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# Are Decentralised Governments More Effective in Mitigating Disaster Risks?

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This paper studies the effect of fiscal and political decentralisation on the death toll by disasters for up to 46 developing and transitional economies from 1974 to 2004. The results show that elected government at the local level does not help mitigate disaster risk. This study underscores the importance of the joint effects of different forms of decentralisation and shows that when political decentralisation is accompanied by fiscal decentralisation, it significantly reduces the number of total deaths due to natural disaster for the lowest tier of the government. Greater fiscal responsibility is argued to make local elected government more responsive to the vulnerable people.

**Keywords:** Fiscal Decentralisation, Political Decentralisation, Disaster Management
**JEL Classification:** H7

## I. INTRODUCTION

A consensus has been growing among international donors and policy makers that a decentralised government is more efficient in mitigating disaster risk than a more centralised one. The UN World Conference on Disaster Reduction (WCDR), held in 2005 in Kobe, Japan considered the role of local government as a precondition for effective disaster risk reduction.[1] Following Hurricane Mitch in 1999, a declaration signed by El-Salvador and donors called for reinforcing the decentralisation effort of the government (UNDP 1999).[2] Multilateral donors such as the World Bank have also embraced decentralisation as a critical element in disaster risk mitigation strategy. At the World Bank workshop on "The Role of Local Governments in Reducing the Risk of

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[1]http://www.unisdr.org/wcdr
[2]It devastated the coasts of Honduras, Nicaragua, El Salvador and Guatemala with an estimated damage of one seventh of the region's gross domestic product.

Disasters" in Istanbul, in 2003, Demeter, Ayse and Nihal (2006) noted local government as an important influence in changing paradigm of disaster risk management. The Asian Disaster Preparedness Center (ADPC) strongly advocates strengthening local government for disaster management.[3] Despite this growing recognition of the role of decentralised government in disaster management, there has been no study to rigorously address this issue.

In this study we investigate the role of political and fiscal decentralisation in mitigating disaster risks. While Sen (1984) pointed out long ago the role of democracy and free media in preventing famine,[4] we begin by noting that the impact of decentralisation can be isolated effectively using disaster data because disaster is mostly a local phenomenon and the local government can address local issues more effectively, and physical proximity of the government to the people is more crucial in an emergency than in normal periods as it helps the government respond quickly and cost effectively.

By considering both political and fiscal decentralisation, we highlight the importance of the combination of the two forms to understand the effectiveness of decentralisation. We investigate the effect of fiscal and political decentralisation on the death toll by natural disasters from 1974 to 2004 for up to 46 developing and transitional countries. The share of local revenues in total revenue (local and central) is used to measure the extent of fiscal decentralisation. Political decentralisation is captured by the elected government at the state/provincial and the lowest tier of government. There are four major findings – (i) An elected government at the lowest tier is associated with a higher number of deaths by disasters; the effect of the elected government at state or provincial level is not significant. (ii) The effect of fiscal decentralisation is not robust. (iii) Political decentralisation at the lowest level of government is found to improve the disaster outcome in the presence of fiscal decentralisation; again for the state or provincial level, this result is not significant. (iv) The above results are more robust for the disasters of hydro-meteorological origin (e.g., flood) than that of geological origin (e.g., earthquake).

[3] http://www.adpc.net/v2007/

[4]Dreze and Sen (2002) identified "information failure" from the local to the central government as a major cause that made China's performance in famine prevention worse than India's. Besley and Burgess (2002) showed that vulnerable people received an increased allocation from the government-run public food distribution and calamity relief programme during floods and droughts in those states where newspaper circulation and political competition were greater.

These findings offer lessons on how to effectively decentralise and to evaluate the impact of past decentralisation efforts. Political decentralisation alone may not be effective without fiscal decentralisation. We argue that greater fiscal responsibility makes local politicians more accountable to their people. Local people gather more information about government's actions when financial issues are involved. Central government also increases monitoring when its transfer to the local governments is large. Moreover, the result indicates that the central government may increase transfers to the regions with more accountable local government with a cleaner image and good reputation in disaster risk mitigation.

There is a large body of cross-country empirical literature investigating the effect of decentralisation on a host of economic and governance outcomes. Theoretically, decentralisation is argued to increase allocative efficiency and discipline government through greater information and intergovernmental competition. Therefore, greater decentralisation is argued to foster growth, improve governance and public service delivery and reduce the size of the government. However, the results are mixed and the effect of decentralisation is not conclusive.[5] Since we have used data on disasters, we are able to obtain clean insights about the impact of decentralisation.

There is also a growing literature that studies the factors that determine the incidence and extent of damage by disasters. This literature primarily studies the role of geography, economic development and quality of institutions. Kellenberg and Mobarak (2007), Kahn (2005), Anbarci, Escaleras and Register (2005) and Skidmore and Toya (2002) showed that richer countries tend to experience less damage and fewer deaths from natural disasters. Democratic government and better quality institutions are also found to reduce the mortality risk of disasters in Kahn (2005). Anbarci, Escaleras and Register (2005) argued that in countries with greater income inequality, collective action fails to occur to implement costly investment and regulations for disaster prevention. Using data on earthquake fatalities, they show that countries with greater income inequality

[5] Davoodi and Zou (1998), Zhang and Zou (1998), Akai and Sakata (2002), Xie, Zou and Davoodi (1999) studied the effect on growth, while Fan, Lin and Treisman (2009), Enikopolov and Zhuravskaya (2007), Fisman and Gatti (2002) and Treisman (2000) studied the effect on governance and public service delivery. See Fan et al. (2009) for the detail review of this literature.

experience higher death toll. This study on the impact of decentralisation is also new to this literature.

The rest of the paper is organised as follows. Section II explores how decentralisation can affect disaster outcomes. Section III describes the data used and the estimation techniques. Section IV analyses the results which include sub-sections on fiscal and political decentralisation and their interaction. Section V brings up endogeneity issues while section IV checks robustness of the results. Section VII draws conclusion.

## II. HOW DOES DECENTRALISATION AFFECT DISASTER OUTCOME?

According to (FAO, n.d.), the Disaster Management Cycle involves three main phases: (i) pre-emergency phase, (ii) emergency phase, and (iii) post-emergency phase. A decentralised government can be effective in all three phases in disaster management.

Messer (2003) argued that since disaster is mostly a local phenomenon, which rarely hits the entire country, use of local information, knowledge and resources are critical for effective prevention measures.[6] These prevention measures in pre-emergency phase typically include risk-mapping, application of building code, land zoning, construction of dams, embankments, etc. Moreover, macroeconomic stabilisation, political conflict and other national priorities of central government often overshadow local issues such as disaster risk prevention and preparedness. In such cases, local politicians, who are accountable to their voters, can draw attention of the central government and also raise funds locally and allocate more resources for disaster preparedness. Intergovernmental competition over mobile factors of production, such as labour and capital, can also lead to greater investment in disaster preparedness.

In the emergency phase, which requires immediate and quick response, local government can help mobilise resources very quickly using local knowledge and expertise. Local politicians who want to accumulate political capital have strong incentives to participate in relief and rescue efforts. Rehabilitation and reconstruction in post-emergency phase can also be effectively implemented and

[6]The actual geographical area where a disaster hits is not very large even though the number of people affected and killed may be high due to high population density. For example, the effect of most recent earthquake in Pakistan (29 October 2008), which claimed nearly 200 lives, was limited to a small region of Balochistan Province. Most of the casualties were from two villages in Ziarat town.

coordinated by local government with appropriate assessment of the damage and proper targeting. In short, greater information and accountability, targeting efficiency and cost effectiveness, and competition for mobile factors may lead to efficient disaster risk management by the decentralised government.

The basic argument for decentralisation is that it brings government closer to the people so that their preferences are well reflected in public policy making. However, Tanzi (1995) and Prud'homme (1994) argued that too much proximity between the public officials and the local people may breed inefficiency, unprofessionalism, unethical relationships and corruption. Therefore, when local citizens, particularly the local influential people and local politicians collude with the local bureaucrats, it weakens local government regulatory and monitoring capacity and this has a bearing on the vulnerability risk of disasters. For example, local politicians and elites may engage in land grabbing through deforestation, filling up water-bodies and hill cutting. They may also be involved in allowing risky settlements of loyal voters in vulnerable places (e.g. steep land), and massive land excavation in topographically unstable areas.

Moreover, local politicians and interest groups may become more powerful through greater political decentralisation where election outcome does not depend solely on their performance. As a result, local politicians lack incentives to respond to the needs of the people who are vulnerable to natural disasters. The possibility of "elite capture," as in Bardhan and Mookherjee (2000), is higher during both the disaster and post disaster periods when local government receives aid and relief for the affected areas. Stealing and confiscating disaster aid by the local politicians and powerful people is very common in developing countries. Also, press, media and civil society, which play a critical role in providing information during disasters, are very weak and vulnerable to political and elite capture at the local level in developing countries.

In these circumstances greater decentralisation may not help reduce the loss of disasters. Therefore, it is an important empirical question if greater decentralisation is effective in mitigating disaster risk in developing countries.

## III. DATA AND ESTIMATION TECHNIQUE

We use the following regression specification:

$$disaster\ outcome_{it} = \beta_1 + \beta_2 decentralisation_{it} + \beta_3 controls_{it} + u_{it}$$

The disaster outcome includes number of total dead in a year (*t*) by natural disasters in a country (*i*). These data are from the International Disaster Database OFDA/CRED.[7]

We study two types of decentralisation–political and fiscal. For political decentralisation, we use two variables: (i) elected state/provincial government (1 = if state/provincial level government locally elected, 0 = otherwise), and (ii) elected municipal/lowest level of government (1= if municipal level government is locally elected, 0 = otherwise). These variables are taken from the Database on Political Institutions compiled by Beck et al. (2001).[8] For fiscal decentralisation, we use share of sub-national revenues in total revenue from the IMF's Government Fiscal Statistics.[9] These measures are widely used in the literature because of their strength in cross-country comparison, despite the fact that these measures do not necessarily reflect local government's authority over taxation and expenditure.

Disaster risk depends on two components - hazard risks and vulnerability (FAO, n.d.). Hazard risks typically depend on geographical characteristics of a country as some countries are more disaster-prone than others. We include two geographical variables - elevation and latitude. We run country fixed effects to capture the country-specific geographical, meteorological, as well as social, cultural and institutional factors that are fixed over time and have bearing on disaster risk. We also include year dummies to capture time variant unobservables such as advancement of knowledge and technological innovation in disaster management. The vulnerability of a country's population primarily depends on the size of population, ability to manage disaster (i.e., income) and population density. Between the two countries with the same population size, the country with higher population density is more vulnerable to natural disasters than the sparsely populated one, holding other factors fixed. On the other hand, greater population density also helps disseminate information about disaster quickly and cost-effectively. Therefore, it may also have a beneficial impact.

[7]For the description of variables used in regressions, see Table A.4.

[8] Note that the time peiods from 1974 to 2004 have enough variations to estimate the impact of decentralisation on the outcomes of disaster. The data could not be updated because of the mismatch of definitions for the years following 2004.

[9] The correlation between share of revenue and expenditure is very high (0.8) for our sample. We focus primarily on sub-national revenue here.

Moreover, a country's vulnerability also hinges on its socio-political environment. We use the measure of democracy (polity score) and the measure of ethnic fragmentation of Alesina *et al.* (2003) to control for political aspects which add to the vulnerability risks of the population. Democratically elected governments are more accountable to the public for service delivery. And media also flourishes under democracy, helping to ensure greater voice and accountability. In ethnically fragmented nations where voters put more weights on ethnic identities than the performance of politicians in public service delivery, local politicians may lack incentives to take adequate measures to minimize disaster risk. Moreover, the central government may not have incentives to internalise the benefits and costs across jurisdictions if the national politicians identify themselves only to certain spatially located groups.

We use a host of estimation techniques, as each has its own strengths and weaknesses. Following the existing literature, we use Generalized Least Squares (GLS) and Negative Binomial (NB). Both of these methods also allow us to run country and time fixed effects. In the case of GLS, we use Ln(1+disaster outcome) as the dependent variable. Moreover, due to the presence of large number of zero observations, we also use Zero Inflated Negative Binomial (ZINB) model following Kahn (2005). However, this estimation technique does not permit us to run country and time fixed effects. We choose Negative Binomial over Poisson because in the latter case mean and standard deviation are equal, which is not supported by our data.[10]

## IV. ESTIMATION AND DISCUSSION OF RESULTS

### 4.1 Political Decentralisation

Table I presents results for political decentralisation for GLS, NB and ZINB. In basic specification (column 1-3), we use only population density, GDP per capita, log of total population and the frequency of disasters in a year in a country. In the extended specification (column 4-6), we add political and geographical variables. Columns 7 and 8 include country and year fixed effect.

Results from columns 1-6 show that there is no consistent pattern in signs for elected state/provincial government (STATE hereafter) and the coefficients are not significant. However, in the case of elected government at the lowest level

[10]Mean and standard deviation for total death are 472 and 6146 respectively. For Descriptive statistics, see Table A.3.

(MUNICIPALITY hereafter), all the coefficients are positive, and statistically significant (except column 4). That is the elected government at the state or provincial level does not have any significant impact on total dead. But for the lowest level of government, this effect is positive and mostly significant. That is, political decentralisation at the lowest tier of government makes the people more vulnerable to disasters. Higher per capita GDP is found to reduce the death count and this effect is highly significant across specifications and estimation techniques. Total number of disasters, as expected, increases the number of total death. There is no consistent pattern in terms of the signs of democracy index and almost in all specifications the coefficients are not statistically significant. Interestingly, an increase in population density of a country reduces the death toll. Besley and Burgess (2002) found that greater population density also helps disseminate information about disaster quickly and cost-effectively and thus helps mitigate disaster risk. For ethnic fragmentation, the signs are negative, with significant negative effects for NB and ZINB.[11] The signs of both latitude and elevation are positive. Interestingly, a country with higher elevation and latitude is found to experience higher death toll from disaster and this effect is highly significant.

The last two columns of Table I present the results for GLS and NB with country and year fixed effects for full specification only. Again, the effects of STATE, even though the signs are negative, are not statistically significant. However, political decentralisation at the lowest level of government is found to be associated with higher total death as the signs of MUNICIPALITY are all positive and significant in both cases. The signs for other controls are similar to columns 1-6 in Table I.

From Table I, we can conclude that only significant and robust impact of political decentralisation is found at the lowest tier of government. It sheds light on the fact that the impact of disaster is generally limited to only small areas and because of physical proximity, only the lowest tier of government can have significant impact on the disaster outcome. The result also indicates that in developing countries lower tiers of local government are more vulnerable to corruption and "elite capture," and thus are more irresponsive and irresponsible than the upper levels such as state or provincial governments. Election outcome at the lowest tier may depend less on the politician's role in providing local

[11]Kahn (2005) also found similar result. Note that the Zero-Inflated Negative Binomial regression also produces result for Logit model which estimates the probability of no death (and no affected) in a year for a country. Since we are not interested in incidence of the disaster outcomes, these results are not reported here. However, these results are available upon request.

public goods since the possibility of "capture" of the political process is higher at this level. Moreover, the opportunity for upward mobility in a political career is lower for the politicians at the bottom and thus they have less incentive to deliver.

TABLE I

**EFFECT OF POLITICAL DECENTRALISATION ON TOTAL DEATH TOLL**

| | (1) GLS | (2) NB | (3) ZINB | (4) GLS | (5) NB | (6) ZINB | (7) GLS (FE) | (8) NB (FE) |
|---|---|---|---|---|---|---|---|---|
| State | -0.310 | -0.037 | -0.037 | 0.342 | 0.393 | 0.393 | -0.326 | -0.230 |
| | (0.347) | (0.518) | (0.369) | (0.278) | (0.568) | (0.475) | (0.232) | (0.208) |
| Municipality | 0.562 | 1.371 | 1.371 | 0.279 | 0.921 | 0.920 | 0.580 | 0.705 |
| | (0.313)+ | (0.500)** | (0.316)** | (0.298) | (0.510)+ | (0.439)* | (0.246)* | (0.214)** |
| Population Density | -0.116 | -0.012 | -0.012 | -0.323 | -0.515 | -0.516 | -0.052 | -0.187 |
| | (0.138) | (0.168) | (0.110) | (0.128)* | (0.305)+ | (0.199)** | (0.082) | (0.074)* |
| GDP per Capita | -0.351 | -0.444 | -0.443 | -0.449 | -0.649 | -0.649 | -0.310 | 0.098 |
| | (0.153)* | (0.222)* | (0.212)* | (0.146)** | (0.289)* | (0.269)* | (0.124)* | (0.117) |
| Ln(Population) | 0.240 | -0.475 | -0.475 | 0.194 | -0.120 | -0.120 | 0.470 | 0.039 |
| | (0.180) | (0.216)* | (0.176)** | (0.147) | (0.231) | (0.212) | (0.130)** | (0.127) |
| Number of Disaster | 0.900 | 1.414 | 1.414 | 0.859 | 0.998 | 0.998 | 0.860 | 0.324 |
| | (0.067)** | (0.239)** | (0.139)** | (0.073)** | (0.236)** | (0.150)** | (0.061)** | (0.043)** |
| Democracy | | | | -0.014 | 0.008 | 0.008 | 0.003 | -0.047 |
| | | | | (0.028) | (0.053) | (0.053) | (0.029) | (0.027)+ |
| Ethnic Fragmentation | | | | -0.464 | -3.376 | -3.376 | | |
| | | | | (0.555) | (1.176)** | (0.869)** | | |
| Latitude | | | | 0.024 | 0.030 | 0.030 | | |
| | | | | (0.007)** | (0.014)* | (0.010)** | | |
| Elevation | | | | 0.001 | 0.000 | 0.000 | | |
| | | | | (0.000)** | (0.000) | (0.000) | | |
| Constant | -0.035 | 12.798 | 12.798 | 1.951 | 12.722 | 12.723 | -3.703 | -2.900 |
| | (3.225) | (4.240)** | (3.575)** | (2.537) | (4.362)** | (3.470)** | (2.425) | (2.215) |
| Observations | 553 | 553 | 553 | 375 | 375 | 375 | 375 | 375 |
| Number of Country | 29 | 29 | 29 | 22 | 22 | 22 | 22 | 22 |

**Note:** a. Robust standard errors are in parentheses. Columns 7 and 8 include year and country dummies.
b. + significant at 10%; * significant at 5%; ** significant at 1%.

## 4.2 Fiscal Decentralisation

Table II presents the results on the effect of sub-national revenue on the death count. Similar to Table I, we use two specifications and three estimation techniques. For sub-national revenue, there is no pattern in signs and most of the coefficients are not statistically significant. When we control for country and year fixed effects (columns 7-8), the signs are negative but not significant. The result indicates that fiscal decentralisation alone has no robust impact on reducing death toll.

TABLE II
**EFFECT OF FISCAL DECENTRALISATION ON TOTAL DEATH TOLL**

| | (1) GLS | (2) NB | (3) ZINB | (4) GLS | (5) NB | (6) ZINB | (7) GLS (FE) | (8) NB (FE) |
|---|---|---|---|---|---|---|---|---|
| Sub-National Revenue | 0.001 | -0.016 | -0.028 | -0.025 | 0.011 | 0.007 | -0.027 | -0.028 |
| | (0.017) | (0.020) | (0.009)** | (0.024) | (0.026) | (0.022) | (0.048) | (0.025) |
| Population Density | 0.073 | -0.390 | -0.328 | -0.169 | 0.059 | 0.234 | 6.808 | -0.076 |
| | (0.197) | (0.305) | (0.179)+ | (0.276) | (0.279) | (0.268) | (3.627)+ | (0.157) |
| GDP per Capita | -0.053 | -0.540 | -0.819 | 0.111 | 0.268 | 0.069 | 0.900 | 0.114 |
| | (0.211) | (0.469) | (0.283)** | (0.322) | (0.258) | (0.224) | (0.836) | (0.191) |
| Ln(Population) | 0.237 | 0.492 | 0.595 | 0.515 | 0.503 | 0.478 | 1.498 | 0.386 |
| | (0.186) | (0.239)* | (0.137)** | (0.212)* | (0.206)* | (0.176)** | (0.898)+ | (0.112)** |
| Number of Disaster | 0.615 | 0.457 | 0.140 | 0.498 | 0.316 | 0.143 | 0.497 | 0.197 |
| | (0.061)** | (0.163)** | (0.068)* | (0.061)** | (0.079)** | (0.059)* | (0.052)** | (0.031)** |
| Democracy | | | | -0.025 | -0.093 | -0.060 | -0.008 | 0.053 |
| | | | | (0.040) | (0.046)* | (0.039) | (0.055) | (0.028)+ |
| Ethnic Fragmentation | | | | 0.199 | 0.130 | -0.458 | | |
| | | | | (1.145) | (0.911) | (0.902) | | |
| Latitude | | | | -0.002 | 0.017 | 0.014 | | |
| | | | | (0.014) | (0.013) | (0.009) | | |
| Elevation | | | | -0.001 | 0.000 | 0.001 | | |
| | | | | (0.000) | (0.000) | (0.000)+ | | |
| Constant | -2.430 | 2.187 | 3.667 | -6.557 | -7.441 | -5.077 | -70.428 | -8.795 |
| | (3.587) | (5.737) | (2.360) | (4.076) | (2.998)* | (2.321)* | (38.022)+ | (2.643)** |
| Observations | 532 | 532 | 532 | 276 | 276 | 276 | 276 | 272 |
| Number of country | 38 | 38 | 38 | 23 | 23 | 23 | 23 | 21 |

**Note:** a. Robust standard errors are in parentheses. Columns 7 and 8 include year and country dummies.
b. + significant at 10%; * significant at 5%; ** significant at 1%.

### 4.3 Interaction between Political and Fiscal Decentralisation

It is argued that the effectiveness of local government depends on how different forms of decentralisation interact with each other. Citing several cases of "mismatch" among political, fiscal and administrative decentralisation in developing countries, Ahmad, Devarajan, Khemani and Shah (2005) note that lack of balance in different forms may weaken the efficacy of public service delivery of decentralised government. Riker (1964) also argues that locally elected government and strong political party at the top improves the outcome of fiscal decentralisation. The argument is that an elected government at the local level ensures accountability and a strong national political party provides incentives for upward career mobility for the local politicians. Following Riker's (1964), Enikopolov and Zhuravskaya (2007) tested these hypotheses for various measures of governance, basic public service delivery and long run growth and found evidence in support of them.

Table III shows the results for interactions for total death toll. In the case of STATE, the signs of the interaction terms between sub-national revenue and STATE are all positive but insignificant and the pattern remain the same when

we control for country and year fixed effects. In the case of MUNICIPALITY, the signs of the interaction terms between MUNICIPALITY and revenue are all negative and highly significant in all specifications. The individual effects of MUNICIPALITY are positive and significant as well. Even though STATE has negative and significant impact in the first three columns, the effect disappears once controlled for country and year fixed effects. The same is also true for the coefficient of sub-national revenue.

TABLE III

**INTERACTION BETWEEN POLITICAL AND FISCAL DECENTRALIZATION**

| | (1) GLS | (2) NB | (3) ZINB | (4) GLS (FE) | (5) NB (FE) |
|---|---|---|---|---|---|
| Sub-national Revenue (R) | 0.249 | 0.546 | 0.566 | 0.191 | 0.138 |
| | (0.111)* | (0.130)** | (0.175)** | (0.129) | (0.156) |
| State (S) | -6.434 | -13.278 | -12.258 | -0.611 | -0.208 |
| | (4.091) | (3.859)** | (5.073)* | (1.290) | (2.987) |
| Municipality (M) | 3.568 | 6.604 | 6.344 | 2.033 | 2.983 |
| | (1.107)** | (1.440)** | (1.864)** | (0.970)* | (1.284)* |
| R x S | 0.266 | 0.361 | 0.307 | 0.069 | 0.232 |
| | (0.309) | (0.289) | (0.340) | (0.098) | (0.238) |
| R x M | -0.292 | -0.489 | -0.450 | -0.214 | -0.245 |
| | (0.088)** | (0.099)** | (0.137)** | (0.090)* | (0.116)* |
| Population Density | 1.171 | 3.476 | 3.410 | 0.108 | -0.135 |
| | (1.420) | (1.264)** | (1.575)* | (0.373) | (0.666) |
| GDP per Capita | -0.843 | 0.002 | 0.222 | -0.556 | -0.660 |
| | (1.438) | (1.759) | (2.099) | (0.697) | (0.830) |
| Ln(Population) | 0.330 | 0.263 | 0.094 | -0.111 | -1.814 |
| | (0.879) | (0.929) | (1.047) | (0.453) | (0.743)* |
| Number of Disaster | 1.104 | 1.892 | 1.804 | 1.107 | 1.140 |
| | (0.127)** | (0.386)** | (0.352)** | (0.123)** | (0.190)** |
| Democracy | -0.297 | -0.673 | -0.693 | -0.234 | -0.207 |
| | (0.130)* | (0.154)** | (0.179)** | (0.121)+ | (0.152) |
| Ethnic Fragmentation | 1.760 | 5.530 | 5.333 | | |
| | (3.076) | (2.681)* | (3.275) | | |
| Latitude | -0.103 | -0.295 | -0.276 | | |
| | (0.059)+ | (0.063)** | (0.078)** | | |
| Elevation | -0.003 | -0.008 | -0.008 | | |
| | (0.002) | (0.002)** | (0.003)** | | |
| Constant | -0.025 | -11.879 | -11.094 | 6.292 | 18.538 |
| | (14.751) | (15.417) | (17.791) | (5.876) | (820.682) |
| Observations | 80 | 80 | 80 | 80 | 80 |
| Number of country | 10 | 10 | 10 | 10 | 10 |

**Note:** a. Robust standard errors are in parentheses. Columns 4 and 5 include year and country dummies.
b. + significant at 10%; * significant at 5%; ** significant at 1%.

These results imply that fiscal decentralisation with elected government at the lowest level reduces the number of total dead. But in the case of elected government at the state level, the effect of fiscal decentralisation is not significant.

The results shed light on the fact that accountability and responsiveness of the lower level of government may depend on the expenditure and financing responsibilities. Local governments in the developing countries are not self-sufficient and the transfer of funds from the central government constitutes a large portion of their budget. Ahmad *et al.* (2005) argue that central government's transfer to local government has two parts– conditional and unconditional. While the former ensures accountability to the central, the latter leads to accountability to the local people. The results indicate that fiscal responsibility makes local politicians accountable both to the central government and to the local electorate and helps manage disaster better.

We also test if Riker's other hypotheses hold – whether a strong national party provides enough incentives for local politicians to perform. Using the same two variables (age of government and opposition parties and fractionalisation of government) to capture national party strength (and lack thereof) and the same proxies for the political institution variables as Enikolopov and Zhuravskaya (2007), we did not find support for this hypothesis (Table IV). One reason could be that fiscal decentralisation fails to distinguish between different tiers of government as the effect may vary with the number of tiers. More specifically, the interaction terms between sub-national revenue and party age and sub-national revenue and government fractionalisation may not distinguish the effects of different tiers.

TABLE IV

**TEST OF RIKER'S HYPOTHESIS: AGE OF PARTY AND GOVERNMENT FRACTIONALIZATION WITH COUNTRY AND YEAR FIXED EFFECTS**

| | (1) GLS | (2) NB | (3) GLS | (4) NB |
|---|---|---|---|---|
| Sub-national | -0.011 | -0.030 | 0.024 | -0.032 |
| Revenue (R) | (0.059) | (0.022) | (0.057) | (0.019)+ |
| Party Age (A) | 0.000 | 0.008 | | |
| | (0.027) | (0.014) | | |
| R x A | -0.000 | -0.000 | | |
| | (0.001) | (0.001) | | |
| Government | | | 0.670 | 0.827 |
| Fractionalisation | | | (1.000) | (0.644) |
| (F) | | | | |
| R x F | | | -0.080 | -0.017 |
| | | | (0.051) | (0.028) |
| Parliamentary | | | 0.368 | 0.234 |
| System | | | (0.638) | (0.267) |
| Proportional | | | -15.683 | 0.585 |
| Electoral System | | | (7.530)* | (0.311)+ |
| Population | 9.896 | -0.059 | 11.278 | -0.021 |
| Density | (4.434)* | (0.174) | (4.785)* | (0.194) |

*(Contd. Table IV)*

| | (1)<br>GLS | (2)<br>NB | (3)<br>GLS | (4)<br>NB |
|---|---|---|---|---|
| GDP per Capita | 1.677 | 0.092 | 2.084 | 0.302 |
| | (0.938)+ | (0.206) | (0.947)* | (0.237) |
| Ln(Population) | 0.918 | 0.383 | 0.544 | 0.350 |
| | (0.395)* | (0.125)** | (0.483) | (0.154)* |
| Number of Disaster | 0.462 | 0.186 | 0.528 | 0.205 |
| | (0.054)** | (0.035)** | (0.056)** | (0.041)** |
| Democracy | -0.012 | 0.066 | 0.042 | 0.035 |
| | (0.064) | (0.032)* | (0.067) | (0.038) |
| Constant | -84.689 | -8.955 | -70.190 | -11.049 |
| | (31.122)** | (2.817)** | (25.778)** | (3.415)** |
| Observations | 227 | 222 | 219 | 218 |
| Number of country | 21 | 18 | 19 | 18 |

**Note:** a. Standard errors are in parentheses; b. + significant at 10%; * significant at 5%; ** significant at 1%.

## V. ENDOGENEITY ISSUES

One can argue that there is an omitted variable bias – some unobservables may affect both the decentralisation decision and the disaster outcomes. Note that we have already controlled for country and year specific effects. One weak candidate is time-varying and country-specific institutional factors which may have impact on both decentralisation and disaster management.[12] Another possibility is simultaneity bias–decentralisation decision is influenced by disaster risk mitigation strategy. Though at present multilateral donors are strongly advocating the decentralisation agenda to include in disaster risk mitigation strategy, it is very unlikely that governments of developing countries are becoming more decentralised in order to mitigate disaster risks. In developing countries the major forces that lead to decentralisation include collapse of centralised economies in Eastern Europe, transition to strong democracy (Latin America), and response to ethnic conflicts in Africa (Ahmad *et al*. 2005). Treisman (2006) also identified country size, former colony, federalism and democratisation as the key determinants of decentralisation.

[12]Fisman and Gatti (2002) argued that inefficient and corrupt government officials can influence the decentralisation decision and deteriorates mortality risks of disaster. However, these unobservables can be argued to be fixed over time in developing countries and therefore are taken care of by country fixed effects.

TABLE V

**TWO STAGE LEAST SQUARES ESTIMATES OF THE EFFECT OF POLITICAL AND FISCAL DECENTRALISATION ON TOTAL DEATH TOLL**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Sub-natuional Revenue (R) | | -0.046 | -0.018 | 3.987 | 0.378 | 94.029 | 0.382 | 11.216 |
| | | (0.350) | (0.665) | (0.552) | (0.132) | (0.786) | (0.138) | (0.595) |
| State (S) | -0.361 | | 0.354 | 28.617 | | | 0.036 | -4.967 |
| | (0.157) | | (0.481) | (0.527) | | | (0.985) | (0.922) |
| Municipality (M) | 0.890 | | | | 2.564 | 514.273 | 2.574 | 93.958 |
| | (0.002)** | | | | (0.139) | (0.788) | (0.148) | (0.535) |
| R x S | | | -0.018 | -4.025 | | | -0.020 | 3.021 |
| | | | (0.703) | (0.544) | | | (0.917) | (0.194) |
| R x M | | | | | -0.342 | -90.947 | -0.343 | -14.200 |
| | | | | | (0.046)* | (0.786) | (0.048)* | (0.538) |
| Population Density | -0.017 | -0.156 | -0.217 | -0.555 | 0.655 | -124.670 | 0.703 | 26.010 |
| | (0.867) | (0.697) | (0.299) | (0.571) | (0.298) | (0.815) | (0.295) | (0.803) |
| GDP per Capita | -0.294 | -1.426 | -0.276 | -2.255 | -0.687 | 62.793 | -0.670 | 2.484 |
| | (0.062)+ | (0.019)* | (0.308) | (0.113) | (0.576) | (0.781) | (0.658) | (0.906) |
| Ln(Population) | 0.336 | 0.478 | 0.679 | 0.336 | 0.581 | 54.547 | 0.611 | -78.919 |
| | (0.022)* | (0.345) | (0.000)** | (0.738) | (0.420) | (0.889) | (0.454) | (0.407) |
| Number of Disaster | 0.773 | 0.366 | 0.449 | 0.354 | 1.046 | 3.546 | 1.051 | 1.417 |
| | (0.000)** | (0.000)** | (0.000)** | (0.015)* | (0.000)** | (0.726) | (0.000)** | (0.163) |
| Democracy | -0.008 | 0.017 | -0.024 | -0.243 | -0.133 | -0.716 | -0.130 | 0.142 |
| | (0.804) | (0.799) | (0.535) | (0.588) | (0.537) | (0.889) | (0.557) | (0.898) |
| Ethnic Fragmentation | 0.152 | 0.849 | -0.624 | 0.478 | -0.407 | -6.974 | -0.284 | 95.354 |
| | (0.781) | (0.428) | (0.475) | (0.876) | (0.839) | (0.985) | (0.900) | (0.385) |
| Wu-Hausman Test | 0.79 | 0.83 | 0.24 | 0.94 | 1.87 | 2.44 | 1.04 | 1.22 |
| | F(2,351) | F(1,88) | F(3,209) | F(3,75) | F(3,56) | F(3,12) | F(5,52) | F(5,8) |
| P-value | 0.92 | 0.33 | 0.87 | 0.42 | 0.14 | 0.11 | 0.40 | 0.38 |
| Constant | -2.413 | 7.068 | -5.777 | -8.431 | -6.638 | -1,620.646 | -7.507 | 1,107.508 |
| | (0.360) | (0.502) | (0.074)+ | (0.849) | (0.174) | (0.828) | (0.264) | (0.394) |
| Observations | 362 | 97 | 222 | 88 | 69 | 25 | 69 | 25 |
| Instruments | Lags | Legal origin, Lags | Lags | Legal origin, Lags | Lags | Legal origin, Lags | Lags | Legal origin, Lags |

**Note:** a. p values are in parentheses; b. + significant at 10%; * significant at 5%; ** significant at 1%.

However, it can also be argued that sub-national revenue responds to disaster shocks. Central government's transfer, which constitutes a part of sub-national revenue, may increase in periods of disaster. To control for this reverse causality, we need to use some exogenous variations that are correlated with decentralisation. For fiscal decentralisation, Fisman and Gatti (2002) used legal origin and Enikolopov and Zhuravskaya (2007), Arzaghi and Henderson (2005)

and Panizza (1999) used country size as an instrument. Since country size violates exclusion restriction in our case, we use legal origin and past values to instrument fiscal decentralisation and only past values to instrument political decentralisation (Table V).[13] The basic results survive in this case also. Note that the Wu-Hausman test for endogeneity fails to reject the exogeneity of regressors for all cases.[14] Therefore, we can safely conclude that our results are not driven by unobserved heterogeneity or by any simultaneity.

## VI. ROBUSTNESS CHECK

We have already used two specifications, six estimation techniques and three measures of decentralisation.[15] We also check if the effects of fiscal and political decentralisation change with the type of disasters because the disasters differ in terms of length, severity and suddenness. Hence, we first check the effect of decentralisation for individual disaster. But the results are mostly statistically insignificant.[16] Then we categorise the disasters into two groups – disasters with hydro-meteorological origin (flood and wind storm) and disasters with geological origin (earthquake, extreme temperature and landslide) (ECLAC 2002). We report only GLS and NB with year and country fixed effects in Tables VI and VII for total deaths. It is interesting that the effects of political and fiscal decentralisation are qualitatively similar to previous results in section IV–disaster risk increases with elected government at the lowest tier but it decreases when elected government is accompanied by greater fiscal decentralisation. The results are found to be significant and robust for the disasters with hydro-meteorological origin. For the disasters with geological origin, the signs are similar but insignificant. It indicates that resource poor local governments are more efficient

[13]Acemoglu (2005) argues that instruments used for political institutions are valid only for broad categories; no good instrument is available for particular political institution. For detail, see footnote 21 in Enikolopov and Zhuravskaya (2007).

[14]In most of the cases, F-statistics from first stage regressions are greater than 200 with minimum value of 21.51 and maximum value of 708.61. Also note that our dependent variable is of count data nature, but there is no standard econometric software for estimating NB and ZINB with instruments.

[15]We also included income inequality in the right hand side. Our findings are robust to inclusion of this variable.

[16]In order to save space, we did not report these results. These results are available upon request.

in managing disasters which strike slowly, lack suddenness and occur recurrently.[17]

TABLE VI

**EFFECT OF POLITICAL AND FISCAL DECENTRALISATION ON TOTAL DEATH FOR DISASTERS OF HYDRO-METEOROLOGICAL ORIGIN WITH COUNTRY AND YEAR FIXED EFFECTS**

| | (1) GLS | (2) GLS | (3) GLS | (4) NB | (5) NB | (6) NB |
|---|---|---|---|---|---|---|
| State (S) | 8.930 | | -56.807 | 0.034 | | -3.772 |
| | (3.791)* | | (23.586)* | (0.221) | | (1.893)* |
| Municipality (M) | 0.432 | | 4.585 | 0.790 | | 3.807 |
| | (0.368) | | (1.024)** | (0.242)** | | (1.636)* |
| Sub-National Revenue (R) | | -0.072 | 0.181 | | -0.024 | 0.169 |
| | | (0.042)+ | (0.091)* | | (0.016) | (0.140) |
| R x S | | | 0.227 | | | 0.456 |
| | | | (0.283) | | | (0.199)* |
| R x M | | | -0.266 | | | -0.370 |
| | | | (0.070)** | | | (0.180)* |
| Population Density | 0.433 | 5.976 | 20.884 | -0.129 | 0.097 | 0.053 |
| | (0.310) | (3.412)+ | (9.017)* | (0.083) | (0.175) | (0.589) |
| GDP per Capita | -0.276 | 0.703 | 4.969 | 0.109 | 0.283 | -0.184 |
| | (0.638) | (0.782) | (2.607)+ | (0.128) | (0.227) | (0.712) |
| Ln(Population) | 5.227 | 2.431 | 14.353 | -0.052 | 0.631 | -1.196 |
| | (2.423)* | (0.844)** | (6.236)* | (0.130) | (0.129)** | (0.563)* |
| Number of Disaster | 1.157 | 0.653 | 1.433 | 0.394 | 0.200 | 1.433 |
| | (0.079)** | (0.065)** | (0.140)** | (0.049)** | (0.039)** | (0.205)** |
| Democracy | -0.063 | 0.055 | -0.266 | -0.058 | 0.053 | -0.299 |
| | (0.046) | (0.051) | (0.099)** | (0.031)+ | (0.029)+ | (0.111)** |
| Constant | -97.461 | -80.303 | -337.570 | -3.609 | -15.390 | 16.956 |
| | (45.376)* | (36.110)* | (147.168)* | (2.431) | (3.075)** | (9.396)+ |
| Observations | 375 | 276 | 80 | 375 | 272 | 76 |
| Number of country | 22 | 23 | 10 | 22 | 21 | 9 |

**Note:** a. Standard errors are in parentheses ; b. + significant at 10%; * significant at 5%; ** significant at 1%.

[17]In our sample, 66 per cent of hydro-meteorological disasters are floods and composition of geological disasters is: earthquake (48 per cent), landslide (34 per cent) and extreme temperature (18 per cent).

TABLE VII

**EFFECT OF POLITICAL AND FISCAL DECENTRALISATION ON TOTAL DEATH FOR DISASTERS OF GEOLOGICAL ORIGIN WITH COUNTRY AND YEAR FIXED EFFECTS**

| | (1) GLS | (2) GLS | (3) GLS | (4) NB | (5) NB | (6) NB |
|---|---|---|---|---|---|---|
| State (S) | 0.129 | | -15.670 | -1.082 | | -20.970 |
| | (1.719) | | (23.108) | (0.349)** | | (6,566.028) |
| Municipality (M) | -0.273 | | 1.957 | 0.013 | | 2.836 |
| | (0.252) | | (1.202) | (0.311) | | (4.709) |
| Sub-national | | 0.013 | 0.115 | | 0.066 | 0.200 |
| Revenue (R) | | (0.034) | (0.107) | | (0.067) | (0.306) |
| R x S | | | 0.108 | | | 0.147 |
| | | | (0.184) | | | (3.522) |
| R x M | | | -0.131 | | | -0.592 |
| | | | (0.086) | | | (0.379) |
| Population Density | 0.088 | 1.750 | 5.020 | 0.169 | 11.108 | 1.733 |
| | (0.164) | (2.088) | (8.916) | (0.125) | (11.747) | (7.349) |
| GDP per Capita | -0.223 | 0.147 | -1.140 | 0.220 | 2.845 | -11.989 |
| | (0.393) | (0.443) | (2.800) | (0.263) | (1.295)* | (8.185) |
| Ln(Population) | 0.350 | -0.393 | 3.246 | 0.340 | 5.265 | 2.085 |
| | (1.233) | (0.565) | (6.164) | (0.201)+ | (3.135)+ | (9.918) |
| Number of Disaster | 1.848 | 1.359 | 1.662 | 1.250 | 0.736 | 2.933 |
| | (0.075)** | (0.087)** | (0.138)** | (0.101)** | (0.099)** | (1.018)** |
| Democracy | -0.009 | -0.011 | -0.147 | 0.014 | -0.014 | -0.472 |
| | (0.019) | (0.034) | (0.112) | (0.043) | (0.066) | (0.224)* |
| Constant | -4.177 | -4.390 | -58.433 | -9.807 | -194.179 | 52.565 |
| | (24.808) | (22.260) | (146.180) | (4.352)* | (0.000) | (57,155.534) |
| Observations | 375 | 276 | 80 | 341 | 276 | 75 |
| Number of country | 22 | 23 | 10 | 20 | 23 | 8 |

**Note:** a. Standard errors are in parentheses.
b. + significant at 10%; * significant at 5%; ** significant at 1%.

We also used an alternative dependent variable – total number of people affected (Table VIII), for checking the robustness of our results and report only the estimates controlling for country and year fixed effects.[18] The results are qualitatively similar to the past results in section IV. The Revenue-MUNICIPALITY interaction is negative and significant in the case of GLS, whereas the Revenue- SATE interactions are insignificant in both cases.

[18]There are a large number of cases where total number of affected people and damage are zero/missing when total number of people killed is positive, which is very unlikely. On the other hand, data on death count is much reliable and cleaner. Since this variable is less reliable, we focused our analysis with the dependent variable Total Dead.

TABLE VIII

**EFFECT OF POLITICAL AND FISCAL DECENTRALISATION ON TOTAL AFFECTED WITH COUNTRY AND YEAR FIXED EFFECTS**

| | (1) GLS | (2) NB | (3) GLS | (4) NB | (5) GLS | (6) NB |
|---|---|---|---|---|---|---|
| State (S) | 17.901 | 0.029 | | | -162.904 | -66.411 |
| | (11.577) | (0.195) | | | (67.727)* | (0.000) |
| Municipality (M) | 1.469 | 0.699 | | | 9.859 | 2.472 |
| | (0.862)+ | (0.219)** | | | (3.697)** | (2.777) |
| Sub-national Revenue | | | -0.127 | -0.066 | 0.822 | 0.261 |
| | | | (0.134) | (0.014)** | (0.356)* | (0.234) |
| R x S | | | | | 0.238 | 0.180 |
| | | | | | (0.615) | (0.304) |
| R x M | | | | | -0.751 | -0.303 |
| | | | | | (0.278)** | (0.206) |
| Population Density | -0.564 | -0.071 | 18.458 | 0.062 | 64.146 | 35.179 |
| | (0.976) | (0.069) | (10.356)+ | (0.141) | (26.112)* | (18.266)+ |
| GDP per Capita | -4.265 | -0.113 | -0.327 | 0.317 | 19.536 | 10.035 |
| | (1.955)* | (0.104) | (2.249) | (0.176)+ | (8.795)* | (4.860)* |
| Ln(Population) | 9.601 | -0.228 | 4.338 | 0.327 | 41.015 | 23.616 |
| | (8.090) | (0.112)* | (2.455)+ | (0.108)** | (17.942)* | (12.426)+ |
| Number of Disaster | 1.616 | 0.382 | 0.891 | 0.253 | 3.513 | 1.281 |
| | (0.155)** | (0.036)** | (0.123)** | (0.032)** | (0.297)** | (0.205)** |
| Democracy | -0.356 | -0.025 | -0.163 | 0.001 | -1.296 | -0.445 |
| | (0.124)** | (0.026) | (0.126) | (0.026) | (0.298)** | (0.211)* |
| Constant | -141.352 | 0.918 | -168.048 | -10.658 | -1,019.688 | -585.614 |
| | (158.109) | (2.035) | (107.127) | (2.495)** | (429.918)* | (933.501) |
| Observations | 375 | 375 | 276 | 275 | 80 | 80 |
| Number of country | 22 | 22 | 23 | 22 | 10 | 10 |

**Note:** a. Standard errors are in parentheses.
b. + significant at 10%; * significant at 5%; ** significant at 1%.

## VII. CONCLUSION

The role of decentralised government in disaster management is well recognised among international donors and policymakers. However, there has been no rigorous attempt to address this issue. This is the first rigorous attempt to study the effect of political and fiscal decentralisation on disaster outcomes. It is found that the effect of decentralisation on disaster outcomes varies with types and the tiers of the decentralised governments. The results are found to be significant and robust only at the lowest tier of government (e.g. Municipality). Elected government at the lowest level is found to increase the number of death and affected people, while at the state level the effect is not significant. The

effect of fiscal decentralisation alone is mostly insignificant. However, when fiscal decentralisation comes with political decentralisation, it significantly reduces the number of total dead for the lowest tier of the government. This paper emphasises the role of fiscal decentralisation for political decentralisation to be effective in mitigating disaster risks. This paper offers valuable lessons for both effective decentralisation strategies in general for improving public service delivery and the role of decentralised efforts in disaster management.

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**APPENDIX**

TABLE A.1
**LIST OF COUNTRIES**

| | | |
|---|---|---|
| Algeria | Guatemala | Nicaragua |
| Bangladesh | Honduras | Nigeria |
| Bolivia | Hungary | Pakistan |
| Brazil | India | Panama |
| Cambodia | Indonesia | Papua New Guinea |
| Chile | Iran, Islam Rep | Peru |
| China | Kenya | Philippines |
| Colombia | S. Korea | Romania |
| Costa Rica | Madagascar | Russia |
| Cuba | Malawi | South Africa |
| Dominican Republic | Malaysia | Sri Lanka |
| Ecuador | Mexico | Tajikistan |
| Egypt | Morocco | Thailand |
| El Salvador | Mozambique | Turkey |
| Ethiopia | Nepal | Venezuela |
| | | Vietnam |

TABLE A.2
**CORRELATION**

| | Municipality | State | Sub-national Revenue | Sub-national Expenditure | Total Dead | Total Affected |
|---|---|---|---|---|---|---|
| Municipality | 1 | | | | | |
| State | 0.346* | 1 | | | | |
| Sub-national Revenue | 0.007 | 0.075 | 1 | | | |
| Sub-national Expenditure | 0.141 | 0.361* | 0.80* | 1 | | |
| Total Dead | 0.025 | -0.025 | -0.053 | 0.039 | 1 | |
| Total Affected | -0.023 | -0.041 | -0.104 | -0.040 | 0.279* | 1 |

**Note:** * implies significant at 10 per cent.

TABLE A.3

**DESCRIPTIVE STATISTICS**

| Variable | Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Total Dead | 553 | 466.84 | 6112.51 | 0 | 139469 |
| Total Affected | 553 | 582054 | 3187535 | 0 | 53600000 |
| Number of Disaster | 553 | 1.48 | 1.80 | 0 | 11 |
| Sub-national Revenue (%) | 532 | 11.20 | 10.55 | 0.47 | 52.36 |
| Sub-national Expenditure (%) | 523 | 15.26 | 13.08 | 1.15 | 55.61 |
| STATE | 553 | 0.36 | 0.48 | 0 | 1 |
| MUNICIPALITY | 553 | 0.76 | 0.42 | 0 | 1 |
| Population (000) | 553 | 27016.21 | 32201.72 | 1991.58 | 153699.20 |
| Real GDP per Capita | 553 | 3764.07 | 2679.71 | 346.65 | 13637.80 |
| Population Density (person/km2) | 553 | 149.97 | 233.79 | 5.40 | 1176.29 |
| Elevation (meter above sea level) | 375 | 717.23 | 605.42 | 85.47 | 2565.38 |
| Absolute Value of Latitude (degrees) | 375 | 20.94 | 11.55 | 3.88 | 47.20 |
| Democracy | 375 | 4.87 | 3.57 | 0 | 10 |
| Ethnic Fragmentation | 375 | 0.47 | 0.23 | 0.04 | 0.87 |
| Parliamentary System | 219 | 0.32 | 0.46 | 0 | 1 |
| Proportional Electoral Rule | 219 | 0.72 | 0.44 | 0 | 1 |
| Government Fractionalisation | 219 | 0.17 | 0.28 | 0 | 1 |
| Party Age | 227 | 32.42 | 30.24 | 1.5 | 188 |
| Legal Origin (UK) | 97 | 0.40 | 0.49 | 0 | 1 |
| Legal Origin (France) | 97 | 0.60 | 0.49 | 0 | 1 |

**Note:** Number of observations of each variable corresponds to the regression models in Tables I-VIII.

TABLE A.4

**DESCRIPTION OF THE VARIABLES**

| | |
|---|---|
| Total Dead | Number of total people dead by natural disasters (earthquake, flood, landslide, extreme temperature and windstorm) in a year for a country. Source: The Center for Research on the Epidemiology of Disasters (CRED). http://www.emdat.be/ |
| Total Affected | Number of total people affected by natural disasters (earthquake, flood, landslide, extreme temperature and windstorm) in a year for a country. Source: CRED. http://www.emdat.be/ |
| Total Count | Total number of occurrence of natural disasters (earthquake, flood, landslide, extreme temperature and windstorm) in a year for a country. Source: CRED http://www.emdat.be/ |
| Sub-national Revenue | Share of revenue of all sub-national governments in total revenue (both local and central government). Source: Database on Fiscal Indicators by the World Bank, based on IMF's Government Financial Statistics (GFS).<br>http://www1.worldbank.org/publicsector/decentralization/fiscalindicators.htm |
| Sub-national Expenditure | Share of expenditure of all sub-national governments in total expenditure (both local and central government). Source: Database on Fiscal Indicators by the World Bank, based on IMF's Government Financial Statistics (GFS).<br>http://www1.worldbank.org/publicsector/decentralization/fiscalindicators.htm |
| STATE | It takes on value 1 if both executive and legislature are elected or executive is appointed but legislature is elected; and 0 otherwise. Source:Beck *et al.* 2001. |
| MUNICIPALITY | It takes on value 1 if both executive and legislature are elected or executive is appointed but legislature is elected; and 0 otherwise.Source:Beck *et al.*, 2001. |
| Real GDP per capita | Real GDP per capita is based on Laspeyres index. Source: Penn World Table, version 6.2 (Heston, Summers and Aten 2006)<br>http://pwt.econ.upenn.edu/php_site/pwt_index.php |
| Population | Source Penn World Table, version 6.2 (Heston, Summers and Aten 2006) |
| Population Density | Source: Gallup, Sachs and Mellinger (1999) |
| Democracy | It takes on the values 0-10, 10 being the highest. Source Polity IV database<br>http://www.systemicpeace.org/polity/polity4.htm |
| Ethnic Fragmentation | It takes on values between 0 and 1. Higher the value, greater the fragmentation. 1 Source: Alesina *et al.* (2003 |
| Latitude | Absolute value of latitude. Source: Gallup, Sachs and Mellinger (1999) |
| Elevation | Thousand meter above sea level. Source: Gallup, Sachs and Mellinger (1999) |
| Party Age | Average of ages of the first government party, second government party, and first opposition party, or the subset of these for which party age is known. Source: Beck *et al.* 2001. |
| Parliamentary System | Systems with unelected executives get a 0. Systems with presidents who are elected directly or by an electoral college, in cases where there is no prime minister also receive a 0. Source: Beck *et al.*, 2001. |
| Government Fractionalisation | The probability that two members of parliament picked at random from among the government parties will be of different parties. If the seats of the government parties are unknown, if there is no parliament or if there are no parties in the legislature, it is recorded as missing. Source: Beck *et al.* 2001. |
| Proportional Electoral System | It takes on value 1 if candidates are elected based on the percentage of votes received by their party and/or if sources specifically call the system "proportional representation," and 0 otherwise. Source: Beck *et al.*, 2001. |
| Legal Origin | Origin of a country's legal system. It is based on legal origin of the Company Law or Commercial Code of a country. There are five legal origins: (i) English Common Law, (ii) French Commercial Code, (iii) German Commercial Code, (iv) Scandinavian Commercial Code and (v) Socialist/Communist Laws. Source: La Porta *et al.* (1998) |