Supplementary Materials

The Political Economy of Unfinished Development Projects: Corruption, Clientelism, or Collective Choice?

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Abstract

Development projects like schools and latrines are popular with politicians and voters alike, yet many developing countries are littered with half-finished projects that were abandoned mid-construction. Using an original database of over 14,000 small development projects in Ghana, I estimate that one-third of projects that start are never completed, consuming nearly one-fifth of all local government investment. I develop a theory of project non-completion as the outcome of a dynamically inconsistent collective choice process among political actors facing commitment problems in contexts of limited resources. I find evidence consistent with key predictions of this theory, but inconsistent with alternative explanations based on corruption or clientelism. I show that fiscal institutions can increase completion rates by mitigating the operational consequences of these collective choice failures. These findings have theoretical and methodological implications for distributive politics, the design of intergovernmental transfers and aid, and the development of state capacity.

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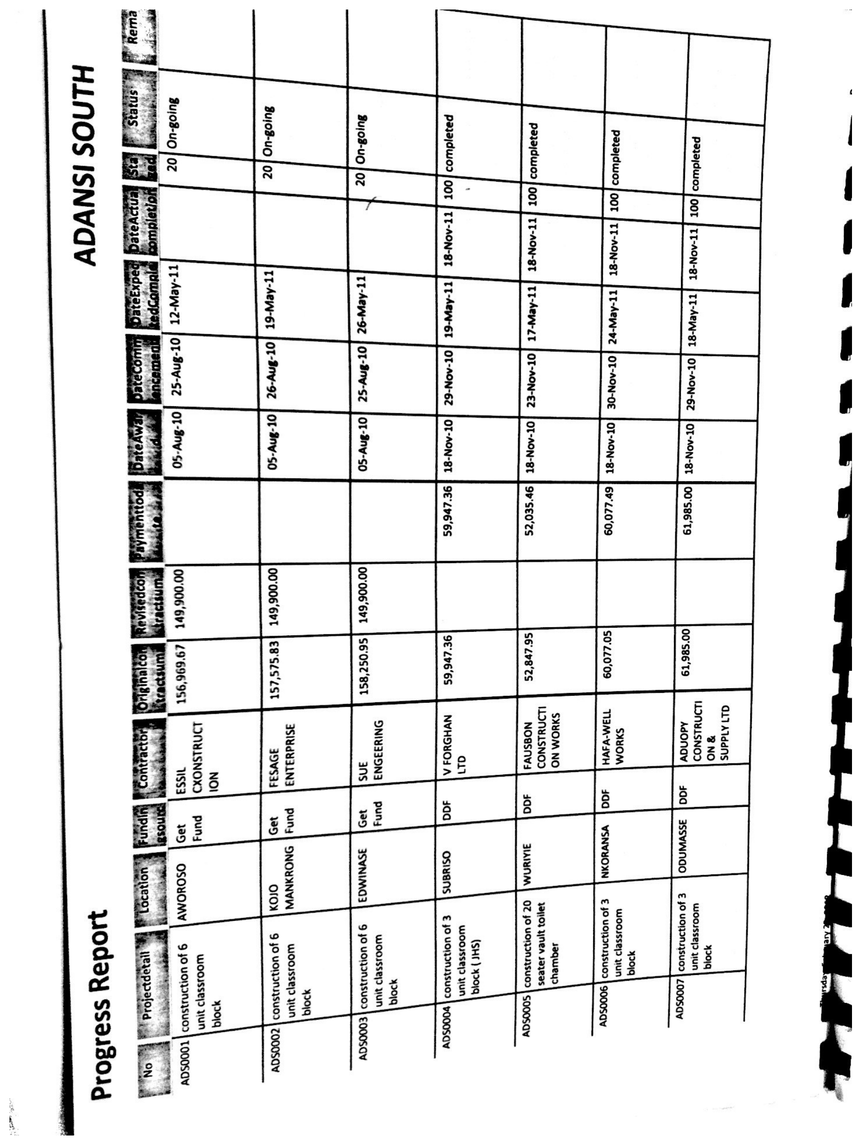
Appendix A Sample Annual Progress Report



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Progress Report

No	Projectdetail	Location	Fundingsource	Contractor	Originalcontractsum	Revisedcontractsum	Paymenttodate	DateAwarded	DateCommencement	DateExpectedComple	DateActualcompletion	Sta	Status	Rema
ADS0001	construction of 6 unit classroom block	AWOROSO	Get Fund	ESSIL CXONSTRUCTION	156,969.67	149,900.00		05-Aug-10	25-Aug-10	12-May-11		20	On-going	
ADS0002	construction of 6 unit classroom block	KOJO MANKRONG	Get Fund	FESAGE ENTERPRISE	157,575.83	149,900.00		05-Aug-10	26-Aug-10	19-May-11		20	On-going	
ADS0003	construction of 6 unit classroom block	EDWINASE	Get Fund	SUE ENGEERING	158,250.95	149,900.00		05-Aug-10	25-Aug-10	26-May-11		20	On-going	
ADS0004	construction of 3 unit classroom block (JHS)	SUBRISO	DDF	V FORGHAN LTD	59,947.36		59,947.36	18-Nov-10	29-Nov-10	19-May-11	18-Nov-11	100	completed	
ADS0005	construction of 20 seater vault toilet chamber	WURIYIE	DDF	FAUSBON CONSTRUCTION WORKS	52,847.95		52,035.46	18-Nov-10	23-Nov-10	17-May-11	18-Nov-11	100	completed	
ADS0006	construction of 3 unit classroom block	NKORANSA	DDF	HAFA-WELL WORKS	60,077.05		60,077.49	18-Nov-10	30-Nov-10	24-May-11	18-Nov-11	100	completed	
ADS0007	construction of 3 unit classroom block	ODUMASSE	DDF	ADUOPY CONSTRUCTION & SUPPLY LTD	61,985.00		61,985.00	18-Nov-10	29-Nov-10	18-May-11	18-Nov-11	100	completed	

Appendix B Sample balance

The Annual Progress Reports (APRs) used to construct the database had to be located in hard or soft copy in the offices of the National Development Planning Commission (NDPC) in Accra or of the Regional Coordinating Councils (RCCs) in the ten regional capitals. Altogether 479 APRs were located. The maximum notional number of APRs for the period 2011-13 would be 602: 170 for 2011, 216 each for 2012 and 2013. Of these, 407 APRs contained project tables with sufficient information to be entered into the database. The final database thus covers 67.6 percent of possible district-year observations.

There is little evidence that missing reports are correlated with district characteristics. Figure A1 plots the unweighted means and 95 percent confidence intervals of a wide range of district characteristics, by the number of APRs that are missing for each district. The most important balancing test is for average annual project completion, this study's main dependent variable. Although it is not possible to calculate this for districts with all three APRs missing, there is no statistically significant difference in average project completion rates across districts with different levels of APR completeness.

The sample also appears to be balanced across the other variables reported in Figure A1. In addition to a wide range of demographic, social, and economic variables drawn from the 2010 Population and Housing Census, this includes: districts' scores on the Functional and Organizational Assessment Tool (FOAT) evaluation undertaken to assess districts' compliance with a set of procedural requirements as part of the allocation and disbursement procedure for DDF funds; the vote share in the district of the National Democratic Congress (NDC), which was the ruling party during the sample period, from the 2008 presidential elections; and budget size, as measured by the total revenue of the district in 2013. There are no apparent patterns across reporting completeness in any of the variables examined, so there is no evidence that the sample coverage of the APR database is biased.

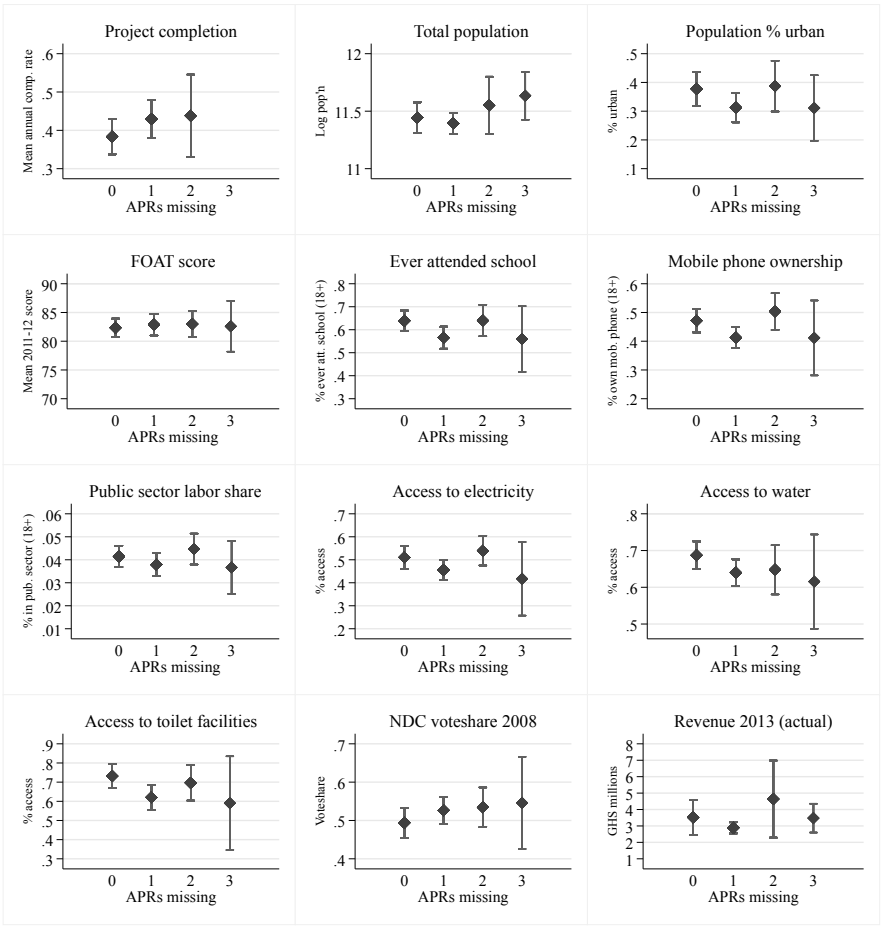
Table A1: Coverage of key variables in dataset

	Non-missing			Non-missing	
Variable	Obs.	Pct.	Variable	Obs.	Pct.
Project title	14,246	100.0%	Contract sum	9,869	69.3%
Completion status	13,339	93.6%	Commencement date	5,518	38.7%
Fund source	11,226	78.8%	Completion date (expected)	5,061	35.5%
Location	11,326	79.5%	Completion date (actual)	1,424	10.0%
Contractor	9,319	65.4%	Expenditure to date	6,224	43.7%

Note: See Appendix C for full variable descriptions. Percentages are as percent of total (n=14,246).

Due to the inconsistent reporting formats used by districts in producing their APRs, many observations are missing important variables, thus restricting the effective sample for certain types of analysis. Table A1 gives an indication of this

Figure A1: APR sample balance on selected variables



Note: Mean and 95% confidence intervals shown for each group of districts. Access to electricity is percentage of individuals reporting using mains electricity for lighting; access to water is percentage reporting using pipe-borne, borehole, or public tap water for drinking; access to toilet facilities is percentage using a WC, KVIP, pit latrine, or public toilet facility (all from Population and Housing Census 2010).

for a selected number of variables. Although this affects the types of analysis that can be done on the data, there is no indication that the missing variables are anything other than a result of districts' use of different reporting formats.

Appendix C Variable coding

All APR database variables were coded algorithmically from text strings by defining a set of word or phrases corresponding to values; the particularities of this process for each variable, along with other relevant data and coding notes, are detailed below. Project numbers and statistics in this appendix are given at the point of coding, and thus may differ from those in the final database from which repeat observations and non-infrastructure projects have been excluded.

Fund source Project fund source was constructed from APR entries for project's fund source for nearly all observations, although in a small number of cases (178, or 1.1 percent) there was no dedicated entry for fund source but fund sources were named in the project title. These were combined, and then coded into fund source categories according to a set of text strings commonly occurring in the data – e.g. for DACF, these were "DACF", "COMMON FUND", "D A C F", and "CF". All projects where the fund source was listed as the district itself were coded as using internally generated funds (IGF), together with those where IGF was directly identified as the fund source. A small number of projects (143) were funded by the local Member of Parliament (MP) using the small portion allocation of the DACF which is disbursed to them as a constituency development fund; these were coded under "Other" rather than DACF because they are selected and implemented separately. All projects with more than one identifiable fund source (about 3 percent) were coded as "Multiple".

Project type Project type was constructed using sets of commonly used text strings in the project title to first group projects into sixteen types of infrastructure projects:

- Agriculture: dams, irrigation, dug-outs;
- Borehole: boreholes, wells;
- Clinic: clinics, health centres, hospitals, wards;
- Construction – other: abattoirs, computer centers, libraries, taxi ranks, lorry parks, community centers, sports stadiums, light industrial areas, warehouses;
- Culvert: culverts, drains, ditches, gutters;
- Electricity: electrification, substations;
- Latrine: latrines, Kumasi ventilated improved pits (KVIPs), toilets, water closets;
- Market: market stalls, stores, sheds, meat shops;
- Office: administration blocks, assembly/town/council halls, courts, police stations, fire stations;
- Road: roads (paved, graveled, or dirt), bridges, spot improvements, speed humps, paving works;
- School: classroom blocks, kindergartens, nurseries, early childhood development centres;

- School – other: dormitories, dining halls, hostels, school feeding kitchens;
- Staff housing: bungalows, guest houses, accommodation blocks, residences, quarters;
- Streetlights
- Waste management: refuse dumps, rubbish storage; and
- Water: water systems, water harvesting, water supply, reservoirs and storage, pipe-borne water works, water distribution.

In addition, two categories of non-infrastructure projects were constructed but not included in the analysis:

- Procurement: purchase, supply, distribution, and furnishing (e.g. tractors, desks, computers), acquiring land for projects, equipment of facilities; and
- Services: a wide variety of activities related to service-provision and other non-infrastructure activities, e.g. training, vaccination campaigns, capacity building, tax collection, celebrations, monitoring, public education, sponsoring.

The guiding principle in distinguishing between infrastructure and non-infrastructure projects was that projects involving physical transformation were coded as infrastructure (e.g. building a classroom block), whereas projects consisting only of related activities that did not themselves involve physical transformation (e.g. acquiring land to build a classroom block, supplying a classroom block with textbooks) were coded as non-infrastructure.

This algorithmic coding resulted in unique project types for 74.4 percent of projects, while 12.8 percent were not assigned a type and another 12.8 percent were assigned two or more types. These 5,569 projects were manually inspected and disambiguated if possible, or if the project genuinely straddled two types it was coded as "multiple".

Finally, the category "school" was sub-divided into six categories according to the size of the classroom block: five categories for 2-, 3-, 4-, 6-, and 12-unit classroom blocks, and a sixth residual category for classroom blocks of indeterminate size, or reported projects which actually involved more than one discrete structure (e.g. construction of two 3-unit classroom blocks). Number of units was coded algorithmically by defining a set of 41 common text string permutations used to denote construction of a single classroom block (e.g. "1NO 3-UNIT [CLASSROOM BLOCK]", "[CONSTRUCTION] OF 3-UNIT [CLASSROOM BLOCK]").

Prior to analysis, projects with missing type or coded as "services", "procurement" were dropped. The project categories used in the analysis therefore comprise the fifteen non-school infrastructure types listed above; six types of schools (five according to classroom block size, and one residual category); and the type "multiple" comprising all projects that could not be manually coded into a unique type.

Construction type Project titles often include a phrase that identifies whether the project constitutes new (greenfield) construction, or repair, maintenance, renovation, or rehabilitation of an existing project that had been completed

previously. The former category was coded as projects including the general text string "CONSTRUCTION OF" and abbreviations or misspellings of this; project type-specific construction verbs such as "DRILLING OF", "PAVING", and "SPOT IMPROVEMENT"; and strings indicating that the project is a greenfield project in its second or subsequent year, such as "COMPLETION OF", "CONTINUE", and "CLADDING". (The APRs are inconsistent in the extent to which they alter these prefaces for a given project across years (i.e. whether they change "CONSTRUCTION OF" in the first year of a project to "COMPLETION OF" in its second year), so these were coded together as greenfield projects.) Project titles containing general phrases such as "MAINTENANCE", "REPAIR", "RENOVATION", and "REHABILITATION", or project type-specific phrases such as "DESILTING", "RE-ROOFING", "RESURFACING", and "RESHAPING" were coded as maintenance/repair/renovation projects. Altogether 76.4 percent of projects were coded as greenfield construction, 11.9 percent as maintenance/repair/renovation, and the remaining 11.6 percent could not be uniquely identified as either type.

Project completion Project completion was coded as a binary variable by combining information from three raw variables, of which one or two are typically reported in each APR: ProjectStatus (e.g. "COMPLETED", "INSTALLED AND IN USE," "100 WORK DONE"), Remarks (similar), and PercentWork (on the scale 0-100; 100 coded as complete). Projects were coded as complete if they were at a stage where physical construction work had been completed, regardless of whether they had been formally handed over, furnished, commissioned, and put into use – for example "COMPLETED YET TO BE FURNISHED AND COMMISSIONED" was coded as complete. This yielded a unique completion coding for 91.6 percent of observations; the remainder were disambiguated by visual inspection if possible, and given a missing value if it was impossible to determine the project's status conclusively.

Although the gap between physical completion and putting the facility into use is of potential interest, physical completion was chosen as a cutoff point for the purposes of the APR database because: 1) the status of post-construction activities like furnishing, commissioning, and use are reported inconsistently in the APRs; and 2) the analytical focus of this paper is on infrastructure project construction, not subsequent service provision using those facilities.

Contractor A total of 6,798 unique contractor names are listed in the APR database for 10,701 infrastructure projects. However, many of these are clearly the same contractor but with different spellings (e.g. "WRKS" for "WORKS"), abbreviations (e.g. "LTD." for "LIMITED"), or omissions (e.g. dropping "LIMITED" or "INC."). In order to combine these, contractor names were stripped of these and other generic elements of company names (e.g. "ENTERPRISE", "TRADING", "MESSRS.", "M/S", "COMPANY"), as well as punctuation marks and spaces. This reduced the number of unique contractor names from 6,798 to 5,113. Using these corrected contractor names rather than the raw names slightly changes the point estimates on fund source regression coefficients, but not the differences between these coefficients, which are the quantities of interest.

District In mid-2012, 45 of Ghana's 170 districts were split to create 46 new districts (one district was split into three), leaving a total of 216 districts. The 46 new districts were all entirely contained within a single parent district, so there was no realignment of borders between districts. The 2011 and 2013 APRs

thus reflect the 170 and 216 districts, respectively. For 2012 districts reported according to the new (216) district names, although many of the newly created districts did not report as they had only been in existence for approximately six months and were still waiting offices, personnel, etc. This creates some concern about duplications or omissions in the reporting of projects in split districts that started prior to the split, and it is unclear how consistently these matters were handled across districts. However, restricting the sample to districts that did not split in 2012 does not affect any of the results presented above, and the regression results include district-year fixed effects that would capture any disruption caused by these administrative splits, so the potential data concerns created by the district splits do not appear to affect the analysis.

For purposes of project linking and fixed effects, the post-split "parent" district (the one that maintained the existing district capital, political leadership, and the majority of its administrative staff) is treated as the same district as the pre-split combined district, regardless of whether it changed its name, while the new "child" district is treated as a new district.

The other secondary data sources drawn on by this paper differ in whether they report the old 170 or new 216 districts for 2012. This means that in some cases (e.g. with budget data) APR data from a post-split 2012 district is matched to other secondary data from a pre-split 2012 combined district. The 2010 Population and Housing Census initially used the 170 districts but has been recoded to correctly reflect the new 216 districts for the analysis years 2012 and 2013.

Classroom block additional facilities For all classroom blocks for which it was possible to identify the number of units (2, 3, 4, 6, or 12), three indicator variables representing additional facilities included in the project were defined: latrines and toilets (project titles including the strings "LATRINE", "TOILET", "KVIP", etc.); offices/stores/libraries ("OFFICE", "STORE", "COMMON ROOM", "LIBRARY"); and general ancillary facilities (various spellings and abbreviations of "ANCILLARY"). These variables were not coded as mutually exclusive, although it is not common for one project to combine multiple types of ancillary facilities. A residual variable was defined for the 38.0 percent of projects that do not appear to include any of these ancillary facilities.

Appendix D Attrition

Because very few districts assign unique tracking numbers to projects, linking projects across years had to be done manually. For each district for which all three years of data were available, records of projects coded as being in the same location (e.g. village, neighborhood) in different years were visually inspected according to their project title, fund source, completion status, contract sum, and other potentially identifying information, and linked if they were obviously the same project. Conditional on being incomplete in 2011 or 2012, only 33.8 percent of projects could be identified in the following year, indicating a high degree of attrition in reporting and linking. This gives rise to two concerns: first, differential attrition rates across fund sources could bias the within-district estimates of fund source completion rates.[1] Second, attrition is likely to be correlated with project completion (if bureaucrats stop reporting unfinished projects that have been abandoned) and thus poses a challenge for estimating the overall completion rate.

To investigate the first possibility, I construct an attrition indicator variable equal to one if a project that is incomplete in 2011 or 2012 can be linked to the same project's record in the following year (2012 or 2013, respectively), and zero otherwise. This variable is defined only for projects in districts that have three years of APR data. I then use this as the dependent variable in an attrition probability model, estimated as a linear probability model, where the key variables of interest are fund source indicator variables.

The results are presented in Table A2. Column 1 estimates the model with no controls and indicator variables only for the three major fund sources; Column 2 adds the baseline set of district-year and project type fixed effects, plus project characteristics; and Column 3 estimates the model with community fixed effects. The differences among the coefficients on the three major fund sources are small and are not statistically significant in any of the specifications.

To address the second concern, I estimate three different sets of completion rates, which are almost identical for projects' first year but diverge thereafter:

- *Upper bound.* Projects are classified into years (1-3) according to their reported year of commencement (e.g. a 2012 observation of a project that started in 2011 is in its second year). No correction is made for attrition. Sample is all projects with non-missing commencement year.
- *Middle estimate.* Projects are classified into years according to manual linking (see above). Incomplete projects that cannot be traced to the

[1] Attrition rates also vary across districts, and it is possible that districts interpret the reporting mandate in slightly different ways: some may report all projects that were underway in the district, whether or not they were active during the year, while others may only report projects that were active or included in annual budgets. However, this does not pose a major threat to this paper's main analysis, as the district fixed effects would cancel out district-level differences in attrition.

Table A2: Attrition probability by fund source

	(1)	(2)	(3)
Gov't-funded	-0.033	-0.012	-0.010
	(0.069)	(0.046)	(0.078)
Centralized	0.019	-0.047	-0.002
	(0.066)	(0.045)	(0.115)
District-Year fixed effects		Yes	
Community fixed effects			
District-Year groups		71	
Community groups			496
R^2	0.002	0.518	0.812
N	915	915	807

Note: Dependent variable is project attrition. All specifications include: fixed effects for 22 project types, with schools grouped by number of classrooms; construction type (construction or maintenance); and indicators for number of years since project start. Year fixed effects included in Column 3. Huber-White robust standard errors clustered by district-year in Columns 1-2 and by community in Column 3. Constant term not shown.

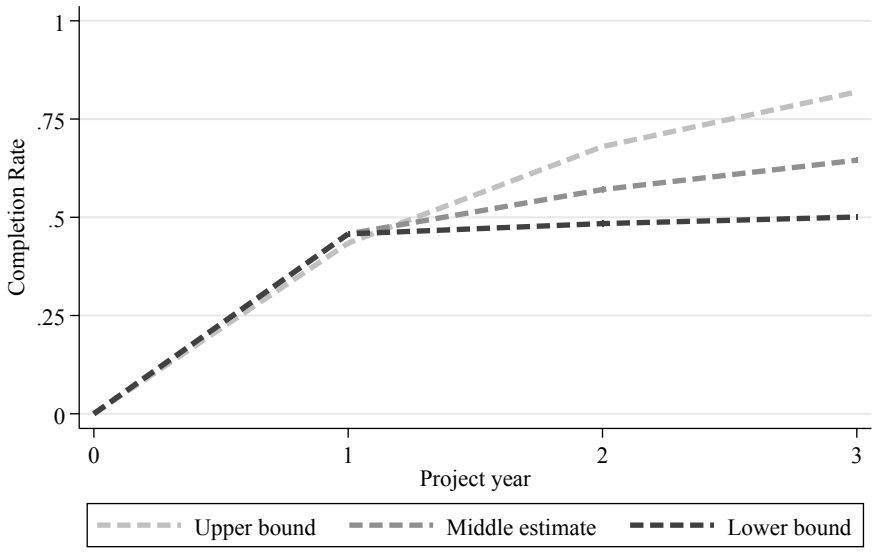
subsequent year are treated as missing in the subsequent year (i.e. no correction is made for attrition). Projects that have not been linked to an observation from previous year are assumed to be in their first year. Sample is all projects from districts for which all three years of data are available. This is the method used in the main body of the paper.

- *Lower bound.* Same as middle estimate, but incomplete projects that cannot be traced to the subsequent year are assumed not to have been finished (i.e. attriting observations are treated as incomplete).

The upper bound estimate will be biased upward if unfinished/abandoned projects are more likely to attrite from the dataset than completed projects, which is probable. Likewise, the lower bound estimate will be biased downward if untraceable projects are actually completed in the subsequent year but not reported, or if the projects were completed and reported but not linked by the manual tracing methodology. The middle estimate is situated between these two but may also be biased, although the direction of this bias is unclear a priori. To the extent that the middle and lower estimates incorrectly group projects that are in their second or subsequent years but are appearing in the dataset for the first time as first-year projects, the first-year completion rates may be biased; in practice however this bias appears to be small, as the first-year completion rates are very similar under all three estimates.

Figure A2 presents the three-year completion rates using these different estimation methods. The differences in the second and third years among the

Figure A2: Alternative completion rate estimates



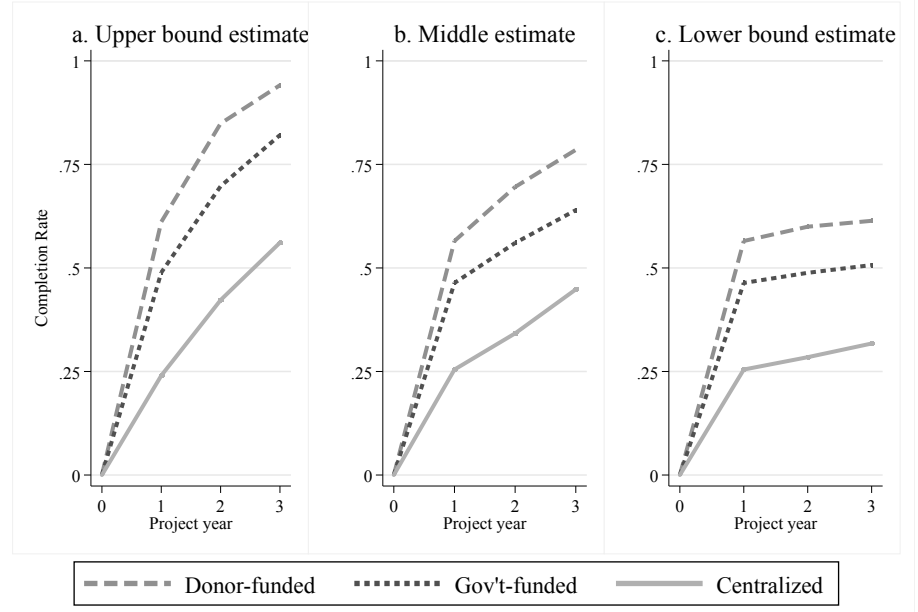
Note: See text for details of methodology.

methods are large, although the completion hazard rate continues to decrease over time across each methodology.

However, Figure A3 shows that the differences across fund sources vary little across the estimation methodologies. This provides further reassurance that the main findings of the paper are not affected by attrition.

Finally, the attrition in linking projects from year-to-year suggests that the low rates of correspondence between district medium-term plans and projects actually implemented (5.7 percent of projects in district plans could be located in the APR database, and 3.8 percent of projects reported in the APR database could be identified in the plan) could overstate the true variance. Since the same linking methodology was used for the plan-APR linking as for the year-to-year linking within the APR database, a conservative approximation of the potential extent of bias can be generated using the observed attrition rate within the APR database (66.2 percent). Under the extremely conservative assumption that all of this attrition is due to error in the linking process (rather than districts ceasing to report on projects on which no new progress had been made), then the plan-APR linking rates could represent only 33.8 percent of the true rate of correspondence. This would roughly triple the true rate of correspondence, to 16.9 percent of planned projects that were implemented and 11.2 percent of implemented projects that were planned. Even these generous estimates are still extremely low in absolute terms, however, and would still support the conclusion that there is a high degree of temporal instability in district collective expenditure priorities.

Figure A3: Project completion by fund source - alternative estimates



Note: See text for details of methodology.

Appendix E Validating completion measures

This appendix reports the numerous steps taken to address concerns about bias in districts' reported levels of project completion. The project completion rates estimated from the APR database used in this paper are in a similar range to figures compiled on smaller project samples through (1) a donor-commission independent evaluation report, (2) an internal Ministry of Education database compiled through separate means, and (3) a Ghana Audit Service monitoring report. I also (4) conducted two sets of site visits to small sub-samples of projects, 128 in total, and found no evidence of systematic bias in reporting. On the specific concern that the finding of systematic under- or delayed payment to contractors may be biased by over-reporting of physical completion or under-reporting of financial expenditure, I (5) present a Ghana Audit Service audit report of 100 projects that found under-payment to be pervasive and over-payment almost non-existent, and (6) show evidence that underpayment to contractors does not appear to be explained by normal delays in payment processing or difficulties in tracking financial expenditure across years. Finally, I (7) argue that districts' have little incentive to misreport completion in the APRs since these reports are not used for accountability purposes, and even if there were some degree of bias in completion reporting, an opinion that is shared by central government auditors. Furthermore, in order to bias the key predictions of the collective choice and clientelism theories, any bias in completion reporting would have to be within rather than across districts, differential across fund sources, and the extent of this difference would have to be correlated with district partisan vote shares.

(1) An independent, donor-commission evaluation report on a sample of 90 projects across 28 districts in late 2013 (Salasan Consulting 2013) found that 78 percent of DDF projects were completed (compared to a three-year completion rate of 78.5 percent from the APR database) and 53 percent of DACF projects were completed (compared to a three-year completion rate of 64.0 percent from the APR database). These completion rates are not directly comparable, since no information is given on the start date or expected completion time of these projects and the sample is non-representative, but it is reassuring that the completion rates are nonetheless in a similar range.

(2) The Ministry of Education maintains its own internal monitoring database of 1,146 GETFund projects, which is compiled by central officials rather than the district officals who write APRs. It reports that of 6-unit classrooms and dormitories started between 2009 and 2013 nationwide, only 36.6 percent had been completed. It is not possible to disaggregate this by year of project commencement, and the date of reporting is not indicated (these figures are based on a database provided by the Ministry of Education in January 2015). (3) In addition, the Ghana Audit Service reports that a June 2013 monitoring effort of 179 school projects in seven regions started in 2010 and 2011 found that 27 percent were complete, despite scheduled completion times of six to twelve months – a similar length to most GETFund projects in the APR database (Ghana Audit Service 2014, 290). While these estimates differ slightly in timespan and project coverage, they are in the same range as APR database estimates that GETFund projects have one-year completion rates of 25.4 percent and three-year completion rates of 44.8 percent.

(4) Though the high cost of locating and travelling to projects in remote areas made it impractical to conduct visits to a representative sample of projects in each district (hence the need to rely on administrative data), I conducted physical site visits to a small sub-sample of projects that had been coded as complete in 2013, spread across four randomly selected districts in two regions. Seventeen of the twenty projects were fully complete, while the remainder were functionally complete but with minor areas of incompleteness (e.g. no windows, untiled floors, holes in roof, some roofing remaining to be done). Sixteen of the projects were in full use; of the remaining four, one was in partial use, one was out of use because of cracks and accessibility issues, and one had not been commissioned yet. The site visits were conducted in October 2014, ten months after the project had been reported as complete; in only one case did people present at the project site report that the project had actually been fully completed in 2014 rather than 2013. The physical evidence from this limited sample suggests that while construction quality, maintenance, and finishing may be issues, there is little evidence that districts' reports of substantial aspects of physical construction are systematically biased towards completion.

In January-March 2017 I conducted a second set of site visits to 108 projects that were reported on in 2015 (selected using preliminary data drawn from the 2015 APRs). The projects were randomly selected from 12 districts in three regions, covered the three most common project types (schools, latrines, and staff housing), and included projects that had been reported as incomplete as well as complete. A research assistant was trained by Ghana government engineers to estimate percentage completion status. In total, 63.6 percent of actual project percentage physical completion estimates were within 10 percentage points of the estimate reported in the APR, 27.3 percent had significantly higher physical

completion than reported, and 9.1 percent had significantly lower physical completion rates than reported. Of the eight projects for which physical progress had been overreported, in only three was the gap between estimates larger than 25 percentage points. The overreported projects were spread across fund sources: two from the GETFund ("centralized"), two from the DACF ("government-funded"), two from the DDF ("donor-funded"), one from district own revenue, and one had no fund source data.

To estimate how much influence the handful of projects for which completion was over-reported might have on the missing expenditure calculations used in discussing the incidence of over- versus under-payment, for these 108 projects I calculate the missing expenditures variable in two ways: first, by using the physical completion status as reported in the APR, as in the main text; and second, using a "corrected" physical completion status measure in which I replace the self-reported completion percentage with the "correct" estimate from the site visit. This is the most conservative possible way to implement this correction, since it assumes that all measurement or reporting error on physical completion is positive (i.e. overestimates completion). Compared to the corrected measure, the APR dataset overstates the percentage of projects where missing expenditures are significantly negative (underpayment) by 8.3 percent (and has no impact on the percentage of projects with positive missing expenditures). The key ratio presented in the main text was that underpayment by 10 percent or more is 3.2 times more frequent than overpayment by 10 percent or more for incomplete projects. If the percentage of projects with significant underpayment were actually 8.3 percent lower due to over-reporting of completion, then this ratio would be 3.0 instead of 3.2. Even under the most conservative assumptions about potential over-reporting of physical completion data, then, the key qualitative finding of the analysis still holds: underpayment for work done is far more common than overpayment for work done.

(5) In 2015 the Ghana Audit Service undertook intensive performance audits of a (non-representative) sample of 100 projects from 50 districts around the country. On the subject of "payment for works", it concluded the delayed payment and underpayment to contractors was pervasive: "Payment to contractors was a serious problem in all the assemblies. In most cases it was [only] the advance mobilization payment that was made on time. All other payments were not regular as envisaged by the conditions of contract." (Ghana Audit Service 2016a, 26) In contrast, the only instance of overpayment it noted - in a section on "Uncommon But Significant Audit Findings" - was the payment of an entire bill of quantities line item for a library that was constructed smaller than had been specified, resulting in overpayment of GHS 18,610.82[2] (Ghana Audit Service 2016a, 28). A senior auditor who worked on the project confirmed that such instances of overpayment were rare: "I don't think it was a common thing. I don't think I saw that in the areas I went... That may have been if they were falsifying information on the payment certificates. There was one district that had something like that. It wasn't something that was cutting across all. Maybe two or three" (Telephone interview, 27 January, 2017).

(6) Districts usually have a period of 28 days after contractors have submitted payment requests in which to inspect work and make payment; the length of this period can vary by contract. Since both financial and physical status are re-

[2]Equivalent to USD 4,561.48 using the exchange rate of June 1, 2015.

ported by districts at the end of the year, this time lag could exaggerate the true extent of underpayment if payment delays were normal or merely a short-term phenomenon. If this measurement issue were driving the over/under-payment ("missing expenditures") measure, then projects completed earlier in the year should have lower rates of underpayment than projects completed later in the year. However, there is no correlation (-0.0026, $p = 0.966$) between projects' reported month of completion and missing expenditures. Thus, negative values really do seem to be measuring severely delayed payment or non-payment rather than normal lags in processing payment.

(7) Finally, district officials would have no incentive to lie in compiling their APRs, since the APRs are not submitted directly to any of the funding institutions, and prior to the compilation of this database were not being used by these institutions for monitoring purposes. The reports were subject only to a perfunctory check by central government officials and there are no reported instances of any district-level being punished based on information reported in an APR. Scrutiny of district operations is somewhat more intense in terms of financial management due to the Ghana Audit Service's annual audits, but if anything this provides an incentive for district-level officers *not* to misreport the financial status of projects on APRs. This is because the information on financial expenditure in APRs is easy to verify against other payment records, so any discrepancy would be likely to be noticed and attract unwanted attention. In an interview, a senior Audit Service official expressed skepticism regarding district officials' incentives to misrepresent projects' physical or financial status in the APRs: "I don't think any of them will represent false information. It's not something that really happens actually... They don't have an incentive to lie at all." (Telephone interview, 27 January, 2017)

Furthermore, it is important to note that data quality and reporting honesty are most likely to vary at the district level, since this is the level at which APRs are written. Since this paper's analysis focuses mainly on within-district variation, however, misreporting would only bias the key results if it were differential across fund sources and the extent of this across-fund source difference was correlated with partisan vote shares.

Supplementary References

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Appendix F Robustness

F.1 Robustness

Table A3 presents the results of several robustness checks on the main results. To account for the binary dependent variable, Column 1 presents the baseline model from Equation **??** estimated with a random effects logit. The large number of district-year groups makes estimation with fixed effects unfeasible, hence the preference for the linear probability model throughout, but Column 1 shows that this estimator choice is not driving the results.

To address the concern that the project type fixed effects do not adequately control for heterogeneity in the physical characteristics of projects, Column 2 restricts the sample to schools (with project type defined by the number of classrooms in the school) and introduces controls for the presence of ancillary facilities attached to the school buildings. The estimated $\hat{\tau}^{Gov't}$ remains large and statistically significant, and significantly greater than $\hat{\tau}^{Central}$.

Another potential concern is that the use of annual project completion rate as dependent variable might be biasing the estimated fund source effects, as could be the case if project completion rates declined over years since project start, if this led latter-year projects from some fund sources to remain in the sample, and if the project-year controls included in the regression did not adequately control for this effect. Column 3 therefore restricts the same to the subset of projects for which commencement dates are available, and thus for which it is possible to determine with certainty that they are in their first year of implementation. The point estimate of $\hat{\tau}^{Gov't}$ is almost unchanged from the baseline model in Table **??** Column 4, but loses statistical significance at conventional levels because the sample restriction dramatically increases the standard error of the estimate.

Another concern is that $\hat{\tau}^{Gov't}$ could be driven by some aspects of project size that are not captured by the project type controls and are correlated with project fund source and partisan alignment. To examine this, Columns 4 and 5 include controls for project contract sum and scheduled project duration, respectively, although properly speaking both these measures of project size are post-treatment variables and so their inclusion could bias $\hat{\tau}^{Gov't}$ up or down. Again, these can only be estimated on restricted samples due to many districts not reporting these variables. The point estimates vary somewhat across specifications and samples, but the key interaction term results are unchanged.

As Hainmueller *et al* (2017) note, interaction models such as the one used in this article are often subject to problems of non-linearity and lack of common support. To address this issue, I implement Hainmueller *et al*'s recommended "binning" procedure that allows for non-linear marginal effects and displays the common support of government- and donor-funded projects. As Figure A4 shows, there is a common support of projects from both fund sources across the spectrum of values for *NDC vote share*. Panel (a) of Figure A4 without district-year fixed effects shows no evidence of non-linearity, and a Wald test fails to reject the null of a linear marginal effect. When district-year fixed effects are added in Panel (b) there is some evidence that the marginal effect of government funding is concentrated in the lower and middle terciles of the distribution of *NDC vote share*, and the Wald test is rejected. This suggests that there could potentially be non-linearities or threshold effects in coalition formation and project priority stabilization. However, this article's key theo-

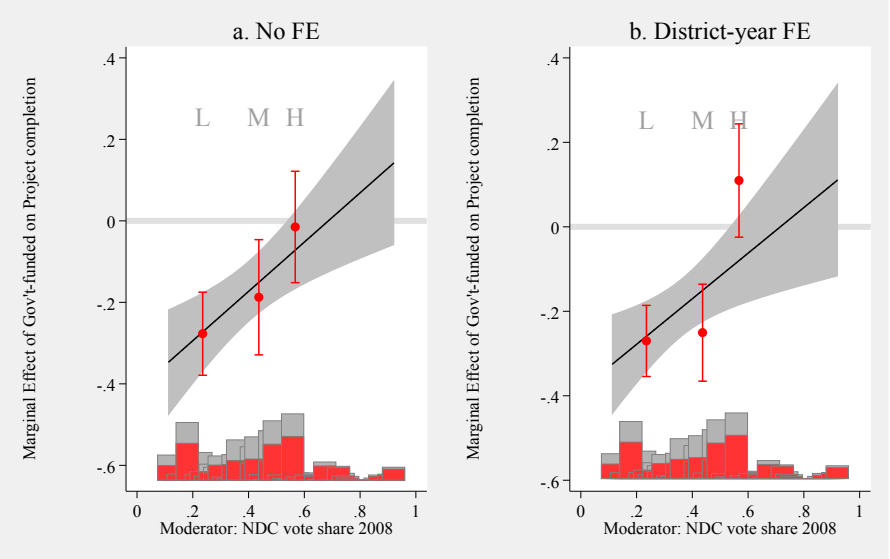
Table A3: Robustness checks

	(1) Logit	(2) Schools	(3) First-year	(4) Cost	(5) Duration
Gov't-funded	-1.179	-0.423	-0.210	-0.222	-0.392
	(0.271)	(0.076)	(0.133)	(0.064)	(0.077)
Centralized	-1.159	-0.377	-0.333	-0.160	-0.357
	(0.393)	(0.082)	(0.213)	(0.084)	(0.096)
Gov't-funded * NDC vote share	1.266	0.573	0.252	0.176	0.553
	(0.508)	(0.160)	(0.289)	(0.126)	(0.197)
Centralized * NDC vote share	-0.554	0.291	0.053	0.018	0.236
	(0.688)	(0.154)	(0.512)	(0.160)	(0.242)
Ancillary facilities		-0.108			
		(0.031)			
Toilet		-0.026			
		(0.044)			
Office/ store/ library		0.026			
		(0.028)			
Ln(contract sum)				-0.134	
				(0.016)	
Scheduled duration					-0.025
					(0.030)
District-Year RE	Yes				
District-Year FE		Yes	Yes	Yes	Yes
District-Year groups		305	147	276	140
R^2		0.421	0.518	0.390	0.405
N	6460	2815	1110	4358	1955

Dependent variable is project completion. All specifications include: fixed effects for 22 project types, with schools grouped by number of classrooms; construction type (construction or maintenance); and indicators for number of years since project start. NDC vote share 2008 is the ruling party's voteshare in the 2008 presidential elections in the district (or its antecedent district, for districts that split in 2012). Huber-White robust standard errors clustered by district-year. Constant term not shown.

retical prediction is simply that the government-funded completion rate should be increasing in *NDC vote share* relative to that of donor projects, and does not specify the functional form of this relationship, so this possibility is not inconsistent with the theory. Further exploring this would be an interesting topic for further research and possibly formal modelling. While Panel (b) suggests that the interaction between partisan alignment and project fund source may be stronger in some parts of the distribution than others, there is no evidence that the effect is non-increasing or significantly non-negative.

Figure A4: Robustness of marginal effects



Note: Marginal effects calculated using Stata command interflex. Sample is all donor- or government- funded projects. Both graphs include controls described in Table A3. Robust standard errors clustered by district-year.

F.2 Ethnicity

The main body of this article uses district ruling party vote share to proxy for the ease of achieving efficient collective choice outcomes at district-level, for reasons described in Section **??**, and shows that this proxy affects government-funded projects where expenditure decisions are taken at local level but not centralized projects. As a robustness check on the idea that non-completion is caused by district-level collective decisionmaking problems, Table A4 re-estimates Equation **??** using two measures of district ethnic diversity as alternative proxies for the difficulty of sustaining intertemporal bargains among district-level political actors. Since poor public good provision has often been attributed to ethnic diversity (Miguel and Gugerty 2005), ethnic diversity could serve as an alternative proxy for the efficiency of district-level collective choices over project distribution, although there is considerable disagreement in the literature over whether and when ethnic diversity reduces public good provision and the proposed mechanism is usually through collective action rather than collective choice (Glennerster, Miguel, and Rothenberg 2013). The two measures of ethnic diversity are: ethnic fractionalization, calculated as standard (e.g. Miguel and Gugerty 2005); and ethnic polarization, calculated following Montalvo and Reynal-Querol (2005). Both are calculated using the primary ethnic categories from Ghana's 2010 Population and Housing Census.

The estimated coefficients on the ethnicity-fund source interaction terms in Columns 1 and 2 imply that government-funded project completion is weakly decreasing in ethnic diversity relative to donor-funded project completion, while the effect on centralized projects is even weaker and actually positive-signed.

Table A4: Ethnic diversity and fund source interactions

	(1)	(2)	(3)	(4)
Gov't-funded	-0.072	-0.024	-0.183	-0.139
	(0.055)	(0.074)	(0.080)	(0.098)
Centralized	-0.276	-0.288	-0.240	-0.251
	(0.067)	(0.082)	(0.102)	(0.120)
Gov't-funded * Ethnic fractionalization	-0.071		-0.072	
	(0.110)		(0.108)	
Centralized * Ethnic fractionalization	0.054		0.047	
	(0.126)		(0.127)	
Gov't-funded * Ethnic polarization		-0.133		-0.123
		(0.120)		(0.120)
Centralized * Ethnic polarization		0.062		0.053
		(0.124)		(0.127)
Gov't-funded * NDC vote share			0.240	0.233
			(0.116)	(0.117)
Centralized * NDC vote share			-0.062	-0.058
			(0.129)	(0.132)
District-Year FE	Yes	Yes	Yes	Yes
District-Year groups	338	338	338	338
R^2	0.351	0.352	0.353	0.353
N	6460	6460	6460	6460

Dependent variable is project completion. All specifications include: fixed effects for 22 project types, with schools grouped by number of classrooms; construction type (construction or maintenance); and indicators for number of years since project start. Ethnic fractionalization and polarization are calculated as standard in the literature (see Miguel and Gugerty 2005, Montalvo and Reynal-Querol 2005), using the primary ethnic categories from Ghana's 2010 Population and Housing Census; and NDC vote share 2008 is the ruling party's voteshare in the 2008 presidential elections in the district (or its antecedent district, for districts that split in 2012). Huber-White robust standard errors clustered by district-year. Constant term not shown.

These patterns are somewhat stronger for ethnic polarization than ethnic fractionalization, consistent with the idea that it is the political salience of ethnic diversity rather than diversity itself that is problematic for collective choice, but even for polarization the differences across fund sources are not statistically significant: $p = 0.269$ for the donor-government comparison, and $p = 0.072$ for the difference between government-funded and centralized projects.

Columns 3 and 4 show that the point estimates and statistical significance of the interaction terms between project fund source and *NDC vote share* are unaffected by the inclusion of the ethnic diversity interaction terms. The relevant collective choice problems - and means of resolving them - thus appear to

be more closely associated with partisan politics rather than ethnic divisions, at least in the Ghanaian context.

Supplementary References

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