Distributive Politics Pre-Analysis Plan

Natural Disasters, Civil Society, and the Discretionary Distribution of Relief Funds in Mexico

Valerie Wirtschafter Cesar Martinez

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1. Introduction

1.1 Motivation and Theoretical Puzzle

According to the NGO "Reliefweb," natural disasters affected an average of 218 million individuals across the world between 1994 and 2013. The human and economic costs of earthquakes, floods, droughts, and hurricanes are immense: 1.38 million deaths in this period and billions of dollars in infrastructure damage. These numbers will likely increase as the consequences of global warming become more apparent, with particular burden on the poorest countries of the world. Subnationally, a growing literature in Sociology, Political Science and History suggests that the impact of natural disasters amplifies pre-existing social and economic cleavages, contributing to higher levels of inequality (Bowen 2002).

In spite of the role that some authors have assigned to social networks, communities, and non-governmental organizations (Aldrich 2016), the state remains the critical provider of immediate assistance and reconstruction funds. National and local governments usually offer initial institutional and financial support to the victims of natural disasters and represent the main source of money for the reconstruction efforts in affected communities. Even though the criteria for the distribution of disaster relief and reconstruction seem clear (the greater the "need" for external support to overcome the catastrophe, the higher the levels of public spending on disaster-relief), in practice, politicians use these funds to fulfill their political agendas and to capture for personal consumption. As Chicago Mayor, Rahm Emmanuel, once said, "You never want a serious crisis to go to waste."* This is clear anecdotally as well: accusations of the political use of natural disasters are widespread in developed and developing countries alike, including for example after the hurricane "Maria" in Puerto Rico and the severe earthquake that hit Mexico City in September 2017.

International civil society organizations and public institutions have documented evidence of malfeasance and other practices that lead to inefficient allocations of disaster-related funds, including corruption and different types of biases in the distribution of these funds. Despite the presence of such practices, research on retrospective voting shows that on average voters do care about how this money is distributed, as well as the effectiveness of public spending. For example, Healy and Malhotra (2009) finds that citizens punish incumbents when the amount of disaster-relief funds does not correspond to the levels of damaged induced by the event. Moreover, some quasi-experimental research (e.g., Fuchs and Rodriguez-Chamussy 2014, Bechtel and Hainmueller (2011)) has found that individuals reward incumbents at the ballot box for disaster-relief funds spending that follows a "need-based" approach and that citizens prefer objective criteria for spending allocation over other types of distribution (Bechtel and Mannino 2017).

If citizens indeed have well-defined preferences and hold the incumbents accountable for not implementing policies accordingly, why is the distribution of disaster-relief funds so flawed? That is, under what circumstances do politicians use a need-based versus a political (or other type of) approach? How can we reconcile this puzzle in the literature of natural disasters management? Whereas most of the existing research has focused on the debate about core versus swing voters, we advance two additional explanations for the patterns of spending decisions on natural disasters: the role of federalism and the importance of local economic elites.

The goal of this paper is to study the Mexican case in order to provide some insights to these hypotheses. Our theory suggests that the use of disaster relief and reconstruction funds follows both an electoral and an economic logic. While the levels of damage should be a strong explanatory factor in the distribution of

*"Rahm Emanuel on the Opportunities of Crisis" *Wall Street Journal*, November 19, 2008.

disaster funds, presidents favor swing municipalities in states where the governor is a co-partisan with local public goods and punish core municipalities of opposition states, as demonstrated in the security policy in Mexico (Diaz-Cayeros 2006; Flamand 2006; Ríos 2015; Ley 2017). Moreover, previous research has shown that fiscal federalism leads to more resource distribution to interest groups (Careaga and Weingast 2003; Palmer-Rubin 2016). This is also consistent with some of the recent literature on the determinants of disaster-relief spending in developing countries. As such, we argue that three factors account for the variable distribution of disaster relief and reconstruction funds: (1) the levels of damage, (2) the electoral composition, and (3) the presence of interest groups.

1.2 Research Question

As mentioned before, the broad objective of this paper is to identify what factors explain the distribution of disaster-relief funds to affected individuals and communities. In particular, we ask: under what circumstances do politicians follow a "need- based" versus other approaches? In order to break this question down into observable implications, we aim to answer the following inquiries:

- For the same levels of damages, do presidents favor swing or core supporters with disaster relief and reconstruction funds? What types of funds are distributed to each group of voters?
- What is the role of federalism in the allocation of these resources? That is, what is the effect of having a co-partisan governor in the amount of resources received by a municipality?
- Is there any evidence of elite capture in the allocation of disaster-relief funds? Controlling for the intensity of the disaster, does the number and size of firms affect the likelihood of receiving aid from the federal government?

2. Background and Theory

Mexico is one of the most vulnerable countries in the world to natural disasters, with clear regional differences in terms of exposure. The north of Mexico is particularly prone to severe droughts and water scarcity, whereas floods and hurricanes are much more common in the south and southeast of the country. Earthquakes and volcanic eruptions mark the central portion of Mexico, where the capital is located.

As noted by the Intergovernmental Panel on Climate Change, the vulnerability of a community to natural disasters depends not only on the exposure to these events, but also their capacity for adaptation and resilience, which is in itself a function of economic development (Fifth Assessment Report) (Cardona et al. 2012). The National Institute of Ecology and Climate Change of Mexico estimates that most of the populations affected by natural disasters are located in poor neighborhoods and municipalities, which amplifies their welfare consequences and increases the likelihood of building clientelistic networks using relief and reconstruction funds.*

For many decades, the Mexican government has implemented programs to support affected populations. However, ample anecdotal evidence suggests that political variables distort the allocation of these funds. Perhaps the most infamous example was the severe earthquake that devastated Mexico City in 1985. First, the lackluster response of the federal PRI government contributed to the erosion of the hegemonic party regime, as citizens blamed the incumbent for the slow recovery process. Second, neighborhood organizations, which took the lead in the reconstruction efforts, quickly became a powerful interest group,

*Instituto Nacional de Ecologia y Cambio Climatico, "Bases para una politica de adaptacion," November 10, 2016

which allied with the opposition party and successfully lobbied local authorities for the provision of specific urban services. Third, in order to allay the widespread criticisms against its policies, the federal government created a massive housing program, which, according to some scholars, was politically motivated (Cueva 1987).

In part as a response to the 1985 earthquake, the federal government reformed the institutional framework of natural disaster management, through the creation of the National Center for Disaster Prevention (CENAPRED) in charge of overseeing the National Fund for Natural Disasters (FONDEN). In the event of a natural disaster, mayors are in charge of filling up relief requests and apply to get funds from the FONDEN; then, they send their requests to the governor, who decides which municipality requests will be integrated into the state-level aid request package. Finally, the President approves the state government's petitions of funds on a municipality-by-municipality basis. The Chamber of Deputies keeps records on all funds received and disbursed.

In spite of the presence of objective rules for the allocation of these resources, there is a widespread recognition that the funds for disaster relief and reconstruction in Mexico are far from following a "need-based approach." Besides the ubiquitous accusations of corruption and malfeasance in the use of the FONDEN and other budget items—for example after the 2017 earthquakes in Mexico City—it is clear that governments assistance does not benefit all citizens equally and that socioeconomic inequalities may shape the allocation of these funds.

At the cross-state level, Oswald Spring (2012) notes that the federal government implemented a much quicker and more effective response to the hurricane Wilma than to the hurricane Stan, which both occurred during the same storm season. According to the author, whereas the former severely hit the core of Cancun's touristic infrastructure (and therefore one of the main economic engines of Southeastern Mexico), the latter affected mostly indigenous communities in the state of Chiapas. Even within the same city, socioeconomic disparities and electoral considerations seem to influence the official responses to disasters in Mexico. For example, Toscana Aparicio (2003) argues that the ruling PRI distributed more disaster aid to its brokers in Acapulco after the hurricane Paulina and that authorities were much more interested in providing reconstruction funds to the powerful touristic business groups than to the impoverished citizens living in the slums of the city. Do these patterns replicate across Mexico? Does the federal government allocate disaster-relief funds based upon electoral and socioeconomic considerations? If so, is this an issue of state capacity (that some regions are easier to reach than others)?

2.1 Existing Literature

Broadly speaking, three different strands of research are used in evaluating the politics of natural disasters: (1) retrospective voting (Healy and Malhotra 2009; Achen and Bartels 2012; J. T. Gasper and Reeves 2011; Cole, Healy, and Werker 2012); (2) distributive politics (Garrett and Sobel 2003; J. Gasper and Reeves 2010; Gallego 2012; Shughart 2006); (3) and the role of intermediate organizations in shaping the patterns of disaster-relief funds allocation (Fair et al. 2017; Cassar, Healy, and Kessler 2017; Eckel, El-Gamal, and Wilson 2009; Gunessee et al. 2017; Anushka et al. 2018; J. Z. Li et al. 2011; Chang and Zilberman 2013, Sovacool, Linnér, and Goodsite (2015), and Herrera (2017)).

The literature on retrospective voting argues that citizens punish incumbents for bad management of natural disasters, but not for the natural disaster per se. For example, in their study on the effects of tornadoes on electoral behavior in the United States, Healy and Malhotra (2009) found effects on vote shares for only the levels of economic damage, but not for the number of casualties. That is, the authors aim to

discredit the theory put forth by Achen and Bartels (2012) that voters are irrational and punish incumbents for events outside their control, such as shark attacks. Recently, Bechtel and Mannino (2017) identified some of the micro-foundations of these results. In their survey experiment, the authors found that voters strongly support a need-based allocation of disaster relief funds; that is, regardless of the socioeconomic status or partisan affiliation of the victims, those individuals more affected by the natural phenomenon should receive more support from the government.

The literature focused on the distributive politics of disaster largely assesses how governments utilize natural disasters to increase their electoral returns. This line of research is particularly strong in the United States, with a significant body of work, including papers by Shughart (2006) and Garrett and Sobel (2003), focused on explaining the allocation of FEMA funds after Hurricane Katrina. Both papers found clear evidence of politically motivated aid distribution. In Mexico, a sizable literature has studied the political determinants of federal spending in different policy areas and the effects of federalism on it. Ríos (2013) and Trejo and Ley (2016) found that presidents provide fewer resources for public security to mayors located in states where the governor is not a co-partisan. That is, it seems that national executives punish municipalities that support the opposition. In addition, Palmer-Rubin (2016) argues that federal authorities distribute different goods to intermediate organizations depending on their partisanship—in this case funds from agricultural promotion programs.

The last strand of literature focuses on the role that intermediate organizations (community associations, political parties' brokers, local business elites, and family networks) play in the actual distribution of these resources. Aldrich (2012) and Aldrich (2016) found that community-level organizations foster social capital and pro-social attitudes that are essential in the process of reconstruction, regardless of the government response. Even more, these groups allow individuals to lobby the government for assistance and represent a crucial link between the state and the affected populations. Other scholars focus more narrowly on the role of family networks and other socio-ethnic groups. Atkinson, Hicken, and Ravanilla (2014) claim that family and clan connections were essential in the patterns of allocation of funds after typhoons in the Philippines. In terms of political parties, Herrera (2017) analyze the relevance of brokers in the distribution of water infrastructure and supplies during droughts. Finally, Chang and Zilberman (2013) found that farmers producing more valuable crops receive relatively more funds for disaster-relief in Taiwan.

Although these three literatures bring valuable insights to the topic, separately they can only provide partial theories to explain the political dimensions of natural disasters. Our main contribution with this research is to unite these three theories. Specifically, we aim to bring the role of local elites to the fore. We argue that the lobbying efforts of these associations mediates between the severity of the disaster and political outcomes, including the allocation of relief and reconstruction funds, as well as the salience of the disaster for retrospective voting.

2.2 Theoretical Framework

The initial point of our theory is the external shock—a natural disaster. Even though the vulnerability to earthquakes, hurricanes, floods, and droughts is not random, the specific timing of the events and the intensity of the damage are. Politicians respond to these natural disasters by distributing three types of goods: (1) in the immediate aftermath of the crisis, they provide temporal shelter, food, and medical aid and equipment, all of which effectively function as private goods, which usually are distributed discretionally; (2) in the weeks after the disaster, authorities allocate resources for reconstruction, in particular housing (either materials or houses) and local public goods, including bridges, roads, and electricity; (3) finally, in

order to prevent additional damage in the future, politicians also invest in prevention, which is mostly public goods such as early warning systems and infrastructure for protection. We theorize that the amount and quality of resources received by a community or neighborhood is a function of three variables: (1) the intensity of the damage, (2) the presence of organized interest groups capable of lobbying the government for public funds (in particular economic elites), and (3) the political alignment between the mayor, the governor, and the president.

The relative importance of these three variables changes at different stages of the reconstruction process and across different goods distributed. At the initial stage—immediate disaster relief—the allocation of public resources should respond mostly to (a) the severity of the damage and (b) the amount of resources available as well as the capacity to reach out to affected populations. However, during the reconstruction phase, politicians should pay more attention to the electoral composition of the community as well as to the presence of organized groups that lobby for more assistance. In line with previous research in Mexico (Diaz-Cayeros, Estevez, and Magaloni 2016), we expect that municipalities that supported the party of the president in the mayoral and governor elections prior to the disaster will receive more goods than those that defected from his electoral coalition. In terms of the political logic of disaster relief funds, we also theorize, following (Diaz-Cayeros, Estevez, and Magaloni 2016), that authorities will distribute more funds to disasters occurring closer to elections. That is, natural disasters allow incumbents to signal a strong commitment to their political allies and the consequences of not supporting their parties at the polls. Given the federal structure of the Mexican state, the political favoritism of the president should be visible at both the municipal and state levels—but stronger at the latter.

Regarding the economic logic of disaster-relief spending, we argue that authorities favor richer communities for two reasons. First, since natural disasters wreak havoc and disrupt normal economic activity, ensuring the recovery of the main sources of employment would decrease the likelihood of retrospective punitive voting—as firms are able to continue functioning, employment and production are kept at pre-disaster levels. Second, businesses have more capacity to lobby local and federal authorities to move faster with the distribution of funds for reconstruction. Both mechanisms produce the same observable implications, but they are quite difficult to disentangle by using quantitative data. In summary, our theoretical framework predicts that the allocation of disaster-relief funds is driven by electoral/federal and elite capture considerations.

3. Study Research Design and Empirical Strategy

The following section provides additional detail on the data sources we will use to test the theory and hypotheses highlighted above. It also presents our level our analysis and empirical strategy.

3.1 Data Sources

We will rely on four types of data for the observational study: (1) electoral data; (2) damages data; (3) disaster relief spending data; and (4) firm level data. The electoral data we have dates back to 1990 and comes from Mexico's Instituto Nacional Electoral and CIDAC, which is available at the polling station level. We are interested in four types of natural disasters: (1) droughts, (2) heavy rainfall, (3) hurricanes and tropical storms, and (4) earthquakes. In order to estimate exposure to droughts and severe rainfall conditions, we will use three measures from the North American Drought Monitor, calculated

by the National Oceanic and Atmospheric Administration (NOAA): (a) the percentage of long-term average precipitation, which calculates the deviations from the 1950-2010 mean rainfall; (b) the standard precipitation index, which represents a measure of the probability of observing a determinate amount of rain given historical conditions (lower values indicate drought and higher values indicate severe rainfall); and (c) the Palmer drought index, that focuses on the long-term circulation trends that produce drought. All of these values are available as text datasets, which record the values of the variables for different climate stations.*

The data on the trajectory of hurricanes and tropical storms comes from two datasets: (a) the Atlantic Hurricane Database (HURDAT2) 1851-2017 and the Northeast and North Central Pacific Hurricane Database (HURDAT2) 1949-2017, both of which are comma-delimited and text-based datasets of the trajectories and intensity of all hurricanes, compiled by the National Hurricane Center of the National Oceanic and Atmospheric Administration (https://www.nhc.noaa.gov/data/?#hurdat). Finally, the data for exposure to seismic risks comes from the National Seismic Service of Mexico; in specific, the information includes the epicenter, depth, magnitude and duration of all earthquakes during the period of analysis. It is important to mention that the distribution of disaster-relief funds is attached to a particular event (for example severe rainfall affecting certain municipalities for a specific number of days). We plan to use the official disaster declarations to specify to match particular events with the intensity of exposure.

Data on disaster relief funding is publicly available, and we submitted a FOIA request act to get the entire time series since 1990. At present, we have received state-level data on the types of disasters and the amount of funds received from the federal government between 2006 and 2018. We are submitting an additional request for disaster relief funding dating back to 1990, as well as disaggregated at the municipal level. Lastly, for our firm level data, we have information on the sector, year of incorporation, geographic location, and employee size of firms from during the period of analysis from the Registry of Economic Units, compiled by the National Institute of Statistics and Geography.

3.2 Level of Analysis

For the purposes of this observational study, the unit of analysis is the municipality in Mexico from 1990 to 2016. We will test the hypothesis of a discretionary use of reconstruction funds in three different ways: (1) assess the correlation between actual levels of damage with disaster relief funding received from the federal government; (2) calculate the relationship between firm size/location and disaster relief spending; and (3) evaluate the approval probability for proposals from municipalities where the mayor is co-partisan or where the governor is co-partisan. The first assessment is more exploratory, and we are simply interested in the correlation between damages and disaster relief funding. For the latter two approaches, we will use more sophisticated statistical analysis, which we highlight below in the sections "Challenges to Causal Inference" and "Empirical Strategy."

3.3 Empirical Strategy

3.3.1 Correlation Between Spending and Damages

As a first step in the observational study, we will assess whether or not damages follow a need-based approach, or if there is some room for discretionary deployment of disaster relief funds. In order to do

*For more information, see the website of the North American Drought Monitor: https://www.ncdc.noaa.gov/

this, we will use a simple Ordinary Least Squares model with covariates. The purpose of this first step is to evaluate if spending on disaster relief truly does deviate from a needs-based approach, and if so, how significant this deviation may be. In formal terms, the relationship we will estimate can be written as follows:

$$spending = \beta_0 + \beta_1 damages + \beta_2 PIB + \beta_3 education + \beta_4 partisanship + \beta_5 firms + \beta_6 population + \varepsilon$$

Per our hypotheses, we expect damages to have a positive effect on spending, but we also expect partisanship and number of firms to be a significant positive predictor of disaster relief spending. In R, we will use the following formula to calculate this relationship:

```
#create dataframe
n <- 2000

damages <- sample(1:5, 2000, replace = TRUE) #5 is highest damages, 1 is lowest damages
education <- sample(1:9, 2000, replace = TRUE) # 9 years is highest education average
firms_per_mun <- rnorm(n, 2000, 500)
copartisan <- complete_ra(2000)
pop <- rnorm(n, 50000, 13000)
spending <- rnorm(n, 10000000, 2500000)
pib <- rnorm(n, 700, 80)



df <- cbind.data.frame(damages, damages, education, firms_per_mun,
                       copartisan, pop, spending)

#run OLS Model to determine effect of damages on spending
lm1 <- lm(spending ~
            pib + education +
            firms_per_mun + copartisan +
            pop + spending, data = df)
```

Table 1: OLS Data Simulation Results

	Dependent variable:
	spending
pib	−1,008.493
	(681.861)
education	11,107.020
	(21,613.330)
firms_per_mun	−57.314
	(110.981)
copartisan	40,848.210
	(111,170.500)
pop	2.562
	(4.284)
Constant	10,481,367.000***
	(583,532.500)
Observations	2,000
R^2	0.002
Adjusted R^2	−0.001
Residual Std. Error	2,485,210.000 (df = 1994)
F Statistic	0.640 (df = 5; 1994)
Note:	*p<0.1; **p<0.05; ***p<0.01

3.3.2 Expected Findings for the Naive Regression

We expect that the results of this first basic linear regression model will provide initial statistical support to our two additional hypotheses. First, the coefficient of the number of firms on the amount of federal spending should be positive and statistically significant, controlling for the levels of damage, partisanship, population, GDP per capita, terrain and education. This result would indicate the presence of "elite capture": for the same levels of damage due to natural disasters, places with stronger economic elites would be able to attract more funding from the federal government. Second, the coefficient for the "partisanship" variable should also be positive and statistically significant. This would mean that a municipality with a mayor co-partisan with the president would receive more funds for disaster relief than a municipality from the opposition, for the same levels of damage, GDP per capita, number of firms, population, and education.

At this stage, should our analysis yield null findings or negative effects, we would still continue with subsequent analysis. A null finding would likely tell us that our model is poorly specified, and would provide further rationale for the empirical strategy that follows. A negative effect would be substantively interesting, as it goes against popular perceptions of disaster relief spending as well as the findings of other articles on the subject. In this case, further exploration would still be valuable.

3.4 Challenges to Causal Inference

The main argument of our paper is that the electoral composition and the economic characteristics of a municipality influence the allocation of disaster-relief funds, therefore amplifying pre-existing socioeconomic inequalities. Although we use controls in the model presented above, naturally, the first and foremost challenge to causal inference is the presence of lurking variables that explain both a high number of firms, a certain pattern of voting, and the allocation of disaster-relief funds, including corruption or even geography. Moreover, reverse causality is an equally relevant concern as well. For example, it's entirely possible that some municipalities receive fewer funds because they are territorially isolated, which, in turn, affects the concentration of economic activity and the distribution of electoral support (PRI has traditionally thrived in rural environments). In addition, poverty may explain why mayors of certain municipalities cannot send relief requests to the federal government, as well as the presence of clientelism (which benefits certain parties) and the lack of a vibrant private sector. In terms of reverse causality, it is also possible that the economic activity and the partisan composition of a community change as a result of the distribution of disaster relief funds. This is, in fact, the most relevant hypothesis of the retrospective voting literature. Some authors (e.g., Zucco 2013) found that the roll out of social programs, for example Bolsa Familia, shifts partisan preferences of individuals over time.

For the purposes of our paper, exposure to natural disaster and the continuous support from the government may incentivize changes in political preferences and the location of firms—which may exit a particular municipality when funds are not available or continue operating in high-risk areas, as they know the government will support them financially in case of a major natural disaster. Finally, assuming that the direction of causality goes from disaster-relief to partisan composition, the presence of a wide array of social programs may confound the effect of this particular spending. As mentioned before, the municipalities most vulnerable to environmental change in Mexico are also the poorest; therefore, we may observe higher levels of support for the incumbent in places with more disaster-relief funds because these localities tend to receive more money from other social policies.

In order to allay these concerns, we employ two statistical techniques to improve our causal inference

claims: (1) selection on observables to study the effect of economic elites; and (2) a regression discontinuity design to study the electoral dynamics of disaster-relief spending. These two approaches will assess the second and third parts of our observational study: (1) the relationship between firm size/location and disaster relief spending; and (2) the approval probability for proposals from municipalities where the mayor is co-partisan or where the governor is co-partisan.

3.4.1 Selection on Observables for Elite Activity

As mentioned before, the presence of lurking variables constitutes one of the main challenges to study the effects of the economic structure and the electoral composition of a municipality on the patterns of disaster-relief spending. We will use selection on observables to select comparable treatment and control groups that differ only in the concentration of economic activity measured by the number of firms.

Specifically, we will follow Imai and Ratkovic (2014) and employ covariate balancing propensity score matching, which is analogous to the classic propensity score algorithm but for continuous treatment variables. It consists of estimating a parametric model of assignment into treatment. Given that our dependent variable is discrete—the total number of firms per municipality—and the variance is much higher than the mean, we will use a negative binomial regression model. We hypothesize that the total number of firms in a municipality is a function of the following variables: (1) population, (2) PIB per capita, (3) distance to major highways or the U.S. border, (4) rule of the law, (5) economic growth at the state level, (6) municipal budget, (7) urbanization levels. The specific equation we will run for this model is detailed below using simulated data:

```
#create dataframe
n <- 2000
firms_per_mun <- rnorm(n, 2000, 500)
pop <- rnorm(n, 50000, 13000)
pib <- rnorm(n, 700, 80)
dist_highway <- rnorm(n, 800, 220)
dist_border <- rnorm(n, 800, 220)
rule_of_law <- rnorm(n, 6, 1.5)
state_economic_growth <- rnorm(n, 7000, 4000)
mun_budget <- rnorm(n, 10000000, 2500000)
urbanization <- rnorm(n, 6, 1.5)

df <- cbind.data.frame(firms_per_mun, pop, pib, dist_highway,
                       dist_border, rule_of_law, state_economic_growth,
                       mun_budget, urbanization)

#run negative binomial model to get predicted number of firms based on range of covariates
lm1 <- glm.nb(firms_per_mun ~
                        pop + dist_highway +
                        dist_border + rule_of_law +
                        state_economic_growth + mun_budget +
                        urbanization, data = df)
```

After estimating this model, we will use the CBPS algorithm to match municipalities by their number of firms. This would allow us to construct treatment and control groups that are more equivalent in the

Table 2: Simulated Output for Negative Binomial Model

	Dependent variable:
	firms_per_mun
pop	0.00000
	(0.00000)
dist_highway	0.00003
	(0.00003)
dist_border	-0.0001^{**}
	(0.00003)
rule_of_law	-0.0004
	(0.004)
state_economic_growth	0.00000
	(0.00000)
mun_budget	0.000^{*}
	(0.000)
urbanization	0.006
	(0.004)
Constant	7.554^{***}
	(0.057)
Observations	2,000
Log Likelihood	$-15,368.770$
θ	13.923^{***} (0.439)
Akaike Inf. Crit.	30,753.550
Note:	*p<0.1; **p<0.05; ***p<0.01

treatment assignment. As explained by Zucco "the important assumption here is that within groups, variations in coverage [the treatment variable] are as good as random [...] The treatment effect is calculated within each strata by a simple linear regression of [the dependent variable] on the treatment variable, controlling for the propensity score itself" (Zucco 2013, 6). We will then regress the treatment variable matched from the CBPS algorithm on the federal disaster relief spending in order to evaluate the role firms play in shaping decisions about funding. We will estimate this using the CBPS package.

3.4.1.1 Expected Findings for the CBPS Model

We expect that the aforementioned statistical test will provide support to our first hypothesis. The main coefficient of interest is associated with the number of firms: the higher the number of economic units in a given municipality, the larger the federal spending on natural disasters-relief, controlling for the level of damage, GDP per capita, population, and education. A positive and statistically significant coefficient would imply that a stronger concentration of firms is causally associated with more federal spending, regardless of the amount of damage. In terms of the other parameters of the model, the β for population should not be statistically significant; the β for PIB per capita should be statistically significant and positive (indicating that richer places should receive more aid); and, finally, the coefficient for partisanship (presence of a mayor co-partisan with the president) should also be positive and statistically significant.

3.4.2 Regression Discontinuity Design

In order to test the second hypothesis of the paper (about the relevance of partisanship in the allocation of disaster-relief funds) we propose a Regression Discontinuity Design. According to the preliminary data we have collected from the Ministry of Interior, every year hundreds of municipalities receive funds for reconstruction of hydraulic infrastructure, agriculture, housing, electricity, and highways, among others. For example, in 1999 alone, 2,220 municipalities receive some sort of funds for disaster relief from the FONDEN; in 2005 the number was closer to 1,000 municipalities; and in 2009, 310 municipalities received some support. The decentralized nature of the Mexican electoral calendar implies that every year at least some municipalities elect mayors and that every three years all of them elect their representatives at the federal and state level. This implies that a large number of municipalities receive funds and hold elections in the same year.

In the first step of our design, we will subset the data from all the municipality-year observations to those that receive some federal disaster-relief funds. Then, from that pool of data we will restrict our analysis to those municipalities that had elections for mayor, governor, local representative, federal representative, and president in the year when they receive the federal resources. Then, we will be able to run a regression-discontinuity model where the treatment is the presence of a co-partisan mayor, representative, or governor of the president. The main assumption of our identification strategy is that municipalities located in the threshold are indistinguishable from one another except in the treatment assignment, which should be as good as if random. That is, for municipalities with close races (5% for example), the fact that a co-partisan of the president won is as-if random. Naturally, the main concern with this strategy is the number of observations located at the threshold. However, as mentioned before, since 1990, thousands of municipalities have received funds for disaster-relief during the period of analysis; moreover, the competitive nature of the Mexican political system implies that many of these races are won by small margins. In our analysis, we will pool all close elections and utilize municipal-year fixed effects. However, despite this reassurance, if we do not have a fairly balanced panel or if we have too few

observations for statistical power, we would re-evaluate whether this is an appropriate empirical strategy for testing our research question.

3.4.2.1 Estimation for the Regression Discontinuity Design

As mentioned before, the main assumption of this empirical test is that the units located around the threshold are indistinguishable from each other except in the treatment assignment.

In formal terms: $E[Y_{1i}|X_i]$ and $E[Y_{0i}|X_i]$ are continuous in X_i when the threshold $X_i = c$

Then, following Angrist and Pischke (p. 253),

$$Y_i = \alpha + \beta X_i + \rho D_i + \epsilon_i$$

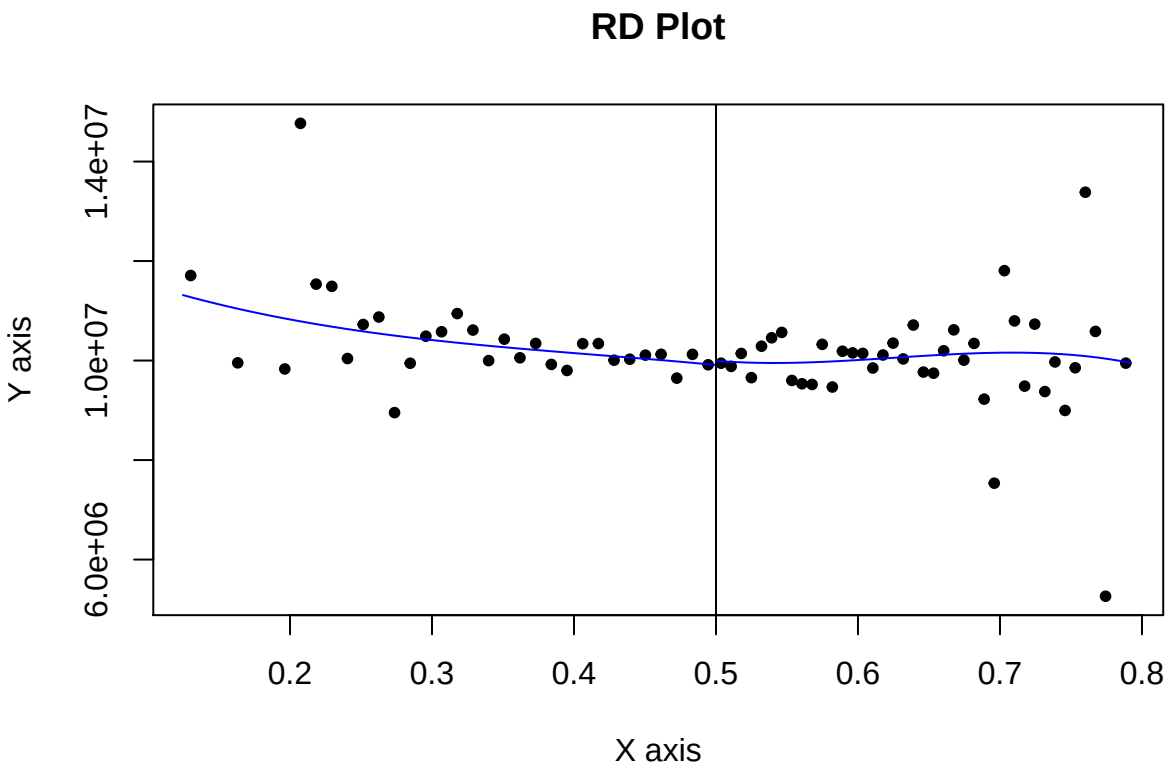
Where D is the treatment variable (mayor who is a co-partisan of the president); X is the forcing variable "electoral returns"; and Y is the outcome (disaster-relief funds received by that municipality). In this equation, ρ is the main parameter of interest, as it represents the causal effect of co-partisanship on the dependent variable. We will use the RDRobust package to estimate the treatment effect. Following Gelman and Imbens (2017) we will use a low order polynomial in our design.

```
#create dataframe

copartisan <- simple_ra(2000)
spending <- rnorm(n, 10000000, 2500000)
electoral_returns<- rnorm(n, 50, 10)/100

df <-cbind.data.frame(copartisan, spending, electoral_returns)

rdplot(y = df$spending, x = df$electoral_returns, p = 3, c = .50)
```




```
# RDD model
ittRdr <- rdrobust(y = df$spending, x = df$electoral_returns, c = .50)
```

Table 3: RD Robust Output

Call: rdrobust		
Number of Obs	2000	
BW type	mserd	
Kernel	Triangular	
VCE method	NN	
Number of Obs	982	1018
Eff. Number of Obs.	454	530
Order est. (p)	1	1
Order bias (p)	2	2
BW est (h)	0.067	0.067
BW bias (b)	0.112	0.112
rho (h/b)	0.592	0.592

Given that it is impossible to sort around the threshold – electoral victory – we do not need to run a McCrary test. However, we will run a number of placebo tests at various thresholds to assess whether or not jumps occur at various locations unrelated to our cut point throughout our data.

3.4.2.2 Expected Findings for the RD Design

We expect the effect of the treatment to be positive and statistically significant. As mentioned before,

the treatment variable here represents the presence of a co-partisan mayor on the amount of disaster-relief funds received. This result would clearly indicate a causal relationship between the electoral characteristics of a municipality and the disaster-relief funds allocated by the federal government: presidents distribute more resources to her co-partisans, even at the same levels of damage, education, GDP per capita, and other non-observable confounding variables.

4. Future Research: Investigating the Mechanisms

The goal of this research paper is to study the determinants of federal spending on natural disasters in Mexico, one of the most vulnerable countries to the effects of climate change. In spite of recent institutional changes designed to insulate the distribution of these resources from political considerations and to foster a "need-based" approach in their allocation, anecdotal evidence suggests that public officials may be using these to advance their own political goals. Specifically, we test two hypotheses: federal authorities favor municipalities with more firms, which indicates the presence of economic elite capture; and second, the president distributes more resources to municipalities where the mayor is a co-partisan, suggesting the presence of an electoral logic in the allocation of funds. We propose two causally oriented empirical strategies to disentangle these relationships. However, we think it will be necessary to complement our findings with qualitative data, in particular in-depth interviews with mayors and affected firms and citizens in highly vulnerable municipalities. By combining the quantitative assessment highlighted above with qualitative research collected through fieldwork, thes research will make an important contribution to the study of disaster relief funding in Mexico.

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