DEFORESTATION IN DECENTRALIZED AND DEMOCRATIC INDONESIA

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Deforestation in Decentralized and Democratic Indonesia

Vid Adrison[1]*

Abstract

This study investigates the effect of forestry decentralization on deforestation in Indonesia. A theoretical model is constructed to explain the effect of decentralization on deforestation, and tested using the same dataset as used in [1]. We find the following evidence; (1) Forestry decentralization increases deforestation rate, (2) Except for production forest, there are statistical evidence linking deforestation with district head election, (3) Local government spending on environmental is ineffective in reducing deforestation.

Keywords

Deforestation — Decentralization — Democratization — Asia — Indonesia

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INTRODUCTION

Indonesia forest has decreased substantially from 1.1 million square km in 1990 into 0.944 million square km [2]. Given Indonesia has the eight largest forest area and fourth largest population in the world, Indonesia has a potentially important role in determining the green-house gas emission in the world.

Some existing studies found that decentralization and local democratization contribute to deforestation in Indonesia.

For instance, [3] concludes that regulatory flaws between existing Regional Government Law No. 32/2004 and Forestry Law No. 41/1999. [4] also found that regional autonomy pushed illegal logging even further by "legalizing" them, as the local government applied charges/fee for transporting timber. Recent study by [1] found that increased number of jurisdiction and local district election also play a role in deforested Indonesia.

The effect on deforestation as found by existing literature is contradictory to what the proponents of decentralization and local democratization believes. Theoretically, decentralization will bring greater benefit to local economy than centralized regime as it brings the government closer to the people. There are several channels that make decentralization beneficial such as inter-jurisdictional competition [5], informational advantage [6] and better preference homogeneity [7]. On the other hand, local democratization increases the chance of bringing greater benefit as only the politician that can represent the local needs the best will be elected through local election (theoretically).

The discrepancy between theoretical versus actual results of decentralization and local democratization are realized by the policy makers, both parliament and executives. This can be reflected by the fact that some decentralization-related laws – such as law No. 32/2004 on Regional Government and law No. 33/2004 on Fiscal Balance – are listed in the 2009-2014 National Legislation Program (*Program Legislasi Nasional/Prolegnas*) of Indonesian Parliament (*Dewan Perwakilan Rakyat*/DPR). In addition to the above laws, law No. 41/1999 on Forestry is also listed in the *Prolegnas*. As of November 2013, none of these laws have been amended.

This study aims at investigating the effect of forestry decentralization on deforestation in Indonesia[1]. In order to

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answer the research question, we review existing relevant literatures on deforestation and decentralization, conduct in-depth interviews with relevant stakeholders at the national and local policy makers, conducting empirical test through econometric modeling.

This paper is organized as follows; in the next section, we discuss the existing literature of decentralization from theoretical and empirical aspects, and the effect decentralization on forestry resource management in international context as well as Indonesian context. Section 3 discusses data source and empirical strategies. The findings from in-depth interviews and empirical results are discussed in section 4, and followed by conclusion and policy recommendation in section 5.

1. LITERATURE REVIEW

1.1 Theoretical prediction and empirical evidence of decentralization

Decentralization is defined as the transfer of authority and responsibility for public function from the central government to subordinate or quasi-independent government organization of the private sectors [8]. There are several types of decentralization, namely; political, administrative, fiscal and market decentralization.

From theoretical standpoint, the effect of decentralization on public service delivery is ambiguous. In the proponent sides, there are several channels that make decentralization leads to improved public service deliveries, such as increased inter-jurisdictional competition [5], informational advantage [6], better preference homogeneity [7] increased direct accountability as local government is only responsible for a certain task that is specific to their jurisdiction [9].

On the other hand, decentralization may results in decreased public service delivery. The channels may come from coordination breakdown among bureaucrats which lead to excess rent extraction which leads to a decrease in the quality of public goods and service [10] and low capacity of local bureaucrat [11].

The empirical evidence on the effect of decentralization is also mixed. The impact of decentralization on growth are found negative in some studies, for instance, [12] on China, [13] for United States, and [14] on developed and developing countries. In contrast some other studies found positive effect of decentralization on economic growth, for instance [15] on United States, [16], cross country analysis by [17], [18] and [19]. On public goods provision, [20] find that local competition and public participation has increased efficiency of public goods provision at the village level in Indonesia. On corruption, negative correlation between decentralization with corruption is found by [21] and [22], while [23] found that federalist countries tend to have higher corruption.

1.2 Decentralization and deforestation in international context

Numerous studies have been conducted to investigate the effect of decentralization on natural resources management and the results vary from one country to another. Decentralization is found to have positive impact on forest investment in Guatemala [24], Bolivia ([24]; [25]), Kenya and Mexico [25], while for Uganda it is found negatively correlated [25]. For the case of Indian Himalayas, [26] found that forests managed by local communities are 20–30% less lopped.

[24] conducted a comparative analysis of forestry decentralization in Bolivia and Guatemala and they find that decentralized political power and fiscal power in Guatemala is more likely to encourage the mayors to invest more on their staffs and capital in the forestry sector compare to relatively stringent Bolivia. A mixed result is also found by [25] on the case of Bolivia, Kenya, Mexico and Uganda. Their empirical finding indicates that decentralization in followed by increase forest investment in Uganda, and Mexico, a slight increase in Bolivia, while for Kenya forest investment falls significantly.

Study by [27] and [28] indicate the importance of institutional factor when designing decentralization in natural resource management. [27] conducted three case studies on Nueva Vizcaya province in Philippines and found that conflicting authorities in forestry sector with almost identical responsibilities lead to ineffective policy implementation. [28] use a panel of 124 countries from 1980 to 2004 and conclude that countries with abundant natural resources with low democratic tend to have higher tendency to corrupt as their governments take on rent-seeking activities.

1.3 Decentralization and deforestation in Indonesian context

The Regional Government Law No. 22/1999, which is considered the milestone for new era of decentralization in Indonesia, does not list forestry sector as the affair to be carried out by the central government. And neither does Regional Government Law No. 32/2004 which replaced law No. 22/1999. The existing Forestry Law No. 41/1999, which was passed four months after law No. 22/1999, assigns the central government to carry out forestry resource management function. However, ministerial decree allows governors and district heads to issue small scale forestry extraction licenses[2].

These regulations were later revoked by the issuance of Government Regulation No. 34/2002. Such regulatory problems – i.e., flawed division of authorities between central and regional government and inconsistencies between laws – have been considered as the contributing factor to deforestation in Indonesia by [3].

The negative effect of decentralization on deforestation is also found by [4] and [1]. [4] conducted case studies in

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through centralized-decentralized-and recentralized regime.

[2]Governor can issue forestry extraction licenses up to 10,000 hectares (Kepmenhutbun No. 312/Kpts-II/1999), while district head can issue up to 5,000 hectares (Kepmenhutbun No. 051/Kpts-II/2000).

Berau district of East Kalimantan and Kotawaringin Timur of Central Kalimantan. They found that regional autonomy has pushed illegal logging activities even further by "legalizing" them through applying local fees/charges. A recent study by [1] covers four major islands in Indonesia (Sumatera, Kalimantan, Sulawesi and Papua) and concludes that increased political jurisdiction has positive correlation with deforestation rate. They also find that deforestation occur at higher rate prior in the year prior to local election.

The effect on community payoffs logging contract in a decentralized regime is investigated by [29]. Using a survey of 60 communities in East Kalimantan, they find that while some communities have successfully claimed their share, others continue to lose their forests to industrial interest for very little financial compensation. They conclude that the communities payoff depend on the communities' valuation over the forest. Higher valuation and greater ability to self-enforce are positively correlated with payoffs. Communities for whom self-enforcement is costly – either they have high opportunity of time or low collective actions – have difficulties in claiming an effective share in logging benefit.

2. DATA SOURCES AND EMPIRICAL SPECIFICATION

2.1 Data sources
In order to empirically test the effect of forestry decentralization and local democratization on deforestation, we employ the same dataset as [1]. They use satellite image from Moderate Resolution Imaging Spectroradiometer (MODIS) dataset to calculate the changes of forest area by type from 2000 to 2008 for all districts in four major islands, namely Sumatera, Kalimantan, Sulawesi and Papua. They use the smallest scale of satellite imaging, which one pixel equals to 250m x 250m in the actual size. This means that one pixel equals to 6.25 hectares. Multiplying the number of changes in the total forest area by year with a factor of 6.25 would provide us the annual change in forest area in hectares. This would serves as dependent variable for deforestation equation.

For the independent variables, we use data from Ministry of Finance Ministry of Home Affairs and BPS. The BPS data covers socio economic variables which includes the share of agriculture, mining and manufacturing sector in non-oil and gas Gross Regional Domestic Product (GRDP) which reflect the local economic structure as the proxy for non-forestry sector resources, mean years of schooling (as the proxy for citizen control for quality of public goods). The data from Ministry of Finance includes the share of local own source revenue in total district revenue (as the proxy for district fiscal capacity), the share of environmental spending in total district spending (as the proxy for local preference toward environment) and the share of infrastructure spending in total district spending. As [1] find statistical evidence that deforestation occurred at higher rate prior to local election year, dummy variable for lagged one and two years prior to

direct local election are included. The descriptive statistics for all variables are depicted in Table 1.

2.2 Empirical specification
The empirical specification to investigate the effect of forestry decentralization and local democratization on deforestation is as the following

$$
\begin{aligned}
Extraction_{it} \quad = \quad & Z\beta + \alpha_1 Forest_{it-1} + \alpha_2 Decentralization_t \\
+ \quad & \alpha_3 LocalElection_{it+1} \\
+ \quad & \alpha_4 LocalElection_{it+2} + c_i + u_{it\,Where} \quad (1)
\end{aligned}
$$

$Extraction_{it}$: Level of forestry extraction of district i in time t;

Z : Set covariates for non-forestry endowment, which includes:

- Per capita non-oil and gas GRDP to reflect the level of economic development. As forestry sector is one component in GRDP, using the contemporaneous value of per capita GRDP introduces endogeneity problem. Thus, as the solution we use lagged one year of per capita non-oil and gas GRDP.
- Contribution of agriculture, manufacturing and mining sectors in non-oil and gas GRDP.
- Mean years of schooling (as the proxy for local human capital quality that enable them to for control the quality of public goods).
- Share of local own source revenue in total district revenue (as the proxy for district fiscal capacity). We use lagged value to indicate whether or not district with low fiscal capacity in will extract more forestry resource in the next period in order to receive higher revenue sharing from forestry.
- Share of environmental spending in total district spending (as the proxy for local preference toward environment). We also use interaction term to see the impact of changes of local preference toward forestry due to forestry decentralization;

$Forest_{it-1}$: Total forest stock in previous year, which reflects the maximum amount that can be extracted this year;

$Decentralization_t$: Dummy for forestry decentralization, which takes value of one for 1999–2002 period, and zero after 2002;

$LocalElection_{it+1}$: Dummy for one year before election, which takes value of one if it is one year before election, zero otherwise;

$LocalElection_{it+2}$: dummy for two years before election, which takes value of one if it is two years before election, zero otherwise;

c_i : Unobserved heterogeneity of district i;

u_{it} : Idiosyncratic error of district i in time t.

Our parameter of interest is α_2, where positive and statistically significant result indicates that the implementation of decentralization - i.e., local government are given the authority to issue licenses for forestry extraction – leads to higher extraction of forestry resources.

Table 1: Descriptive statistics

	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
Deforestation in convertible forest (hectare)	2,456	521	2,187.0	0	33,888
Deforestation in conservation forest (hectare)	2,456	177	1,271.7	0	36,775
Deforestation in production forest (hectare)	2,456	1,437	4,978.8	0	92,275
Deforestation in protection forest (hectare)	2,456	168	723.1	0	25,013
Deforestation other forest (hectare)	2,456	884	2,966.2	0	59,088
Independent variables					
Size of convertible forest (hectare)	2,763	58,639	138,013	0	865,513
Size of conservation forest (hectare)	2,763	57,994	146,672	0	1,136,881
Size production forest (hectare)	2,763	187,657	360,015	0	2,350,194
Size of protection forest (hectare)	2,763	98,322	175,770	0	1,720,056
Size of other forest (hectare)	2,763	95,861	153,969	0	960,138
Per capita GRDP (million rupiah)	2,034	5.786	7.843	0.564	141.519
Share of agriculture sector in non-oil and gas GRDP	2,811	0.425	0.209	0.007	0.942
Share of mining sector in non-oil and gas GRDP	2,811	0.037	0.126	0	0.974
Share of manufacturing sector in non-oil and gas GRDP	2,811	0.042	0.085	0	0.565
Share of local own source revenue in total local government revenue (%)	1,717	0.047	0.034	0.000	0.306
Natural log of forestry revenue sharing	3,143	12.229	9.543	0	24.622
Share of environmental spending in total local government spending (%)	1,580	0.012	0.017	0	0.192
Mean years of schooling	1,799	7.272	0.953	4.52	10.980

Source: Author

There are five categories of forest which we estimate, namely convertible forest, conversion forest, production forest, protection forest and other forest. We also estimate the total rate of deforestation for all categories. The level of forestry extraction is measured in natural logarithm for ease of analysis. Since there are district without particular type forest, thus the deforestation rate is zero, the dependent variable is measured using log(deforestation+1) to avoid many missing observations. For robustness check, we run using random effect and fixed effect for each category of dependent variable.

3. FINDINGS

3.1 Finding from in-depth interviews

In addition to discussion with national parliament and central government agencies, we have also conducted in-depth interviews with relevant stakeholders in four districts receiving large amount of forestry revenue sharing, namely Seruyan and Katingan in Central Kalimantan, and Kutai Barat and Berau in East Kalimantan. The respondents include forestry office, environmental office, revenue office, planning agency and parliament at both province and district level.

Some important points from in-depth interviews with local stakeholders are as follow. First, the utilization of reforestation fund (*Dana Bagi Hasil Dana Reboisasi*/DBH DR) – which is a part of forestry revenue sharing – is very low. Government Regulation No. 35/2002 is considered very restrictive by local forestry offices, such that they decide not to use reforestation fund to avoid being held against the law. Second, local forestry offices claim they do not have sufficient fund to carry out their assigned function. On average, the annual budget for local forestry office is between IDR 4–6 billion (USD 400–600 million). Third, inconsistencies between forest map and ground fact is a common phenomenon. For instance, a village that has been established for years is

categorized as forest zone by the central government. Fourth, deforestation usually takes place within a particular distance from the forest boundaries. Thus, if a forest is seen intact in the outside boundary, it does not mean that whole forest is still intact, as. Fifth, agriculture and mining sector are considered as significant contributor to deforestation as there have been massive conversions of forest zone to non-forest and some mining activities take place even in conservation area.

3.2 Results from econometric estimation

As we can see in Table 2, we find that forestry decentralization before 2002 leads to higher deforestation rate. This result is consistent using all type of forest. We also find that two years before local district head election, deforestation occurred at a higher rate in convertible and protection forest, while for conservation forest deforestation increased one year before local district head election. This finding is consistent with [1], where they find that the deforestation rate occurs at higher rate before election.

The share of mining sector is also positive and statistically significant for conservation forest and other forest. This finding is also consistent with our interview results where mining activities often take place in conservation forests. We do not find the evidence supporting the changes in local preference toward environment can reduce the deforestation rate. This is shown by none of the interaction variable between environmental spending and forestry decentralization is negative and statistically significant. This supports our in-depth interview results that the budget allocation for local forestry office is very small such that they cannot effectively reduce the deforestation rate.

The regression result using fixed effect specification is available in Table 3. Unlike random effect specification, decentralization variable only significant in total forest, protection forest and other forest while for convertible and conservation forest are insignificant. We also do not find the support for the effectiveness of local government spending toward environment in reducing deforestation rate. Similarly, we find evidence of the positive relationship between district head election with deforestation for convertible, conservation and other forest.

4. SUMMARY AND POLICY RECOMMENDATION

4.1 Summary

The empirical results provide several interesting findings. First, there are statistical evidences supporting that the deforestation rate is higher due to the implementation of forestry decentralization in 1999–2002. Thus, from environmental perspective, the decision of central government to withdraw the license for forestry extraction is justified to avoid even higher deforestation rate.

Second, except for production forest, there are statistical evidences linking that local election cycle has positive correlation with deforestation, even in the conservation forest

(where forestry utilization is strictly prohibited) and protection forest (where timber harvesting is prohibited). However, we have to be careful in interpreting this result as the forestry is a common resource. Moreover, unlike visible public goods such as road infrastructure where decreasing quality is easily observed, deforestation is less observed by the public as the size of forest is huge. Some of local stakeholders whom we have interviewed state that deforestation took place in the inner side of the forest, which make it difficult for the general public to observe. This means that we cannot conclude who are the actors responsible for deforestation.

Third, increased spending on environmental is ineffective in reducing the deforestation rate. From theoretical point of view, this indicates that the (perceived) marginal benefit from forestry extraction is higher than its marginal cost. Form practical point of view, small budget for local forestry offices prevent them to effectively carry out their assigned function, among them is to perform forest monitoring.

4.2 Policy recommendation

Although Regional Government Law No. 32/2004 was passed five years after Forestry Law No. 41/1999 and article 237 in Regional Government Law clearly requires the forestry law to adjust and conform its regulation with regional government law, Forestry Law No. 41/1999 has not been amended until 2013. As [3] pointed out that regulatory inconsistency play a role in deforestation in Indonesia and this study find that allowing regional government to issue forestry licenses leads to higher deforestation, it is important for the upcoming regional government law to specifically include where the forestry resource management should be assigned. If the national government wants to reduce deforestation rate, forestry resource management should be put as a function to be carried out by the central government.

The design of forestry revenue sharing in current Fiscal Balance Law No. 34/2004 should also be reconsidered. The forestry revenue sharing formula is intended to compensate the reduction of forestry resources with higher revenue in the form of license fee (*Dana Bagi Hasil Iuran Izin Usaha Pemanfaatan Hasil Hutan*/DBH IIUPHH), volume-based royalty (*Dana Bagi Hasil Provisi Sumber Daya Hutan*/DBH PSDH) and reforestation fund (DBH DR). However, under the current system, revenue sharing from DBH IIUPHH and DBH PSDH are not earmarked. This means the spending allocation originated from these revenues are under local government discretion. For DBH DR, the revenue sharing is earmarked. Nonetheless, we find that many district governments do not use DBH DR fund to avoid being held responsible as the use of DBH DR is very restrictive. The combination of these factors leads to insufficient funding for the local government to perform its function in forest monitoring. Political democratization (direct election of district head) contributes to higher deforestation rate. Given that resource to monitor forest is limited and the fact that forestry is a common resource, this condition provides additional

Table 2: Regression results using random effect specification

	Forest type					
	Total	Convertible	Conservation	Production	Protection	Other
Forestry decentralization	0.549	0.228	0.241	0.338	0.593	0.443
	(3.37)***	(1.89)*	(1.73)*	(2.02)**	(3.23)***	(2.59)***
Share of local own source revenue (Lag one year)	5.030	-1.310	-0.547	2.282	3.270	0.891
	(2.63)***	(0.84)	(0.31)	(1.06)	(1.50)	(0.46)
Natural log of per capita GRDP (Non-oil, lag one year)	0.209	0.316	-0.001	0.230	-0.257	0.207
	(1.30)	(2.31)**	(0.01)	(1.23)	(1.41)	(1.30)
Share of mining sector in GRDP (Non-oil and gas)	0.540	-0.084	1.786	1.304	1.451	2.498
	(0.68)	(0.11)	(2.29)**	(1.27)	(1.56)	(3.27)***
Share of agriculture sector in GRDP (Non-oil and gas)	1.077	0.868	0.793	1.821	1.631	0.860
	(1.78)*	(1.64)	(1.42)	(2.46)**	(2.43)**	(1.57)
Share of manufacturing sector in GRDP (Non-oil and gas)	2.773	1.133	0.918	3.246	3.182	2.854
	(3.58)***	(1.79)*	(1.30)	(3.70)***	(3.59)***	(3.62)***
Natural log of forest area (Lag one year)	0.988	0.439	0.273	0.504	0.297	0.675
	(18.37)***	(25.89)***	(15.58)***	(17.08)***	(11.21)***	(22.33)***
Mean years of schooling	0.074	0.101	0.073	0.205	0.122	-0.271
	(0.66)	(1.07)	(0.72)	(1.60)	(0.98)	(2.50)**
Share of environmental spending in local budget	3.888	2.048	-0.329	1.240	3.387	2.230
	(1.38)	(0.97)	(0.14)	(0.42)	(1.07)	(0.76)
Environmental spending share x forestry decentralization	3.139	-3.246	10.417	5.326	20.869	9.002
	(0.41)	(0.57)	(1.59)	(0.68)	(2.42)**	(1.12)
One year before election	0.220	0.124	0.179	0.175	0.171	0.212
	(1.76)*	(1.36)	(1.70)*	(1.38)	(1.22)	(1.62)
Two years before election	0.232	0.129	0.035	-0.020	0.249	0.167
	(2.22)**	(1.67)*	(0.40)	(0.19)	(2.12)**	(1.52)
Constant	-7.794	-1.827	-1.167	-3.825	-1.957	-1.477
	(6.66)***	(2.23)**	(1.31)	(3.37)***	(1.79)*	(1.47)
Observations	1190	1190	1190	1190	1190	1190
Number of district id 2008, using 2008 ids, dejure	256	256	256	256	256	256

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Source: Author

incentive to illegal forestry extraction. Thus, we suggest that the portion of earmarked fund in the forestry revenue sharing should be added not only in the form of DBH DR, such that the local authorities have sufficient revenues to perform their function and prevent illegal forestry extraction.

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Table 3: Regression results using fixed effect specification

	Forest type					
	Total	Convertible	Conservation	Production	Protection	Other
Forestry decentralization	0.359	0.097	0.057	0.185	0.516	0.453
	(2.09)**	(0.79)	(0.41)	(1.08)	(2.67)***	(2.55)**
Share of local own source revenue (Lag one year)	-1.713	-2.655	-2.298	-3.516	1.758	-2.326
	(0.70)	(1.49)	(1.14)	(1.43)	(0.63)	(0.92)
Natural log of per capita GRDP (Non-oil, lag one year)	-0.030	0.269	-0.037	-0.249	-0.309	0.371
	(0.13)	(1.58)	(0.19)	(1.06)	(1.17)	(1.52)
Share of mining sector in GRDP (Non-oil and gas)	1.048	2.834	-0.410	-0.716	-5.754	2.946
	(0.43)	(1.61)	(0.20)	(0.29)	(2.08)**	(1.17)
Share of agriculture sector in GRDP (Non-oil and gas)	1.815	1.437	-0.351	2.824	1.890	-0.534
	(1.28)	(1.38)	(0.30)	(1.97)**	(1.16)	(0.36)
Share of manufacturing sector in GRDP (Non-oil and gas)	1.731	2.008	0.268	2.632	2.333	0.680
	(1.62)	(2.57)**	(0.30)	(2.44)**	(1.91)*	(0.61)
Natural log of forest area (Lag one year)	6.720	5.012	14.265	2.889	1.954	9.806
	(4.23)***	(5.15)***	(8.74)***	(2.36)**	(3.04)***	(7.08)***
Mean years of schooling	0.641	-0.012	0.172	0.658	0.363	0.537
	(3.96)***	(0.10)	(1.28)	(4.03)***	(1.96)*	(3.19)***
Share of environmental spending in local budget	6.033	0.969	-0.096	1.379	4.227	7.750
	(2.06)**	(0.46)	(0.04)	(0.47)	(1.27)	(2.54)**
Environmental spending share x forestry decentralization	-3.945	-2.152	8.645	-2.168	18.500	-3.928
	(0.49)	(0.37)	(1.30)	(0.27)	(2.03)**	(0.47)
One year before election	0.253	0.107	0.178	0.196	0.171	0.266
	(2.04)**	(1.18)	(1.72)*	(1.56)	(1.20)	(2.06)**
Two years before election	0.223	0.156	0.027	-0.033	0.180	0.129
	(2.12)**	(2.03)**	(0.31)	(0.31)	(1.50)	(1.18)
Constant	-79.111	-21.892	-81.687	-27.483	-17.606	-98.037
	(4.20)***	(4.79)***	(8.67)***	(2.50)**	(3.11)***	(7.06)***
Observations	1190	1190	1190	1190	1190	1190
Number of district id 2008, using 2008 ids, dejure	256	256	256	256	256	256
R-squared	0.06	0.05	0.10	0.03	0.07	0.09

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

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