Crowdout and Competition: How non-governmental development programs shape public spending

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Abstract

Foreign aid and inter-governmental grants have been shown to crowd out public spending, but non-governmental development assistance is also fungible. Additionally, empirical analyses yield mixed results. How do politicians allocate limited funds amidst non-governmental development programs, and what explains variation? I argue that while non-governmental development assistance substitutes for public spending, political competition dampens the incentive to shirk. I test these intuitions in the context of a randomized evaluation of a World Bank community development program in the Philippines, showing that aid lowers public spending when political competition is low. I demonstrate that crowd-out bears consequences for human development and shapes treatment effects of non-governmental programs. I also exploit supervised learning to explore budget reallocation and find that aid lowers taxes and increases discretionary public sector employment. While my results imply that crowd-out is significantly more pervasive than previously believed, I demonstrate that political institutions can mitigate the perverse economic incentives induced by aid. This clarifies a conflicting body of research and provides powerful evidence to policymakers who wish to maximize the impact of development assistance.

1 Introduction

International aid agencies spend billions of dollars yearly on development assistance, providing disaster relief, building schools and infrastructure, and establishing public health programs.[1] Such spending translates into valuable improvements in human development: microcredit can help the poor to start or expand small businesses (Banerjee et al. (2015)); cash transfer programs can encourage school enrollment and mitigate child labor (Baird et al. (2014); Kabeer and Waddington (2015)); and biometric interventions for public services can reduce ghost beneficiaries and afford governments valuable cost savings (Gelb and Clark (2013)).

However, aid can bear pernicious consequences for the regions to which it is delivered. It can crowd out government labor, funneling top candidates into the NGO sector (Deserranno and Qian (2020)). It can provide politicians programs for which they can claim credit and reap electoral rewards (Cruz and Schneider (2017)). It can also hamper long-run development when aid agencies face incentives to produce programs with demonstrable short-term impacts (Riddell and Niño-Zarazúa (2016)). Evidence garnered within the context of a particular development program can fail to capture its downstream consequences and broader institutional effects, limiting our judgement about its impact.

Development programs also afford citizens necessary services that the government might otherwise need to address. If students receive textbooks from the Peace Corps, the department of education does not need to purchase them. If Relief International provides shelter and material relief following a destructive typhoon, a federal disaster response agency does not need to do so. While a benevolent government may leverage such programs to free up funds for additional social programs or reallocate them to portions of the budget that are stretched thin, others may use development programs as an opportunity to shirk.

Literature on the fungibility of aid has extensively documented that intergovernmental grants and official development assistance can crowd out public spending (Feyzioglu, Swaroop, and Zhu (1998)). However, development programs shift politicians' incentives even when aid is not given to the government. Development assistance constitutes service spending whether delivered to citizens via aid agencies or the state, and these grants are fungible. Even when development programs achieve precisely the outcomes that policymakers intend for their participants, they may also allow politicians to reduce valuable public service spending that might otherwise have been released. Thus, international development assistance may diminish public programs, offering citizens the same extent of support but outsourced to aid agencies that subsume the burden.

How do politicians allocate limited resources in response to non-governmental development programs? I explore this question in the context of a randomized

[1] The Organization of Economic Cooperation and Development reports that $214 billion was spent on official development assistance in 2023. This marks nearly a 30% increase in the last three years.

evaluation of a World Bank community development program in the Philippines, comparing public spending in municipalities that were and were not selected to receive funding. I begin by developing a theoretical intuition for state service substitution, drawing on crowding theory and the flypaper effect to model the political economy of local service delivery. I then consider politicians' allocation of public funds, exploring the incentives that drive the decision to maintain or pull back service provision. In particular, I explore the effect of electoral competition, showing how reelection incentives can encourage politicians to maintain public service spending.

I leverage a randomized controlled trial (RCT) in which World Bank community development assistance was allocated to citizen committees in randomly selected municipalities in order to test these implications empirically and identify causal effects on municipal-level government spending. I find strong evidence that World Bank assistance reduced state spending in the same domains, as well as reduced overall spending across the entire budget. I then incorporate municipal election returns data and show that these effects are moderated by electoral competition. Finally, I develop supervised learning models to examine whether treatment produced additional effects on broader municipal spending and identify how funds may be reallocated. I offer evidence that non-governmental development programs lower taxes and increase casual government employment, a discretionary spending category linked to patronage rewards.

This paper contributes to an ongoing debate as to whether development assistance complements or crowds out state spending. Empirical social scientists have explored this question across countries and grant programs and reached conflicting conclusions, but there have been limited attempts to theorize these heterogeneous findings. I demonstrate that political context, electoral competition in particular, moderates pubic spending decisions and determines whether aid will induce a crowd-out effect. These results offer critical insight to policymakers. Understanding when and where aid might reduce public service provision ensures that development agencies can target their programs to avoid perverse political incentives and achieve the best possible outcomes for beneficiaries.

Furthermore, few studies on aid fungibility offer credible causal evidence. Grants are rarely randomly allocated and researchers must rely on quasi-experimental methods to infer causation. Given that aid agencies target their programs to underdeveloped and low-resourced regions which may spend differently on development, research designs with credible causal identification are crucial. Looking at the effects of development programs on public spending from an RCT specifically allows me to disentangle the natural association of where development agencies work from the effect of their work on political institutions.

This study is the first to my knowledge to employ data generated via random assignment to show that aid can crowd out public spending and to explain variation therein. In addition, it is the first to recognize that non-governmental development programs also substitute for public spending. This is important

not only because it implies that crowd-out is significantly more pervasive than previously believed, but also because it demonstrates that non-governmental development programs shape the allocation of public resources. Evaluating the impact of development interventions thus requires careful consideration of the public service economy. While programs may achieve their intended benefits, downstream reductions in public spending can bear consequences for human welfare.

2 Theory

Throughout the developing world, public institutions and aid agencies offer similar services to a limited population of overlapping beneficiaries. Villages receive water purification or electrification projects installed by an NGO while people in other parts of the country enjoy clean drinking water and electricity provided by a government utilities system. Children are inoculated in UNICEF vaccination drives while enrolled in a government health insurance scheme. Teenagers attend remedial reading classes or mathematics tutoring sessions taught by a Peace Corps volunteer at their local public school while teachers lead courses in these subjects down the hall.

Such resources are vital supplements to public service provision without which many governments would be unable to meet the needs of their citizens. However, they might also reduce demand for government services. Constituents who already have their needs met do not need to compel their elected representatives to provide them. While voters might hold under-performing incumbents accountable, aid agencies contract the performance gap. Voters might also fail to distinguish between public and private programs, rewarding politicians for aid agency services (Cruz and Schneider (2017)). Development programs thus create a perverse political incentive to shirk. Without sanctions, politicians can reduce public service provision and expect to stay in office.

Economists have long argued that grants crowd out public spending. Following an influx of resources, governments should reduce their own spending in order to lower taxes or shift funds to discretionary categories. However, this intuition has not always borne out empirically, and there have been limited attempts to explain this variation.

The conditions under which the economic logic for substitution fractures is the focus of this paper. Why does aid crowd out public spending in some contexts and not others? I argue that political incentives, electoral competition in particular, shape the decision to substitute development assistance for public spending. While politicians in less competitive districts can diminish public programs and expect to stay in power, those facing electoral competition must maintain service provision in order to win reelection.

This section proceeds as follows. I begin by reviewing the theoretical economic motivation by which aid should crowd out public spending and offer a brief

survey of studies that evaluate this relationship empirically. I then explore how political competition drives public spending, drawing on literature on political business cycles in particular.

Crowd-out or crowd-in

The allocation of public resources involves trade-offs. Governments operate under budget constraints, and funding is finite. Money spent in one domain necessitates less in others. However, grants shift budgetary incentives. When funds are given for a particular purpose, the opportunity cost of spending for that purpose is reduced and politicians should move funds to portions of the budget for which the opportunity cost is higher. Thus, aid is often theorized to "crowd out" public resources that would otherwise have been spent, rendering some amount of net spending lost to substitution.

The economic intuition for substitution has been developed over a number of contributions, notably in the context of intergovernmental grants and fiscal federalism. Oates (1972) argues that such grants are fungible and viewed by lower levels of government as additional income which may be used to reduce their own spending on targeted programs. Bradford and Oates (1971) employ the median voter theorem to predict that transfers will have a limited impact on public goods access. Citizens might prefer that additional funds reduce the tax burden rather than increase public services, and given that levels of public spending are determined by the median voter in a representative democracy, politicians should allocate funds accordingly when localities receive grants. Zampelli (1986) argues that governments seek to maximize discretionary resources and can shift budgets accordingly through grant funding without increasing overall spending.

Substitution has been documented empirically in various contexts, from American federal to state transfers, to foreign aid, to non-profits and other non-governmental agencies. From panel data on 67 countries spanning 1972-2000, Chatterjee, Giuliano, and Kaya (2012) find that approximately 70 percent of total aid is fungible. Evaluating the effect of official development assistance (ODA) on tax collection in 118 countries, Benedek et al. (2014) find a negative relationship, but that the effect diminishes over time in response to efforts to mobilize public revenue collection. They also find that the effect is particularly stark for poorer countries and those with weak institutions.

The empirical findings, however, are inconclusive. Grants appear to substitute for government spending in many contexts, but complement it in others. This has been documented perhaps most significantly in a broad array of studies that provide evidence for the "flypaper effect", that money tends to stick where it lands. Observed originally by Hines and Thaler (1995), American intergovernmental grants tend to increase public spending much more than equivalent increases in local revenue. In contrast to economic theory, this "anomaly" sees local governments spend a disproportionately large share of grants rather than treating them as fungible income.

Crowd-in is not just a feature of American intergovernmental grants alone. Dahlberg et al. (2008) leverage discontinuity in the Swedish federal grant system to demonstrate that these funds crowding-in local government spending and fail to reduce local tax revenue. Masaki (2018) extends these findings to the developing world, documenting that intergovernmental transfers mobilize local revenue collection in Tanzania. In the Philippine context, Troland (2016) finds that intergovernmental grants increased local government spending per federal dollar. These single-country studies are substantiated by cross-country panel data which also find evidence for a crowd-in effect (Remmer (2004)).

Politics and public spending

Why is it that aid seems to substitute for public spending in some contexts but complement it in others? Considering the political incentives that moderate public spending decisions sheds light on this discrepancy and clarifies a conflicting body of research.

Electoral incentives shape public spending. This can be observed particularly starkly in the context of political business cycles. Economic policies and macroeconomic outcomes correspond to electoral cycles. Incumbents leverage expansionary policies before elections in order to reduce unemployment, stimulate growth, and improve their chances of reelection (Nordhaus (1975)). Voters face an information asymmetry about the competence of politicians and must judge candidates on the basis of short-term economic performance (Rogoff and Sibert (1988)). Political business cycles have been documented particularly profusely in developing country contexts where institutions are weak (Brender and Drazen (2005); Shi and Svensson (2006)), and have been found in municipal Philippine government spending (Labonne (2016)).

Political competition heightens electoral incentives and promotes public service provision. Harding and Stasavage (2014) find that countries with stronger electoral competition spend more on primary education and have higher enrollment rates. Burgess et al. (2015) find that Kenyan districts with greater competition receive more road infrastructure investments than those where incumbents face little competition. Ferraz and Finan (2011) find that electoral competition increases public goods provision and lowers corruption in Brazilian municipalities.

I argue that political competition also determines whether politicians leverage foreign aid to reduce public service provision. Incumbents must win reelection, and those in competitive districts need to beat out additional candidates in order to win voters' favor. While aid offers an opportunity to shirk, politicians facing competition must maximize their electoral chances and maintain service provision.

3 Data

Established in 2003, the Kapit-bisig Laban sa Kahirapan ("Linking Arms Against Poverty") – Comprehensive and Integrated Delivery of Social Services (Kalahi-CIDSS) aims to reduce poverty and increase local participatory governance in the Philippines. Financed by a number of agencies, including the World Bank, Millennium Challenge Corporation, and a matching grant from local governments themselves, the program assigns grants to qualifying municipalities[2] that are distributed directly to citizen committees for community development projects. Particular projects are determined by communities themselves and include the construction of farm-to-market roads, establishing health stations, encouraging school enrollment, developing footpaths, and building small-scale irrigation and drainage systems, among others.

From 2011-2015, Innovations for Poverty Action conducted an impact evaluation of Kalahi-CIDSS aiming to evaluate the effects of the program on key socioeconomic and governance outcomes via a randomized controlled trial (RCT). The impact evaluation spanned 198 municipalities across all three of the main island groups of the Philippines (Luzon, the Visayas, and Mindanao). While the exact timing of grant allocation varied, municipalities selected for treatment received one grant per year from 2013-2015. These were calculated per municipality on the basis of its number of barangays, the smallest administrative unit in the Philippines and the level at which citizen committees were organized. While all barangays in a participating municipality were eligible to receive Kalahi-CIDSS, funds were allotted in accordance with project priorities.[3] In addition to financing local development projects, Kalahi-CIDSS trains community members and local governments in choosing, designing, and implementing projects.

Kalahi-CIDSS was found to have statistically significant impacts on several socioeconomic outcomes. Road improvements reduced the time to key services and the cost to get farm products to market, water projects reduced the time and cost to obtain water, and education projects increased school enrollments (Beatty et al. (2018)). Kalahi affected local politics as well. Other research outside of the impact evaluation sample has found that Kalahi-CIDSS increased incumbent vote share (Cruz and Schneider (2017)).

I evaluate effects of Kalahi-CIDSS on quarterly public spending among the IPA impact evaluation sample for the years in which grants were given to all treated municipalities (2013 and 2014). Data on local government spending

[2]Municipal poverty rate is the predominant qualification for Kalahi-CIDSS. In the Philippines, municipalities are rated on a class scale of 1 (wealthiest) to 6 (poorest). In order to receive Kalahi-CIDSS, 4th – 6th class municipalities must have a poverty incidence above the national average of 26.5%, based on the 2009 Small Area Estimates (SAE) of the National Statistical Coordination Board (NSCB). 1st – 3rd class municipalities qualify if they have a poverty incidence of 40% or higher (DSWD (2024)).

[3]For a detailed review of selection criteria for the IPA impact evaluation, see Beatty et al. (2018). More information on project priorities and funds allocation within a given municipality can be found on the website of the Department of Social Welfare and Development (DSWD) of the Philippines, the federal agency that administers Kalahi-CIDSS (DSWD (2024)).

are obtained from the Bureau of Local Government Finance of the Philippines. Data on the Innovations for Poverty Action (IPA) impact evaluation of Kalahi-CIDSS are publicly available through the Millennium Challenge Corporation Evidence Platform of the ICPSR (IPA (2019)). Grant allocation years and other qualitative information on implementation of the randomized controlled trial are derived from the third round impact evaluation report (Beatty et al. (2018)). Data on municipalities included in the impact evaluation affected by Typhoon Yolanda are obtained from the Kalahi-CIDSS supplementary documentation from the Asian Development Bank (Asian Development Bank (2013)). I merge these data with 2013 municipal election returns published by the Commission on Elections of the Philippines (COMELEC). In addition to these data sources, I obtain and merge quarterly labor force surveys from the Philippine Statistics Authority (PSA).

Each municipality in the Philippines completes a standardized table to document quarterly expenditures. This table contains a number of categories and the amount spent per category in Philippine pesos. In order to determine the impact of Kalahi-CIDSS on public spending in the same domains for which Kalahi-CIDSS provided funds, I code total spending in key project categories. These include "education, culture, sports, and manpower development", "health, nutrition, population control", housing and community development", and "social services and social welfare."

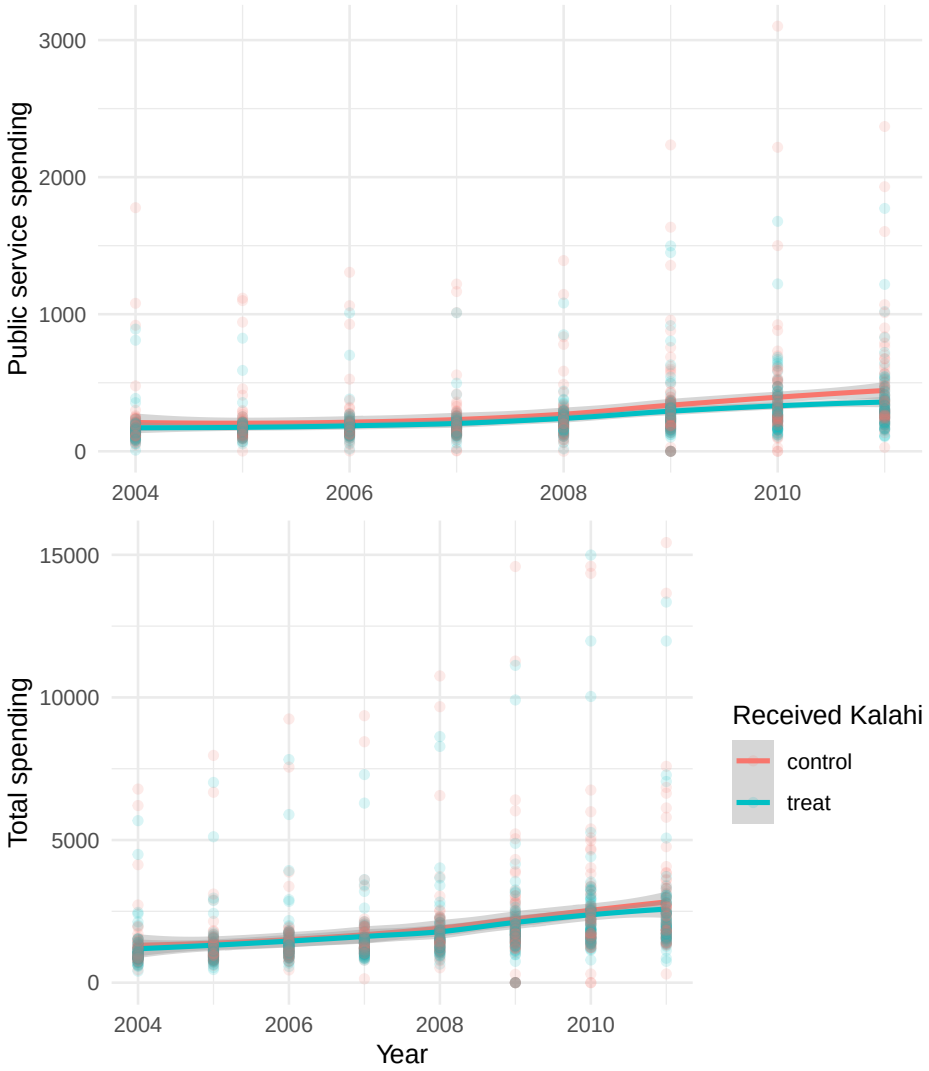
While some amount of discretion is required in order to categorize budget categories as within or outside of the realm of barangay-level Kalahi projects, my coding scheme is conservative and includes all spending categories that at least partially overlap with Kalahi. For example, Kalahi did not provide funds for culture and sports, but did so for education and manpower development, and so I label the entire budget category as Kalahi-related service provision. This should bias effect sizes downwards - expenditures for which Kalahi should not substitute are included in my key outcome variable.

Balance on pre-treatment covariates is presented in Table 1, including mean, standard deviation, and p-value from a two-tailed t-test of the null hypothesis of no difference in means. I also evaluate whether pre-treatment covariates systematically predict treatment via an F test. Neither the p-value of the F statistic nor the p-values of any individual covariates are statistically significant at conventional levels ($p < .1$).

Table 1: Pretreatment covariate balance

var	mean_treat	mean_cont	sd_treat	sd_cont	p
kalahi spending	251.1280	296.9443	195.5572	307.5693	0.0947
total spending	1846.4499	1973.7646	1545.8290	1824.4833	0.8480
poverty index	46.0117	45.4177	8.4639	9.1353	0.3547
num barangay	27.5325	25.9399	17.4396	13.2732	0.3068
population	32279.5114	31612.7663	19993.6295	20556.8453	0.9682
land area	193.1302	191.6261	191.0539	189.9700	0.7870

Figure 1: Balance on pretreatment spending



Note: Spending measured yearly per capita in Philippine pesos

4 Results

In order to identify the effect of Kalahi-CIDSS on total public service spending across infrastructure, agriculture, and health, I estimate the following equation

$$y_{irt} = \tau D_{ir\in 0,1} + \gamma_{it} + \pi_i + \lambda_i + \rho_i + \alpha_r + \delta_t + \epsilon_{it}$$

where y_{it} represents public service spending for municipality i at quarter t and

τ is a the treatment effect of Kalahi-CIDSS.

On November 8, 2013, nearly one year into grant implementation for the Kalahi-CIDSS impact evaluation, Typhoon Yolanda (international name Haiyan) struck the Philippines. One of the most powerful tropical cyclones ever recorded, Yolanda killed at least 6,300 Filipinos and is estimated to have cost the Philippine government nearly $13 billion USD (World Bank (2017)). Given the impact on public spending, I code a binary variable that takes the value of 1 if a municipality received heavy damage from Yolanda and 0 otherwise, as documented by the Asian Development Bank materials on the impact of Yolanda on Kalahi-CIDSS regions (Asian Development Bank (2013)). As Philippine government continued recovery efforts for many years after Yolanda, I code this variable as 1 for all years included in the impact evaluation sample. γ_{it} measures the effect of this dichotomous variable.

I include a number of additional covariates as well. These include population (π_i), land area (λ_i), and poverty index (ρ_i). I also include region and quarter fixed effects, represented by the terms α_r and δ_t. The error term ϵ_{ir} is clustered at the region by quarter level. In order to standardize comparison across municipalities of varying sizes, I consider per capita spending, fitting a model that divides public service spending by the municipal population. Effects can thus be interpreted as the impact on public spending per capita.

Kalahi reduced public service spending in recipient municipalities, and this result is significant at conventional levels ($p < .001$). Interpretation yields particularly striking results. Kalahi reduced quarterly per capita infrastructure, agriculture, and health spending by about PhP 44 (roughly $.77), or PhP 179 per year (roughly $3.07). This constitutes a .16 standard deviation reduction (Cohen's d). The median municipal population in the Kalahi-CIDSS impact evaluation sample is 28,267. This spending reduction for the median municipality would amount to about 5 million pesos yearly, or $88,000.

Crowd-out is not offset by spending increases elsewhere

This reduction is not offset by spending increases elsewhere. Table 3 shows the effect of Kalahi-CIDSS on total per capita spending across the entire municipal budget. Treatment reduced quarterly per capita spending by about PhP 2406 (roughly $44), or PhP 9624 (about $166) yearly. This exceeds the reduction in spending categories related to Kalahi alone. In fact, Kalahi-CIDSS appears to have reduced spending in additional budget categories.

Table 2: Effect of Kalahi on quarterly public service spending

	Public service spending	Total
treat	−679.706***	−621.074***
	(150.197)	(178.438)
yolanda	−1018.310***	−720.688*
	(204.985)	(327.510)
population	−12.184***	−12.298***
	(2.754)	(3.616)
poverty incidence	−16.585**	6.821
	(5.351)	(10.570)
land area	1.432***	1.525***
	(0.303)	(0.390)
num barangays	−6.260	−14.234*
	(5.015)	(5.827)
Num.Obs.	1381	1381
R2	0.854	0.832
R2 Adj.	0.833	0.807
AIC	21 816.2	22 624.8
BIC	22 736.8	23 545.4
RMSE	573.81	768.99

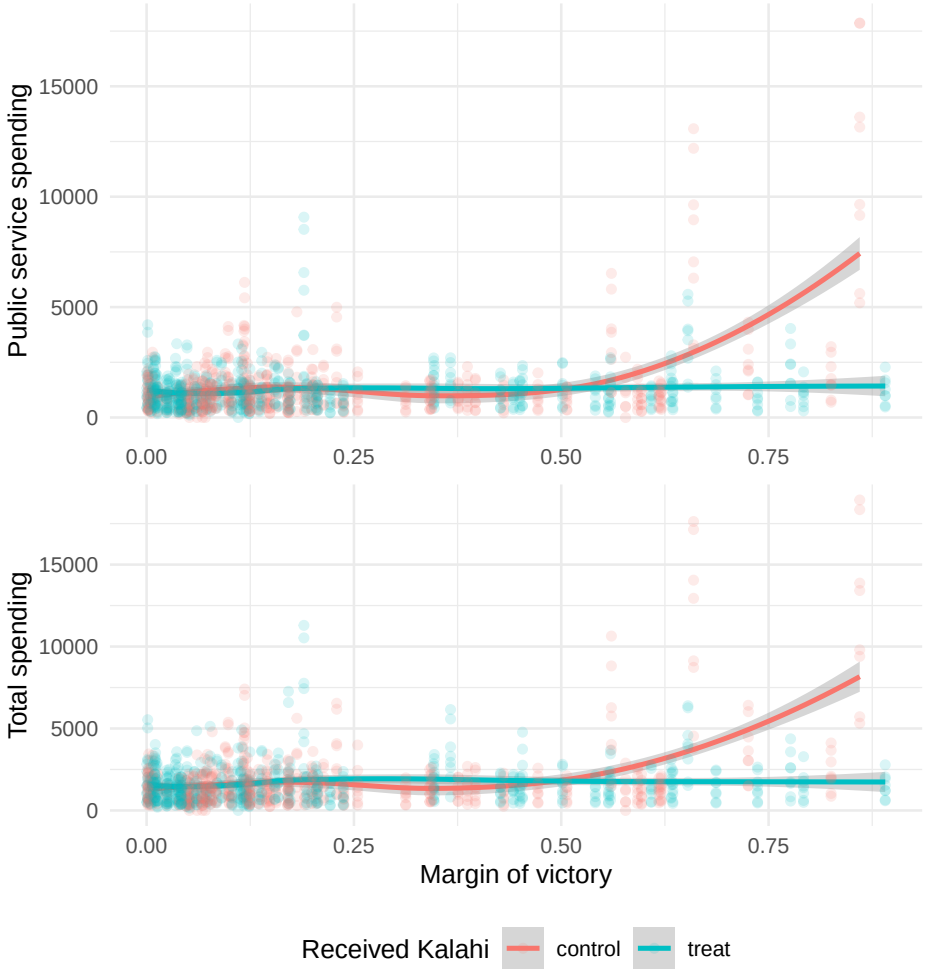
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Spending measured in Philippine pesos. Population covariate scaled per 1,000 people such that significant digits are visible in the parameter estimate. Models include municipal and quarter-fixed effects.

Political competition can dampen crowd-out

Now I turn my attention to features that moderate this effect. If aid crowds out public spending in some contexts and not others, what factors drive this variation? Here I present evidence that political competition determines how politicians respond to development assistance.

Figure 2: Political competition and public spending



Note: Spending measured quarterly per capita in Philippine pesos

In order to determine if political competition moderates crowd out, I interact treatment with margin of victory in the mayoral contest coinciding with program implementation (2013). As anticipated, I find that municipalities with more

Table 3: Effect of Kalahi on public spending by electoral competitiveness

	Public services	Total	Public services	Total	Public services	Total
treat	−1198.441***	−948.686***	−469.582**	−531.829*	−579.160**	−647.027**
	(167.908)	(241.781)	(162.632)	(216.437)	(181.971)	(234.865)
margin of victory	−1423.014***	−1078.461+				
	(282.533)	(615.091)				
treat x margin of victory	1991.971***	1081.266				
	(358.348)	(742.871)				
65th margin			5540.130***	7355.820***		
			(1095.850)	(1646.204)		
treat x 65th margin			−6058.018***	−8779.756***		
			(1087.585)	(1586.675)		
55th margin					−623.013***	−349.571
					(165.571)	(239.043)
treat x 55th margin					1409.909***	1176.826**
					(286.342)	(384.935)
yolanda	−37.959	−755.748*	−1005.757***	−1793.870***	−6879.214***	−9194.717***
	(248.844)	(313.510)	(191.435)	(468.122)	(1082.584)	(1586.617)
population	−3.980	−1.999	−25.779***	−18.510*	−27.736***	−20.568*
	(3.059)	(3.844)	(3.709)	(8.536)	(3.904)	(8.769)
poverty incidence	−26.700***	4.725	−28.364***	2.671	−32.558***	−1.738
	(4.876)	(14.497)	(5.116)	(15.239)	(5.129)	(15.552)
land area	1.314***	1.306***	1.936***	1.731***	1.967***	1.763***
	(0.287)	(0.384)	(0.298)	(0.517)	(0.304)	(0.523)
num barangays	−11.932*	−12.754+	−7.958	−13.517*	−28.915***	−35.550***
	(5.525)	(6.679)	(5.472)	(6.450)	(3.608)	(5.591)
Num.Obs.	1101	1101	1101	1101	1101	1101
R2	0.858	0.830	0.858	0.830	0.858	0.830
R2 Adj.	0.836	0.804	0.836	0.804	0.836	0.804
AIC	17 356.1	17 996.1	17 356.1	17 996.1	17 356.1	17 996.1
BIC	18 086.6	18 726.6	18 086.6	18 726.6	18 086.6	18 726.6
RMSE	561.38	750.73	561.38	750.73	561.38	750.73

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Note: Spending measured per capita in Philippine pesos. Population covariate scaled per 1,000 people such that significant digits are visible in the parameter estimate. Models include region and quarter-level fixed effects.

competition continue to spend on public services while Kalahi crowds out state spending in less competitive municipalities.

Table 4 presents effects on per capita public spending in Kalahi budget categories, as well as across the total budget. While treatment and vote margin are positively associated with public spending, the interaction effect is negative. Treatment alone seems to raise public spending and politicians in uncompetitive districts seem to spend more per capita, but Kalahi in an uncompetitive municipality reduces public spending.

These results are not sensitive to particular measures of electoral competition. For robustness, I code binary variables that take the value of 1 if the vote margin is within 20 or 15 percent, respectively. Results from regressions using these interaction terms are also presented in Table 4.

Development programs affect broader budget allocation

Does foreign aid merely reduce public service provision, or do politicians redistribute funds to other portions of the budget? If so, how are funds reallocated? I now turn my attention to this question, exploring whether Kalahi-CIDSS impacted broader quarterly budget allocation.

I exploit supervised machine learning in order to determine whether Kalahi-CIDSS bore additional effects on public spending. I fit nested models to predict treatment trained on Kalahi-related budget categories as well as the whole budget and compare model fit. The logic behind this approach is simple. If politicians reduced public service provision while spending identically everywhere else, then the remaining budget variables should be unrelated to treatment, and a model trained on the full budget should predict treatment no better than a model trained only on Kalahi-related budget categories. If additional features of the budget hold explanatory power, then treatment likely had effects beyond substituting for Kalahi-related line items.

Model fit is relatively straightforward to compare for categorical supervised learning models. The out-of-bag (OOB) error rate provides of measure of model performance on data outside of the training set. The random forest algorithm, which I employ here, randomly samples a subset of the data from which to build a decision tree, then predicts the outcome for excluded observations (Breiman (2001)). Many such trees are built when fitting a random forest (the exact number set by the programmer), and final predictions are determined for each observation by aggregating among the decisions from trees in which it was excluded from the training set. The out of bag error rate is thus the rate of unsuccessful classification from these final predictions.

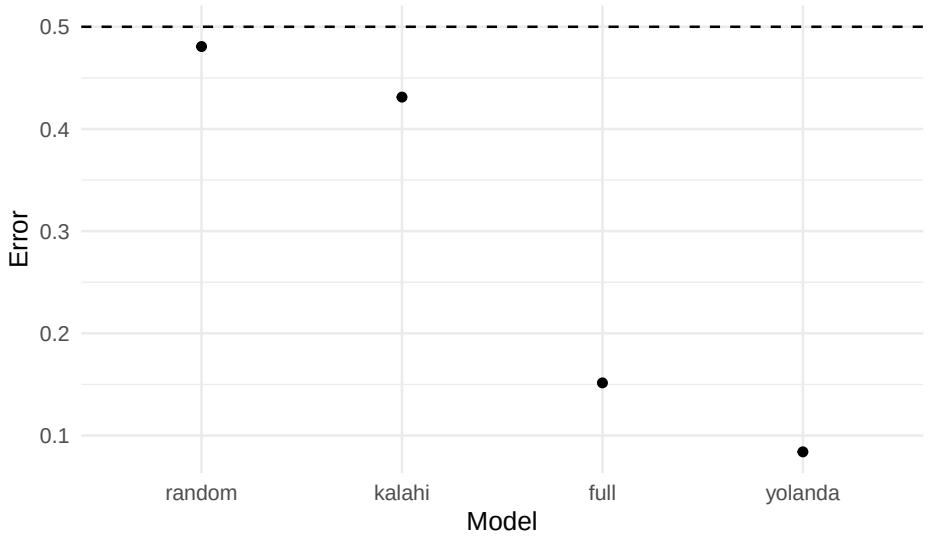
However, given that random forests randomly sample the data at each split, decision trees and their predictions can vary each time a model is fit, and thus the out of bag error rate can vary as well (although often only slightly). In order to evaluate whether model fit improves significantly when trained on the full budget and not just because a particular model happened to have an unlikely small error rate, I fit 100 limited and 100 full random forests of each model type. This bootstrap approach allows me to sample from the distribution of possible error rates and compare them statistically via a t-test.

In order to falsify this approach, I also fit random forests to predict my binary indicator for heavy damage from Yolanda from the full budget. Given that Yolanda significantly impacted public spending, if a random forest cannot sufficiently predict heavy damage, then it is unlikely that it can predict a municipality receiving Kalahi-CIDSS. As a placebo test, I code a binary random variable entirely unrelated to how politicians allocate their financial resources. I fit random forests to predict this random variable as well from the municipal budget data.

Figure 2 displays the average out of bag error rates across each model type are

in comparison to the expected rate obtained via random guessing (.5). I find that a random forest is able to predict heavy damage from Yolanda significantly better than random guessing and that a model trained on the complete budget has significantly lower error than that fit on Kalahi line items alone.

Figure 2: Out of bag error rate across 100 models



T-test results are presented in Table 5. I find that the models trained on the full budget are significantly more predictive of treatment than those trained on the limited budget with only Kalahi-related categories. Additionally, random forests can predict heavy damage from Yolanda from municipal budget data better than random guessing, and they perform the worst when attempting to predict a random exogenous variable, increasing confidence in the approach. Kalahi-CIDSS seems to have impacted municipal spending beyond crowding out public services.

Table 4: Comparison of model fit

Models	p
Yolanda vs random guessing	2.256e-208
Kalahi vs random guessing	1.102e-107
Kalahi vs full	1.287e-139

Funds may be redirected to political supporters

Kalalhi shifted broader fund allocation beyond public service provision, but how so? How do politicians reallocate resources that are freed up by development programs? I again exploit supervised learning to explore this question. I produce variable-specific model performance measures in order to identify the features that are most predictive of treatment.

Mean decrease accuracy measures variable performance in a random forest. More specifically, it describes how accuracy drops when the variable is removed from the model, computed using out of bag data (Breiman (2001)). Higher mean decrease accuracy therefore indicates that a given variable is more important to model prediction. Although mean decrease accuracy scores alone are difficult to interpret, they offer a sense of the ordinal predictive importance of each variable relative to others. While these results are not a formal hypothesis test and should not be interpreted causally, mean decrease accuracy provides an exploratory indication of how Kalahi is associated with municipal budget allocation that can help guide further more rigorous inquiry.

Table 6 presents a ranking of each municipal budget variable by descending mean decrease accuracy. The most predictive budget category is housing and community development, one of the categories for which Kalahi-CIDSS provided funds. Taxes are also significantly predictive of treatment. Three of the ten variables with highest mean decrease accuracy measure taxes. These include business taxes, other taxes, and total tax revenue. This is consistent with formal political economy models that argue that fungible aid lowers the tax burden (Pack and Pack (1993)).

Cash balance at the beginning of the quarter is the budget category with the third highest mean decrease accuracy. Higher cash balance implies unused funds, or portions of the budget left unspent from prior quarters. Evidence from the Philippines suggests that unexhausted budgets indicate clientelism ().

Patronage cannot be directly observed from Philippine budget reports. However, state employment is frequently used by politicians to reward political allies and maintain power (Robinson and Verdier (2013)). The size of the public sector is associated with clientelism, and short term and contractual employment are particularly indicative of patronage appointments (McCoy (2009); Gimpelson and Treisman (2002); Colonnelli, Prem, and Teso (2020)). If politicians redirect funds freed up by Kalahi to political supporters, we should observe an increase

in short term government employment in recipient municipalities.

I exploit data from the Philippine Labor Force Survey (LFS) to test this hypothesis. Fielded quarterly, the LFS gathers data on economic activity in the Philippines, including employment. Respondents provide information about the sector in which they are employed (public or private) as well as the nature of their employment (contractual or salaried). I code a binary variable indicating whether a respondent reports contractual government employment and run a logistic regression of this outcome on treatment.

Kalahai-CIDSS increases the log-odds of short term government employment. On average, treatment doubles the predicted probability of casual government employment. While this is not necessarily indicative of patronage appointments, which would depend on the political affiliation of individuals hired into the municipal bureaucracy, this evidence is consistent with a clientelist equilibrium.

Additional research should investigate the relationship between development programs and public resource allocation more rigorously. Patronage appointments are not the only perverse political incentive that development programs could ostensibly induce. In addition to bloating the public bureaucracy, development programs could free up funds to be corrupted. If development programs are fungible, for which I offer evidence, then they could drive politicians could redirect funds from public programs into their own pockets.

Table 5: Predictive importance of budget categories

Category	Mean Decrease Accuracy
tax_on_business	27.0403395
housing_and_community_development	25.5268968
regulatory_fees	23.3055695
service_user_charges	22.8295736
other_taxes	22.2053740
add_cash_balance_beginning	22.0178240
total_tax_revenue	21.5323029
debt_service_interest_expense_other_charges	19.9642709
other_receipts_other_general_income	19.2995694
total_local_sources	19.2603064
receipts_from_economic_enterprises	18.6769199
special_education_fund	18.2477913
fund_cash_available	17.6828552
less_payment_of_prior_year_s_accounts_payable	17.5800037
general_fund	17.5525071
total_nontax_revenue	16.8515371
total	16.7034224
fund_cash_balance_end	16.6424951
economic_services	16.2501831
total_nonoperating_expenditures	15.5417600
payment_of_loan_amortization	15.0316556
education_culture_sports_manpower_development	14.7490057
health_nutrition_population_control	14.0852355
total_capital_investment_expenditures	13.9480551
net_operating_income_loss_from_current_operations	13.9203120
total_debt_service_principal_cost	13.7691431
social_services_and_social_welfare	13.6934482
purchase_construct_of_property_plant_and_equipment_assets_capital_outlay	12.5503927
other_nonoperating_expenditures	11.9670003
continuing_appropriation	11.9524701
net_increase_decrease_in_funds	11.9196211
total_social_services	11.4042672
other_shares_from_national_tax_collections	10.5105851
total_nonincome_receipts	9.6259442
total_current_operating_income	9.5197155
general_public_services	9.3510225
other_nonincome_receipts	9.1439475
extraordinary_receipts_grants_donations_aids	8.7729323
interlocal_transfers	7.9960714
total_current_operating_expenditures	7.7588505
total_external_sources	7.7020625
internal_revenue_allotment	7.6848400
labor_and_employment	6.9791551
proceeds_from_sale_of_assets	6.9019285
total_capital_investment_receipts	4.4531765
total_receipts_from_loans_and_borrowings	3.9273113
acquisition_of_loans	2.6744252
collection_of_loans_receivables	1.7379410
proceeds_from_sale_of_debt_securities_of_other_entities	0.0000000
issuance_of_bonds	0.0000000
purchase_of_debt_securities_of_other_entities_investment_outlay	-0.8452134
retirement_redemption_of_bonds_debt_securities	-1.5778399
grant_make_loan_to_other_entities_investment_outlay	-1.6363032

5 Conclusion

Aid has long been theorized to crowd out government spending, substituting for local revenue and rendering some portion of fungible funds lost to reallocation. The empirical picture, however, is muddied, with a broad array of studies documenting both crowd-out and crowd-in effects. In this paper, I have extended the theoretical model for substitution and argued that non-governmental development programs also substitute for public spending and afford an opportunity to shirk. Furthermore, I demonstrate that political context moderates crowd-out. Electoral competition drives politicians to maintain public service provision.

Leveraging a randomized evaluation of a World Bank community development program in the Philippines, I substantiate these intuitions empirically, finding that the grant substituted for municipal government spending and that that this effect is moderated by margin of victory. Mayors who won by a tighter margin maintain public service provision.

I show that political institutions shape the incentives that politicians face, and therefore their allocation of public budgets, and in so doing help clarify a conflicting literature. In this paper I extend our understanding of crowd-out and ask not only *if* aid substitutes for public spending but *under what conditions*. In analyzing outcomes from a randomized development program, I offer some of the most credible causal estimates of crowd-out resulting from non-governmental spending.

The case of Kalahi-CIDSS offers a cautionary tale to policymakers. While conventional wisdom suggests that pursuing independent development programs and channeling valuable aid to citizens outside of public pathways can avoid misallocation, these programs create perverse political incentives. Service provision reduces demands on government services and spending whether or not politicians actually receive the windfall. Understanding these consequences and the mechanisms that drive them can help to design superior development programs that maximize human development outcomes and maintain public programs.

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Baseline group not specified; choose treat = 0 as the baseline group.

Baseline group not specified; choose treat = 0 as the baseline group.

Baseline group not specified; choose treat = 0 as the baseline group.

Baseline group not specified; choose treat = 0 as the baseline group.

Baseline group not specified; choose treat = 0 as the baseline group.

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Baseline group not specified; choose treat = 0 as the baseline group.
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Baseline group not specified; choose treat = 0 as the baseline group.
Baseline group not specified; choose treat = 0 as the baseline group.
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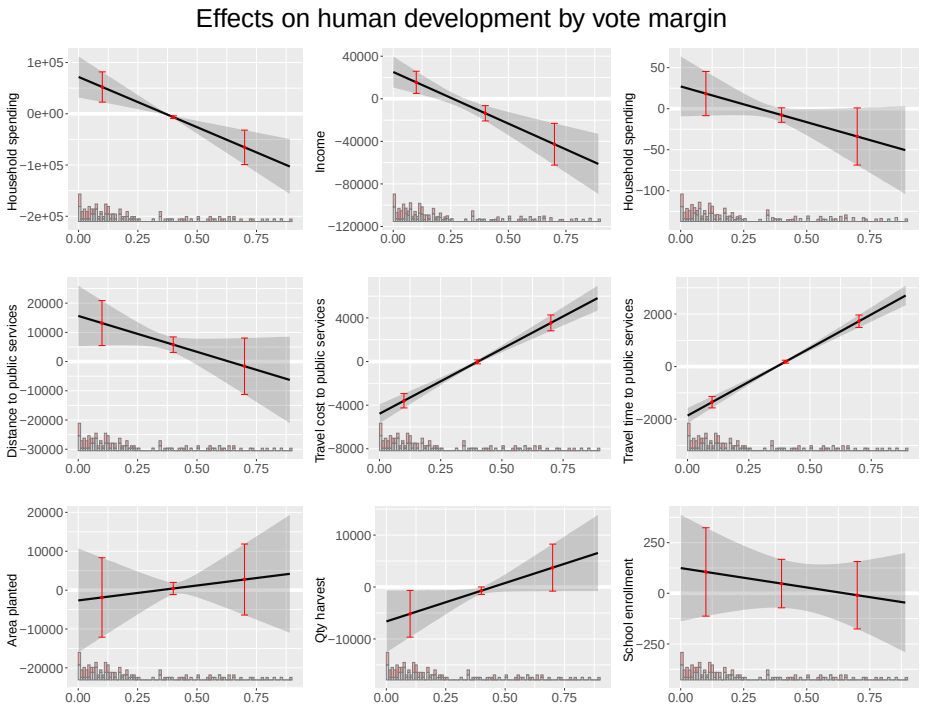
Table 6: Effect of Kalahi on short term government employment

	Short term gov employment
(Intercept)	−3.732
	(2.420)
treat	4.502**
	(1.608)
as.factor(C06_SEX)2	0.149***
	(0.039)
as.numeric(C07_AGE)	−0.050***
	(0.001)
pi	−0.018
	(0.016)
I(pop07nso/1000)	0.042+
	(0.023)
land	0.003**
	(0.001)
bgytot	−0.068*
	(0.031)
as.factor(mun)Alangalang	1.419*
	(0.613)
as.factor(mun)Albuera	3.061**
	(1.001)
as.factor(mun)Arteche	6.071***
	(1.779)
as.factor(mun)Asuncion	2.972***
	(0.828)
as.factor(mun)Baao	−0.269+
	(0.151)
as.factor(mun)Babatngon	0.355
	(0.221)
as.factor(mun)Barugo	1.314*
	(0.625)
as.factor(quarter)Q12015	0.229**
	(0.088)
as.factor(quarter)Q22014	0.332***
	(0.087)
as.factor(quarter)Q22015	0.202*
	(0.087)
as.factor(quarter)Q32013	−0.072
	(0.086)
as.factor(quarter)Q32014	0.564***
	(0.084)
as.factor(quarter)Q42013	0.258**
	(0.084)
as.factor(quarter)Q42014	0.175*
	(0.086)
Num.Obs.	21 953
AIC	17 911.8
BIC	18 087.7
RMSE	0.36

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Note: Population covariate scaled per 1,000 people such that significant digits are visible in the parameter


Effects on human development by vote margin
Household spending
Income
Household spending
Distance to public services
Travel cost to public services
Travel time to public services
Area planted
Qty harvest
School enrollment
Spending measured in Philippine pesos and distance measured in meters

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