P_C$ , while elections depend on both groups, this assumption seems reasonable.

## Payoffs

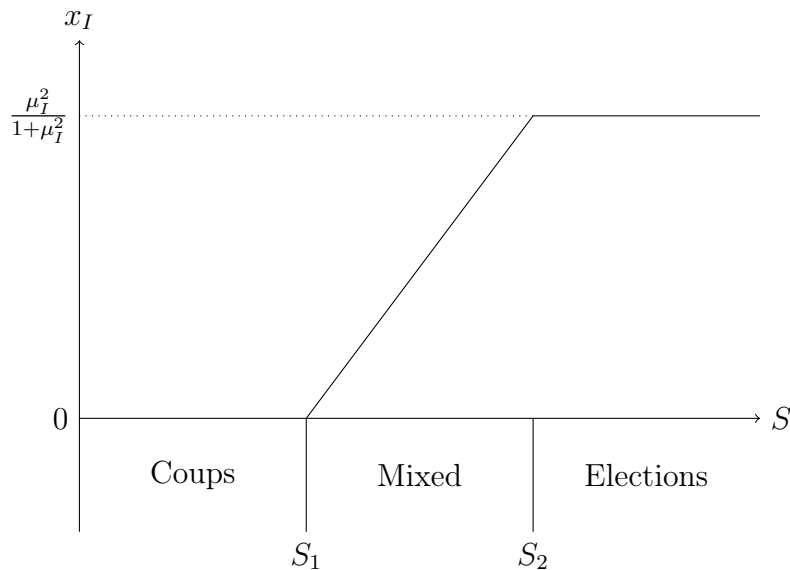
The utilities are the same for coups and elections: 1 for the winner, and 0 for the loser. The payoff is therefore the expected probability of winning: for the incumbent,  $\Psi$  in elections,  $\Phi$  in coups. For the challenger, the payoffs are respectively  $1 - \Psi$  and  $1 - \Phi$ . When elections are held, the payoff for the government is  $\Psi$  and the payoff for the opposition is  $1 - \Psi$ . When there is a coup attempt, the payoffs are respectively  $\Phi$  and  $1 - \Phi$ . This emphasizes that elections and coup attempts are exclusive: when there is a coup attempt, the challenger cannot participate in elections; and when the coup fails, the incumbent always wins.

## 3.2 Solution

The model is solved by backward induction. In the main body of the paper, we only give a simple idea of the solution of the model. We show in appendix A.1 that the main variable describing the problem is  $S = -S_{PI} + (\beta - 1)S_{PC} + \beta\alpha$ , which parameterizes the relative initial advantage of the incumbent in coups. This is symmetrically the relative initial advantage of the challenger in elections.

We show in appendix A.2 that, when  $S$  is lower than  $S_1 = -(\beta - 1) - \sqrt{1 + \mu_C^2} + \beta\mu_C$ , there is a pure strategy equilibrium.  $C$  prefers coups at stage 2, irrespective of the strategy of  $I$ , so both players anticipate a coup. They choose their optimal investment for a coup:  $x_I = x_C = 0$ . Similarly, when  $S$  is greater than  $S_2 = \frac{-\beta}{\sqrt{1 + \mu_I^2}} + \sqrt{1 + \mu_I^2} - \sqrt{1 + \mu_I^2} + \beta\mu_C > S_1$ , there is a pure strategy equilibrium.  $C$  prefers elections at stage 2, irrespective of the strategy of  $I$ , so both players anticipate that elections will be held. They choose their optimal investment for elections:  $x_I = \frac{\mu_I^2}{1 + \mu_I^2}$ ,  $x_C = \frac{1}{1 + \mu_C^2}$ .

When  $S \in [S_1, S_2]$ , there is a mixed strategy equilibrium at stage 1. In this equilibrium, the challenger is indifferent between playing  $x_C = 0$  - considering attempting a coup at stage 2 - and playing  $x_C = \frac{1}{1 + \mu_B^2}$  - considering going to the polls at stage 2. Symmetrically, (at least) when  $F$  is concave, the government plays a pure strategy, pooling the risks between having the opposition playing  $x_C = 0$  (and subsequently trying a coup) and  $x_C = \frac{1}{1 + \mu_I^2}$  (and

Figure 2: Incumbent's investments at equilibrium ( $x_I$ )

$S$ : relative ability of the opponent in elections  
 $x_I$ : amount promised by the incumbent to his districts  $P_I$

subsequently going to the polls). In this situation,  $I$  therefore plays  $x_I$  which is midway between the optimum for coups,  $x_I = 0$ , and the optimum for elections,  $x_I = \frac{\mu_I^2}{1+\mu_I^2}$ . We depict the situation in Figure 2.

## Summary

This model presents a simple game between incumbent and challenger, with electoral and non-electoral competition. In the electoral game, both players spend more with their supporters. In the non-electoral game, the incumbent spends in the challenger's districts. Indeed, s/he wants to avoid the challenger having extreme supporters willing to rebel in his/her districts. Lastly, challenger participation in elections may be uncertain in some democracies. In this case, the incumbent spends more in the challenger's districts than in a full democracy. In some cases, s/he may even spend more in the challenger's districts than in his/her own districts. This is the most likely when the challenger's districts have a strong ideological preference for the opposition.

In what follows, we empirically test our framework in the case of Ghana at the end of the 1990s. Analyzing the first democratic changeover in Ghana in 2000, we find that both governments tended to invest relatively more in the leading opposition leader's districts. This is true only when these districts appeared to display strong support for the opposition. The intensity of support for the opposition is measured by the gap in the number of votes for the opposition party at the previous election. We observe, therefore, that when these districts led by opposition leaders massively voted for the opposition party, they received more public

Figure 3: National elections and national household surveys in Ghana between 1996 and 2004

	1996	1997	1998	1999	2000	2001	2002	2003
<b>Election</b>								
	<b>NDC</b>				<b>NPP</b>			
<b>Surveys and census</b>			<b>GLSS</b>		<b>Census</b>			<b>CWIQ</b>

funds than other districts.

## 4 Data

Our dependent variables compare public fund allocations between Ghanaian districts. We use two proxies for this, drawn from different sources. First, the change in infrastructure availability and the share of civil servants are drawn from national household surveys and census data. Second, external funding of district assemblies (DA hereafter) is taken from panel data on Ghanaian local government public finances (DA accounts).

### Treatment of information from national household surveys and census data

National household surveys and census data are aggregated at district level: GLSS4 (1998), the 2000 national individual<sup>6</sup> and facility census, and the 2003 CWIQ survey. These surveys are representative at district level, with the exception of GLSS4. Their sample sizes are given in Appendix B.1. Figure 3 presents an overview of the timing of the national surveys used and the dates of the national elections.

Our dependant variables measure the availability of public goods and the share of civil servants in each Ghanaian district. We measure these public good variables at district\*urban/rural level, splitting each sample district into two separate geographic entities.<sup>7</sup> The public good variables are chosen in keeping with the public policies implemented in Ghana from the late 1990s to the early 2000s (this choice is obviously constrained by data availability). At the time, Ghanaian development policies were concentrating on public education and health infrastructure as well as road infrastructure, energy supply and improving the water supply (National Development Planning Commission, 1997, and Ministry of Finance, 2000). We use six dependent variables for these Ghanaian policy tracks: primary school, upper secondary school, health centers, electricity, water, and the number of civil servants. We are aware that

<sup>6</sup>We actually use a 10% extract from this census.

<sup>7</sup>Some of these entities are empty, because some districts are totally rural or urban.

the share of civil servants cannot generally be considered as a public good; and that this is particularly true in the case of pork-barreling. However, for the sake of simplicity, we call our variables “public good variables” throughout the paper.<sup>8</sup>

The public good variables are defined and computed as follows. The share of the population with access to electricity, the share of the population with access to tap water and the share of civil servants are drawn from the survey and census household and individual data (denoted “individual variables” hereafter). They are computed separately for rural and urban areas. The shares of the population with access to a primary school, secondary school and health center are taken from the community sections of the surveys and from the 2000 facility census (denoted “community variables” hereafter). These variables are computed for rural areas only as the GLSS4 survey provides this information solely at this geographical level. For the “community variables”, we define “having access to a public good” as being able to reach it within a radius of 2 km based on GLSS4 and Census data. Unfortunately, the 2003 CWIQ survey does not provide this information. In this survey, “having access to a public good” is defined as living in a community where 50% of the population answered that the facility is at most 30 minutes away by foot.

Given that the GLSS4 survey is not representative at district level, the change in “community variables” between 1998 and 2000 is obtained from matching GLSS4 communities with localities in the national facility census.<sup>9</sup> This enables us to eliminate the effect of sampling differences between surveys. Unfortunately, we could not do the same for the “individual variables”, as the individual census data do not include any locality information. Locality information is not available either in the 2003 CWIQ survey either.

We examine survey and census data comparability. The cross-survey comparability of the public good variables is checked by two descriptive statistics: their variability over the years and correlations between surveys. These statistics are given in Appendix B.3 (Tables B.1 and B.2). They show that the national level is stable or smoothly increasing over time, suggesting no sign of measurement differences between surveys. However, the correlation of district averages across surveys is rather low (around 60% in most cases). This probably means that the measurement errors are quite strong in some surveys. We discuss whether this is a problem for our estimations in the “identification issues” section.

In the paper’s main regressions, the public good variables are pooled. For comparability across public good variables, the public good variables are standardized within each

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<sup>8</sup>Nevertheless, in rural areas, more than 60% of civil servants work in health and education (source: 2000 Population Census).

<sup>9</sup>The match is based on locality name and enumeration area number

type of good times date.<sup>10</sup> In addition, we balance the panel: we make the type of public good\*district\*urban/rural available for each year. We end up with 95 rural districts and 58 urban districts.<sup>11</sup>

The paper also takes control variables from national household data and from the population census. Education, the quality of the household's dwelling, and the ethnic and religious structure of each district's urban and rural areas are computed from the GLSS4 household survey. The share of urban population and the share of Ashanti are from the census. They do not vary over time. All this information is aggregated at rural/urban times district level. Appendix B presents the definition of each variable in detail and gives descriptive statistics.

#### **D.A. Accounts**

We also use the DA public finance data gathered by Mogues and Benin (2012). These data include annual information on district assembly revenues and expenditures from 1994 to 2004. DA revenues come from a number of internal sources (including land taxes, fees and fines, rental income and investment income) and external sources. We use mainly total DA revenues from external sources from 1999 to 2002 as an outcome variable.<sup>12</sup> These revenues from external sources include salary transfers from central government, and various central government and donor funds.<sup>13</sup> They represent, on average, 75% to 85% of total district assembly revenues.

#### **Elections and political leaders**

The election results for the 1996, 2000 and 2004 presidential elections are aggregated at district level.<sup>14</sup>

Lastly, we take two variables to single out districts with influential political figures. We draw up a list of Ghanaian former ministers at the end of the 1990s and the beginning of the 2000s.<sup>15</sup> We take the names of each minister in Kufuor's government from 2001 to 2005 and the names of each minister in Rawlings' government from 1993 to 2000. The 1996

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<sup>10</sup>Transformed by a linear function to have a mean of 0 and a standard deviation of 1.

<sup>11</sup>Of a total of 110 Ghanaian districts, two are strictly urban and four exclusively rural.

<sup>12</sup>We use solely the data from 1999 to 2002 for consistency with the public good variables observed between 1998 and 2002, and to focus on the democratic changeover at the end of 2000. The results are very similar to the information from 1997 to 2002. As the information on 2003 and 2004 is presented differently to previous years in the original data, we choose to exclude it to avoid any related comparability issue.

<sup>13</sup>External revenues are not disaggregated by source except for 2003 and 2004, when donor funds represent an average 10% of external sources.

<sup>14</sup>Parliamentary and presidential elections are held at the same time in Ghana. Given that both results are closely correlated, this paper focuses on the presidential election outcomes. Parliamentary constituencies are nested in the 2000 districts.

<sup>15</sup>This list is taken from Wikipedia and may not be complete.

parliamentary election results provide information on whether they were elected and, if so, in which district. Fifteen of the 37 Kufuor ministers were candidates in the 1996 parliamentary election. Eight of the corresponding 15 districts were urban (proportion of urban population greater than 50%) and six of these were regional capitals. We also single out the districts in which the 1996 MP candidates were ministers prior to 2000, under NDC rule. Seventeen of the 39 Rawlings ministers were candidates. Only five of the corresponding 17 districts were urban and two of these were regional capitals.

## 5 Empirical strategy and identification

Our illustrative model shows that, under the threat of a coup, the government may be prompted to invest more in opposition leaders' districts. In the empirical section, we test precisely the following predictions:

- Governments may spend more than their opponents in opposition districts.
- This is especially true when opposition leaders' districts have previously voted massively for the opposition.

A district is considered as a party A leader's district whenever a 1996 general election candidate was minister during party A's rule.<sup>16</sup> The corresponding dummy variables are denoted "has an NPP leader" and "has an NDC leader" hereafter. Districts with no minister are considered as neutral.

We test this on the basis of the Ghanaian democratic changeover in 2000. The empirical methodology to test the first prediction is based on a double difference: between leading party members' districts and neutral districts, and between NDC rule (before 2000) and NPP rule (after 2000).

We use the two proxies for public spending allocation presented in section 4: pooled household surveys aggregated at the urban/rural times district level, and external funds received by DA. This gives rise to model (4/5):

$$G_{g,d,t} = \rho_t^g G_{d,t-1}^g + P_d^A \delta_{t1} \beta_1 + P_d^A \beta_2 + \nu_t^g + \epsilon_{d,t}^g \quad (4)$$

$$EF_{d,t} = P_d^A \delta_{t1} \beta_1 + P_d^A \beta_2 + \nu_t + \epsilon_{d,t} \quad (5)$$

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<sup>16</sup>We consider only ministers during the 1993-2005 period.

In equation (4),  $G_{g,d,t}$  reflects public good  $g$  in district  $d$  at date  $t$ .  $t$  refers to the observation year: 2000 and 2003 with household surveys. It is a function of its lag  $G_{d,t-1}^g$ ,  $t - 1$  refers respectively to 1998 and 2000. The slope  $\rho_t^g$  varies across goods and dates.

In equation (5),  $EF_{d,t}$  is the log of the income from external funds for district  $d$  at date  $t$ .  $t$  refers to the observation year, between 1999 and 2002. We therefore have four observations by district. Given that  $EF_{d,t}$  is a flow rather than a stock, we do not control for  $EF_{d,t-1}$ .

$P_d^A$ ,  $A \in \{NPP, NDC\}$  are two dummies taking value 1 when district  $d$  has a leading party member  $A$ .  $\delta_{t1}$  is a dummy for period 1 (NDC ruling). Hence the coefficients in  $\beta_1$  measure a double difference coefficient: they measure the difference between the dynamics of our indicators between NPP (and NDC) districts and between period 1 (NDC) and period 2 (NPP).  $\nu_t^g$  are indicator times date fixed-effects and  $\nu_t$  are date fixed-effects.

The second prediction is that the coefficients in our model are stronger in NPP districts with radical electoral preferences for the NPP (and NDC districts with radical electoral preferences for the NDC). This is tested in model (6/7):

$$G_{d,t}^g = \rho_t^g G_{d,t-1}^g + P_d^A S_d^A \delta_{t1} \beta_{1a} + P_d^A \bar{S}_d^A \delta_{t1} \beta_{1b} + P_d^A \beta_2 + S_d^A \delta_{t1} \beta_3 + S_d^A \beta_4 + \nu_t^g + \epsilon_{d,t}^g \quad (6)$$

$$EF_{d,t} = P_d^A S_d^A \delta_{t1} \beta_{1a} + P_d^A \bar{S}_d^A \delta_{t1} \beta_{1b} + P_d^A \beta_2 + S_d^A \delta_{t1} \beta_3 + S_d^A \beta_4 + \nu_t + \epsilon_{d,t} \quad (7)$$

The dummy variables  $S_d^A$  take value 1 when district  $d$  is an electoral stronghold of party  $A$  (vote margin of 25 percentage points (p.p.) for the NPP and 50 p.p. for the NDC at the 1996 presidential elections, given that the average vote margin for the NDC is about 20 p.p.). The  $\bar{S}_d^A$  are their complements. Hence the specification splits coefficients  $\beta_1$  between districts with radical preferences for party  $A$  ( $\beta_{1a}$ ) and other districts ( $\beta_{1b}$ ).

## Identification issues

In the estimations, we find that districts with a leading party A member appear to receive more spending when party B is in charge; especially when the district has a strong preference for party A. We explain this relationship by the fact that party B needs to buy social peace in opposition strongholds. However, a number of related identification issues could come into play.

**Measurement of spending.** The main measurement concern is that our regressions seek to approximate total spending in each district. We do not have this information, so we have



two different proxies for it.

The first proxies are  $G_{d,t}^g$ : local public goods available in district  $d$  at date  $t$ , observed from household surveys. The  $G_{d,t}^g$  probably reflect the districts' outcomes with noise. Their trend is likely to be even noisier considering that the samples are independent across surveys. In order to evaluate this noise, we examine the change in national averages and the correlation of district averages across surveys (see section 4 and Tables B.1 and B.2). However, this should not be a serious issue assuming that sampling is random in both surveys.

Measurement issues are unfortunately not necessarily unbiased. Some survey questionnaires may be biased and increase some districts' relative outcomes in that particular survey. For example, assume the GLSS 4 survey (1998) overestimates access to secondary schools in large villages. The change in secondary school coverage between 1998 and 2000 would be underestimated in districts with large villages. It is generally impossible to assess the effect of similar bias on the coefficients of interest. Nevertheless, it is possible to check that our coefficients are not driven by a single type of information  $g$  in  $G_{d,t-1}^g$ . This is done in Table 3. In addition, this bias might be partly associated with the districts' observable characteristics (population density may be a good candidate in our example). This part of the bias is controlled for in the fully interacted model (see Table 4).

The other proxies for central government spending in the districts are  $EF_{d,t}$ . They represent just part of the government spending targeting the districts: only 1.7% of the central government budget is transferred to the district assemblies.<sup>17</sup> So spending observed through this channel may be offset by spending through other channels. We find that districts with a leading member of party A that vote for party A receive more spending when party B is in charge. This could be balanced by spending through other channels in some cases.

**Spending from other sources than the government.** Assuming that our dependent variables reflect actual total spending in the districts, spending may come from two main sources: central government and other donors, including international aid. We have no information on the geographic allocation of international aid in Ghana over time. Yet in our opinion and given the small share of donor funds in DA accounts (see footnote 14), our results cannot easily be explained in terms of spending from external donors that does not flow through the central government budget.

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<sup>17</sup>This percentage represents the average share of the District Assemblies Common Fund in total central government expenditure and net lending between 2000 and 2002 (source: IMF (2005): p. 24, Central Government Operations and Financing).

**Local economic development.** District outcomes may be correlated with local economic development. The  $G_{d,t-1}^g$  may be affected by domestic savings. In addition, district funding in  $EF_{d,t}$  could be a substitute for (or complement to) local economic growth. We have data on locally collected district assembly funds that are obviously correlated with local economic development trends. They include, for example, property taxes, fines, and royalties on mining (see Mogues and Benin, 2012). These locally collected revenues do not appear to be correlated with our variables of interest (see Table 2).

**Other particularities of the districts with leading politicians.** We find that districts with a leading party A member that vote for party A receive more spending when party B is in charge. Implicitly, the reference is the districts with a leading party A member when party A is in charge.

These districts have their own particularities when A is in charge. The government probably has the incentive to invest more in districts with a leading member of its own party. This is probably due to the political economy in the parties: leading members want to attract public resources to their districts when they are in charge. This effect is likely to be stronger in electorally tight districts. Indeed, leading party members from tight districts have more reason to attract money to their districts in order to ensure their re-election.<sup>18</sup> Hence, compared to districts with similar electoral results, when party A is in charge, districts with a leading party A member receive more public spending, and this effect is stronger in electorally tight districts.

This could mitigate our finding that some districts with a leading party A member receive more spending when party B is in charge. It could even reverse this result in electorally tight districts.

**Reverse causality and persistence of  $G_{d,t}^g$  and  $EF_{d,t}$ .** There is probably some feedback between public spending and the explanatory variables. Indeed, public spending can change the electoral results. If government spending before the 1996 elections caused the election results and government spending is serially correlated, the estimates could be biased. In other words, government spending before the 1996 elections may have undercut the NPP's local results at the 1996 presidential election (the NDC was in charge prior to 1996). If government spending persists over time, it generates a negative correlation between government spending after the 1996 presidential election and votes for the NPP at the 1996 presidential election. The magnitude of this correlation is probably smaller for spending disbursed a long time

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<sup>18</sup>in the same vein as Levitt and Snyder (1997).

after the 1996 election. This would hence lead to our underestimating the pro-NPP nature of districts with falling public investments. We find that districts with a leading NPP party member that vote for the NPP receive more spending before 2000, when the NDC is in charge. We find that districts with a leading NDC party member that vote for the NDC receive more spending after 2000, when the NPP is in charge. In both cases, this might be mitigated by the effect of spending on votes associated with the persistence of  $G_{d,t}^g$  and  $EF_{d,t}$ .

## Results

The results of the estimation of equation (4) are given in Table 1, in columns 1, 3 and 5, and those of the estimation of equation (6) are presented in Table 1, in columns 2, 4 and 6. Columns 1 and 2 display the estimation for the full sample, columns 3 and 4 for the rural variables, and columns 5 and 6 for the urban variables. The results of equation (5) and (7) are respectively shown in columns 7 and 8. We do not report on all the coefficients. We report on  $\hat{\beta}_1$ , the cross effect of having a leading member of either party interacted with the date. We also report on  $\hat{\beta}_{1a}$  and  $\hat{\beta}_{1b}$ : the interaction of this cross effect with being an electoral stronghold of either political party. Both specifications naturally include all the equation covariates, as detailed at the bottom of the table.

Column 1 of Table 1 shows a positive and almost significant coefficient for districts with a leading NPP member when the NDC party is in charge. When the sample is split between rural and urban variables, leading NPP member districts seem to receive more public spending under NDC rule solely in urban areas and not in rural areas (columns 3 and 5 of Table 1). This is consistent with our model for two reasons. Firstly, leading NPP member districts seem to receive more public spending under NDC rule in some cases. Secondly, this effect exists only in urban areas, where demonstrations are the most likely. However, leading NPP member districts display no particularity when it comes to DAs' external funds (column 7). Similarly, leading NDC member districts do not appear to have received fewer funds when the NDC was in charge.

We take the analysis further by testing our second prediction: the incumbent party may spend more in its opponent's district when the opponent has strong support in the district. The extent of support for the opponent is measured by the share of votes in the 1996 presidential elections. As the 1996 elections were massively pro-NDC, we define the NPP and NDC electoral strongholds with two different thresholds. A district is defined as being an NPP electoral stronghold when the NPP won the 1996 presidential elections by a margin of more than 25 p.p. A district is considered as an NDC electoral stronghold when the NDC

Table 1: Determinants of the dynamics of public infrastructure/spending in Ghana

Dependant variable: Sample: Refers to equation	Household surveys: public goods index and share of civil servants						D.A. Accounts: log(Income from External Funds) All sample	
	All sample		Rural		Urban		(5)	(7)
	(4)	(6)	(4)	(6)	(4)	(6)	(5)	(7)
	1	2	3	4	5	6	7	8
Has a NPP leader * NDC in charge	0.21 (0.136)		-0.06 (0.153)		0.61** (0.212)		-0.25 (0.189)	
Has a NPP leader * NDC in charge * NPP electoral stronghold <sup>a</sup>		0.51* (0.203)		0.58* (0.268)		0.91* (0.397)		-0.12 (0.174)
Has a NPP leader * NDC in charge * not a NPP electoral stronghold <sup>a</sup>		0.06 (0.143)		-0.28* (0.113)		0.55+ (0.290)		-0.29 (0.257)
Has a NDC leader * NDC in charge	0.02 (0.137)		-0.08 (0.149)		0.13 (0.205)		-0.04 (0.123)	
Has a NDC leader * NDC in charge * NDC electoral stronghold <sup>b</sup>		-0.03 (0.247)		0.08 (0.264)		-0.55 (0.375)		-0.24* (0.114)
Has a NDC leader * NDC in charge * not a NDC electoral stronghold <sup>b</sup>		0.07 (0.140)		-0.25+ (0.128)		0.35+ (0.181)		0.12 (0.166)
Has a NPP leader, Has a NDC leader NPP electoral stronghold, NDC elec- toral stronghold, both interacted with (NDC in charge)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type <sup>c</sup> * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes		
Lagged variable interacted with Type <sup>c</sup> * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes		
Observations	1,482	1,482	1,134	1,134	348	348	424	424
R-squared	0.457	0.467	0.451	0.465	0.538	0.550	0.267	0.460
Nb. of districts	102	102	95	95	58	58	110	110
Nb. of districts with Parliamentary candidate, minister after 2000	14	14	9	9	12	12	15	15
Nb. of districts with Parliamentary candidate, minister before 2000	14	14	12	12	11	11	17	17
Nb. of NPP electoral strongholds <sup>a</sup>	11	11	9	9	6	6	11	11
Nb. of NDC electoral strongholds <sup>b</sup>	32	32	32	32	17	17	36	36

\*\* , \* and + mean respectively that the coefficients are significant at the 1%, 5% and 10% levels.

Notes: OLS with standard errors given beneath the coefficients. The standard errors are corrected for an arbitrary correlation between different observations of the same district. The indicators included in specifications 1 to 6 are: the share of households connected to the electricity grid in rural areas, the share of households with access to piped water in rural areas, the share of civil servants in the labor force in rural areas, the share of households connected to the electricity grid in urban areas, the share of households with access to piped water in urban areas, the share of civil servants in the labor force in urban areas, the share of the rural population with access to a primary school in the community, the share of the rural population with access to a secondary school in the community, and the share of the rural population with access to a health center in the community.

<sup>a</sup> NPP electoral stronghold: the NPP won the 1996 presidential elections by a margin of more than 25 p.p.

<sup>b</sup> NDC electoral stronghold: the NDC won the 1996 presidential elections by a margin of more than 50 p.p.

<sup>c</sup> Set of dummies for the type of outcome (electricity, water and the share of civil servants interacted with rural/urban; primary school, senior secondary school, health center in rural areas)

won the presidential elections in that district with a margin of at least 50 p.p. We have 11 NPP electoral strongholds and 36 NDC electoral strongholds.

The empirical methodology is summarized in equations (6/7). We split the coefficient of interest ( $\beta_1$ ) into two coefficients ( $\beta_{1a}$  and  $\beta_{1b}$ ) for electoral strongholds and other districts. With respect to NPP electoral strongholds with an NPP leader, columns 2, 4 and 6 show that the public goods indices rose particularly sharply under NDC rule. This is precisely what our model predicts: the NDC government spent money in the districts where demonstrations were the most likely ex-ante. This is true of the rural and urban areas. However, it does not seem to be the case for DA external revenues.

Symmetrically, NDC electoral strongholds with a leading NDC member should have been relatively worse off under NDC rule. This appears to be the case only in terms of DA external revenues.

It is not easy to explain why these results for NDC electoral strongholds with a leading NDC member should be found only in terms of DA external funding, while the results for NPP electoral strongholds with a leading NPP member are found with the “public goods” indicators. We nevertheless believe that this mismatch does not weaken our results. Indeed, pork-barreling may take different channels depending on the government in place. A tiny part of public spending in Ghana is implemented by the district assemblies.<sup>19</sup> So the DAs’ external revenues may reveal only a fraction of pork-barreling. Moreover, additional DA external funds do not necessarily imply better public good indicators. Indeed, NDC electoral strongholds with a leading NDC member received more DA external funds under NDC rule. The DA data available provide no clues as to what the DA assemblies did with this money (see the Table 2 discussion below).

In leading NPP member districts that are not electoral strongholds, the results are mitigated. Indeed, the urban parts of these districts seem to have been better off under NDC rule, which is a similar finding to the NPP electoral strongholds with leading NPP members. However, the rural parts of the districts appear to have been worse off under NDC rule. This is also plausible: leading NPP members’ districts may be better off under NPP rule because leading NPP members attract money to their own districts. As mentioned in the “identification issues” section, this effect is probably stronger when the district is a swing district (defined as not being an electoral stronghold district). Therefore, the incentives for the leading NPP member to ensure his or her re-election are strong. In addition, in rural parts of the districts that are not NPP electoral strongholds, there are few incentives to avoid political agitation from the opposition. Indeed, political agitation is more likely in the cities,

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<sup>19</sup>see footnote 17

and in places that vote massively for the opposition. Similarly, in leading NDC members' districts that are not electoral strongholds, the results are mitigated and rarely significant.

## Specification checks

**Alternative definition of electoral strongholds.** We conduct a robustness check on the definition of electoral strongholds. In Table C.1 in the appendix, the alternative definition of an NPP electoral stronghold is that the NPP won the presidential election by a margin of 5 p.p. at least (instead of 25 p.p.). The alternative definition of an NDC electoral stronghold is that the NDC won the presidential election by a margin of 25 p.p. (instead of 50 p.p.). A total of 26 and 57 districts are therefore respectively classified as NPP and NDC electoral strongholds by the alternative definition. Columns 1, 3, 5 and 7 take up the results of Table 1, while columns 2, 4, 6 and 8 present the specifications with the alternative definition of electoral strongholds. Table C.1 basically confirms our previous results: public good accumulation is faster in NPP electoral strongholds with a leading NPP member (column 2). This result is found in the urban parts of districts (column 6), but not in the rural parts (column 4). Lastly, column 8 shows that NDC electoral strongholds with a leading NDC member were worse off under NDC rule.

**The determinants of taxes collected locally by the DA and its expenditure.** Second, we check districts' internally collected revenues and their expenditure. They include, for example, property taxes, fines, and mining royalties. We have two reasons for checking this. Firstly, should the pattern observed in Table 1 be correlated with differences in Ghanaian districts' economic trends, these patterns would probably impact on the internally collected revenues. Indeed, districts with high economic growth probably drive up internally generated revenues (e.g. taxes). Secondly, when the district assemblies receive more external funds, they can either reduce local taxes or increase spending.

We therefore test model (7), making the dependent variable the (log of) district internal revenues and total district expenditure. The results are given in Table 2. In this table, column 1 reproduces the results of column 8, Table 1. The results on internally generated revenues are observed in column 2. They do not follow the same pattern as the externally generated revenues in column 1. None of the coefficients in column 2 is significant. This suggests that our results are not driven by differences in economic growth between districts. It does not suggest any substitution between external revenues and local taxation/revenues.

In column 3, the expenditure coefficients are not significant either. The NDC electoral

Table 2: Determinants of the dynamics of DA finances: other sources of revenues and expenditure

	Income		log(Total expenses) (3)
	log(External Funds) (1) <sup>c</sup>	log(Internal Funds) (2)	
Has a NPP leader * NDC in charge * NPP electoral stronghold <sup>a</sup>	-0.12 (0.174)	-0.45 (0.272)	-0.23 (0.200)
Has a NPP leader * NDC in charge * not a NPP electoral stronghold <sup>a</sup>	-0.29 (0.257)	-0.22 (0.142)	-0.09 (0.199)
Has a NDC leader * NDC in charge * NDC electoral stronghold <sup>b</sup>	-0.24* (0.114)	0.18 (0.115)	-0.08 (0.138)
Has a NDC leader * NDC in charge * not a NDC electoral stronghold <sup>b</sup>	0.12 (0.166)	-0.06 (0.133)	-0.06 (0.191)
Has a NPP leader, Has a NDC leader NPP electoral stronghold, NDC electoral stronghold, both interacted with (NDC in charge)	Yes	Yes	Yes
Region * (NDC in charge) dummies	Yes	Yes	Yes
Lagged variable interacted with (NDC in charge) dummies	Yes	Yes	Yes
Observations	424	428	425
R-squared	0.460	0.557	0.498

\*\*, \* and + mean respectively that the coefficients are significant at the 1%, 5% and 10% levels.

Notes: OLS with standard errors given beneath the coefficients. The standard errors are corrected for an arbitrary correlation between different observations of the same district.

<sup>a</sup> NPP electoral stronghold: the NPP won the 1996 presidential election by a margin of more than 25 p.p. (11 districts).

<sup>b</sup> NDC electoral stronghold: the NDC won the 1996 presidential election by a margin of more than 50 p.p. (36 districts).

<sup>c</sup> reproduces the estimates of Table 1, column 8.

strongholds with a leading NDC member ultimately received relatively more public funds under NPP rule (that is: relatively less under NDC rule in the regressions). It is hard to say whether they used that money to reduce local revenue collection or to spend more. The column 2 coefficients show a small downturn in local revenue collection and the column 3 coefficients show a small increase in spending, but neither is statistically significant. The regressions split by type of spending and by type of internally generated revenues are largely inconclusive, and are therefore not reported.

Table 3: Determinants of the dynamics of public infrastructure/spending in Ghana: split by type of “public good”

	Dependant variables: public goods index and share of civil servants, in percentage points								
	Rural part of the district			Urban part of the district					
	Water <sup>a</sup>	Electricity <sup>b</sup>	Civil servants <sup>c</sup>	primary schools <sup>d</sup>	secondary schools <sup>e</sup>	health centers <sup>f</sup>	Water <sup>a</sup>	Electricity <sup>b</sup>	Civil servants <sup>c</sup>
Has a NPP leader * NDC in charge *	0.14** (0.029)	0.03 (0.137)	-0.01 (0.010)	0.08* (0.032)	0.06 (0.188)	0.38+ (0.192)	0.16 (0.214)	0.26** (0.050)	0.03 (0.033)
NPP electoral stronghold									
Has a NPP leader * NDC in charge *	-0.06 (0.056)	-0.03 (0.057)	-0.00 (0.007)	-0.02 (0.036)	-0.18+ (0.099)	-0.15 (0.137)	-0.00 (0.110)	0.15* (0.059)	0.04+ (0.024)
not a NPP electoral stronghold									
Has a NDC leader * NDC in charge *	0.12 (0.086)	-0.03 (0.071)	-0.00 (0.005)	-0.11 (0.147)	0.10 (0.204)	0.22 (0.179)	-0.06 (0.147)	-0.09 (0.111)	-0.05+ (0.025)
NDC electoral stronghold									
Has a NDC leader * NDC in charge *	0.02 (0.043)	0.06 (0.039)	-0.00 (0.007)	-0.01 (0.043)	-0.24 (0.150)	-0.51** (0.120)	0.19* (0.088)	0.04 (0.062)	0.01 (0.015)
not a NDC electoral stronghold	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Has a NPP leader, Has a NDC leader									
NPP electoral stronghold, NDC electoral stronghold, both interacted with (NDC in charge)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged variable interacted with (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	190	190	190	188	188	188	116	116	116
R-squared	0.740	0.731	0.701	0.393	0.584	0.483	0.623	0.727	0.655

\*\* , \* and + mean respectively that the coefficients are significant at the 1%, 5% and 10% levels.  
Notes: OLS with standard errors given beneath the coefficients. The standard errors are corrected for an arbitrary correlation between different observations of the same district.  
<sup>a</sup> Water: Share of individuals with access to piped water in the rural or urban part of the district.  
<sup>b</sup> Electricity: Share of individuals with access to electricity in the household in the rural or urban part of the district.  
<sup>c</sup> Civil servants: Share of civil servants in the labor force in the rural or urban part of the district.  
<sup>d</sup> Primary schools: Share of the rural population with access to a primary school.  
<sup>e</sup> Secondary schools: Share of the rural population with access to a secondary school.  
<sup>f</sup> Health centers: Share of the rural population with access to a hospital, health clinic or health center.  
<sup>g</sup> NPP electoral stronghold: the NPP won the 1996 presidential elections by a margin of more than 25 p.p. (11 districts).  
<sup>h</sup> NDC electoral stronghold: the NDC won the 1996 presidential elections by a margin of more than 50 p.p. (36 districts).



**Regression by type of public good.** Table 3 presents the results of the regressions for each public good variable included in the public good indices: water, electricity, civil servants in rural and urban parts of each district and primary and secondary schools as well as health centers in rural areas (see the table for full definitions). The estimates are not precise, but are consistent. With respect to NPP electoral strongholds with a leading NPP member in rural areas, the coefficients in Table 1 are positive and significant for water, primary schools, and health centers. They are positive, but not significant, for electricity and secondary schools. In urban areas, the significantly positive coefficient in Table 1 is due to electricity, but the other coefficients are also positive. These results show that our findings are not really driven by a single type of public good. However, we believe that the data cannot really answer which public goods are the most affected by pork-barreling.

**Correlation of  $P_d^A$  with unobservable characteristics.** Lastly, we check whether our results are robust when a large vector of variables is included in the regressions. The districts with leading party members are probably not randomly chosen, and the estimation of  $\beta_{1a}$  and  $\beta_{1b}$  in equations (6/7) may consequently suffer from an omitted variable bias. We therefore control for the same interactions of observable characteristics  $X_{d,t-1}$  and “has a leading NPP/NDC member”  $P_d^A$  in equation (8/9):

$$G_{d,t}^g = \rho_t^g G_{d,t-1}^g + P_d^A S_d^A \delta_{t1} \beta_{1a} + P_d^A \bar{S}_d^A \delta_{t1} \beta_{1b} + P_d^A \beta_2 + S_d^A \delta_{t1} \beta_3 + S_d^A \beta_4 + X_d S_d^A \delta_{t1} \beta_5 + X_d S_d^A \beta_6 + X_d \delta_{t1} \beta_7 + X_d \beta_8 + \nu_t^g + \epsilon_{d,t}^g \quad (8)$$

$$E_{d,t} = P_d^A S_d^A \delta_{t1} \beta_{1a} + P_d^A \bar{S}_d^A \delta_{t1} \beta_{1b} + P_d^A \beta_2 + S_d^A \delta_{t1} \beta_3 + S_d^A \beta_4 + X_d S_d^A \delta_{t1} \beta_5 + X_d S_d^A \beta_6 + X_d \delta_{t1} \beta_7 + X_d \beta_8 + \nu_t + \epsilon_{d,t} \quad (9)$$

The results of the estimation of this specification are given in Table 4, where columns 1, 3, 5 and 7 display the main estimations (Table 1). In columns 2, 4, 6 and 8, the vector of control variables includes density, share of urban population, average education, household amenities index, ethnic heterogeneity index, share of Akan, Ewe and Ashanti, and Accra region and regional capital district dummies. Table 4 basically confirms our results: compared to columns 1, 3, 5 and 7, the coefficients remain almost unchanged in columns 2, 4 and 6, with the exception that the first coefficient is now 0 on the urban sample. A positive coefficient of a very large magnitude appears in urban districts with an NDC leader and strong electoral support (column 6). We suspect this is probably due to multicollinearity.<sup>20</sup> So, our results

<sup>20</sup>The variance inflation factor for this variable is 74.

Table 4: Determinants of the dynamics of public infrastructure/expenditure in Ghana: fully interacted model

Dependant variable: Sample:	Household surveys: public goods index and share of civil servants						D.A. Accounts: log(Income from External Funds)	
	All sample		Rural		Urban		All sample	
	1 <sup>c</sup>	2	3 <sup>d</sup>	4	5 <sup>e</sup>	6	7 <sup>f</sup>	8
Has a NPP leader * NDC in charge * NPP electoral stronghold	0.51* (0.203)	0.48* (0.238)	0.58* (0.268)	1.29** (0.088)	0.91* (0.397)	0.05 (0.198)	-0.12 (0.174)	-0.20 (0.443)
Has a NPP leader * NDC in charge * not a NPP electoral stronghold	0.06 (0.143)	-0.32* (0.128)	-0.28* (0.113)	-0.45* (0.187)	0.55+ (0.290)	0.16 (0.224)	-0.29 (0.257)	-0.34 (0.277)
Has a NDC leader * NDC in charge * NDC electoral stronghold	-0.03 (0.247)	0.05 (0.249)	0.08 (0.264)	0.05 (0.259)	-0.55 (0.375)	2.94** (0.531)	-0.24* (0.114)	-0.27+ (0.143)
Has a NDC leader * NDC in charge * not a NDC electoral stronghold	0.07 (0.140)	-0.17+ (0.099)	-0.25+ (0.128)	-0.31* (0.140)	0.35+ (0.181)	0.17 (0.199)	0.12 (0.166)	-0.04 (0.144)
Has a NPP leader, Has a NDC leader NPP electoral stronghold, NDC elec- toral stronghold, both interacted with (NDC in charge)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * (NDC in charge) dummies Type * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged variable interacted with Type * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes		
Accra region, log(density), Regional Capital, Share of urban population, Average education, Household ameni- ties index, Ethnic heterogeneity index, Share of Akan, Ewe and Ashanti		Yes		Yes		Yes		Yes
Same variables as above interacted with all the possible interactions of (NDC in charge) * (NPP electoral stronghold) and of (NDC in charge) * (NDC electoral stronghold)		Yes		Yes		Yes		Yes
Observations	1,482	1,482	1,134	1,134	348	348	424	424
R-squared	0.467	0.546	0.465	0.528	0.550	0.732	0.460	0.660

\*\* , \* and + mean respectively that the coefficients are significant at the 1%, 5% and 10% levels.

Notes: OLS with standard errors given beneath the coefficients. The standard errors are corrected for an arbitrary correlation between different observations for the same district. The indicators included in the specification are: the share of households connected to the electricity grid in rural areas, the share of households with access to piped water in rural areas, the share of civil servants in the labor force in rural areas, the share of households connected to the electricity grid in urban areas, the share of households with access to piped water in urban areas, the share of civil servants in the labor force in urban areas, the share of the rural population with access to a primary school in the community, the share of the rural population with access to a secondary school in the community, and the share of the rural population with access to a health center in the community.

a NPP electoral stronghold: the NPP won the 1996 presidential elections by a margin of more than 25 p.p. (11 districts).

b NDC electoral stronghold: the NDC won the 1996 presidential elections by a margin of more than 50 p.p. (36 districts).

c Reproduces the estimates of Table 1, column 2.

d Reproduces the estimates of Table 1, column 4.

e Reproduces the estimates of Table 1, column 6.

f Reproduces the estimates of Table 1, column 8.

are not driven by any other channels than those we presented in the theoretical model, and our results are robust to potential ethnic targeting of public funds.

## 6 Conclusion

This paper sets out to shed light on the mechanisms of political competition in countries where democracy is weak and where the threat of conflicts with opponents is real. In these countries, public transfers can seem irrational in a stable democracy. We develop an illustrative model to explain this mechanism: the government invests more in opposition districts to avoid political agitation originating in these districts.

We test this idea in the case of Ghana at the end of the 1990s. The NDC party was in power until 2000, and then lost power to the NPP. We find leading NPP members' districts that vote the most for the NPP received more public goods under NDC rule. This is also true in the urban parts of leading NPP members' districts. Symmetrically, we find evidence that leading NDC members' districts that vote the most for the NDC received more funds through some channels at the beginning of NPP rule. In our opinion, opposition-voting districts with a leading opposition party politician and urban parts of districts with a leading opposition party politician are targeted because they are more likely to undertake riots or even foment a coup. By targeting these districts, government makes compromises with opposition leaders - or the districts' populations - in order to have the democratic rules accepted.

These results tie in with the political environment in Ghana in the late 1990s. Ghana at the time was an emerging democracy, with the former dictator Jerry Rawlings as an elected president. We nevertheless believe that these mechanisms can be relevant to some other African countries. Most of them have held elections since the end of the 1990s, with highly heterogeneous levels of transparency. However, democratic choices can probably be renegotiated at any time by non-democratic mechanisms in some of these fragile democracies. This was recently the case in Mali. These non-democratic balances of power can induce a substantial change in the democratic sharing rules, as the framework presented in this paper shows.

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# Appendices

## A Resolution of the model

### A.1 Stage 2: coups or elections

A simple reparametrization of the model gives:

$$\begin{cases} \Psi = G(\mu_I \sqrt{x_I} + \sqrt{1-x_I} - \sqrt{x_C} - \mu_C \sqrt{1-x_C}) \\ \Phi = G[S + \beta(\sqrt{1-x_I} - \mu_C \sqrt{1-x_C})] \end{cases} \quad (\text{A.1})$$

where  $S = -S_{PI} + (\beta - 1)S_{PC} + \beta\alpha$  is the relative initial advantage of the incumbent in coups.

At stage 2, the challenger chooses the technology to increase his or her likelihood to take charge. Hence s/he chooses to lead a coup when  $1 - \Phi > 1 - \Psi$ . This is equivalent to

$$\Psi > \Phi \Leftrightarrow \Delta = \mu_I \sqrt{x_I} - (\beta - 1)\sqrt{1-x_I} - \sqrt{x_C} + (\beta - 1)\mu_C \sqrt{1-x_C} - S > 0 \quad (\text{A.2})$$

It is easy to see that when the incumbent has a large relative initial advantage in terms of coups, coups are unlikely as the challenger chooses when s/he leads a coup. In addition,  $\Delta$  is increasing in  $x_I$ . When the incumbent invests in district  $I$ , where s/he does not increase his or her probability to win coups, coups are likely. Symmetrically,  $\Delta$  is decreasing in  $x_C$ .

### A.2 Stage 1: Pure strategies

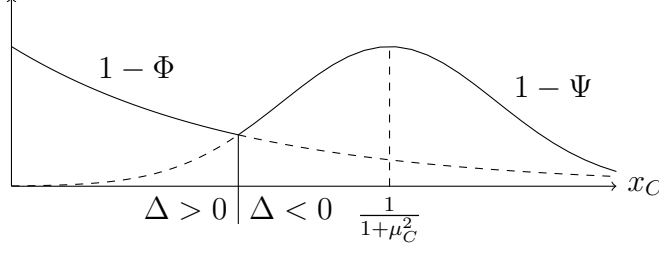
#### Choice of the challenger conditional on $x_I$

The challenger's payoff is written:

$$\mathbb{1}(\Delta > 0)(1 - \Phi) + \mathbb{1}(\Delta < 0)(1 - \Psi) \quad (\text{A.3})$$

We know that  $\Delta$  is decreasing in  $x_I$ , and  $\Delta = 0$  when  $\Phi = \Psi$ . It is straightforward to show that  $(1 - \Phi)$  decreases with  $x_C$ , and that  $(1 - \Psi)$  has a single local maximum when  $x_C = \frac{1}{1+\mu_C^2}$ . This is illustrated in Figure A.1.

Depending on the relative position of  $(1 - \Phi)$  and  $(1 - \Psi)$ , the conditional utility of  $C$  has two local maxima. This restricts the space of the potential strategies of  $C$  to two points.

Figure A.1: Conditional utility of  $C$ 

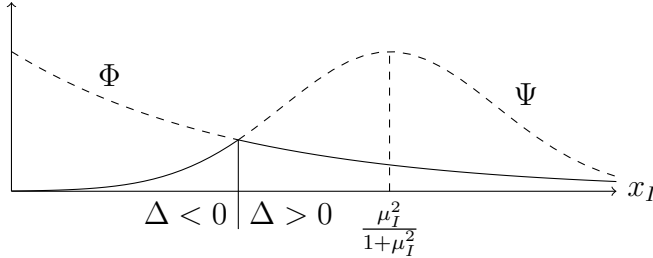
Either  $C$  considers that a coup will be his or her best option, and s/he chooses  $x_C = 0$ ; or s/he considers that s/he should participate in the elections and chooses  $x_C = \frac{1}{1+\mu_C^2}$ .

### Choice of the incumbent conditional on $x_C$

The incumbent's payoff is written:

$$\mathbb{1}(\Delta > 0)\Phi + \mathbb{1}(\Delta < 0)\Psi \quad (\text{A.4})$$

We know that  $\Delta$  is increasing in  $x_I$ , and  $\Delta = 0$  when  $\Phi = \Psi$ . It is straightforward to show that  $\Phi$  decreases with  $x_I$ , and that  $\Psi$  has a single local maximum when  $x_I = \frac{\mu_I^2}{1+\mu_I^2}$ . This is illustrated in Figure A.2.

Figure A.2: Conditional utility of  $I$ 

The conditional utility of  $I$  has a single local maximum, which can be in three positions. It can be in  $x_I = 0$ , when  $\Delta(x_I = 0, x_C) > 0$ . This happens when the opponent always prefers a coup:  $\forall x_I, \Delta > 0$ . The optimum of  $I$  is therefore the maximum of  $\Phi(x_I, x_C)$  over  $x_I$ , for  $x_I = 0$ .

The maximum is in  $x_I = \frac{\mu_I^2}{1+\mu_I^2}$  when  $\Delta\left(x_C, x_I = \frac{\mu_I^2}{1+\mu_I^2}\right) < 0$ . This happens when the opponent always prefers elections:  $\forall x_I < \frac{\mu_I^2}{1+\mu_I^2}, \Delta < 0$ . The optimum of  $I$  is therefore the optimum of  $\Psi(x_I, x_C)$ .

When neither conditions apply, the maximum is the interior solution satisfying  $\Psi = \Phi$  (as in Figure A.2).

### Equilibrium 1: systematic military opposition

As explained by Figure A.1, the choice of the challenger is driven by the comparison between  $1 - \Phi(x_I, x_C = 0)$  and  $1 - \Psi\left(x_I, x_C = \frac{1}{1+\mu_C^2}\right)$ . This section studies one of the situations where this choice is systematic: when  $\min_{x_I} \left\{ \Psi\left(x_I, x_C = \frac{1}{1+\mu_C^2}\right) - \Phi(x_I, x_C = 0) \right\} > 0$ . In this case,  $1 - \Phi > 1 - \Psi$  ensures that the challenger will prefer to lead a coup, irrespective of the choice of  $I$ .

We write the two functions driving the choice of the challenger:

$$\Psi\left(x_I, x_C = \frac{1}{1+\mu^2}\right) = G\left(\mu_I\sqrt{x_I} + \sqrt{1-x_I} - \sqrt{1+\mu_C^2}\right) \quad (\text{A.5})$$

$$\Phi(x_I, x_C = 0) = G[S + \beta(\sqrt{1-x_I} - \mu_C)] \quad (\text{A.6})$$

We solve  $\Psi > \Phi$ , and observe that this inequality is the least likely when  $x_I = 0$ :

$$\Psi\left(x_I, x_C = \frac{1}{1+\mu_C^2}\right) - \Phi(x_I, x_C = 0) > 0 \quad (\text{A.7})$$

$$\Leftrightarrow \mu_I\sqrt{x_I} + \sqrt{1-x_I} - \sqrt{1+\mu_C^2} - S - \beta(\sqrt{1-x_I} - \mu_C) > 0 \quad (\text{A.8})$$

$$\Leftrightarrow \mu_I\sqrt{x_I} - (\beta-1)\sqrt{1-x_I} - \sqrt{1+\mu_C^2} + \beta\mu_C - S > 0 \quad (\text{A.9})$$

$$\min_{x_I} \left\{ \Psi\left(x_I, x_C = \frac{1}{1+\mu_C^2}\right) - \Phi(x_I, x_C = 0) \right\} > 0 \quad (\text{A.10})$$

$$\Leftrightarrow -(\beta-1) - \sqrt{1+\mu_C^2} + \beta\mu_C - S > 0 \quad (\text{A.11})$$

$$\Leftrightarrow S < S_1 = -(\beta-1) - \sqrt{1+\mu_C^2} + \beta\mu_C \quad (\text{A.12})$$

In this situation,  $C$ 's optimum is necessarily  $x_C = 0$ , and  $C$  will lead a coup in stage 2. Hence  $I$ 's optimum is  $x_I = 0$ . It is intuitive that this situation arises for the lowest  $S$ : when the incumbent's relative initial advantage in coups is low, the challenger's relative initial advantage in coups is high. Hence the challenger prefers coups.

### Equilibrium 2: systematic elections

This section studies the other Nash equilibrium of the game when  $\max_{x_I} \left\{ \Psi\left(x_I, x_C = \frac{1}{1+\mu_C^2}\right) - \Phi(x_I, x_C = 0) \right\} < 0$ . In this case,  $1 - \Phi < 1 - \Psi$  ensures the challenger will prefer elections irrespective of the choice of  $I$ .



$$\max_{x_I} \left\{ \Psi \left( x_I, x_C = \frac{1}{1 + \mu_C^2} \right) - \Phi(x_I, x_C = 0) \right\} < 0 \quad (\text{A.13})$$

$$\Leftrightarrow \frac{\mu_I^2 - (\beta - 1)}{\sqrt{1 + \mu_I^2}} - \sqrt{1 + \mu_C^2} + \beta\mu_C - S < 0 \quad (\text{A.14})$$

$$\Leftrightarrow \frac{-\beta}{\sqrt{1 + \mu_I^2}} + \sqrt{1 + \mu_I^2} - \sqrt{1 + \mu_C^2} + \beta\mu_C - S < 0 \quad (\text{A.15})$$

$$\Leftrightarrow S > S_2 = \frac{-\beta}{\sqrt{1 + \mu_I^2}} + \sqrt{1 + \mu_I^2} - \sqrt{1 + \mu_C^2} + \beta\mu_C \quad (\text{A.16})$$

Hence this happens for the greatest  $S$ , which is intuitive. Indeed, the challenger prefers elections when his or her relative initial advantage in coups is low. In this situation,  $C$ 's optimum is necessarily  $x_C = \frac{1}{1 + \mu_C^2}$ , as  $C$  will choose elections in stage 2.  $I$ 's optimum is therefore  $x_I = \frac{\mu_I^2}{1 + \mu_I^2}$ . In addition,  $S_2 > S_1$  :

$$\mu_I > 1 \Rightarrow \frac{-\beta}{\sqrt{1 + \mu_I^2}} < \beta, \sqrt{1 + \mu_I^2} > 1 \quad (\text{A.17})$$

$$S_2 - S_1 = \frac{-\beta}{\sqrt{1 + \mu_I^2}} + \sqrt{1 + \mu_I^2} + (\beta - 1) > 0, QED \quad (\text{A.18})$$

### A.3 Stage 1: Mixed strategies

Equilibriums 1 and 2 solve the game in situations with extreme  $S$ . In these situations, either  $C$  will always choose elections, or  $C$  will always choose coups. In intermediary situations, when  $S \in [S_1, S_2]$ , both could arise: depending on  $x_I$ ,  $C$  may want to choose either a coup or elections.

In practice, there is no Nash equilibrium to the game in these situations. If  $I$  chooses a small  $x_I$ ,  $C$  wants to play  $x_C = \frac{1}{1 + \mu_C^2}$  and will choose elections at stage 2. In this case,  $I$ 's behavior is not optimal. If  $I$  chooses a great  $x_I$ ,  $C$  wants to play  $x_C = 0$  and will choose a coup at stage 2. In this case,  $I$ 's behavior is still not optimal.

We therefore solve the model with mixed strategies. In Figure A.1, the best strategies for  $C$  are  $x_b \in \{0, \frac{1}{1 + \mu_C^2}\}$ . We prove there is a Nash equilibrium where  $C$  plays a mix of these strategies ( $x_C = 0$  with probability  $P$ ).<sup>21</sup>

We denote  $\Delta_0(x_I) = \Delta(x_I, x_C = 0)$ , and  $\Delta_1(x_I) = \Delta(x_I, x_C = \frac{1}{1 + \mu_C^2})$ .  $\Delta_0$  and  $\Delta_1$  are strictly increasing in  $x_I$ ; and for any  $x_I$ ,  $\Delta_0 > \Delta_1$ :

<sup>21</sup>Formally, the equivalent of Figure A.1 when  $I$  plays mixed strategies might include local maxima in some cases. Hence the Nash equilibrium we find might not be unique in some cases.

$$\Delta_0(x_I) = \mu_I \sqrt{x_I} - (\beta - 1) \sqrt{1 - x_I} + (\beta - 1) \mu_C - S \quad (\text{A.19})$$

$$\Delta_1(x_I) = \mu_I \sqrt{x_I} - (\beta - 1) \sqrt{1 - x_I} + \frac{-1 + (\beta - 1) \mu_C^2}{\sqrt{1 + \mu_C^2}} - S \quad (\text{A.20})$$

The program of  $I$  is written:

$$\max_{x_I} \{P [\mathbb{1}(\Delta_0 > 0) \Phi_0 + \mathbb{1}(\Delta_0 < 0) \Psi_0] + (1 - P) [\mathbb{1}(\Delta_1 > 0) \Phi_1 + \mathbb{1}(\Delta_1 < 0) \Psi_1]\} \quad (\text{A.21})$$

We want to find the maximum of this program over  $x_I$ . We start with the lowest  $x_I$ .

**Smallest  $x_I$ :**  $0 > \Delta_0 > \Delta_1$

The first situation to consider is  $0 > \Delta_0 > \Delta_1$ , as the  $\Delta$  are increasing with  $x_I$ . In this situation,  $I$ 's program is written  $\max_{x_I} P \Psi_0 + (1 - P) \Psi_1$ . All the  $\Psi(x_I, x_C)$  have a single maximum over  $x_I$  when  $x_I = \frac{\mu^2}{1 + \mu^2}$ ; so  $P \Psi_0 + (1 - P) \Psi_1$  has a single maximum in  $x_I = \frac{\mu_I^2}{1 + \mu_I^2}$ . However, for  $x_I = \frac{\mu_I^2}{1 + \mu_I^2}$  and  $S \in [S_1, S_2]$ ,  $\Delta_0 > 0$ :

$$\Delta_0 \left( \frac{\mu_I^2}{1 + \mu_I^2} \right) = \frac{\mu_I^2 - (\beta - 1)}{\sqrt{1 + \mu_I^2}} + (\beta - 1) \mu_C - S; \text{ as } S < S_2 : \quad (\text{A.22})$$

$$> \frac{-\beta}{\sqrt{1 + \mu_I^2}} + (\beta - 1) \mu_C - \frac{-\beta}{\sqrt{1 + \mu_I^2}} + \sqrt{1 + \mu_C^2} - \beta \mu_C \quad (\text{A.23})$$

$$> \sqrt{1 + \mu_C^2} - \mu_C > 0 \text{ as } \mu_C > 1 \quad (\text{A.24})$$

Hence the maximum of the curve  $P \Psi_0 + (1 - P) \Psi_1$  is on the right-hand side of the zone where  $0 > \Delta_0 > \Delta_1$ . So when  $0 > \Delta_0 > \Delta_1$ ,  $P \Psi_0 + (1 - P) \Psi_1$  is strictly increasing with  $x_I$ .

**Intermediate  $x_I$ :**  $\Delta_0 > 0 > \Delta_1$

The second situation is the situation where  $\Delta_0 > 0 > \Delta_1$ . This is the situation where  $C$  prefers a coup at stage 2 when s/he plays  $x_C = 0$ , and prefers elections when  $x_C = \frac{1}{1 + \mu_C^2}$ . This is therefore the most intuitive situation. In this case,  $I$ 's program is written  $\max_{x_I} P \Phi_0 + (1 - P) \Psi_1$ , with:

$$\begin{cases} \Psi_1 = G \left( \mu_I \sqrt{x_I} + \sqrt{1 - x_I} - \sqrt{1 + \mu_C^2} \right) = G_1 \\ \Phi_0 = G \left[ S + \beta \left( \sqrt{1 - x_I} - \mu_C \right) \right] = G_0 \end{cases} \quad (\text{A.25})$$

We write the FOC:

$$-\frac{P\beta}{2\sqrt{1-x_I}}G'_1 + (1-P)G'_0 \left( \frac{\mu_I}{2\sqrt{x_I}} - \frac{1}{2\sqrt{1-x_I}} \right) = 0 \quad (\text{A.26})$$

$$(1-P)G'_0\mu_I\sqrt{1-x_I} = [P\beta G'_1 + (1-P)G'_0]\sqrt{x_I} \quad (\text{A.27})$$

$$x_I = \frac{(1-P)^2 G_0'^2 \mu_I^2}{(1-P)^2 G_0'^2 \mu_I^2 + [P\beta G'_1 + (1-P)G'_0]^2} \quad (\text{A.28})$$

$$x_I = \frac{(1-P)^2 \mu_I^2}{(1-P)^2 \mu_I^2 + [1 + (\beta - 1)P]^2} \quad (\text{A.29})$$

At the Nash equilibrium,  $\Psi_1 = \Phi_0$  implies  $G'_1 = G'_0$ . Hence the FOC give a single solution,  $x_I = \frac{(1-P)^2 \mu^2}{(1-P)^2 \mu^2 + [1 + (\beta - 1)P]^2}$ . When this  $x_I$  is a Nash equilibrium,  $\Delta_0 > 0 > \Delta_1$ , making this first order condition relevant:

$$\Psi_1 = \Phi_0 \Leftrightarrow \mu_I\sqrt{x_I} + \sqrt{1-x_I} - \sqrt{1+\mu_C^2} = S + \beta(\sqrt{1-x_I} - \mu_C) \quad (\text{A.30})$$

$$\Leftrightarrow \mu_I\sqrt{x_I} - (\beta - 1)\sqrt{1-x_I} = S - \mu_C\beta + \sqrt{1+\mu_C^2} \quad (\text{A.31})$$

Hence:

$$\Delta_0(x_I) = \sqrt{1+\mu_C^2} - \mu_C > 0 \quad (\text{A.32})$$

$$\Delta_1(x_I) = -\mu_C\beta + \sqrt{1+\mu_C^2} + \frac{-1 + (\beta - 1)\mu_C^2}{\sqrt{1+\mu_C^2}} \quad (\text{A.33})$$

$$= -\mu_C\beta + \frac{\beta\mu_C^2}{\sqrt{1+\mu_C^2}} < 0 \text{ as } 0 < \frac{\mu_C}{\sqrt{1+\mu_C^2}} < 1 \text{ as } \mu_C > 0 \quad (\text{A.34})$$

We compute the second derivative of the payoff of  $I$  towards  $x_I$ . A sufficient condition for it to be strictly negative is  $G'' \leq 0$ , and the second derivative is written:

$$P\frac{\beta^2}{4(1-x_I)}G_1'' + (1-P)G_0'' \left( \frac{\mu_I}{2\sqrt{x_I}} - \frac{1}{2\sqrt{1-x_I}} \right)^2 \quad (\text{A.35})$$

$$- \frac{P\beta G_1' + (1-P)G_0'}{4(1-x_I)^{3/2}} - \frac{(1-P)G_0'\mu_I}{4x_I^{3/2}} \quad (\text{A.36})$$

**Greatest  $x_I$ :  $\Delta_0 > \Delta_1 > 0$**

The last situation is the situation where  $\Delta_0 > \Delta_1 > 0$ . In this situation,  $I$ 's payoff is written  $\max_{x_I} P\Phi_0 + (1 - P)\Phi_1$ , which is strictly decreasing towards  $x_I$ . However,  $x_I = 0$  does not verify  $\Delta_0 > \Delta_1 > 0$  when  $S \in [S_1, S_2]$ : when  $x_I = 0$  and  $x_C = \frac{1}{1+\mu_C^2}$ :

$$\Delta_1(x_I) = -(\beta - 1) + \frac{-1 + (\beta - 1)\mu_C^2}{\sqrt{1 + \mu_C^2}} - S \quad (\text{A.37})$$

$$< \frac{-1 + (\beta - 1)\mu_C^2}{\sqrt{1 + \mu_C^2}} + \sqrt{1 + \mu_C^2} - \beta\mu_C \quad (\text{A.38})$$

$$< \frac{\beta\mu^2}{\sqrt{1 + \mu_C^2}} - \beta\mu_C < 0 \text{ as } 0 < \frac{\mu_C}{\sqrt{1 + \mu_C^2}} < 1 \text{ as } \mu_C > 0 \quad (\text{A.39})$$

Hence, when  $\Delta_0 > \Delta_1 > 0$ , the derivative of  $I$ 's payoff towards  $x_I$  is negative.

**Summary**

In summary, when  $C$  plays (his or her optimal) mixed strategy and  $G$  is convex or linear,  $I$ 's payoff has a single maximum where  $x_I = \frac{(1-P)^2\mu_I^2}{(1-P)^2\mu_I^2 + [1+(\beta-1)P]^2}$ . In this case, given that the strategy of  $I$  is a pure strategy,  $C$ 's strategy can be either  $x_C = 0$  or  $x_C = \frac{1}{1+\mu_C^2}$ .

The equilibrium  $x_I$  is defined by the FOC above (equation (A.29)).  $P$  is defined by the indifference condition between  $\Phi_0$  and  $\Psi_1$ , given by (A.31):

$$\begin{cases} x_I = \frac{(1-P)^2\mu_I^2}{(1-P)^2\mu_I^2 + [1+(\beta-1)P]^2} \\ \mu_I\sqrt{x_I} - (\beta - 1)\sqrt{1 - x_I} + \mu_C\beta - \sqrt{1 + \mu_C^2} - S = 0 \end{cases} \quad (\text{A.40})$$

We can see that the function in the second line is increasing with  $x_I$ , decreasing with  $S$ , increasing with  $\mu_I$  and  $\mu_C$ , increasing with  $\beta$ . Hence  $x_I$  increases with  $S$ , and decreases with  $\mu_I$ ,  $\mu_C$  and  $\beta$ . In addition, we can check  $x_I = 0$  when  $S = S_1$ , and  $x_I = \frac{\mu_I^2}{1+\mu_I^2}$  when  $S = S_2$ .<sup>22</sup> We can study the particular case where  $x_I > 0.5$ :

$$\frac{\mu_I - (\beta - 1)}{\sqrt{2}} + \mu_C\beta - \sqrt{1 + \mu_C^2} - S < 0 \quad (\text{A.41})$$

$$\Leftrightarrow \frac{\mu_I - (\beta - 1)}{\sqrt{2}} + \mu_C\beta - \sqrt{1 + \mu_C^2} = S_3 < S \quad (\text{A.42})$$

$S_3$  is an increasing function of  $\mu_I$ ,  $\mu_C$  and  $\beta$ .

<sup>22</sup>The closed-form solution for  $x_I$  and  $P$  exists, but does not call for economic interpretation.

It is surprising that  $x_I$  decreases with  $\mu_I$  in the mixed strategy equilibrium. This means that, in a mixed strategy,  $I$  makes fewer promises to district  $P_I$  when these promises are more efficient. To rationalize this, consider that in the mixed strategies equilibrium,  $C$  should be indifferent at stage 1 between choosing  $x_C = 0$  (considering attempting a coup) and  $x_C = \frac{1}{1+\mu_C^2}$  (considering going to the polls). When  $\mu_I$  increases, the payoff for  $C$  in elections decreases, which breaks with this equilibrium. Hence  $I$  invests a bit less in districts  $P_I$  and a bit more in districts  $P_C$ . S/he can marginally decrease  $C$ 's payoff for a coup attempt and balance the indifference constraint of  $C$ . Hence  $C$ 's average payoff unambiguously decreases.

## B Data

### B.1 Data sources

Data	GLSS4	Census	CWIQ
	1998	2000	2003
Date	Apr.98- Mar.99	March 2000	Jan. 03 - May 03
Sample size (# of households)	6,009	379,372	39,584
# of clusters	300		3,267

### B.2 Definition of the variables

**D.A. accounts, External funds:** This variable is extracted from the database gathered by Mogues and Benin (2012) on local public finances and decentralization. It is the grants variable of District Assembly accounts from 1999 to 2002. The actual amounts are valued in current cedi from 1999 to 2002.

**D.A. accounts, Internal funds:** This variable is the sum of property tax, fees and fines revenues, royalties, rental income, investment income, licences and miscellaneous revenues. It is extracted from the database gathered by Mogues and Benin (2012) on local public finances and decentralization. The actual amounts are valued in current cedi from 1999 to 2002.

**D.A. accounts, Total expenses:** This variable is the total actual expenditures of District Assemblies. It is the sum of personal emolument, general expenses, traveling and transport, maintenance/repairs and renewal expenses and capital expenditures, extracted from the

database gathered by Mogues and Benin (2012) on local public finances and decentralization. The actual amounts are valued in current cedi from 1999 to 2002.

**Difference between shares of votes for the NPP and the NDC:** Difference between the district's shares of votes for the NPP and the NDC at the 1996 presidential elections.

**Education level:** Average of an education variable for individuals aged 25 and over in the rural and urban parts of each district. The education variable takes the value of 0 if the individual has never been to school (but possibly pre-school), 1 if s/he started primary school, 2 if s/he completed primary school, 3 if s/he went to lower secondary school, 4 if went to upper secondary school, and 5 if s/he went to university. This variable is computed using 1998 GLSS4 survey.

**Ethnic heterogeneity:** Sum of the squares of the shares of Akan, Ewe, Ga-Adangbe and Others in the rural and urban parts of each district. Included in the  $[0, 1]$  interval. This variable is computed using 1998 GLSS4 survey.

**Household amenities index:** Synthetic variable measuring the comfort of the dwelling. It is the sum of four variables, averaged at district level. The first variable takes the value of 1 if the cooking energy is charcoal, 2 if the cooking energy is electricity, gas or kerosene, and 0 otherwise. The second variable takes the value of 1 if the roof is made of metal, concrete or asbestos, and 0 otherwise. The third variable takes the value of 1 if the wall is in stabilized or made of burnt bricks, concrete or metal. The last variable takes the value of 0 if the floor is made of earth, and 1 otherwise. This index is computed for rural and urban parts of each district. This variable is computed using 1998 GLSS4 survey.

**Log (population density):** The population density is calculated at the district level from the 2000 census.

**NDC candidate, minister before 2000:** This variable takes value 1 if one or more 1996 NDC parliamentary election candidates in this district were minister(s) at some point between 1996 and 2000. It takes the value of 0 otherwise. Of the 39 Rawlings' ministers, 17 were NDC parliamentary candidates.

**NPP candidate, minister after 2000:** This variable takes value 1 if one or more 1996 NPP parliamentary election candidates in this district were minister(s) at some point between

2000 and 2005. It takes the value of 0 otherwise. Taking the names of each minister in Kufuor’s government from 2001 to 2005, the 1996 parliamentary election results provide information on whether they were candidates and, if so, in which district. Of the 37 ministers, 15 were NPP candidates in the 1996 parliamentary election and 14 were elected. Eight of the corresponding 15 districts were urban (proportion of urban population greater than 50%) and six of these were district capitals.

**Public good indicators:** We pool six types of public goods. Three of them are available in rural and urban areas, three of them in rural areas only, resulting in a maximum of nine observations by date and district:

- Civil servants: Share of civil servants in the labor force in the rural and urban areas of each district.
- Electricity connexion: Share of individuals with access to electricity in the household in the rural and urban areas of each district.
- Tap water connexion: Share of individuals with access to piped water in the rural and urban areas of each district.
- Health centers: Share of the rural population with access to a hospital, health clinic or health center. We define “having access to an health center” as being able to reach them in a radius of 2 km for GLSS4 and Census data. We define “having access to an health center” as living in a community where 50% of the population answered the facility is at most 30 minutes by foot for the 2003 CWIQ survey. Available in rural areas only.
- Primary schools: Share of the rural population with access to a primary school. We define “having access to a primary school” as being able to reach them in a radius of 2 km for GLSS4 and Census data. We define “having access to a primary school” as living in a community where 50% of the population answered the facility is at most 30 minutes by foot for the 2003 CWIQ survey. Available in rural areas only.
- Secondary schools: Share of the rural population with access to a secondary school. We define “having access to a secondary school” as being able to reach them in a radius of 2 km for GLSS4 and Census data. We define “having access to a secondary school” as living in a community where 50% of the population answered the facility is at most 30 minutes by foot for the 2003 CWIQ survey. Available in rural areas only.

We normalize these variables at the date-level, and pooled them.

**Regional capital:** Dummy variable equal to one for districts where the 10 regional capitals are located: Shama-Ashanta East, Cape Coast, Accra, Ho, New Juaben - Koforidua, Kumasi, Sunyani, Tamale, Bolgatanga and Wa.

**Share of Akan:** Share of individuals that belong to the Akan ethnic group in the geographic entity (district \* urban/rural). This variable is computed using 1998 GLSS4 survey.

**Share of Ashanti:** Share of individuals that belong to the Ashanti ethnic group in the geographic entity (district \* urban/rural). This is calculated from the 2000 census data.

**Share of Ewe:** Share of individuals that belong to the Ewe ethnic group in the geographic entity (district \* urban/rural). This variable varies is computed using 1998 GLSS4 survey.

**Share of urban population:** This is calculated from the 2000 census. The definition of an urban area in Ghana is one with a population of more than 5,000 inhabitants.



### B.3 Comparison of statistics between surveys

Table B.1: Comparison of the national statistics between surveys

Variable <sup>a</sup>	GLSS4 1998 <sup>b</sup>	Census 2000 (GLSS4 e.a. <sup>c</sup> )	Census 2000 <sup>d</sup>	CWIQ 2003 <sup>e</sup>
Rural areas	91%	93%	88%	86%
	Primary school	[87 - 96]	[89 - 97]	[85 - 88]
		(94)	(94)	(107)
		12%	11%	14%
	Secondary school	[7 - 18]	[6 - 15]	[13 - 17]
		(94)	(94)	(107)
		31%	41%	37%
	Health center	[24 - 38]	[33 - 49]	[44 - 49]
		(95)	(94)	(107)
		11%		15%
Urban areas	Electricity connexion	[7 - 15]		22%
		(95)	(108)	(108)
		11%	13%	13%
	Tap water connexion	[7 - 16]		[12 - 15]
		(95)	(108)	(108)
		3.4%	3.6%	3.9%
	Civil servants	[2.5 - 4.3]		[3.6 - 4.1]
		(95)	(106)	(108)
		73%		74%
	Electricity connexion	[65 - 81]		[77 - 80]
	(58)	(106)	(106)	
	72%	66%	71%	
Tap water connexion	[63 - 81]		[69 - 74]	
	(58)	(106)	(106)	
	10.9%	11.5%	12.8%	
Civil servants	[8.6 - 13.2]		[11.9 - 13.6]	
	(58)	(106)	(106)	

The number of observations (districts) are in parentheses for each public good and year, whereas confidence intervals are in brackets.

*a.* See point B.2 for the definitions of each variable.

*b.* National average using GLSS4 data.

*c.* National average computed using 2000 Census data information, restricted to enumerated areas (e.a.) sampled by the GLSS4 survey. (with GLSS4 weights)

*d.* National average using 2000 Census data.

*e.* National average using CWIQ 2003 data.

Table B.2: Correlations between different surveys

	Variable <sup>a</sup>	GLSS4 1998 - Census 2000	Census 2000 - CWIQ 2003
Rural	Primary school	47% <sup>b</sup>	53%
	Secondary school	60% <sup>b</sup>	64%
	Health center	61% <sup>b</sup>	64%
	Electricity connexion	41%	89%
	Tap water connexion	56%	94%
	Civil servants	82%	86%
Urban	Electricity connexion	61%	78%
	Tap water connexion	50%	79%
	Civil servants	46%	67%

*a.* See point B.2 for the definitions of each variable.

*b.* Census 2000 refers to the restriction of the facility census to the GLSS4 enumerated areas.

Table B.3: Descriptive statistics

	Variable <sup>a</sup>	# of obs.	mean	std. dev.	min.	max.
Full sample	Public good aggregate	1482	0.0004	0.9493	-5.5298	5.6606
	diff NPP 96 election	1482	-0.2634	0.4041	-0.9822	0.5266
	NPP candidate, minister after 2000	1482	0.1174	0.3220	0	1
	NDC candidate, minister before 2000	1482	0.1377	0.3447	0	1
	Share of urban population <sup>b</sup>	1482	0.3019	0.1967	0	1
	log(population density) <sup>b</sup>	1482	4.6175	0.9221	2.0992	9.1007
	Regional capital	1482	.0729	0.2600	0	1
Rural areas	Education level <sup>c</sup>	1086	0.9589	0.3429	0.1894	1.9998
	Household amenities index <sup>c</sup>	1086	1.5393	0.5795	0.3541	3.7953
	Ethnic heterogeneity <sup>c</sup>	1086	0.8455	0.0495	0.7527	0.9349
	Share of Akan <sup>c</sup>	1086	0.4313	0.3138	0.0042	0.9225
	Share of Ewe <sup>c</sup>	1086	0.1291	0.2251	0	0.9345
	Share of Ashante <sup>b</sup>	1086	0.1177	0.2167	0.0001	0.8824
Urban areas	Education level <sup>c</sup>	336	1.4757	0.3535	0.4458	2.0936
	Household amenities index <sup>c</sup>	336	2.9216	0.6698	0.979	4.0924
	Ethnic heterogeneity <sup>c</sup>	336	0.8479	0.0398	0.7716	0.9308
	Share of Akan <sup>c</sup>	336	0.5180	0.3089	0.0311	0.9373
	Share of Ewe <sup>c</sup>	336	0.1383	0.2399	0	0.9015
	Share of Ashante <sup>b</sup>	336	0.1259	0.1964	0.0022	0.7647

*a.* See point B.2 for the definitions of each variable.

*b.* Time invariant variables computed using 2000 Population Census data.

*c.* This variable is computed using 1998 GLSS4 survey.

## C Additional table

Table C.1: Determinants of the dynamics of public infrastructure/expenditure in Ghana: alternative definition of electoral strongholds

Dependant variable: Sample: Refers to equation	Household surveys: public goods index and share of civil servants						D.A. Accounts: log(Income from External Funds)	
	All sample		Rural		Urban		All sample	
	(4)	(6)	(4)	(6)	(4)	(6)	(5)	(7)
	1 <sup>e</sup>	2	3 <sup>f</sup>	4	5 <sup>g</sup>	6	7 <sup>h</sup>	8
Has a NPP leader * NDC in charge * NPP electoral stronghold <sup>a</sup>	0.51*		0.58*		0.91*		-0.12	
	(0.203)		(0.268)		(0.397)		(0.174)	
Has a NPP leader * NDC in charge * NPP electoral stronghold <sup>c</sup>		0.30*		0.10		0.54*		-0.15
		(0.150)		(0.203)		(0.264)		(0.238)
Has a NPP leader * NDC in charge * not a NPP electoral stronghold <sup>a</sup>	0.06		-0.28*		0.55+		-0.29	
	(0.143)		(0.113)		(0.290)		(0.257)	
Has a NPP leader * NDC in charge * not a NPP electoral stronghold <sup>c</sup>		-0.20		-0.39*		-0.21		-0.37
		(0.217)		(0.179)		(0.320)		(0.272)
Has a NDC leader * NDC in charge * NDC electoral stronghold <sup>b</sup>	-0.03		0.08		-0.55		-0.24*	
	(0.247)		(0.264)		(0.375)		(0.114)	
Has a NDC leader * NDC in charge * NDC electoral stronghold <sup>d</sup>		-0.02		0.06		-0.26		-0.18+
		(0.212)		(0.235)		(0.383)		(0.109)
Has a NDC leader * NDC in charge * not a NDC electoral stronghold <sup>b</sup>	0.07		-0.25+		0.35+		0.12	
	(0.140)		(0.128)		(0.181)		(0.166)	
Has a NDC leader * NDC in charge * not a NDC electoral stronghold <sup>d</sup>		0.10		-0.25		0.46*		0.21
		(0.157)		(0.154)		(0.179)		(0.182)
Has a NPP leader, Has a NDC leader NPP electoral stronghold, NDC electoral stronghold, both interacted with (NDC in charge)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes		
Lagged variable interacted with Type * (NDC in charge) dummies	Yes	Yes	Yes	Yes	Yes	Yes		
Observations	1,482	1,482	1,134	1,134	348	348	424	424
R-squared	0.467	0.469	0.465	0.462	0.550	0.571	0.460	0.452
Nb. of districts	102	102	95	95	58	58	110	110
Nb. of districts with Parliamentary candidate, minister after 2000	14	14	9	9	12	12	15	15
Nb. of districts with Parliamentary candidate, minister before 2000	14	14	12	12	11	11	17	17
Nb. of NPP electoral strongholds <sup>a</sup>	11	25	9	21	6	18	11	26
Nb. of NDC electoral strongholds <sup>b</sup>	32	46	32	45	17	21	36	57

\*\* , \* and + mean respectively that the coefficients are significant at the 1%, 5% and 10% levels.

Notes: OLS with standard errors given beneath the coefficients. The standard errors are corrected for an arbitrary correlation between different observations of the same district. The indicators included in specifications 1 to 6 are: the share of households connected to the electricity grid in rural areas, the share of households with access to piped water in rural areas, the share of civil servants in the labor force in rural areas, the share of households connected to the electricity grid in urban areas, the share of households with access to piped water in urban areas, the share of civil servants in the labor force in urban areas, the share of the rural population with access to a primary school in the community, the share of the rural population with access to a secondary school in the community, and the share of the rural population with access to a health center in the community.

<sup>a</sup> NPP electoral stronghold: the NPP won the 1996 presidential elections by a margin of more than 25 p.p.

<sup>b</sup> NDC electoral stronghold: the NDC won the 1996 presidential elections by a margin of more than 50 p.p.

<sup>c</sup> NPP electoral stronghold: the NPP won the 1996 presidential elections by a margin of more than 5 p.p.

<sup>d</sup> NDC electoral stronghold: the NDC won the 1996 presidential elections by a margin of more than 25 p.p.

<sup>e</sup> Reproduces the estimates of Table 1, column 2.

<sup>f</sup> Reproduces the estimates of Table 1, column 4.

<sup>g</sup> Reproduces the estimates of Table 1, column 6.

<sup>h</sup> Reproduces the estimates of Table 1, column 8.