

Money or Votes?

The Political and Financial Incentives for Local Forest Management

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Biographical Statement (73 words)

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Abstract (147 words)

Although decentralized regimes may enjoy some advantages in implementing efficacious policy, local politicians in decentralized regimes may lack motivation to provide public goods and services that have positive spillovers. Such situations lead to temptations for local politicians to free-ride on the public good provision of other jurisdictions. Here, we study the institutional incentives that may sway local politicians to invest in public goods and services related to forestry, a sector with large spillovers. We argue that providing a basket of incentives may be the best approach. We test this idea by analyzing a new and unique longitudinal data set for 100 local governments in Bolivia and find that both economic and political incentives drive local public goods provision. We find that local politicians' investments into local public good provision increase most strongly from local incentives—with political pressure from below and opportunities to collect revenue service provision.

Keywords: Bolivia, Local Governance, Decentralization, Public goods, Incentives, Forestry

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Introduction

Although decentralization reforms have been proposed as a solution to many problems in the developing world, decentralized governments face their own set of problems. For one thing, local politicians—to whom the burden of providing many services has shifted under decentralization—are often under-motivated to provide public goods for which there is little local benefit. Under such circumstances, local politicians are tempted to free-ride on other jurisdictions to provide the public goods and services—unless local politicians are extrinsically motivated to provide the goods and services, they will not invest in their provision (Hardin 1968; Heckathorn 1996; Olson 1971; Ostrom 1990).

These problems are particularly severe in the area of environmental protection. The fundamental challenge for forest conservation, for example, is to motivate local forest users to forego the short-term pay-offs that are associated with the conversion of forests to more profitable land uses, such as agricultural crop production.

One common prescription to address these types of motivational problems is through the transfer of resources from central to local governments; to get local politicians to invest in forest conservation, the central government pays local governments to carry out monitoring and enforcement of forestry rules. But are such transfers enough to stimulate conservation behavior? We argue that it may be best to create a range of incentives, including transfers and local incentives such as citizen pressure and economic incentives. Specifically, we propose that fiscal transfers matter, but local sources of motivation—including local political incentives and local

fees, fines, and other local revenue sources—are also important for motivating politicians to provide conservation services.

We test these ideas using statistical methods, with a unique, longitudinal dataset on local government decision making about forestry in a random sample of 100 Bolivian municipalities, as well as extensive, qualitative fieldwork. Bolivia is an excellent setting in which to examine the causes of effective local natural resource governance, because Bolivia is a country which has, over the last twenty years, devolved real authority and resources to local governments to play a more prominent role in the governance of forest resources.

Our results add to the existing literature on decentralization through improved data and methodology. We find that the strongest incentives that municipal actors face are local, including both political and economic incentives. In our analysis, the importance of forestry as a source of income is more often significantly associated with forestry-related outcomes than most other incentives. We find that both long-term and short-term economic incentives are important sources of motivation to provide public forestry services; we also find strong empirical support for the importance of local electoral pressure, and we find some support for the idea that local economic incentives may substitute for political pressure, where political pressure is absent.

We have structured the paper in the following way: We begin by reviewing the existing research on the institutional drivers of decentralized public goods provision. To help address the knowledge gaps identified in the literature review, we present a theoretical argument about the conditions under which local politicians will decide to invest in forest governance. We then turn to our empirical case and present a summary of the formal-legal situation in Bolivian forestry governance. After outlining our data and methods, we present our statistical findings and discuss

our results. We conclude with a discussion about the policy implications of these results and topics for future research.

Theoretical Approach

While all public goods exhibit physical characteristics that make consumption of benefits non-subtractable¹ and exclusion relatively costly (Gibson, et al., 2005), the cost of exclusion varies substantially from one public good to another. For some public goods, such as education, many of the benefits are localized, making it feasible to create institutional arrangements that ask the main beneficiaries of the good (students and their families) to contribute to the provision of these goods and services. For public goods for which the benefits are spread more widely—and forests often primary provide global benefits, such as forest carbon sequestration and other environmental services—it is more difficult to match benefits to contributions.

Nowhere is the dilemma of global goods provision more evident than in recent climate change negotiations over a proposed international program called Reduced Emissions from Deforestation and Forest Degradation (REDD). The purpose of this program is to monetarily reward countries that are able to reduce their rates of tropical forest destruction, which currently accounts for about 20 percent of global carbon dioxide emissions (IPCC, 2007). The idea is that paying countries will motivate them to invest forest protection.

Whether the proposed REDD program will manage to alter the existing incentive structures for deforestation, however, remains an open question. One of the challenges for recipient countries is to use the funding in ways that affect local people's decisions about land use. Since the majority of the world's developing countries have decentralized forest governance responsibilities to varying degrees, the effectiveness of forestry sector governance depend to a large extent on the performance of local governance actors. We argue that without a thorough

understanding of the existing incentive structures of these local political actors, it is difficult to design national policies that affect local decisions and behavior.

We hypothesize that the *local* provision of public goods with *global* benefits is dependent upon local politicians' beliefs that they will benefit personally through such public goods provision. In the absence of such benefits, we predict that local politicians will not invest in forest governance, even in the presence of mandates to do so. More specifically, we propose that two particularly important sources of incentives can sway local politicians to pay more attention to forests.

First, investing in forest governance may increase politicians' perceived chances of reelection by winning citizen support directly. And second, investing in forestry may, in many cases, increase municipal income, which may also make reelection more likely, by increasing politicians' ability to provide more politically desirable goods and services. Financial gains may come from outside transfers or from local sources, but our evidence from Bolivia tells us that self-generated income through local fees and fines seem to have an effect on the motivation to invest in forest governance. We test these hypotheses in the context of municipal forest governance in Bolivia.

Literature Review

Our research is a part of the most recent wave of a research program which studies the effects of decentralization on policy outcomes. The earliest work on decentralization was mostly theoretical, and argued that decentralization was either highly desirable, or highly undesirable. Treisman (2007) presents a good summary of these arguments (pp 11-15), which have a long and venerable pedigree. Proponents of decentralization argue that decentralized regimes are better at administering policy more efficiently due to local variations in needs, preferences, and resources

Error! Reference source not found., promote desirable policy competition between jurisdictions **Error! Reference source not found.**, promote greater citizen engagement and more meaningful participation **Error! Reference source not found.**, prevent capricious, autocratic governance and rapid policy change by creating a check on central government authority **Error! Reference source not found.**, provide better, more context-sensitive information to policy makers **Error! Reference source not found.**, and slow down or stop the implementation of undesirable policy **Error! Reference source not found.**. Opponents argue that decentralization promotes duplication and inefficient spending **Error! Reference source not found.**, and prevents policy and fiscal coordination **Error! Reference source not found.**.

More recent work has found little empirical support for many of these claims. The effects of decentralization, it turns out, mostly depend on local context and the incentive structures generated by specific local policy environments and specific decentralized structures **Error! Reference source not found.**. For example, local governments in decentralized regimes tend to respond to political pressures from citizens and economic pressures exerted from both above and below, just like national governments **Error! Reference source not found.**.

Here, we extend earlier work by Andersson, Gibson, and Lehoucq, who examine the effects of institutionally-structured incentives on municipal forest governance in Latin America. Using the first large-N statistical dataset of municipal forest policy and a theoretical approach grounded in rational choice institutionalism, these scholars found that a portfolio of incentives promote more energetic municipal forestry policy, including central government pressure and supervision, funding transfers from central governments, and community pressure for forestry services **Error! Reference source not found.**. We add a second wave of observations for the Bolivian

subset of municipalities, using improved time series techniques, and generating a series of new findings on the relative importance of different incentives.

We have four important findings. We find that local incentives appear to be the most consistent drivers of municipal forestry policy, including (first) community pressures and (second) local economic pressures. The findings regarding the importance of local economic pressures are surprising, given the lack of legal mechanisms for forestry to generate such pressures, but we find that (third) municipalities often skirt the law and generate revenue from forestry sources anyways. We argue that the legalization of these sources of revenue nationwide might result in reduced deforestation across the country, as municipalities would probably take advantage of the new funding source, incentivizing forestry enforcement. Finally, we find some evidence that local pressures and economic incentives may be substitutes, in that economic pressures may create incentives for forestry where community pressures for forestry do not already exist, but where community pressures exist, economic incentives may have little additional effect.

Municipal Forest Governance in Bolivia

Like most other Latin American countries, Bolivia was long organized as a *de facto* unitary state. This *de facto* centralization changed dramatically in the mid-1990s, when the Congress of Bolivia passed the 1994 *Ley Participación Popular*, the “Popular Participation Law”—essentially a package of decentralization reforms which granted substantial authority and 20% of national tax revenues to municipal governments (Andersson 2003; CIFOR 2007; de Jong et Al. 2004; Oemer 2004; Pacheco 2006; Ruíz 2004).

Decentralization in the forestry sector has been less dramatic, but the 1996 *Ley Forestal 1700*, Forestry Law 1700, was designed to encourage sustainability in the forestry sector by

lengthening the tenure of forestry concessionaires, making concessions renewable, and improving the security of tenure for the forest-dependent poor by creating new jurisdictions for the communal management of local forest resources. (Contreras-Hermosilla and Vargas Ríos 2002; Pacheco 2003; Pacheco 2006).

Today, municipalities are required to monitor forestry concessions and enforce national forestry rules and regulations within their territory (Andersson 2003; Andersson, Gibson, and Lehoucq 2006), but our observations suggest that municipal governments often view these tasks as unimportant. This is unsurprising, because (as we note above) municipalities are not rewarded or punished for such forestry enforcement activities (Andersson 2003; Pacheco 2003).

Fiscal decentralization in Bolivia has primarily taken the form of transfers of funding from the central government to municipal governments. In general, funds are not linked to the implementation of any particular policies (Contreras-Hermosilla and Vargas-Ríos 2002; de Jong et Al. 2004; Ley 843 2000; Pacheco 2006).

Transfers from forestry sources are provided annually to municipalities based on the size of the municipal territory currently under management as forestry concessions. These funds are not linked to municipal policy in any way, except that over the very long term, as (20 year) forestry concessions expire, if they have been abused by concessionaires, their size may decrease and thereby decrease municipal forestry revenue (Contreras-Hermosilla and Vargas-Ríos 2002; de Jong et Al. 2004; Ley 843 2000; Ley 1700 1996; Oemer 2005).

Bolivian municipalities have traditionally also had a number of other revenue sources, but no other forestry-related income is allowed under law (Ley 843 2000; Pacheco 2003). However, many municipalities charge fees and fines for forestry-related services and enforcement. The

extent to which any these sources of income affect the local politician's decisions to invest in forest governance is part of the empirical investigation, which we turn to next.

Data and Methods

Most of our data are drawn from a unique, time-series cross-sectional survey dataset gathered from interviews with mayors, municipal forestry officials, and community leaders in 100 randomly selected municipalities in Bolivia during 2001 and 2007-8. During the first wave, interviews were conducted with mayors, and during the second wave, surveys were conducted also with forestry officials and the heads of elected “*Comités de Vigilancia*,” oversight committees. The descriptions of most variables are in table 1, except for a few variables which require deeper explanation.

[Figure 1 here]

Our first dependent variable, the “relative importance of forestry policy” comes from a survey question asked of mayors, in which they reported the importance of forestry sector policy, relative to other municipal government activities. The responses to this question were recorded on a five point scale, ranging from “much less important” to “much more important” than other listed policy areas including education, security, roads and health services. These initial responses were skewed (because mayors were unwilling to report policy areas as “less important” or “much less important,”) so we transformed the responses by taking the mean reported importance of other policy areas, and subtracted this value from the responses for forestry to create a normally-distributed variable. Higher values indicate that forestry is a higher priority relative to other areas of public goods and services.

The other dependent variables we use here are the “municipal budget in forestry,” which is the percent of the municipal budget dedicated to forestry activities and “employees in forestry,”

the total number of municipal employees engaged in forestry activities. These dependent variables were all constructed using our two waves of municipal survey data from 2001 and 2008.

Our independent variables of interest are all five-point responses to survey questions about institutionally-structured incentives. Our “central government supervision” variable is a five-point question which asks, “How frequently were central government officials sent to the municipality to oversee or supervise municipal forestry activities?” Responses range from “never” to “very frequently.” The “importance of forestry as a revenue source” is taken from the same surveys, and “frequency of community organization demands on forestry” asks how frequently community organizations provided opinions regarding forestry, with similar responses.

[Table 1 here]

The control variables we use in the models we show here as well as our robustness checks (see appendix) are described in table 1, although some controls deserve special note:

We control for income per capita, which is an estimated value derived from the 2001 census data and 2007 municipal and provincial averages from large-n national surveys (2007 Encuesta de Hogares), not from our own forestry survey data. When designing our survey, we anticipated that 2007 municipal per capita income figures would be available at from Bolivian government sources, however, that turned out not to be the case. Therefore, we generated our own income projections, using municipal and provincial averages of individuals surveyed in Bolivian Government national surveys (surveys, that is, which were designed to aggregate to the regional level), and average these with 2001 census figures to derive an current projection of municipal income for our second survey wave, and use the 2001 census figure for the 2001 wave. We also

test all the models reported here with 2007 data and with 2001 census data. These results never vary in direction or significance from the results reported here.

“Officialist party” is a measure of the political party of the mayor. It is coded 1 if the party of the mayor is the party of the president at the same time. In order to test for ideological consistency and the importance of ideology, these codings were also reversed for the first wave in alternate statistical models we tested. Political party affiliations were never significant, however².

The statistical models we present here include OLS (ordinary least squares) regression models, logit regressions, and poisson models. We use a GEE (generalized estimating equation) time-series approach, to account for correlations in the longitudinal data.

We use poisson regression with dependent variables “employees in forestry” and “budget in forestry”. Poisson regression is a generalized linear approach that is appropriate for count data and count-like data such as proportional data (Hoffman 2004; Rabe-Hesketh and Skrondal 2008)³. Poisson models assume an identical mean and standard deviation. When the standard deviation and mean differ significantly in count-data models, as it does in our poisson models, there are a number of approaches which are appropriate (Hoffman 2004; Rabe-Hesketh and Skrondal 2008). These models are deviance-adjusted extradispersed poisson models, but we tested all of the models we show here with chi-squared adjusted extradispersed poisson and negative binomial regressions with substantively identical results.

Because the data is cross-sectional, time-series data, we use a population-averaged Generalized Estimating Equation (GEE) time-series approach. GEE models are extensions of generalized linear models like poisson and logit regression, but which allow analysts to compensate for serial autocorrelation by specifying a within-unit correlation matrix and adjusting

errors accordingly (Duncan et Al 1995; Horton and Lipsitz 1999; Liang and Zeger 1986; Zeger and Liang 1986; Zeger, Liang and Albert 1988). All the models here were tested in regressions which assume within-unit correlations of .9, .7, .5, .3, and .1, with no substantive differences in our results⁴.

Results

Our results show that economic incentives—the financial importance of forestry to the municipality—are significantly and positively correlated with mayors’ assessments of the relative importance of forestry, the percent of municipal budgets in forestry, the total number of municipal employees engaged in forestry, and the presence of a municipal forestry unit. These results support our hypotheses that both political and economic incentives are likely to motivate politicians to invest in forestry services. Political incentives—community organization pressures—are also significantly associated with forestry-related outcomes.

The regression models we show in Table 2 summarize the results of our findings⁵. These results are robust for a range of model specifications. “Importance of forestry as a revenue source” is a highly significant predictor of the mayor’s rating of the importance of forest policy (compared to other policy areas), the number of employees allocated to the forestry sector, and the amount of money allocated to forest monitoring in the municipal budget. Likewise, “community organization pressure” is also a statistically significant predictor of these dependent variables. Other variables, such as “central government supervision” and “mayor’s education” are also significant, but only in one out of the three models⁶.

[Table 2 about here]

Our statistical results hold, even when we use a large number of control variables, controlling for many alternate explanations. As robustness checks, we control for a number of alternative

theoretical approaches, including institutionally-structured incentives, characteristics of mayors, values- and ideology-based explanations, modernization theory, as well as a number of municipal characteristics, simultaneously and in separate models. The results of these models are similar. These robustness checks are shown in the appendix.

Substantively, a change in our independent variable of interest—the importance of forestry as a revenue source—produces a substantial change our dependent variables, as is visible in figures 2 and 3. As shown in figure 2, if the importance of forestry as a revenue source is varied from “unimportant” to “much more important than other sources”, the relative importance of forestry as a political priority increases substantially. As the importance of forestry as a revenue source increases through its range of values, the predicted percentage of the municipal budget dedicated to forestry also increases, from below .25 percent to over 1.25 percent. This is a fourfold increase in the percentage dedicated to this policy area.

[Figures 2 and 3 here]

We also found a consistent and strong effect of the frequency of community organization demands for forestry service on forestry expenditures and other outcomes. For an illustration of this effect, see figure 3, which shows the effect of community organization demands for forestry services on forestry budgets is similar in strength to the effects of the financial importance variable⁷.

A New Puzzle and Secondary Hypotheses Tests

We did not expect economic factors to correlate so consistently with forestry-related outcomes; Bolivian forestry and financing regulations seem to provide few formal incentives for providing forestry-related services.

One possible explanation is that municipalities generate their own revenue in the forestry sector--by charging for permits, fines, and services--and that it is this possibility of revenue generation that gives forestry its primary importance (even though the legality of such actions is not clear under Bolivian law). Our survey data supports the idea that self-generated income in forestry does represent a significant source of income—figure 5 shows that a substantial number of municipalities receive local income from quasi-legal forest governance practices. We proceed to test this explanation by investigating whether the quantity of the municipalities' own forest-related income is correlated with forestry-related investment decisions, and whether the quantity of the central government transfers for forestry affect those same outcomes.

[Figure 5 about here]

For these tests, we construct two additional independent variables. First, we include “percent of forestry income from transfers,” which is the percentage of forestry funding the municipality receives through the *patente forestal*. Second, we use the “percent of forestry income from own sources”—which is the sum of forestry income received for local permits, fines, fees for services, and an “other” category, which typically includes payments for the sale of forestry-related goods (saplings, or seed, for example)⁸.

Our findings provide support for both of our secondary hypotheses. In the three models we show here, two models show a significant and positive correlation between “forestry transfers” and forestry outcomes—number of municipal employees in forestry and the percent of the municipal budget in forestry—and three models show significant and positive correlations between “own forestry income” and forestry outcomes—the number of employees assigned to forestry tasks, the proportion of the municipal budget in forestry, and the relative importance of forestry⁹.

Figure A1 (appendix) shows the effect of “own forestry income” on the percent of municipalities’ budgets dedicated to forestry. As the graph shows, other things being equal, an increase in “own forestry income” from 0 to 100 percent of forestry income is associated with a nearly 150 percent increase in the budgetary percentage committed to forestry. Substantively, the effects of forestry transfers from central government are similar in scale.

Our secondary models also show that forestry transfers—through the *patente forestal*—are significantly related to forestry service provision outcomes. That is to say that mayors and other officials dedicate resources to forestry not only to increase their short-term income, but to protect long-term income from forestry activities. Figures showing the substantive effects of these incentives are included in the appendix.

We were also interested to see if constituent pressures and financial incentives for forestry-related services are complements or substitutes. Therefore, we created an interaction term—“the financial importance of forestry * community organization pressures for forestry”—and tested it in models with each of our dependent variables. Although the results were not consistent—the interaction was only significant in models using one of our dependent variables—the results suggest that these two types of incentives may be substitutes; community organization pressures only seem to be a substantial driver of forestry policy where financial incentives for forestry are not strong. These results are also visible in the appendix.

What do these results tell us about the on-going efforts to reform forestry sector governance through decentralization? First, in places where forestry is not an important policy goal in and of itself, it may be difficult to convince local actors to bear the costs of forest conservation. However, considering short and long term political and economic incentives, and linking service provision to local incentive structures—such as forestry services, enforcement and planning

activities to locally-charged fees and fines—can significantly increase local politicians’ motivation to provide global public goods such as forestry enforcement. Allowing local authorities to raise funds from forestry enforcement through fines and fees may help motivate local politicians to provide forestry services for which they might otherwise lack an interest. So far, both international donors and national governments have largely overlooked this important incentive for local governments.

To address the market's under-valuation of forests, and to motivate local landowners to forego the short-term market opportunities of forest conversion, several public policy solutions are under discussion at the international level. These approaches—often referred to as Payments for Ecosystem Services (PES)—seek to protect ecosystems which provide life-supporting services such as carbon sequestration by transferring funds from the consumers of these services (usually governments in the developed world) to local groups in the developing world, who might not otherwise protect important local ecosystems such as forests. The idea is that by introducing monetary incentives, local resource users will be induced to conserve and enhance existing ecosystem service provision (Quintero, Wunder, and Estrada 2009; Wertz-Kanounnikoff, Kongphan-apirak, and Wunder 2008; Wunder 2009).

Conclusion

Decentralization, a process which has now taken place around the world, has provided sub-national governments a much greater degree of flexibility with which to allocate limited resources. The way municipal politicians choose to allocate those resources, however, is influenced by a diverse set of incentives.

Here, we have shown that mayors of municipal governments in Bolivia are motivated by both economic and political incentives in making decisions about the allocation of resources to

the forestry sector. Municipalities that receive more revenue from forest activities allocate more resources to forest management. And oversight from central government is not consistently related to the allocation of resources to forest activities, suggesting that municipal governments are a necessary point of contact in implementing forest programs in decentralized contexts.

Overall, the results here suggest that a range of incentives, with both short and long-term time horizons, significantly increase municipal politicians' motivation to implement effective forest conservation policy. These findings imply that institutional arrangements should be designed to incorporate a range of incentives, in order to best motivate local-level governments to allocate resources to activities like afforestation and reforestation.

In other words, if policy makers—including the designers of policy initiatives like REDD+—seek to promote effective forest conservation policy, they should seek to promote mechanisms which create local accountability (through democratic elections, for example), permit central governments to pressure local governments for more effective governance (including, perhaps, setting benchmark expectations, withholding of funds when forest governance is ineffective), and encourage local governments to charge fees and fines for forestry-related permits and infractions.

END NOTES

¹ For example, one person enjoying the benefits of national defense, does not reduce the availability of this good for other people within the country.

² We did not use a more complex coding of political party ideologies because Bolivian parties are primarily personalist and many mayors are not even registered with an established party.

³ Sometimes, analysts transform poisson-like distributions to get a normal distribution, but we found no transformation that could transform our count data into a normal distribution.

⁴ Fixed effects models present methodological problems for our type of data because the fixed-effects dummy variables consume degrees of freedom, some our data exist for only one time period, and some of our control variables do not vary between time periods (Rabe-Heskett and Skrondal 2008, 396). Nevertheless, we did estimate these models here with fixed-effects techniques and we did find significant and positive correlations with our “importance of forestry as a revenue source” independent variable in our more parsimonious (preferred) models, where the dependent variable was the percent of the municipal budget employed in forestry, and the number of municipal employees employed in forestry.

⁵ We describe these relatively parsimonious models as our “preferred models” because, although there is no commonly-accepted measure of goodness of fit for GEE models, these regression models have lower standard errors than alternative specifications.

⁶ The finding that these variables are inconsistently significant is also true in a number of other models we show elsewhere (see online supplement/appendix).

⁷ In addition to these tests, we tested whether the financial incentives facing mayors to promote forestry services will have a stronger effect when other incentives—political incentives—are also present, but this interaction effect was not statistically significant.

⁸ Both of these variables come from our 2008 municipal forestry survey. Here, we use extradispersed, deviance-adjusted poisson models (for dependent variables “percent of municipal budget in forestry” and “number of municipal employees in forestry,” and heteroskedasticity-robust OLS regression for the “relative importance of forestry”).

⁹ In addition to the models we show here, we tested a number of alternative specifications, including models which used actual amounts of income for municipalities' own forestry income and transfers (rather than percentages), and models that used combinations of these independent variables, with both chi-squared and deviance-adjusted extradispersed poisson models, negative binomial regression models, and with a varied series of controls, including the controls displayed here, municipalities' total incomes from their own sources, and the importance of forestry as a source of municipal income. One or both measures for local forestry income and forestry transfers were significant in every model we tested.

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Table 1: Variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.	Source(s)	Description
Employees in forestry	218	1.22	1.63	0	10	'01 and '08 mayor surveys, '08 UFM	Total number of employees in forestry
Municipal budget in forestry (pct.)	218	2.62	4.71	0	40	'01 and '08 mayor surveys, '08 UFM survey	Size of the municipal budget (millions of Bolivianos)
Relative importance of forestry	212	-0.80	1.08	-3	1.5	'01 and '08 mayor surveys	See text.
Importance of forestry as a revenue source	210	2.18	1.37	0	5	'01 mayor and '08 UFM surveys	Importance of forestry for municipal income compared to other economic activities such as agriculture and ranching
Central government supervision	244	2.27	1.20	1	5	'01 and '08 mayor surveys	See text.
Central government transfers	244	3.57	1.53	1	5	'01 and '08 mayor surveys, '08 UFM survey	Similar to "central government supervision"—how frequently central governments provided significant amounts of money for projects related to forestry.
Frequency of community organization demands on forestry	244	2.45	1.10	1	5	'01 and '08 mayor surveys, '08 UFM survey, '08 CV survey	See text.
Frequency of NGO opinions on forestry	244	2.38	1.20	1	5	'01 and '08 mayor surveys, '08 UFM survey	Similar to "central government supervision"—how frequently NGOs expressed opinions regarding forestry.
Frequency of NGO donations	244	0.35	0.44	0	1	'01 and '08 mayor surveys, '08 UFM survey	Similar to "central government supervision"—how frequently NGOs provided significant amounts of money for projects related to forestry.
Mayor's sex	216	1.05	0.22	1	2	'01 and '08 mayor surveys	Mayor's sex
Mayor's ethnicity	213	0.67	0.47	0	1	'01 and '08 mayor surveys	1 if self-identified as some indigenous group, 0 if self-identified as "white" or "mestizo"
Mayor's age	215	44.07	8.18	30	70	'01 and '08 mayor surveys	Mayor's age
Mayor's years in office	215	3.06	2.13	0.08	18	'01 and '08 mayor surveys	Years mayor has been in office
Mayor's education	217	12.90	4.22	1	18	'01 and '08 mayor surveys	Mayors' years of education
"Officialist" party	240	0.43	0.49	0	1	'01 and '08 mayor surveys	See text
Forest cover (pct.)	244	55.82	41.43	0	100	Remote sensing data, '01 and '08	Percent of municipal land-area covered in forest
Budget (millions of Bolivianos)	218	20.38	99.59	0	1293.40	2001 and 2007 Bolivian government statistics	Size of municipal budget
Total municipal employees	217	32.30	52.80	0	400	'01 and '08 mayor surveys	Total number of municipal employees

Table 2: Preferred Models

	<u>Dependent variable</u>		
	<u>Relative importance of forestry</u>	<u>Percent of muni. budget in forestry</u>	<u>Total no. of muni. employees in forestry</u>
Model Type	GEE with unstructured within-unit population-averaging	Extradispersed poisson GEE with unstructured within-unit population-averaging and deviance-adjusted standard errors	Extradispersed poisson GEE with unstructured within-unit population-averaging and deviance-adjusted standard errors
Importance of forestry as a revenue source	0.296 (0.051)***	0.182 (0.058)**	0.268 (0.061)***
Central government supervision	0.197 (0.056)***	0.115 (0.074)	0.032 (0.075)
Frequency community orgs. express opinions about forestry	0.146 (0.067)*	0.333 (0.086)***	0.196 (0.088)*
Mayor's education	-0.038 (0.017)*	-0.008 (0.023)	-0.004 (0.023)
'Officialist' party	-0.017 (0.134)	-0.021 (0.173)	0.057 (0.170)
Mean index of HDI education and income measures	-0.138 (0.823)	-1.255 (1.141)	0.236 (1.156)
Forest cover (pct.)	-0.000 (0.002)	0.008 (0.002)***	0.000 (0.002)
Total size of muni. budget--millions of Bolivianos	0.000 (0.001)	-0.000 (0.001)	-0.004 (0.004)
Constant	-1.763 (0.470)***	-0.379 (0.644)	-4.252 (0.654)***
Observations	206	208	206
Number of municipalities	121	121	120

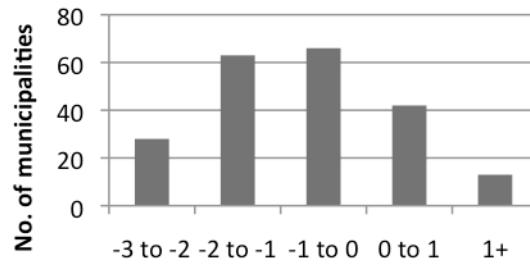
Standard errors in parentheses

* significant at 5%; ** significant at 1%; *** significant at .1%

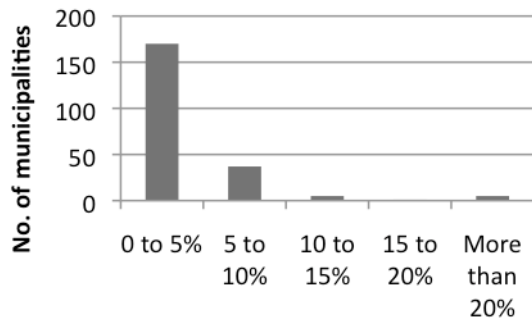
Table 3: Secondary Hypotheses

<i>Model type</i>	<i>Deviance-adjusted, extradispersed poisson</i>		<i>OLS</i>
Dependent variable	Total no. of muni. employees in forestry	Percent of muni. budget in forestry	Relative importance of forestry
Own forestry income (pct. of forestry income)	0.007 (0.003)*	0.010 (0.003)**	0.002 (0.003)
Forestry transfers (pct. of forestry income)	0.010 (0.002)**	0.008 (0.003)*	0.009 (0.003)**
Frequency community orgs. express opinions about forestry	0.344 (0.105)**	0.401 (0.129)**	0.281 (0.104)**
Central government supervision	0.086 (0.083)	0.175 (0.105)+	0.158 (0.085)+
Mayor's education	-0.054 (0.027)*	-0.008 (0.032)	-0.021 (0.028)
'Officialist' party	0.047 (0.243)	0.226 (0.283)	-0.063 (0.250)
Mean index of HDI education and income measures	4.025 (1.889)*	-2.865 (1.826)	-1.627 (1.500)
Forest cover (pct.)	0.002 (0.004)	0.001 (0.004)	0.002 (0.004)
Total size of muni. budget--millions of Bolivianos	-0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)
Total no. of muni. employees	0.003 (0.002)		
Constant	-3.448 (1.117)**	0.667 (1.025)	-1.208 (0.866)
Observations	99	99	99
R-squared			0.26
Standard errors in parentheses + significant at 10%; * significant at 5%; ** significant at 1%			

Relative importance of forestry



Forestry budget (pct.)



Forestry employees

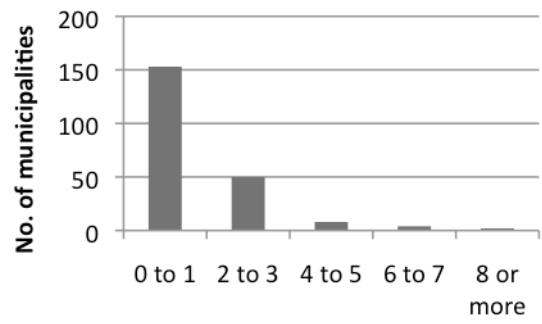


Figure 1: Distribution of dependent variables

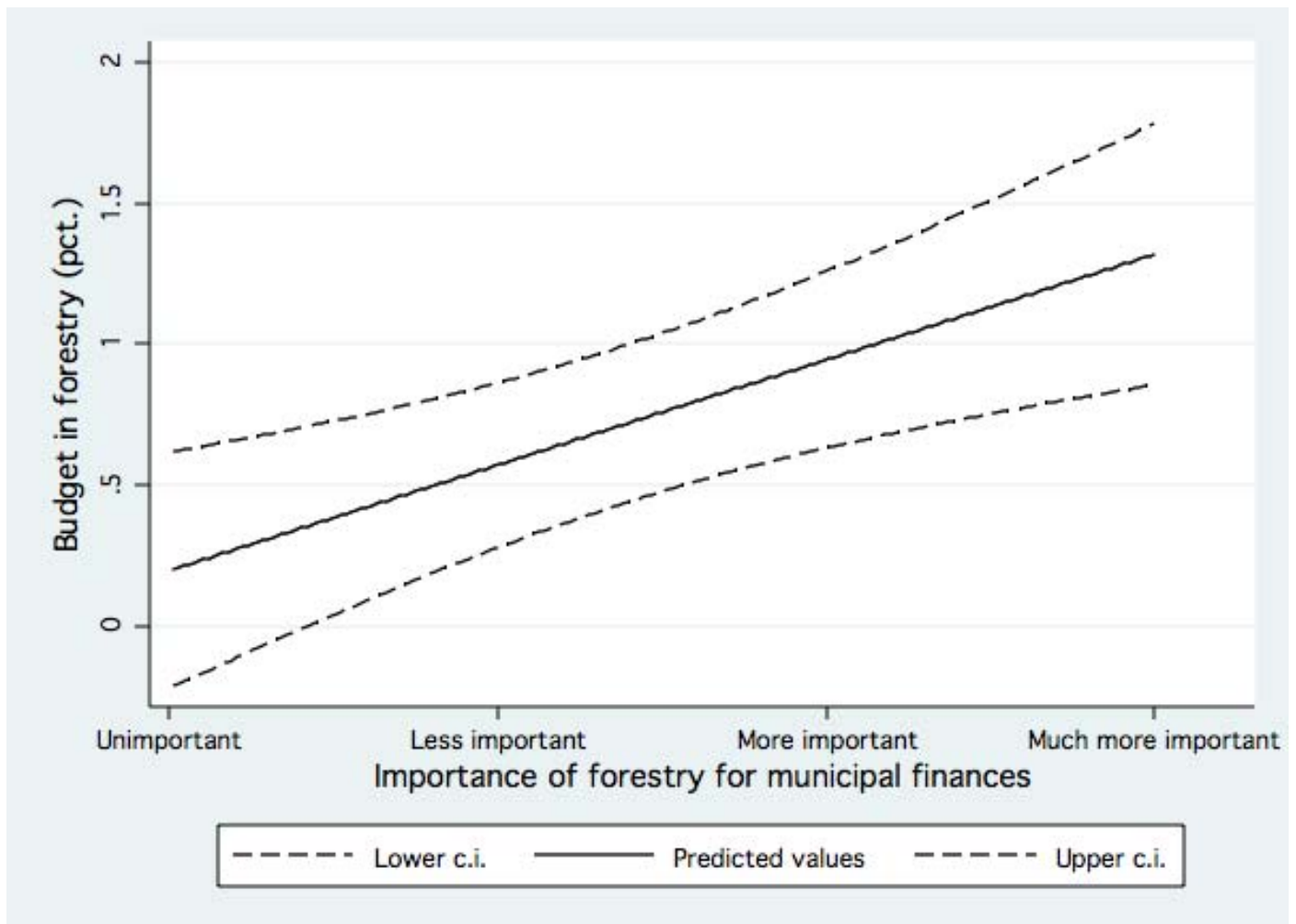


Figure 3: As the importance of forestry as a source of revenue increases, municipalities commit more resources to forestry. This chart was made with all control variables set at their means, except for party, which was set at 1.

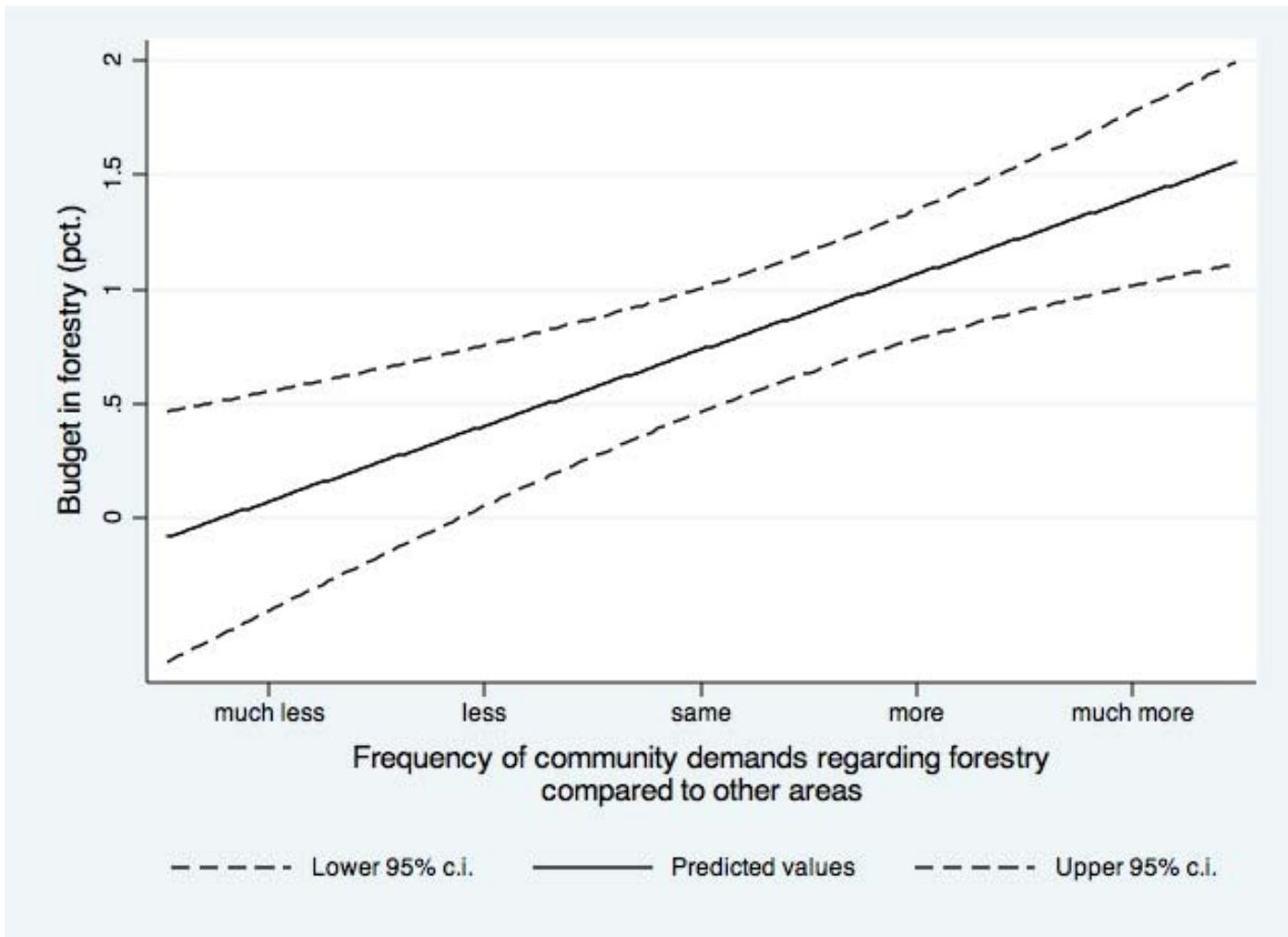


Figure 4: As the frequency of community demands increases from “much less frequent” than other policy areas to “much more frequent,” the percentage of municipal budgets spent in forestry increase from nothing, on average, to more than 1.5 percent.

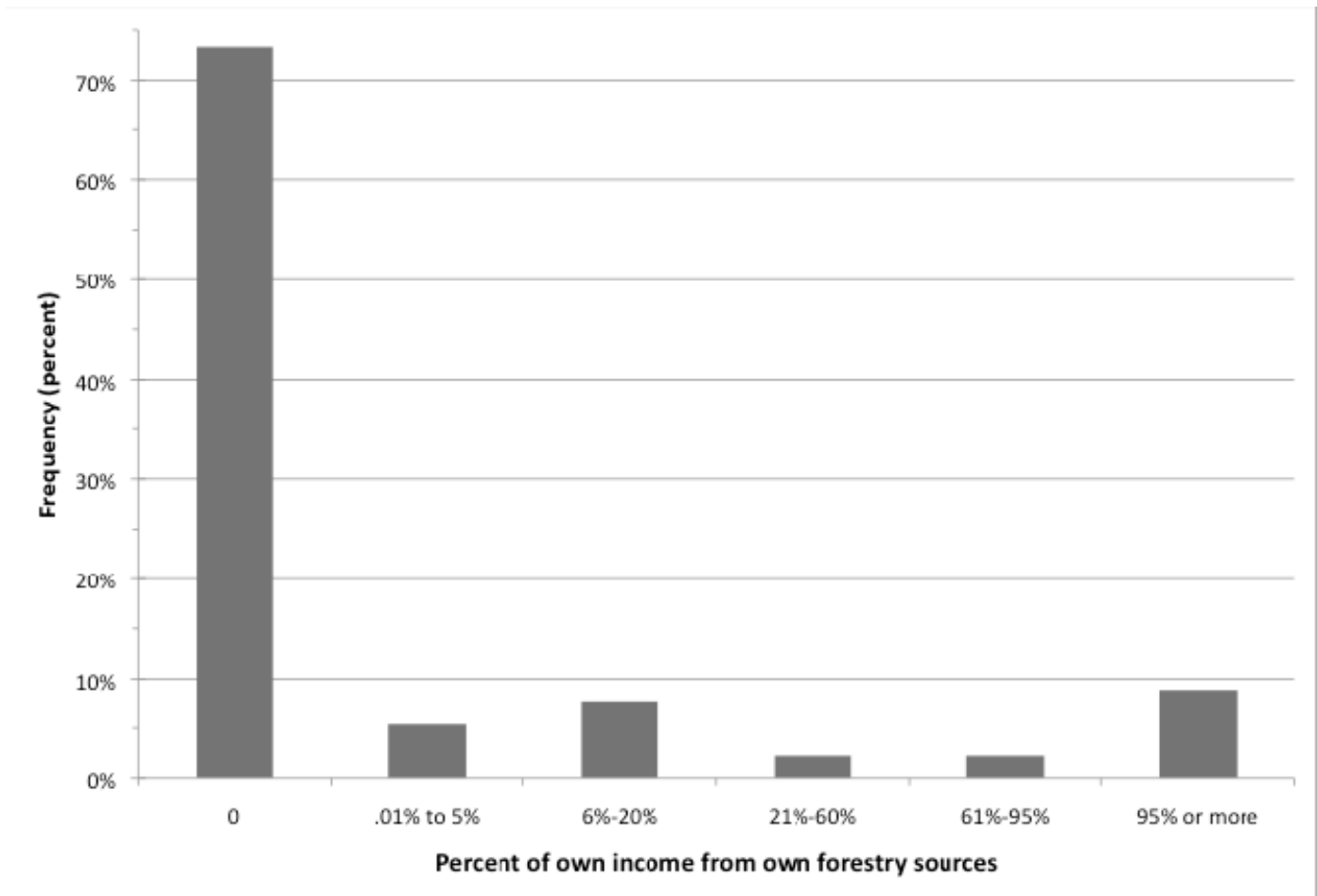


Figure 5: Although a minority of municipalities in our sample gather income from forestry, a substantial percentage of our sample (more than 15%) gather more than a sixth of locally-collected funds from forestry-related sources. According to estimates from our surveys with local government personnel in the 100 municipalities, more than 10% of all municipalities get more than 90% of their total incomes in the forestry sector from their own collection of local fees and taxes.

Appendix¹

[Tables 4 through 10 and figure 8 here]

¹ We propose the inclusion of these robustness checks as an online supplement
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Table A1: All Control Variables

Dependent variable	Relative importance of forestry
Model type	OLS with unstructured within-unit correlation assumptions
Institutionally-structured incentives	
Importance of forestry as a revenue source	0.250 (0.053)***
Central government supervision	0.128 (0.061)*
Importance of central government transfers	-0.120 (0.062)+
Frequency community orgs. express opinions about forestry	0.091 (0.072)
Frequency NGOs express opinions about forestry	0.143 (0.066)*
Importance of NGO donations for forestry	0.106 (0.164)
Mayor's Characteristics	
Mayor's gender	0.205 (0.294)
Mayor's ethnicity	-0.285 (0.162)+
Mayor's age	-0.007 (0.008)
Mayor's years in office	0.025 (0.034)
Mayor's education	-0.043 (0.017)*
Values and ideology	
Political Party	0.062 (0.137)
Indigenous population with 2007 estimates	-0.004 (0.003)
Modernization and Development	
HDI income index squared (Kuznets curve)	-1.592 (2.206)
Mean index of HDI education and income measures	0.805 (1.856)
Municipal characteristics	
Forest cover (pct.)	-0.001 (0.002)
Total size of muni. budget--millions of Bolivianos	0.001 (0.001)
Constant	-1.013 (1.009)
Observations	196
Number of geographic units	115
Standard errors in parentheses	
+ significant at 10%; * significant at 5%; ** significant	

Table A2: All Control Variables

<u>Dependent Variable</u>	<u>Presence of a municipal forestry unit</u>
<u>Model Type</u>	<u>Logit (cross sectional)</u>
Institutionally-structured incentives	
Importance of forestry as a revenue source	1.071 (0.411)***
Central government supervision	0.178 (0.301)
Importance of central government transfers	1.314 (1.345)
Frequency community orgs. express opinions about forestry	0.298 (0.361)
Frequency NGOs express opinions about forestry	0.154 (0.322)
Importance of NGO donations for forestry	0.789 (1.204)
Mayor's characteristics	
Mayor's ethnicity	-0.380 (0.864)
Mayor's age	0.044 (0.057)
Mayor's years in office	0.209 (0.230)
Mayor's education	0.105 (0.097)
Values and ideology	
Indigenous population	-0.048** (0.035)
'Officialist' party	0.480+ (0.807)
Modernization and development	
HDI income index squared (Kuznets curve)	0.473 (10.585)
Mean index of HDI education and income measures	2.930 (10.894)
Municipal characteristics	
Forest cover (pct.)	-0.023 (0.013)**
Total size of muni. budget--millions of Bolivianos	0.003 (0.004)
Constant	-13.131 (9.564)
Observations	83
Standard errors in parentheses	
+ significant at 10%; * significant at 5%; ** significant at 1%; *** significant at .1%	

Table A3: All Control Variables

Dependent variable	Municipal
Model type	Extradispersed, deviance-adjusted poisson with unstructured intra-unit c
Institutionally-structured incentives	
Importance of forestry as a revenue source	
Central government supervision	
Importance of central government transfers	
Frequency community orgs. express opinions about forestry	
Frequency NGOs express opinions about forestry	
Importance of NGO donations for forestry	
Mayoral characteristics	
Mayor's gender	
Mayor's ethnicity	
Mayor's age	
Mayor's years in office	
Mayor's education	
Values and ideology	
'Officialist' party	
Indigenous population (pct.)	
Modernization and development	
HDI income index squared (Kuznets curve)	
Mean index of HDI education and income measures	
Municipal characteristics	
Forest cover (pct.)	
Municipal employees (total)	
Total size of muni. budget--millions of Bolivianos	
Constant	
Observations	
Number of geographic units	
Standard errors in parentheses + significant at 10%; * significant at 5%; ** significant at 1%; *** significant at .1%	

Table A4: Robustness Checks—Percent of Municipal Budget in Forestry

Extradispersed population-averaged poisson with deviance-adjusted standard errors and unstructured within-unit correlation assumptions				
	Values and Ideology	Modernization and Development	Mayor's Personal Characteristics	Institutional Incentives
Importance of forestry to muni. finances	0.237 (0.059)***	0.265 (0.058)***	0.257 (0.064)***	0.187 (0.053)***
'Officialist' party	-0.031 (0.181)			
Indigenous population	-0.008 (0.003)**			
HDI income index squared (Kuznets curve)		-4.631 (2.935)		
Mean index of HDI education and income measures		2.711 (2.427)		
Mayor's gender			-0.636 (0.517)	
Mayor's ethnicity			-0.275 (0.200)	
Mayor's age			-0.004 (0.012)	
Mayor's years in office			-0.011 (0.045)	
Mayor's education			-0.020 (0.023)	
Central government supervision				-0.008 (0.078)
Importance of central government transfers				0.343 (0.084)***
Frequency community orgs. express opinions about forestry				0.331 (0.090)***
Frequency NGOs express opinions about forestry				0.027 (0.080)
Importance of NGO donations for forestry				0.651 (0.206)**
Total size of muni. budget--millions of Bolivianos	-0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)
Constant	0.744 (0.255)**	-0.343 (0.881)	1.606 (0.853)+	-2.241 (0.479)***
Observations	205	209	203	210
Number of municipalities	117	121	121	122
Standard errors in parentheses + significant at 10%; * significant at 5%; ** significant at 1%; *** significant at .1%				

Table A5: Robustness Checks—Total Municipal Employees in Forestry

Extradispersed population-averaged poisson with deviance-adjusted standard errors and unstructured within-unit correlation assumptions				
Model	Values and Ideology	Mayor's personal characteristics	Modernization and Development	Institutional Incentives
Importance of forestry to muni. finances	0.307 (0.049)***	0.296 (0.053)***	0.288 (0.046)***	0.271 (0.046)***
'Officialist' party	0.117 (0.156)			
Indigenous population (pct.)	-0.002 (0.003)			
Mayor's gender		-0.007 (0.360)		
Mayor's ethnicity		-0.065 (0.167)		
Mayor's age		-0.009 (0.010)		
Mayor's years in office		0.022 (0.031)		
Mayor's education		0.001 (0.021)		
HDI income index squared (Kuznets curve)			-0.863 (2.365)	
Mean index of HDI education and income measures			3.902 (2.179)	
Central government supervision				0.062 (0.070)
Importance of central government transfers				0.080 (0.066)
Frequency community orgs. express opinions about forestry				0.250 (0.083)**
Frequency NGOs express opinions about forestry				-0.094 (0.075)
Importance of NGO donations for forestry				0.337 (0.178)+
Total number of municipal employees	0.006 (0.001)***	0.006 (0.001)***	0.004 (0.001)***	0.006 (0.001)***
Constant	-0.756 (0.235)***	-0.415 (0.699)	-2.728 (0.835)***	-1.824 (0.378)***
Observations	204	203	208	209
Number of municipalities	117	121	121	122
Standard errors in parentheses + significant at 10%; * significant at 5%; ** significant at 1%; *** significant at .1%				

Table A6: Financial incentives and community demands as substitutes

Model type: Extradispersed poisson with standard errors corrected using square root of deviance adjustment and unstructured correlation assumptions	Muni. employees in forestry (pct.)
Importance of forestry to muni. finances	0.615 (0.180)**
Central government supervision	0.006 (0.076)
Frequency community orgs. express opinions about forestry	0.492 (0.169)**
Mayor's education	0.001 (0.023)
'Officialist' party	0.017 (0.168)
Mean index of HDI education and income measures	0.436 (1.140)
Forest cover (pct.	-0.000 (0.002)
Total size of muni. budget--millions of Bolivianos	-0.003 (0.003)
Financial importance of forestry X frequency of community organization demands for forestry	-0.119 (0.059)*
Constant	-0.579 (0.800)
Observations	206
Number of jurisdictions	120
Standard errors in parentheses + significant at 10%; * significant at 5%; ** significant at 1%	

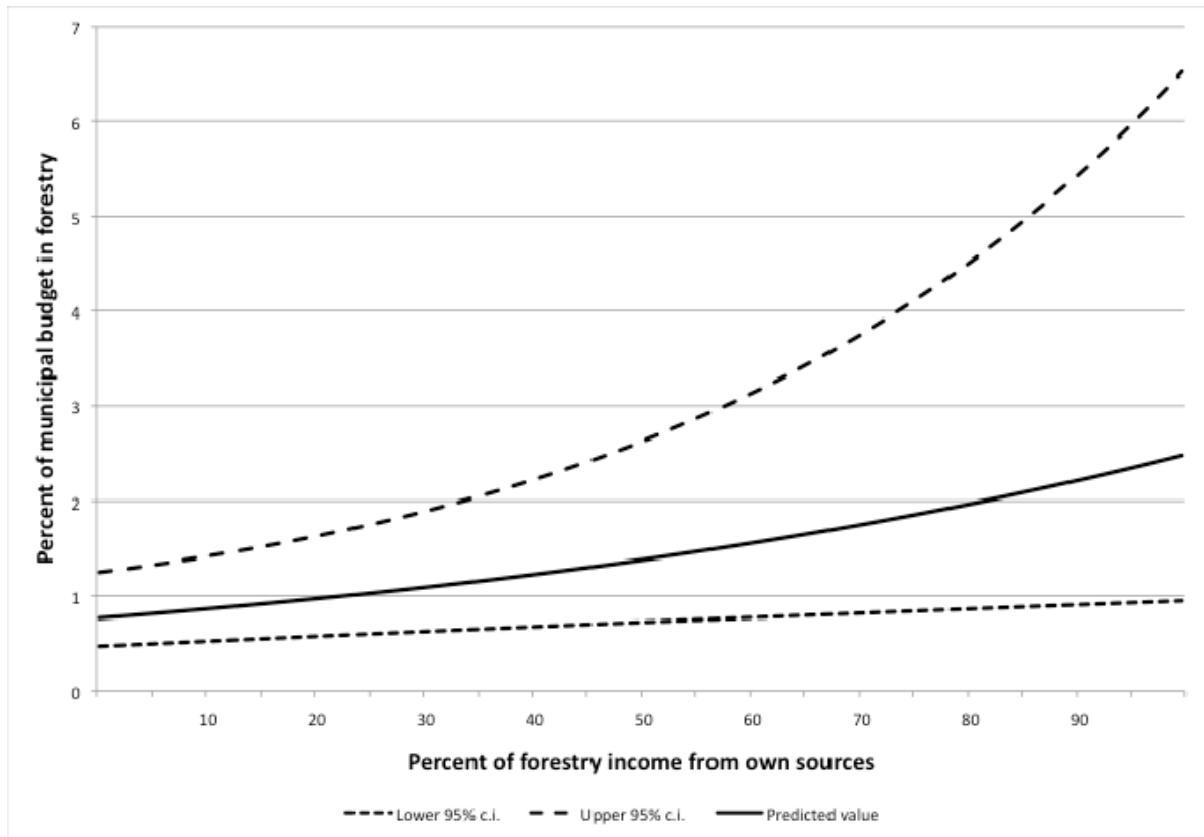


Figure A1: Our secondary, cross-sectional models show that the percent of forestry income from municipalities’ own sources—a quasi-legal source of income—is a significant predictor of a number of forestry-related outcomes, including how much municipalities spend in forestry. This suggests that in many cases, these relatively small sources of income are enough to motivate municipal policy-makers to engage in forestry regulation for short-term gains. These relationships are significant at the 95% level.

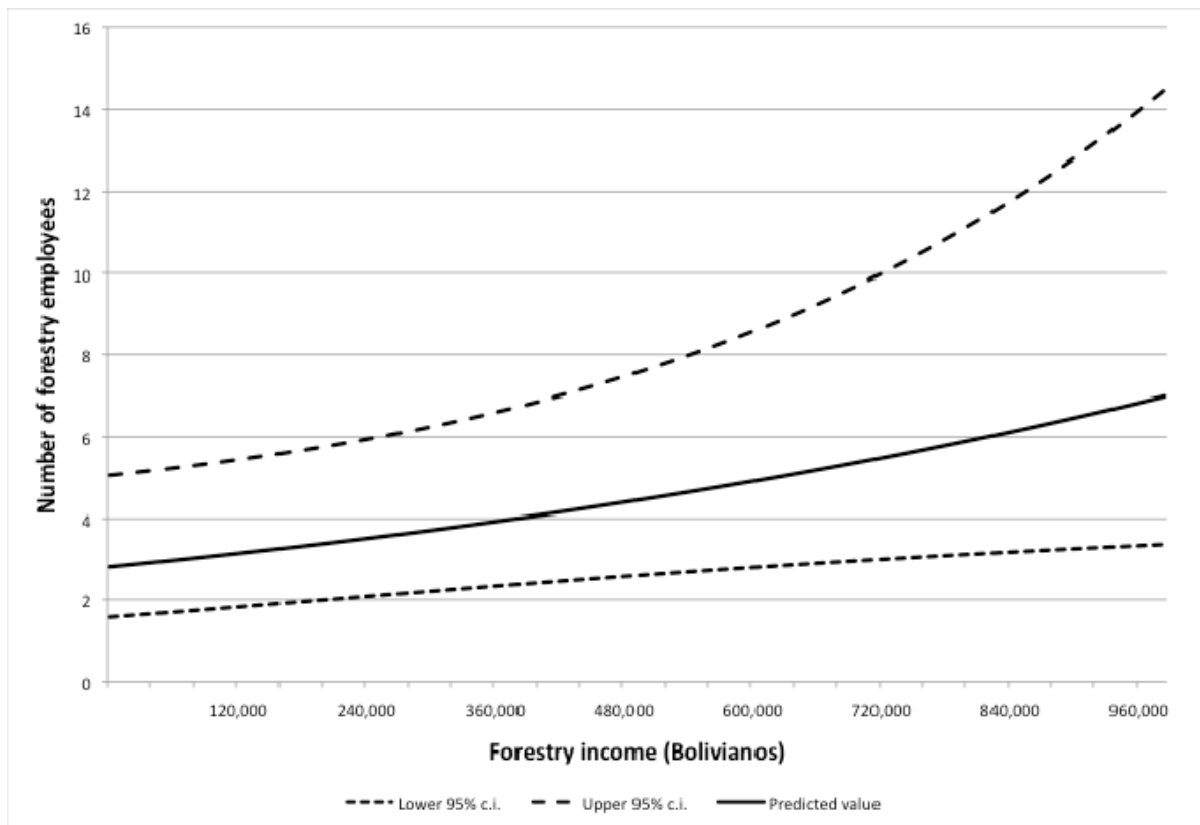


Figure A2: After controlling for municipalities’ own forestry income, forestry transfers are also significantly correlated with forestry-related outcomes, including the number of employees municipalities dedicate to forestry tasks. The implication is that municipalities are motivated by the potential for long-term gains to support municipal forestry activities, in places where the potential for such gains is relatively high, even though the payoffs from such activity are likely to be seen in mayors’ current terms. It should be noted that the confidence intervals around these predictions are confidence intervals bounding the predicted values, not the marginal effects—these relationships are significant at the 95% level.

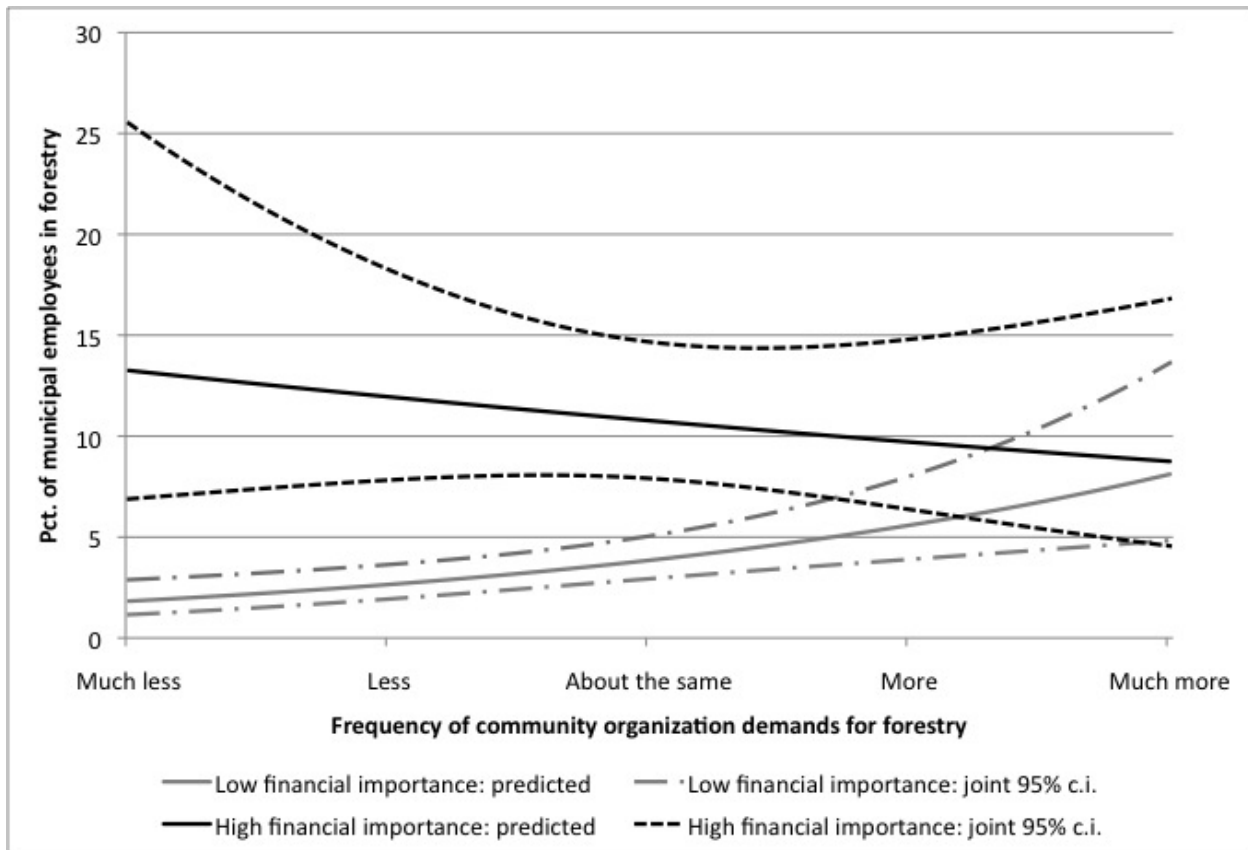


Figure A3: An interaction term we constructed—the frequency of community organization demands for forestry X the financial importance of forestry—was significant in statistical models where the dependent variable was the percentage of municipal employees engaged in forestry. Although this variable was not significant in other models, its’ significance here suggests that community organization demands and other democratic pressures may be substitutes for the financial incentives associated with forest policy. Where financial incentives are strong, a change in community organization pressures for forestry will have little effect, but where financial incentives are weak, community organization pressures can be substantial in promoting more energetic forestry policy.

Table A7: Correlations

	1	2	3	4	5	6	7	8	9	10
1	1									
2	0.6185	1								
3	0.2057	0.1182	1							
4	0.2746	0.3973	0.3413	1						
5	0.5035	0.5951	0.2741	0.4243	1					
6	0.1261	0.1437	0.1023	0.2204	-0.0087	1				
7	0.1613	0.1717	0.0651	-0.077	0.1634	-0.2794	1			
8	0.3392	0.357	0.263	0.3671	0.3077	0.2003	0.0736	1		
9	0.0413	0.1931	0.1533	0.3777	0.1331	0.3917	-0.0903	0.3392	1	
10	-0.0827	0.0244	0.2725	0.1469	-0.1107	0.4843	-0.0641	0.0502	0.4627	1
11	0.0562	-0.1572	-0.0695	-0.1038	-0.1007	-0.048	0.0525	-0.196	-0.1851	-0.0781
12	-0.2333	-0.3154	-0.0323	-0.2305	-0.3636	-0.0694	0.066	-0.1076	-0.005	0.0995
13	-0.0245	-0.0819	0.0138	-0.169	-0.071	-0.0186	-0.388	-0.2408	-0.0478	-0.0318
14	0.0889	0.2444	-0.0018	0.1666	0.3343	0.1148	-0.1984	0.0991	0.0623	-0.1591
15	-0.0663	0.1873	-0.0593	-0.0962	0.0998	0.1318	0.0731	-0.0053	0.0009	0.0565
16	-0.3428	-0.2776	-0.0222	-0.273	-0.3186	-0.1796	0.1224	-0.1181	-0.0115	0.2556
17	-0.0236	-0.0838	0.0708	-0.0338	-0.0802	-0.1404	0.1769	-0.0508	-0.0379	-0.015
18	0.2248	0.155	-0.1058	-0.0176	0.1088	0.0576	-0.0388	0.0331	-0.0364	-0.1728
19	0.2654	0.2012	-0.0852	-0.049	0.1483	0.0668	-0.0433	0.0328	-0.0346	-0.1849
20	-0.0119	-0.2095	-0.0182	-0.0589	0.0161	-0.0523	-0.1408	-0.1535	-0.1547	-0.0099
21	-0.0032	0.1306	0.0019	0.1407	0.1773	-0.0068	0.0499	0.165	0.0644	-0.115
22	0.1955	0.1202	0.0061	-0.0105	0.1195	-0.0408	0.0208	0.0261	-0.008	-0.016

	11	12	13	14	15	16	17	18	19	20
11	1									
12	0.0197	1								
13	0.188	-0.0984	1							
14	-0.1742	-0.1362	0.0967	1						
15	-0.1102	-0.31	0.1924	0.1704	1					
16	0.0361	0.5425	-0.1275	-0.2869	-0.0806	1				
17	-0.1464	0.4096	-0.149	-0.0192	-0.2988	0.3145	1			
18	0.1388	-0.4421	0.1135	0.0796	0.3452	-0.3995	-0.274	1		
19	0.1337	-0.47	0.1846	0.0468	0.4182	-0.3988	-0.3704	0.9175	1	
20	-0.0663	0.1357	0.1802	-0.0195	-0.0574	0.028	0.1492	-0.0107	-0.0085	1
21	-0.0084	-0.0993	0.0404	0.1424	0.0831	-0.1594	-0.0898	0.1152	0.1084	-0.0597
22	0.0146	-0.1464	0.0196	0.0826	0.1769	-0.0997	0.142	0.5236	0.4301	0.064

	21	22
21	1	
22	0.0408	1

1	Total municipal employees in forestry
2	UFM
3	Municipal budget in forestry (pct.)
4	Relative importance of forestry
5	Importance of forestry as a revenue source
6	Central government supervision
7	Central government transfers
8	Frequency of community organization opinions on forestry
9	Frequency of NGO opinions on forestry
10	Importance of NGO transfers as a revenue source
11	Mayor's sex
12	Mayor's ethnicity
13	Mayor's age
14	Mayor's years in office
15	Mayor's education
16	Indigenous population (pct.)
17	Party
18	Kuznets curve
19	HDI education and income index
20	Forest cover (pct.)
	Municipal budget size (millions of Bolivianos)
21	Bolivianos
22	Total municipal employees