Natural Resources and Social Conflict: Explaining Anti-Mining Protests in Brazil

September 20, 2018

Abstract

Due to the potential for mining's negative externalities to spark new grievances, the literature on social conflict and resource extraction assumes a causal link between mining and social protest. However, theory on social movements and conflicts cautions that protest events are the result of complex interactions between strategic actors, and therefore endogenous to local political contexts. Therefore, evidence on this specific causal relationship has been elusive. We adopt a new empirical approach to uncover causal evidence by exploiting exogenous variation in international commodity prices and geospatial data on pre-existing mineral deposits. We examine the specific case of Brazil, which has an active mining industry but only recently has experienced a nascent anti-mining movement. Our results support a causal relationship between mining and protest—a causal effect that has been long assumed but never properly identified in the literature. We also find that this relationship is strongly moderated by local mobilization capacity. Contrary to other studies, we find little evidence that local political opportunity structures influence the emergence of protests.

Keywords: protests; contentious politics; social conflict; natural resources; Brazil; resource mobilization.

Word Count: 9,500

Note on supplementary materials: The authors will provide the original dataset and a replication file to reproduce all statistical analyses, tables, and figures in the paper and appendix.

1 Introduction

Commodity price booms have fueled economic growth across the world, but the rents from natural resource extraction often come with high social and environmental costs for local communities. Studies show that although mining activity brings economic wealth, it is also associated with land degradation, water pollution, and social conflict (Bebbington and Williams, 2008; Bebbington and Bury, 2009; Loayza, Mier y Teran, and Rigolini, 2013; von der Goltz and Barnwal, 2014). As a result, natural resource extraction is a possible motivating factor spurring resistance from local communities and civil society organizations.

Consider the recent disaster in the Mariana iron mine in the state of Minas Gerais, Brazil. In early November 2015, the mine's tailings dam broke open and sent a sea of mud flooding into nearby communities, washing away houses, cars, and animals, and leaving several dead and hundreds homeless.[1] Two weeks later when the mud flow reached the sea, many labeled the accident as the worst ecological disaster in Brazil (Garcia et al., 2016). The disaster also precipitated a series of protests from indigenous communities who blocked important railway lines leading to the mine. Although the Mariana disaster is just one highly salient event, popular protest has also increased across Brazil following the explosive growth of mining in recent years.

Can booms in extractive industries cause the emergence of new cycles of social protest? Existing studies on the relationship between resource extraction and social protest, while drawing on a rich theoretical tradition in the social movements literature (McCarthy and Zald, 1977; McAdam, 1999), have confronted two empirical limitations. First, most studies examine correlations between mining and protest, thereby failing to account for endogeneity between the decisions of firms to extract resources and the decisions of social groups to mobilize protests (e.g., McAdam and Boudet, 2012; Haslam and Tanimoune, 2016). This, in spite of the repeated cautions of scholars on the endogeneity of grievance-framing and social movement strategies (McAdam, Tarrow, and Tilly, 2001) and the strategic nature of conflict settings (Fearon, 1995). Because of such endogeneity, a correlation between mining activity and protests does not say much about whether mining, on

[1] "Brazils mining tragedy: was it a preventable disaster?" *Guardian*, http://www.theguardian.com/sustainable-business/2015/nov/25/brazils-mining-tragedy-dam-preventable-disaster-samarco-vale-bhp-billiton.

average, triggers protests. Simple correlations could either overestimate the impact of mining on protest by excluding cases in which firms strategically avoid conflict-prone areas. Alternatively, they can underestimate effects if mining operators invest extra resources to reduce mining in such areas. Bias can also affect estimates if new anti-mining protests are merely the result of pre-existing distributional conflicts which become redirected at new or highly salient targets such as profitable mines.

The second problem involves utilizing the wrong level of analysis. Due to data limitations, authors are forced to aggregate data to a national or regional-level (Arellano-Yanguas, 2011; Arce, 2014). This is unfortunate, given that resource conflicts, and in particular mining conflicts, deal with very localized costs and benefits that most strongly impact communities in and around mining projects (Haslam and Tanimoune, 2016). Therefore, aggregating to the wrong level of analysis can create an additional source of bias in measurements and suffer from the modifiable areal unit problem inherent in spatially coded data (Arbia, 2006).

This study offers a simple empirical strategy to address both of these problems and uncover causal evidence of the relationship between resource extraction and social conflict. We borrow from other areas of conflict literature that use exogenous variation from economic shocks to study the outbreak of violence (e.g., Hidalgo et al., 2010; Dube and Vargas, 2013). Specifically, we exploit plausibly exogenous variation in global commodity prices and spatial data on pre-existing mineral deposits in Brazilian municipalities to explore the relationship between mining and protests. The major benefit of this approach is that while mining activity is clearly endogenous to local potential for social conflict, global commodity prices are not directly affected by any individual protests in Brazil. In contrast, the presence of mineral deposits is determined by geological factors and thus does not vary with global commodity prices; in addition global commodity prices are independent of a locality's predisposition for social conflict. Therefore, examining the differential sensitivity of protest activity in municipalities with greater mineral deposits offers a useful empirical solution to the difficult problem of identifying the causal effects of mining activity on protests. We also employ municipal-level data on social protests from 2000-2013 and geospatial data on exact locations of mining deposits to focus on the correct unit of analysis—local conflict—thereby reducing concerns with MAUP and ecological fallacy problems.

We find evidence suggesting that increases in current and potential mining activity cause social protest events. When commodity prices increase, protests on mining activity and more generally on environmental destruction increase in municipalities with mineral deposits, but not elsewhere. A placebo test shows that protests unrelated to mining and environmental problems are not sensitive to commodity price variation in municipalities with mineral deposits. Taken together, these findings demonstrate a plausible causal relationship between mining activities and social protests—a causal effect that has been long assumed but never properly identified in the literature.

Finally, we run additional tests to explore two additional hypotheses common in the social movements literature: the role of "resource mobilization" capacity of pre-existing civil society organizations (McCarthy and Zald, 1977), and "political opportunity structures" conducive to protests (McAdam, 1999). We find strong evidence that the presence of non-governmental organizations is a necessary pre-condition for social protests. This result is intriguing in the Brazilian context, in which protests against mining have historically been relatively uncommon, and therefore indicates that existing resources for social mobilization can be repurposed or redirected toward emerging issues. We also find that local political opportunity structures, specifically political alignment between the mayor and the president and political competition, do not affect the emergence of protests, which contradicts some findings in earlier studies (Arce and Mangonnet, 2013; Arce, 2014). These result suggests that local political contexts may not be crucial for social movements mobilizing around mining firms.

2 Natural resource extraction and social conflict

The classic approach to analyzing the emergence of both protests and conflict begins with the sources of motivation, originally understood as a commonly held grievance that provokes collective action (Gurr, 1970; Gamson, 1975) or distributional concerns for benefit sharing (Collier and Hoeffler, 2004; Arce, 2014). Negative externalities related to mining often center on environmental impacts, such as water pollution from acid mine drainage (Hilson, 2002; Bebbington and Williams, 2008), negative social effects on traditional livelihoods and social relations (Bebbington and Bury, 2009), or health outcomes (von der Goltz and Barnwal, 2014). The economic consequences of mining can also be another motivation for mobilization. Although mining may increase household incomes and the prices of nontradables in nearby areas (Aragón and Rud, 2013), it also may be accompanied by rising income inequality (Loayza, Mier y Teran, and Rigolini, 2013), or local corruption (Knutsen et al., 2017). Mining can also bring in outside resources and revenue, such as increased municipal budgets flushed with royalties, that motivate social actors to seek redistribution (Arce, 2014).

Nonetheless, the contentious politics literature has long recognized that a simple, mechanical relationship between grievances and protest activity is incomplete (e.g., McAdam, Tarrow, and Tilly, 2001). The most notable critique is that while grievances seem prolific, they only translate into mobilization and political activity under certain circumstances, and therefore lack explanatory power (e.g., Fearon and Laitin, 2003; Collier and Hoeffler, 2004). Framing, strategies of contention, and organizing structures developed through strategic choices of social movement actors and past histories of mobilization are all influential in defining justified grievances and motivating individuals to act upon them. Conceptual frames in particular are essential for the "attribution of new threats and opportunities by one or more parties to an emerging conflict and the reimagining of the legitimate purposes attached to established social sites and/or identities" (McAdam, Tarrow, and Tilly, 2001: 48).

Theoretical arguments on more complete explanations of contentious political cycles notwithstanding, the specific relationship between grievances and protests is essentially a classic endogeneity problem. Social problems require framing to become actionable grievances, but framing choices are influenced by other political conditions. A particular mine may not exacerbate or otherwise contribute to social or environmental problems, but the presence of a mine could be a valuable target around which mobilization related to prior inequalities or injustices can be more successfully expressed and articulated. Conversely, a mine may cause much social disruption, but for these disruptions to generate grievances, the mine must be understood as a justifiable target of social claims. In both cases the causal link between resource extraction and protests will not be observable through simple correlations alone.

Added to the above complications are the strategic decisions of firms and social movement actors (see e.g., Fearon, 1995). Selection effects could result from the strategic choices of resource extraction firms to target only areas with low potential for social mobilization or pay off social actors to offset the potential for conflict. Similarly, social movement actors and NGOs could strategically target mining firms that are vulnerable to public pressure for new protest campaigns. In both cases, selection bias resulting from strategic decisions of actors would muddle estimates of the average potential of resource extraction to generate social conflict.

Prior studies on resource extraction and protest, while aware of these limitations, have thus far been unable to completely mitigate these concerns. The majority of these studies have principally examined contentious protests with qualitative methods (Trebeck, 2007; Bebbington and Williams, 2008; Bebbington and Bury, 2009; Orta-Martínez and Finer, 2010; Arellano-Yanguas, 2011), an approach which, while providing a rich portrait of cases, limits the ability of researchers to measure the relative impact of competing causal mechanisms. Several studies also employ quantitative analysis (Inclan, 2009; Trejo, 2009; Barros, Faria, and Araujo, 2014) to examine these effects in diverse settings. McAdam and Boudet (2012) combine quantitative and qualitative methods to examine protests against potentially divisive energy projects in US communities. In Latin America, Arce (2010) finds that weak political institutions are associated with protest activity by creating space for contentious protests. In another study (Arce, 2014), he finds that waves of democratization in Peru have been accompanied by protests against mining when political liberalization and party fragmentation favors political action. A more recent study of mining and social conflict in Latin America by Haslam and Tanimoune (2016) shows that distance to mines and certain firm characteristics correlate with social conflict.

Although providing more empirical data on the relationship between mining an protest, these newer studies use designs that cannot account for the endogeneity of mining activity to local political conditions, nor do they employ strategies (beyond covariate adjustment) to eliminate unobserved confounders that can bias estimates. We join an emerging body of conflict literature that exploits exogenous variation in economic activity to estimate causal effects on the emergence of conflict. These studies employ shocks or fluctuations in international commodity prices (e.g., Hidalgo et al., 2010; Dube and Vargas, 2013; Christensen, 2015) to identify the causal effect of exogenous changes in returns to labor, which in turn inform the costs and benefits of participation in violent conflict.[2] These approaches explain the emergence of violent politics as a function of the cost of labor/participation, based on the assumption that participation in violent forms of politics, such as armed rebellion or land occupations, prevents participating in labor markets. However, we argue that their empirical strategy is also a valid for studying participation in sporadic protests, which are generally short-term activities that need not exclude protestors from continuing to participate in labor markets. This is because economic shocks can provide exogenous variation in mining activity itself, thereby providing leverage for casual identification.

This leads to a straightforward prediction for our analysis. We utilize exogenous shocks in international commodity prices as a source of exogenous variation in mining activity. When international commodity prices are high, areas with mineral deposits become attractive prospects for mining. This will include areas with ongoing exploitation in addition to new areas undergoing exploration and development for future mining activities. However, commodity prices should not produce such an effect in areas without known mining deposits. Thus, if there is a positive effect of resource extraction on social conflict, when global commodity prices for minerals increase, protests in municipalities with mineral deposits should increase relative to municipalities without deposits.

Hypothesis 1. *When global commodity prices for minerals increase, protests in municipalities with mineral deposits increase, but not in municipalities without mineral deposits.*

3 Mining in Brazil

Brazil is an interesting case to study a new cycle of protest and contentious politics emerging from the growth of the natural resources extraction industry and the internal commodity boom in the early 2000's. Both historically and presently, Brazil has been a major player in global mineral production in a wide range of minerals (USGS, 2012: 4.2). Nonetheless, the country has experienced a significant growth in the mineral production sector, which according to the National Department of Mineral Production (DNPM), has grown from contributing to less than 1.0% of Brazil's GDP in the late 1990's to 4.0% in 2015 (DNPM, 2015). In this sense, Brazil is similar to

[2] For example, in the case of civil war, Dube and Vargas (2013) use variation in the prices of two export commodities, coffee and oil, and find that (i) high coffee prices reduce violence because they increase the opportunity cost for potential recruits, but (ii) high oil prices increase violence by increasing gains from winning the conflict.

other countries in Latin America (Bebbington et al., 2008; Arce, 2014) and other regions (Arce and Miller, 2016; Christensen, 2015) that have experienced a boom of mineral production in response to rising international prices. Despite the history of mining and of rural mobilization in Brazil, protests arising specifically around mining issues are a relatively recent phenomenon, offering an ideal opportunity for studying the emergence of social conflict and the factors that determine when and where new protest will appear.

The relative openness of Brazil's mining sector and the system for assigning mineral rights also facilitates our research design, which relies on the sensitivity of the Brazilian mining industry to international market conditions. Like many Latin American countries, subsurface mineral rights are by default property of the state (Federal Constitution, Art 20(IX)). Mineral exploration and exploitation rights are distributed on a first-come-first-served basis through the DNPM, a federal agency under the Ministry of Mines and Energy. Maintenance fees for both exploration and production rights also serve to reduce speculation in mining rights and maintain open access to new producers (Vilhena Filho, 1997). There are no tax incentives for mining firms under current Brazilian legislation. However, the federal and state governments have been active in promoting investment in the sector, particularly through foreign direct investment (FDI), which has been possible through Brazilian subsidiaries since 1995 (Fleche, 2015). The relative openness of the mining market in Brazil has resulted in a large diversity of players, with over 43,600 distinct entities holding mining titles.[3] The diversity of operators, easy access to mining rights, and high levels of participation of FDI, all suggest that the production of minerals in Brazil will follow international market conditions, and that no single operation will affect national or international production levels.

Although royalties and taxes on resource extraction activities are set by national and state legislation, there are often many opportunities for mining promotors and local communities to engage in negotiation over the distribution of rents and risks of externalities for individual mining operations. Royalties are relatively low, and are fixed at rates of 1-3% depending on the type of mineral. Collection of royalties is managed through the federal government and the majority of these proceeds are then transferred directly to the affected municipality (CFEM, 2006). There is no

[3] While some companies have a larger market share, for example the Brazilian mining giant Vale, the top 5 mining operators still only hold 18.8% of the total mining titles.

mandate in current legislation for mining operators to contribute to local public goods production, such as development projects. However, the environmental licensing and impact assessment process, both managed by federal agencies, can stipulate measures for minimizing environmental and social risks to local populations. In addition, efforts by mining operators to reduce local opposition and promote "corporate social responsibility," have frequently allowed local actors to demand services in similar contexts (Luning, 2012). Therefore, in practice, civil society groups often have access to a number of strategies to affect the distribution of mineral rents and risks of externalities.

4 Research design

Mining activity and protests are likely endogenous, as the strategic choices of mining companies and protest leaders are made in anticipation of the response of other actors. Rather than estimating the effect of mining activity on protest directly, which could lead to either over or underestimating effects, we exploit exogenous variation in international commodity prices to improve causal identification. Localized protests in Brazil likely have no effect on internationally set commodity prices. Similarly, we assume that international prices should only affect mining protests through their impact on mining production or exploration activities, a strategy that has proved successful in studies on other types of conflicts (Dube and Vargas, 2013). In essence, our model compares the marginal effect of prices on levels of protest across Brazilian municipalities with and without mineral deposits. As global commodity prices only vary over time (they are the same for all of Brazil), our model only needs to account for variation over municipalities, which reduces the number of assumptions needed for causal identification. This approach has the additional benefit of linking protests to both potential and realized mining activity and therefore can capture the impact of proposed or future expansions in mining on preemptive social conflict.

Our dataset consists of 5,565 Brazilian municipalities, with boundaries defined as in the 2000 Brazilian census. The protest dataset, in turn, covers the years 2000-2013. With 14 observations per municipality, we have a balanced panel with a total of 77,910 observations. Our focus on micro-level data from Brazil's municipalities is a major strength of our research design, as it allows us to analyze a large sample of municipalities together with geo-coded data on mineral deposits and local protests, thereby reducing concerns with MAUP or ecological fallacy problems.

Because we include several controls for fixed effects in our models, our preferred specification is a linear regression based on ordinary least squares. The variable *Deposits* is a count of mineral deposits within 10 kilometers of the municipality and the variable *Index* is a global commodity price index. Using these definitions, the following equation represents our primary specification:

$$Y_{i,t} = \alpha_i + \beta_1 \text{Deposits}_i \times \text{Index}_t + \sum_k \gamma_k x_i^k \times \text{Index}_t + \mu_t + \epsilon_{i,t}, \tag{1}$$

where i indexes municipalities and t years. Variables x^k are time-invariant control variables which we interact with the index variable. Note also that α_i is the municipality fixed effect, μ_t the year fixed effect, and $\epsilon_{i,t}$ the error term. In some models, we also replace the year fixed effects with a product term of *Index* and state fixed effects. Throughout, we cluster standard errors by municipality.[4] Finally, note that the constituent terms for *Deposits* and *Index* are excluded from the estimation because of the inclusion of municipality and year fixed effects. Only the product term exhibits variation after cross-sectional and temporal variation have been captured by the fixed effects, which control for the direct effects of deposits across municipalities and commodity prices across years.[5] In addition to the main model presented here, we conduct a battery of robustness checks using alternative models that we include in the appendix and throughout our discussion.

4.1 Dependent variable

Our primary dependent variable is a count of public protests by rural communities and civil society organizations related to mining (and in some models, environmental issues more broadly) within a municipality in a given year. We draw the data from DATALUTA's (2014) coding of the annual reports on rural conflicts of the Pastoral Land Commission (*Comissão Pastoral da Terra* or CPT), an organization affiliated with the Catholic Church in Brazil and which has been documenting rural conflicts in Brazil's countryside for over 30 years.

The CPT gathers protest data from two primary sources. First, CPT agents in regional

[4] As a robustness check we also follow Conley (1999) and estimate standard errors using yearly and municipal fixed effects and assuming serial correlation over time and spatial correlation between nearby municipalities. Our results remain very robust to these alternate estimation techniques and are included in our appendix (Table A14).

[5] A possible disadvantage of this approach is that municipalities without any protests are subsumed by the municipal fixed effects. In the appendix (Table A8), we estimate fully specified models without municipality fixed effects and including the constituent terms of *Deposits* and *Index*; the results remain robust.

offices receive first-hand accounts of protests or conflicts either directly from affected parties or through its affiliates. Second, the CPT uses secondary sources of information including media reports or official government documentation to corroborate evidence. The CPT's database only includes conflicts which involve rural communities or workers or which are related to disputes regarding the use, occupation, or possession of rural land (CPT, 2015: 12-13), including those related to mining and resource extraction.

Unfortunately, there is no specific coding for mining-related protests. Therefore, we conduct a separate coding through a key-word search for all protests which specifically mention mining activity. This coding yields 102 protests in our final dataset. Given the low number of protests that can be unambiguously identified as mining-related, we also analyze a second, broader category of protests as a robustness check. This second coding includes additional protests related to environmental concerns—the primary grievance expressed during mining protests in the dataset (see Appendix Table A15)—while excluding protests obviously connected with non-mining activity (e.g. large dams, forestry, industrial agriculture, etc.). This broader coding produces 436 mining-related protests, but does not alter results.

The low number of rare events reflects the strict requirements of the coding, and fact that the CPT data was not originally gathered to find mining-related protests. The rate of false negatives (protests against mining *not* recognized by our coding) is thus probably high. In evaluating our results, it is therefore important to keep in mind the possibility of downward bias in the coefficient: because some anti-mining protests are not captured by the outcome variable, it is possible that we understate the effects of the explanatory variables. Another possible source of downward bias is non-local protesting against mining, perhaps in state capitals of Brazil; we guard against this possibility by including both municipality and state-year fixed effects in our models.

The geographic distribution of the dependent variable is illustrated in Figure 1. As the figure shows, there is a clear difference between the number of narrowly and broadly defined protests. However, both can be found across a wide geographic area of Brazil, including the less densely populated municipalities in the Amazon region.

[Figure 1 about here.]

The distribution of our dependent variable is also skewed (see Appendix Section A1.4). To deal with any resulting bias in the estimation, we also re-estimate our models using a logarithmized count of protests and a dichotomous indicator for *any* (that is, non-zero) protests or demonstrations as the dependent variable. To foreshadow, the results are fully robust to these changes (see Tables A6 and A7).

4.2 Explanatory variables

Our first explanatory variable is a count variable for the number of known, and potentially exploitable mineral deposits that affect a given municipality. These deposits include a large list of metals, rare elements, and other materials that are mined within Brazil both for internal consumption and export to international markets. We obtained geospatial point data for these deposits from the Geological Service of Brazil (CPRM),[6] which has information on over 29,000 known mineral deposits. We then constructed our variable by creating a 10km-radius buffer around each deposit point and then counting the number of deposits that are within or border a given municipality. We chose to include deposits outside, but closely bordering, municipal boundaries because mining activities often generate negative externalities nearby borders.[7]

We use these points as time-invariant indicators for the presence of mineral and metal resources in Brazil's territory, and not as a proxy for active exploration or exploitation of subsoil resources. As mentioned above, mining operations are potentially endogenous to protests and other forms of social conflict, and therefore these activities cannot be used as an exogenous independent variable without introducing bias into estimates.

However, as we assume deposits are invariant over the years in our dataset, they thus respond neither to protests nor to international commodity prices.[8] Therefore, this variable should

[6]See GEOBANK visualizer at `http://geowebapp.cprm.gov.br/ViewerWEB/`.

[7]As Figure 2 below shows, the 10km radius is a conservative choice that avoids false positives in the detection of mineral deposits. If anything, our estimates would thus exhibit downward bias because some affected municipalities would be coded as being without deposits. Note that the same deposit can appear in multiple municipalities when the 10-kilometer buffers overlap.

[8]Importantly, though, mining deposits are highly correlated with the issuance of mining titles (a necessary precondition for any mining activity). We test this first order relationship by rerunning our main models with a measure of new mining titles granted per year in each municipality as the dependent variable. Results show that commodity prices have a strong and very statistically robust relationship with new mining titles in municipalities with mining deposits, and are included in the appendix Table A3.

be understood as a measure of the known *mining potential* of a given municipality. The CPRM information from which we create our dataset was largely developed by geological surveys undertaken since the late 1960's and easily accessible in an online format since 2003 (DNPM, 2006). It is therefore reasonable to assume that, for the period of our dataset (2000-2013), all deposits were previously known and the information we use does not depend on the commercial activities of mining companies during the study period. Any earlier activities, in turn, will not bias our estimates.

Figure 2 shows the geographic distribution of deposits (for other maps, see Section A1.3). Mining deposits are located in or near a large number of Brazilian municipalities (3,622), with a high concentration in the Southern and Northeastern highlands, the Amazon region, and the state of Goiás. The distribution and limitations of our mining deposit data posses two potential problems. First, the highly skewed distribution of municipalities with a very high number of mineral deposits could reduce reliability of our results. In addition, we do not have data on the relative size and extraction activity associated with each deposit, and therefore cannot adequately distinguish potentially exploitable deposits from unprofitable ones. To account for these sources of error, we also include two additional sets of models that use a logarithmized count of deposits and a dummy variable for any deposit within 10km of a municipality.[9]

[Figure 2 about here.]

Our second source of exogenous variation is a global commodity price index for metal and mineral commodities. We use commodity prices from the World Bank's Global Economy Monitor (GEM)[10] to measure the availability of additional rents to distribute and external influences on mining activity. When commodity prices are high, mining activity increases in a country such as Brazil and the profits from doing so are larger. In Figure 3, shows that there is considerable variation in the GEM commodity price index and the prices of several key metals over time. A comparison of variation in commodity prices and annual mineral production in Brazil between 2000-

[9] In addition to these transformed measures of deposits, we also test alternative models using Poisson, Negative Binomial, and Zero-Inflated Negative Binomial distributions and give results in Table A10. We find that all main effects are robust to these alternative models and maintain statistical significance and a positive direction.

[10] See `http://data.worldbank.org/data-catalog/global-economic-monitor` (accessed November 30, 2015).

2013 also reveals a strong positive correlation.[11] The boom years of the 2000s, led by increased demand from China, resulted in increased commodity prices, until the onset of the financial crisis in 2008 brought prices back down. Note also that the commodity price boom does not coincide with the political left's rise into power: President Lula was inaugurated on January 1, 2003, at a time when commodity prices remained flat, and remained in office through the commodity price collapse after the financial crisis. For ease of analysis, we divide the value of the index by 1,000 to make the coefficients legible.

[Figure 3 about here.]

We use a general commodity index instead of specific mineral prices for two reasons. First, we cannot weigh the price index by the specific mineral deposits in each municipality, as an equivalent weight cannot be created for non-deposit municipalities. For credible inferences, all deposit and non-deposit municipalities must have the exact same index. Otherwise the statistical comparisons would not have a meaningful interpretation, as the counterfactuals for any given municipality would be wrongly specified. Second, using a general commodity index reduces concerns about endogeneity. While it is unlikely that localized protests against any particular mine could influence the prices of a specific mineral internationally, it is even more unlikely that such a protest would shape commodity prices globally. Thus, our focus on a general commodity index strengthens our claim against simultaneity bias.

Temporal variation in protests across municipalities with and without mining deposits is illustrated in Figures 4. As the figures show, there is a much stronger association between protests and commodity prices in municipalities with mineral deposits than in municipalities without. Another notable feature of the temporal variation is how strongly the pattern in municipalities with mineral deposits resembles the pattern of the commodity price index, as our theory would imply.

[Figure 4 about here.]

[11] Using data from Minerals UK `http://www.bgs.ac.uk/mineralsUK/statistics/worldStatistics.html`, the pairwise over-time correlations are +0.87, +0.41, +0.82, and +0.17 for the major Brazilian minerals iron, gold, copper, and manganese ore.

4.3 Empirical strategy

Our identification of the interactive effects of global commodity prices and mining deposits is based on two primary assumptions. First, we assume that mining protests in Brazil do not affect the values of the global commodity index. This assumption appears valid, as commodity prices during the period of investigation were largely driven by variation in demand, in turn depending on the global economic outlook.[12] Moreover, we use an index for *all* commodity prices, as opposed to only those in which Brazil is a producer.[13]

The second assumption is that the distribution of mineral deposits is unrelated to incidence of protest *except* through mining activity. This, again, appears plausible because mineral deposits are immutable geological features that do not depend on other characteristics of a municipality.[14] By focusing on deposits instead of mining activity, we can rule out bias from endogenous strategic behavior by mining companies.

Because global commodity prices could be correlated with other external changes, we include either year or state-year fixed effects in all models. These fixed effects allow us to account not only for any other secular trends over time, but also to consider differential trends between Brazilian states. Thus, to bias our estimates, any external changes correlated with commodity prices would have to produce differential effects on protest activity across municipalities with and without deposits within Brazilian states.

Another possible concern is the possibility that municipalities with mineral deposits are sys-

[12]The impact of global commodity prices on mining activity in Brazil is not affected by variation in the value of the Brazilian Real, because factor inputs for mining are largely imported from international markets, and most mining activities are conducted by multinational corporations traded on international markets, such as the Brazilian mining giant Vale S.A. (traded on the NYSE). The yearly averages for the USD-BRL exchange rate also largely track the variation in global commodity prices, with a correlation of -0.709 for the years in our dataset.

[13]We also find strong evidence that the international commodity price index is a good predictor of mining activity. We test this first order relationship by rerunning our main models with a count variable measuring the number of new mining titles granted per year in each municipality as the dependent variable. Mining titles, while not a direct measure of mining activity, do provide evidence of both expansion of existing mines and exploration to develop new mines, and therefore should be highly correlated with commodity prices in areas with a high number of mining deposits. Results show that commodity prices have a strong and very statistically robust relationship with new mining titles in municipalities with mining deposits, and are included in the appendix Table A3.

[14]One possible critique of this assumption would be if information regarding the location of deposits was not exogenous to our model, for example, if new deposits where recently discovered or if information regarding deposits was not public knowledge. While we do not have specific dates of discovery for each deposit, the information from the CPRM databank includes only well-established locations of deposits and are publicly available and easily accessible through a government web site.

tematically different from other municipalities along other dimensions that also could be related to protests. To account for this possibility, we interact four key control variables with global commodity prices. First, we control for GDP per capita in 2000, as low levels of economic development are likely related to a host of economic and political grievances that can spark protests. Second, Brazilian municipalities vary greatly in size, and the CPT database of protest events specifically targets rural conflicts. We therefore control for municipal area and rural population under the 2000 census.[15] Fourth, we include an indicator for coastal municipalities, as these may be more vulnerable to fluctuations in international prices as they are more likely to be connected to global markets through ports.

Summary statistics are included in the appendix Tables A1 and A2. Municipalities with deposits have slightly higher average number of protests than either the entire sample of municipality-year observations or the subset of municipalities without deposits. Also, the prevalence of all types of protests increases over the 14 years of our analysis. For the main control variables in our analysis, there is some degree of imbalance between municipalities with mineral deposits, which tend to be larger, more rural, and have lower GDP per capita.

5 Results: Linking mining activity and protests

Results linking mining activity and protests are reported in Table I. Models 1-3 do not include control variables, while the remaining models interact the commodity price index with four time-invariant municipality characteristics. Models 1 and 4 use counts of mineral deposits; models 2 and 5 use an indicator for the presence of any deposits; and models 3 and 6 use the logarithmized values of the index and the count of deposits. As the estimates show, the interaction term for the index and deposits is always positive and, in 5 out of 6 models, statistically significant. The substantive effects are best illustrated with model 6, which includes a full set of control variables. In a municipality with 17 deposits (sample mean), increasing the value of the global commodity index from the minimum to the maximum generates an increase of approximately 0.2 percentage points in the probability of a mining related protest relative to a municipality with no deposits at

[15] In Section A4 of the appendix, we also include models that control for municipal population and/or population density, with no changes in results.

all, that is, *twice* the sample mean of 0.1 percentage points. The control variables, in turn, show that protests increase with commodity prices in urban municipalities with large areas.

[Table 1 about here.]

Next, we consider a broader definition of mining protests that also includes environmental protests, but eliminates those that are unrelated to mining. Table II shows result with this alternate specification of the DV. All other aspects of these models are identical to those in Table I. As the results show, the coefficient of the interaction term is again always positive and, in 4 out of 6 models, statistically significant. When we again illustrate substantive effects with model 6, we see that commodity prices now increase the probability of protests by about 0.4 percentage points, against a sample mean of 0.6 percentage points. Control variables generate similar estimates as when the outcome variable is narrowly defined, except that now coastal municipalities also react more strongly to commodity price increases than municipalities in the interior.

[Table 2 about here.]

These results show strong support for a causal relationship that has largely been assumed by the literature—that mining and resource extraction activity can exacerbate social conflict and lead to the onset of new protest activity. Global commodity prices predict the emergence of anti-mining protests only in municipalities with mineral deposits, and in this set of municipalities the substantive effects are relatively large.

6 Exploring the political contexts of protest events

Having established strong evidence of a statistically significant impact of mining activity on social protest, we now begin testing refined hypotheses about the conditions under which protest activity is most likely to occur. First, authors have identified "resource mobilization" as an important factor in social protest outbreak, emphasizing the role of pre-existing organizations capable of turning collective demands into organized action (McCarthy and Zald, 1977; Walsh, 1981). Second, many scholars have pointed to "political opportunity structures"—political openings that enable protesters to achieve their goals—as further explanation for movement activity (Tilly, 1978;

Kitschelt, 1986; Tarrow, 1998). While these theories do not question the importance of motivation, they propose that the mapping from motivation to organized protests depends on favorable structural conditions and the cost or availability of different mobilizing strategies. We evaluate each of these factors in turn.

6.1 Resource mobilization

The theory on mobilization capacity generates a simple prediction: where organizational capacity for protest exists, local actors are more likely to successfully convene members to protest (McCarthy and Zald, 1977; McAdam, 1999). The most common form of mobilization capacity highlighted in the literature are civil society organizations (Tarrow, 1998; Trejo, 2009). Mobilizing supporters to take to the streets is often a costly process that involves connecting potential supporters, convincing them to engage in risky behavior, and drawing upon sources of funding and prior experience of successful mobilization strategies. Pre-existing grassroots organizations or NGOs can facilitate all these activities, thereby increasing the probability of successfully organizing a protest. In the absence of resource mobilization capacity, social movements are unlikely to be able to challenge mining companies to address grievances or to demand a larger share of the rents from mining.

To measure mobilization capacity, we use the presence of registered, non-profit, non-governmental organizations (NGO) in the municipality. We draw NGO data from the Brazilian Institute of Geography and Statistic's (IGBE) registry of businesses. The IGBE identifies Non-profit organizations based on five selection criteria and then culls non-voluntary or state related institutions from this list (IBGE, 2012).[16] We then use the log transformation of the raw count of NGOs to avoid bias from outlier municipalities with high presence of civil-society organizations. We use a time-invariant measure that draws NGO presence from 2006 (the earliest in the IBGE registry) and interacts this variable with both the deposit location and the mineral index variables.[17]

[16] The five selection criteria, which are based on the UN Classification of the Purposes of Non-Profit Institutions Serving Households (COPNI), are the following: the entity must be an organized institution, private, non-profit, self-administered, and with voluntary membership. The culled organizations include: political parties, unions, federations, condominium associations, mediation and arbitration entities, municipal and school funds, cemeteries, and funeral houses

[17] NGO presence is rather stable between 2006, 2008, and 2010, the years for which we have data, The within-municipality correlations between years 2006/2008, 2006/2010, and 2008/2010 are 0.999, 0.998, and 0.998, respectively.

Table III examines the role of NGO presence in explaining protest activity. Here, we see a very strong and statistically significant triple interaction (see Table A13 for models without triple interaction). In the presence of NGOs, the combination of mineral deposits and high commodity prices has a particularly strong effect on protest activity. Indeed, across all six models, the coefficient for the commodity price and mineral deposits interaction with zero NGO presence is negative, though mostly statistically insignificant. This is strong and robust evidence for the importance of resource mobilization capacity as a pre-condition for the effects of grievance on social protests.

[Table 3 about here.]

The modifying effect of NGO presence is substantial. Figure 5 below plots the estimated marginal effect size of the Log Index and Log Deposits interaction term on different values for NGO presence.[18] A move from no pre-existing civil society organization to the maximum in the dataset (16,818 NGOs), shifts the coefficient on the Index and Deposits interaction term from -0.0017 to 0.0084, a 602.24 percent increase. A small shift from the minimum to the median value (17 NGOs) also has a quite large (178.9 percent) increase in the main coefficient size. These effect sizes reinforce our conclusion that mobilization resources is one of the main factors moderating the emergence of mining protests.

[Figure 5 about here.]

While our NGO data is the best source of information available for existing organizational resources, it could potentially cause an upward bias on estimates if the CPT is more likely to register protest events in municipalities with greater NGO presence. While we are unable to eliminate this bias, we argue that any impact on our estimates is limited for two reasons. First, the CPT draws information from secondary sources including media and government outlets, which are likely not correlated with NGO presence. Second, the CPT's regional office locations are not highly correlated with mining protests (correlation 0.15), and while mining protests come from 231 distinct municipalities, only 22 of these correspond to areas with CPT presence.

[18] In computing the marginal effect of the product term, we differentiate the estimation equation with respect to both components of the product term. This approach yields a cross derivative that can be graphed.

6.2 Political opportunity structures

The impact of mining activity on the incidence of protests is also likely contingent on the local political context (Tarrow, 1998). In municipalities that have both mineral deposits and political opportunities favorable to social mobilization, protest activity should increase more sharply than in other municipalities. To test this hypothesis, we draw on prior literature on contentious politics in Latin America and propose two measures of political opportunities: (i) partisan alignment between the municipality's mayor and the president; and (ii) the mayor's margin of victory.

First, party alignment between the mayor and the president could affect opportunities to mobilize (Murillo and Ronconi, 2004; Arce and Mangonnet, 2013). Specifically, the Workers' Party (PT) traditionally has had stronger ties with civil society groups and may be able to co-opt and divert popular pressure through official channels where the PT controls the mayorship (Goldfrank, 2011). This prediction would agree with other studies that have found that having a favorable local politician in power may serve to dampen protests (e.g., Inclan, 2009). Therefore, political alignment of the mayor with the PT's national government may serve to lessen incidence of protest.

Second, the degree of political competition in a municipality may also provide an opportunity for successful mobilization (Inclan, 2009; Arce, 2014). Previous studies have found conflicting results on the impact of political competition, sometimes finding that it increases mobilization (Almeida, 2008; Arce, 2014), while in other studies finding that competition dampens protest (Inclan, 2009; Murillo and Ronconi, 2004).

Unlike previous studies (e.g., Inclan, 2009; Arce, 2014), we do not use a measure of political fragmentation based on the number of parties to measure political competition. Instead, we use a mayor's margin of victory in previous elections as a proxy for political competition. We argue that a measure of the margin of victory better reflects the likelihood of future turnover (and provides a strong signal to societal actors) that would open space for making additional demands on local government. Specifically, a strong mayor in a non-competitive district would be less likely to suffer from a change in political power and therefore less vulnerable to pressure from popular protest, whereas a well-timed demonstration might be enough to cajole a weak mayor into making concessions and siding with protesters. Therefore, we expect to see the effect of commodity prices on protest increase in municipalities with mayors elected by a narrow margin of victory.

For political opportunity structures, we borrow data on election results from the Superior Electoral Court of Brazil (TSE). For political alignment, we use a dummy variable that indicates whether the mayor of the municipality for the observation-year is a member of the Workers' Party (PT) at the same time that the PT has the presidency, either during the administration of Luiz Inácio Lula da Silva (2003-2010) or Dilma Roussef (2011-2016). For margin of victory we use a measure from the TSE data that gives the percentage point difference in vote totals between the mayor and the runner-up candidate in the previous election. The total dataset with political variables covers three complete mayoral cycles beginning in 2001.

Table IV shows the estimates using both political variables in model 2 (dummy indicator for mineral deposits). As can be seen, the triple interaction terms between the political opportunity variable, mining deposits, and the international commodities index all produce null results. We include full results for all 6 models in the appendix for reference (Tables A11 and A12). In every case, we fail to find evidence for the modifying roles for political alignment or the mayor's margin of victory. Overall, political opportunity structures, at least on the local level, seem not to be necessary for mining-related grievances to generate protests. These results also indicate that the role of political actors in the emergence of mining protests is more limited than previous studies have estimated.

[Table 4 about here.]

As recommended by Hainmueller, Mummolo, and Xu (2016), we also test whether the interactions between mineral deposits and the presence of mobilization resources and political opportunities are actually reflected in the data, and not an artifact of modeling choice (see appendix Section A6). We check for evidence of linear interaction effects with all interaction variables and for common support of observations at different combinations of the moderator and treatment variables. We find that our data has common support for all triple interaction models and that there is evidence of the linear interaction effect for mobilization resources (NGO presence), that is central in our conclusions.

6.3 Placebo test: Land occupations and all protests

In addition to the robustness checks already mentioned above in Sections 4, we conduct two placebo tests by estimating our models with (1) a count of land occupations by landless peasant movements and (2) non-mining protests recorded by the CPT networks as the dependent variable. First, these tests allow us to reject the possibility that CPT data collection results in over-reporting, which could lead us to overstate the importance of NGO presence based on the resource mobilization hypothesis. Such a bias would cause us to see protests increase regardless of whether they are related to mining; in the absence of this bias, these two dependent variables should not respond to commodity prices in municipalities with deposits. In addition, testing the effect of mining on the entire protest database allows us to reject the possibilities that mining protests are simply a result of other distributional grievances, or that they follow a more generalized trend of growing protests over recent decades.

The results for all protests are reported in the Appendix Table A4 and land occupations are displayed in Table A5. As the tables show, there is no effect for either placebo. Without control variables, the interaction term for all protests consistently has a positive, large, and statistically significant coefficient, but this association disappears as soon as we account for other municipality characteristics. This is reassuring because it shows that commodity prices only predict mining-related protests, as opposed to social conflict more generally.

7 Conclusion

The origins of social conflict have motivated a large body of research in both political science and sociology, but systematic empirical tests of different theoretical mechanisms remain rare and inconclusive. Our contribution to the literature is an empirical approach that exploits exogenous variation in international commodity prices and mineral deposits to test for causal evidence of the relationship between resource extraction and social protest. Variation in commodity prices generates variation in the likelihood of protest activity by increasing mining activity or the potential for new resource extraction through expansion of existing projects or development of new mines on known deposits. These results offer strong support for a relationship that was commonly assumed, but not thoroughly tested in previous literature on social movements and resource extraction.

The consolidation of these grievances into collective protests is conditional on the resource mobilization capacity of pre-existing NGOs, as groups face difficulties in getting protestors into the streets. The strong support for the resource mobilization hypothesis suggests a need to revisit and develop new theories that generate precise, falsifiable hypotheses about the conditions under which existing non-governmental organizations are able to mobilize resistance to natural resource extraction. We have shown that pre-existing NGO presence moderates the effect of grievances on social protest, and a logical next step for this research agenda would be to develop and test hypotheses about municipal and organizational characteristics that predict such mobilization capacity.

At the same time, the null findings for political opportunity structures reveals a need to both sharpen the predictions of this line of theorization and to employ better empirical strategies. Our results throw doubt on the short term impact of local political opportunity structures such as political competition or local government partisanship on the emergence of protests. Previous findings of positive effects for these variables could be the consequence of modeling choice and the failure to account for endogeneity or omitted variable bias.

Nonetheless, political opportunity structures could still have medium to long term effects on the emergence of cycles of protests either directly or through their indirect effects on the availability of mobilization resources. Alternatively, our results could signal that only strong shifts in political opportunities, such as the opening of a political system after the emergence of democracy (Levitsky and Roberts, 2011), are able to influence trends in contentious politics. These would all be further hypotheses that could be explored following a similar empirical approach to ours, and we strongly hope that the study of contentious politics can move toward this direction.

References

Almeida, Paul D. 2008. *Waves of Protest: Popular Struggle in El Salvador, 1925-2005*. Vol. 29 U of Minnesota Press.

Aragón, Fernando M., and Juan Pablo Rud. 2013. "Natural Resources and Local Communities: Evidence from a Peruvian Gold Mine." *American Economic Journal: Economic Policy* 5 (2): 1–25.

Arbia, Giuseppe. 2006. *Spatial Econometrics: Statistical Foundations and Applications to Regional Convergence*. Springer Science & Business Media.

Arce, Moisés. 2010. "Parties and Social Protest in Latin America's Neoliberal Era." *Party Politics* 16 (5): 669–686.

Arce, Moisés. 2014. *Resource Extraction and Protest in Peru*. Pittsburgh: University of Pittsburgh Press.

Arce, Moisés, and Jorge Mangonnet. 2013. "Competitiveness, Partisanship, and Subnational Protest in Argentina." *Comparative Political Studies* 46 (8): 895–919.

Arce, Moisés, and Rebecca E Miller. 2016. "Mineral Wealth and Protest in Sub-Saharan Africa." *African Studies Review* 59 (3): 83–105.

Arellano-Yanguas, Javier. 2011. "Aggravating the Resource Curse: Decentralisation, Mining and Conflict in Peru." *Journal of Development Studies* 47 (4): 617–638.

Barros, Carlos Pestana, João Ricardo Faria, and Ari Francisco Araujo. 2014. "Brazilian Land Tenure Conflicts: A Spatial Analysis." *Journal of International Development* 26 (4): 409–421.

Bebbington, Anthony, Denise Humphreys Bebbington, Jeffrey Bury, Jeannet Lingan, Juan Pablo Muñoz, and Martin Scurrah. 2008. "Mining and Social Movements: Struggles over Livelihood and Rural Territorial Development in the Andes." *World Development* 36 (12): 2888–2905.

Bebbington, Anthony J., and Jeffrey T. Bury. 2009. "Institutional Challenges for Mining and Sustainability in Peru." *Proceedings of the National Academy of Sciences* 106 (41): 17296–17301.

Bebbington, Anthony, and Mark Williams. 2008. "Water and Mining Conflicts in Peru." *Mountain Research and Development* 28 (3): 190–195.

CFEM. 2006. "Manual de Procedimentos de Arrecadação e Cobrança da Compensação Financeira pela Exploração de Recursos Minerais." Aneco à Portaria No 340, de 10/10/2006.

Christensen, Darin. 2015. "Concession Stands: How Foreign Investment Incites Protest in Africa." Working Paper, Stanford University.
URL: *https://dl.dropboxusercontent.com/u/16041354/ConcessionStands_DC.pdf*

Collier, Paul, and Anke Hoeffler. 2004. "Greed and Grievance in Civil War." *Oxford Economic Papers* 56 (4): 563–595.

Conley, Timothy G. 1999. "GMM Estimation with Cross Sectional Dependence." *Journal of Econometrics* 92 (1): 1–45.

CPT. 2015. *Conflitos no Campo Brasil 2014.* Commissão Pastoral da Terra.

DATALUTA. 2014. "Banco de Dados da Luta pela Terra." Available at `http://www.lagea.ig.ufu.br/bancodedadosdatalutaminas.html`; updated February 10, 2014 and accessed January 23, 2016.

DNPM. 2006. Mineral Negócios: Guia do Investidor no Brasil. Technical report Departamento Nacional de Produção Mineral.

DNPM. 2015. Sumário Mineral 2015. Technical report Departamento Nacional de Produção Mineral.

Dube, Oeindrila, and Juan F. Vargas. 2013. "Commodity Price Shocks and Civil Conflict: Evidence from Colombia." *Review of Economic Studies* 80 (4): 1384–1421.

Fearon, James D. 1995. "Rationalist Explanations for War." *International Organization* 49 (3): 379–414.

Fearon, James D, and David D Laitin. 2003. "Ethnicity, Insurgency, and Civil War." *American Political Science Review* 97 (1): 75–90.

Fleche, Erik Richer La, ed. 2015. *The Mining Law Review.* Law Business Research Ltd.

Gamson, William A. 1975. *The Strategy of Social Protest.* Homewood: Dorsey Press.

Garcia, Letícia Couto, Danilo Bandini Ribeiro, Fabio Oliveira Roque, Jose Manuel Ochoa-Quintero, and William F Laurance. 2016. "Brazil's Worst Mining Disaster: Corporations Must be Compelled to Pay the Actual Environmental Costs." *Ecological applications* .

Goldfrank, Benjamin. 2011. "The Left and Participatory Democracy: Brazil, Uruguay, and Venezuela." In *The Resurgence of the Latin American Left*, ed. Kenneth Levitsky, Steven; Roberts. John Hopkins University Press. Baltimore pp. 162–183.

Gurr, Ted Robert. 1970. *Why Men Rebel.* Princeton: Princeton University Press.

Hainmueller, Jens, Jonathan Mummolo, and Yiqing Xu. 2016. "How Much Should We Trust Estimates from Multiplicative Interaction Models? Simple Tools to Improve Empirical Practice." Working Paper, Stanford University.

Haslam, Paul Alexander, and Nasser Ary Tanimoune. 2016. "The Determinants of Social Conflict in the Latin American Mining Sector: New Evidence with Quantitative Data." *World Development* 78: 401–419.

Hidalgo, F. Daniel, Suresh Naidu, Simeon Nichter, and Neal Richardson. 2010. "Economic Determinants of Land Invasions." *Review of Economics and Statistics* 92 (3): 505–523.

Hilson, Gavin. 2002. "An Overview of Land Use Conflicts in Mining Communities." *Land Use Policy* 19 (1): 65–73.

IBGE. 2012. "As Fundações Privadas e Associações Sem Fins Lucrativos no Brasil 2010." IBGE Instituto Brasileiro de Geografia e Estatística.

Inclan, Maria. 2009. "Repressive Threats, Procedural Concessions, and the Zapatista Cycle of Protests, 1994-2003." *Journal of Conflict Resolution* 53 (5): 794–819.

Kitschelt, Herbert P. 1986. "Political Opportunity Structures and Political Protest: Anti-Nuclear Movements in Four Democracies." *British Journal of Political Science* 16 (1): 57–85.

Knutsen, Carl Henrik, Andreas Kotsadam, Eivind Hammersmark Olsen, and Tore Wig. 2017. "Mining and Local Corruption in Africa." *American Journal of Political Science* 61 (2): 320–334.

Levitsky, Steven, and Kenneth M. Roberts. 2011. "Latin America's 'Left Turn': A Framework for Analysis." In *The Resurgence of the Latin American Left*, ed. Steven Levitsky, and Kenneth M Roberts. Baltimore: Johns Hopkins University Press pp. 1–30.

Loayza, Norman, Alfredo Mier y Teran, and Jamele Rigolini. 2013. "Poverty, Inequality, and the Local Natural Resource Curse." World Bank, Policy Research Working Paper 6366. **URL:** *http://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-6366*

Luning, Sabine. 2012. "Corporate Social Responsibility (CSR) for Exploration: Consultants, Companies and Communities in Processes of Engagements." *Resources policy* 37 (2): 205–211.

McAdam, Doug. 1999. *Political Process and the Development of Black Insurgency, 1930-1970.* 2nd ed. Chicago: University of Chicago Press.

McAdam, Doug, and Hilary Boudet. 2012. *Putting Social Movements in Their Place: Explaining Opposition to Energy Projects in the United States, 2000-2005.* New York: Cambridge University Press.

McAdam, Doug, Sidney Tarrow, and Charles Tilly. 2001. *Dynamics of Contention.* Cambridge: Cambridge University Press.

McCarthy, John D., and Mayer N. Zald. 1977. "Resource Mobilization and Social Movements: A Partial Theory." *American Journal of Sociology* 82 (6): 1212–1241.

Murillo, Maria Victoria, and Lucas Ronconi. 2004. "Teachers' Strikes in Argentina: Partisan Alignments and Public-Sector Labor Relations." *Studies in Comparative International Development* 39 (1): 77–98.

Orta-Martínez, Martí, and Matt Finer. 2010. "Oil Frontiers and Indigenous Resistance in the Peruvian Amazon." *Ecological Economics* 70 (2): 207–218.

Tarrow, Sidney. 1998. *Power in Movement: Social Movements and Contentious Politics*. 2nd ed. New York: Cambridge University Press.

Tilly, Charles. 1978. *From Mobilization to Revolution*. New York: McGraw-Hill.

Trebeck, Katherine Anne. 2007. "Tools for the Disempowered? Indigenous Leverage over Mining Companies." *Australian Journal of Political Science* 42 (4): 541–562.

Trejo, Guillermo. 2009. "Religious Competition and Ethnic Mobilization in Latin America: Why the Catholic Church Promotes Indigenous Movements in Mexico." *American Political Science Review* 103 (03): 323–342.

USGS. 2012. "2010 Minerals Yearbook: Brazil." U.S. Geological Survey, U.S. Department of the Interior, Washington DC.

Vilhena Filho, Carlos Augusto. 1997. "Brazil's Mineral Policy." *Resources Policy* 1 (23): 45–50.

von der Goltz, Jan, and Prabhat Barnwal. 2014. "Mines: The Local Wealth and Health Effects of Mining in Developing Countries." Working Paper, Columbia University.
URL: *http://academiccommons.columbia.edu/catalog/ac:171770*

Walsh, Edward J. 1981. "Resource Mobilization and Citizen Protest in Communities around Three Mile Island." *Social Problems* 29 (1): 1–21.

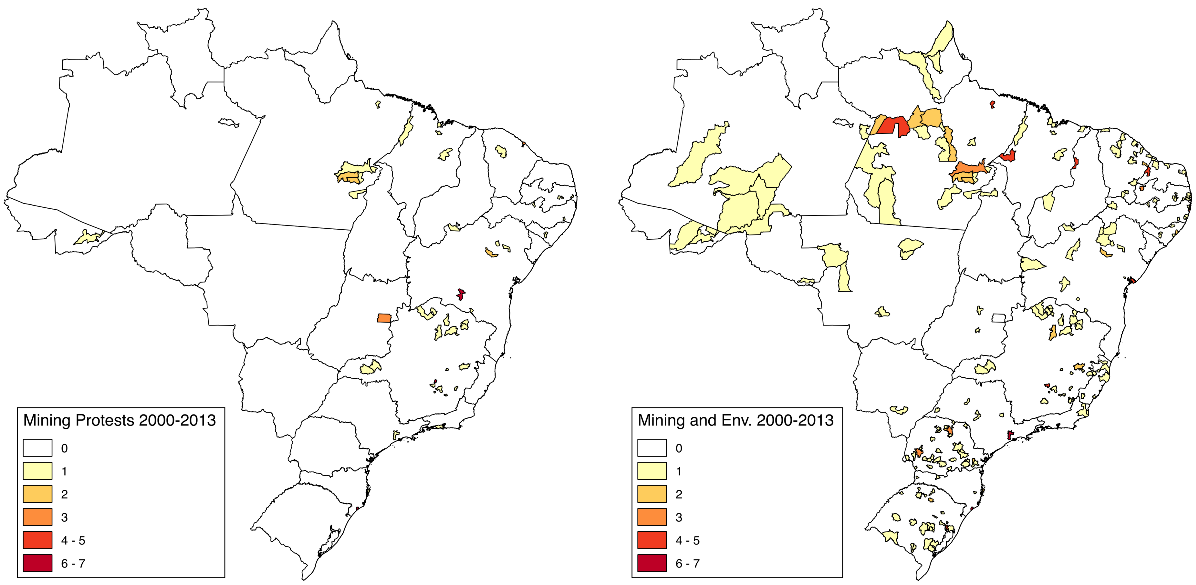

Figure 1: Geographic distribution of mining protests, 2000-2013. **Left**: Mining protests only; **Right**: Mining and environment protests.

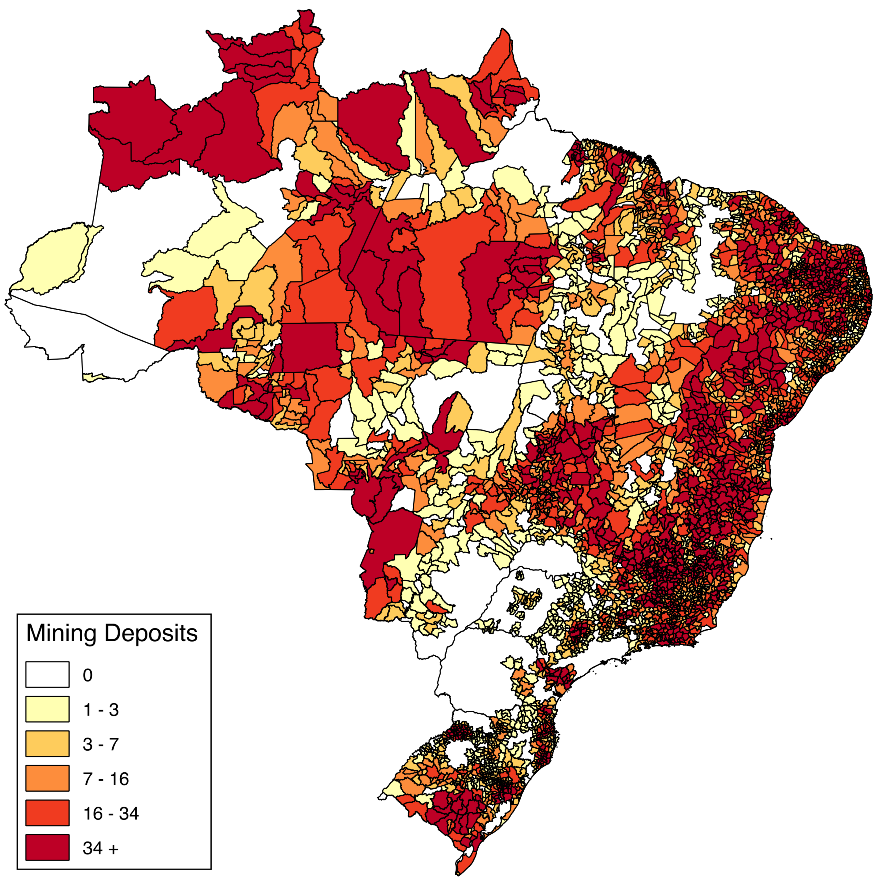

Figure 2: Total mineral deposits located within 10km of municipality.

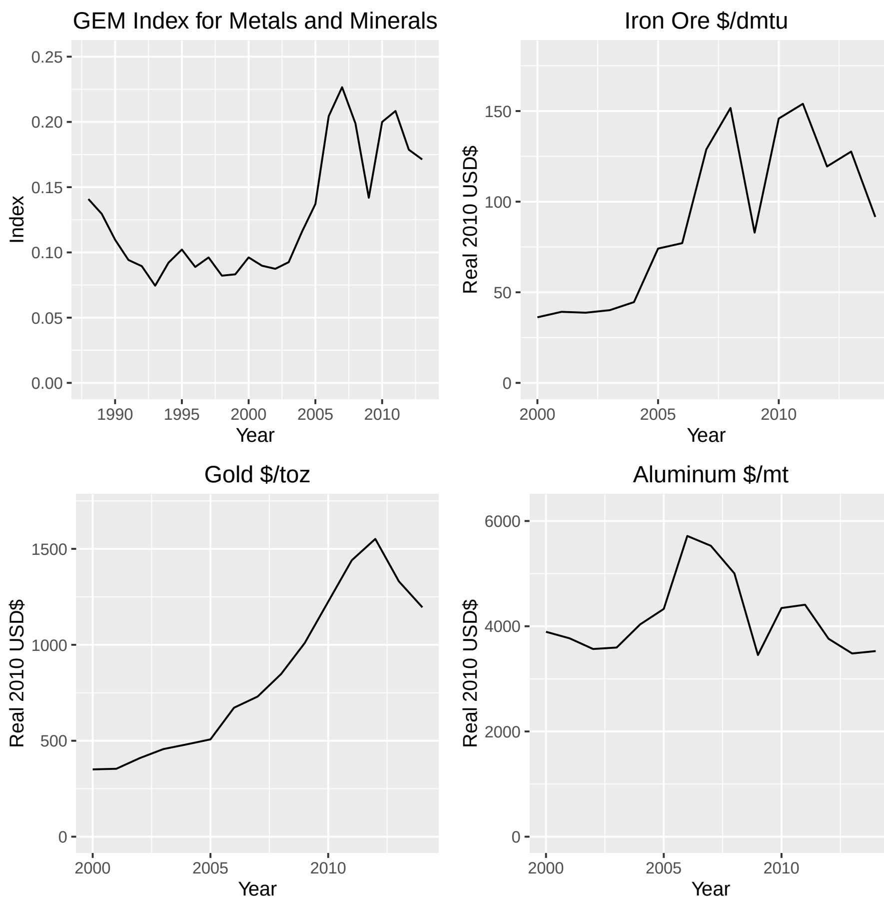

Figure 3: Global commodity prices in real 2010 USD, World Bank Global Economy Monitor (GEM). For the regressions, the value of the commodity index is divided by 1,000 to make the coefficients legible.

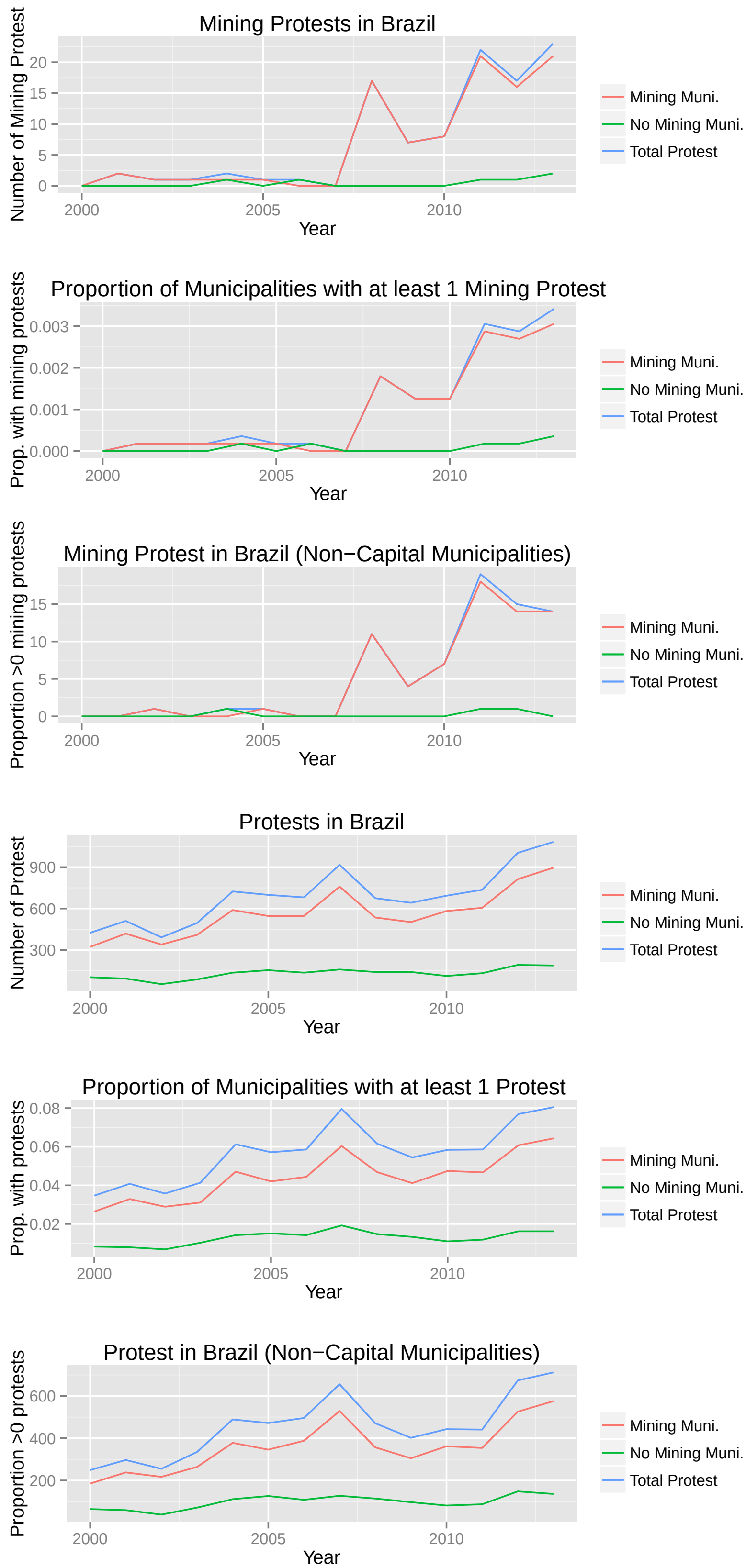

Figure 4: Time series of protests in Brazilian municipalities with and without mineral deposits. **Left**: Mining related protests. **Right**: All protests (mining and non-mining).

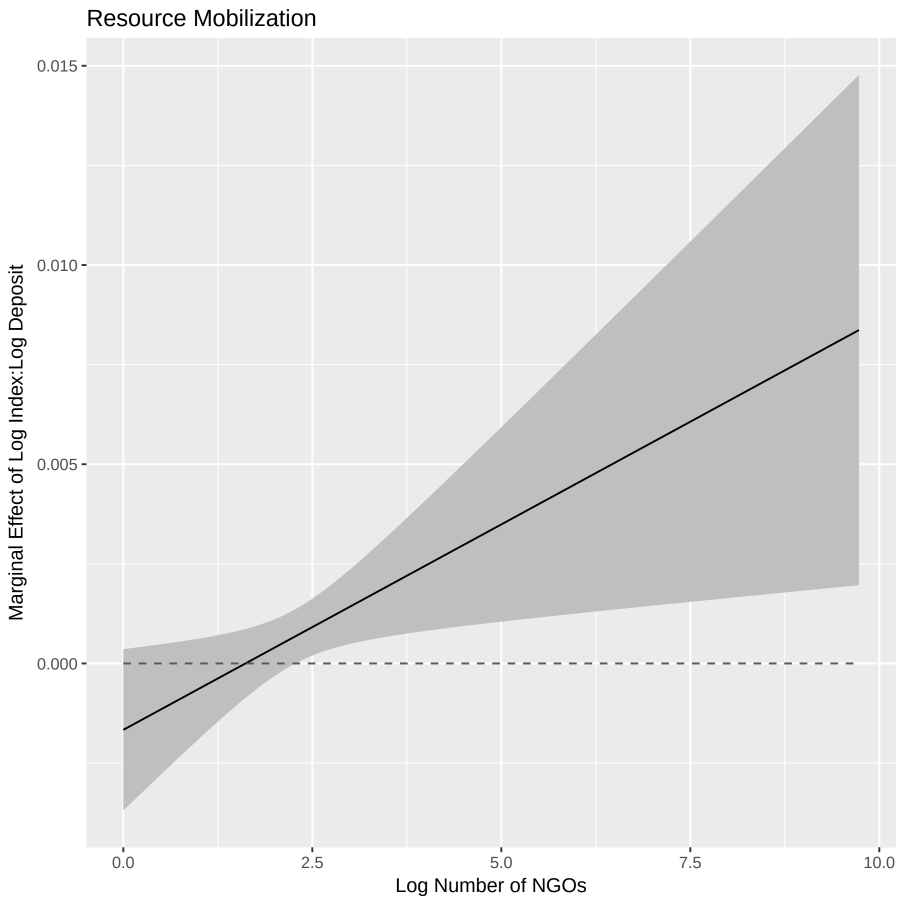

Figure 5: Marginal effect (i.e., cross-derivative) of main interaction term (Index and Mining Deposits interaction) for different values of log NGO presence in municipality. Grey band represents 95% confidence intervals for the size of the interaction.

	Dependent variable:					
	Mining Protests					
	(1)	(2)	(3)	(4)	(5)	(6)
Index:Deposits	0.001***			0.0005**		
	(0.0002)			(0.0002)		
Index:Deposits (Dummy)		0.017***			0.008	
		(0.005)			(0.006)	
Log Index:Log Deposits			0.002***			0.002***
			(0.0005)			(0.001)
Index:Log GDP				0.002	0.001	
				(0.005)	(0.005)	
Index:Rural				−0.024*	−0.032**	
				(0.014)	(0.014)	
Index:Log Muni Area				0.007**	0.009***	
				(0.003)	(0.004)	
Index:Coast				0.043	0.040	
				(0.038)	(0.037)	
Log Index:Log GDP						0.001
						(0.001)
Log Index:Rural						−0.004**
						(0.002)
Log Index:Log Muni Area						0.001**
						(0.0005)
Log Index:Coast						0.005
						(0.005)
Year and Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
State:Index Interaction	No	No	No	Yes	Yes	Yes
Municipalities	5565	5565	5565	5449	5449	5449
Observations	77,910	77,910	77,910	76,286	76,286	76,286
Adjusted R^2	−0.075	−0.076	−0.075	−0.076	−0.076	−0.076
Note:				*p<0.1; **p<0.05; ***p<0.01		

Table I: Linear regression models of mining protests (narrow definition) on mineral deposits and commodity price index. Dependent variable for all models is the count of protests in a municipality-year.

	Dependent variable:					
	Mining and Environment Protests					
	(1)	(2)	(3)	(4)	(5)	(6)
Index:Deposits	0.001***			0.001*		
	(0.001)			(0.0003)		
Index:Deposits (Dummy)		0.019			0.020	
		(0.015)			(0.015)	
Log Index:Log Deposits			0.004***			0.003***
			(0.001)			(0.001)
Index:Log GDP				0.017	0.016	
				(0.011)	(0.011)	
Index:Rural				−0.252***	−0.259***	
				(0.041)	(0.041)	
Index:Log Muni Area				0.047***	0.049***	
				(0.008)	(0.008)	
Index:Coast				0.135**	0.132**	
				(0.059)	(0.058)	
Log Index:Log GDP						0.003*
						(0.002)
Log Index:Rural						−0.035***
						(0.006)
Log Index:Log Muni Area						0.007***
						(0.001)
Log Index:Coast						0.018**
						(0.008)
Year and Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
State:Index Interaction	No	No	No	Yes	Yes	Yes
Municipalities	5565	5565	5565	5449	5449	5449
Observations	77,910	77,910	77,910	76,286	76,286	76,286
Adjusted R^2	−0.073	−0.073	−0.073	−0.070	−0.070	−0.070
Note:				*p<0.1; **p<0.05; ***p<0.01		

Table II: Linear regression models of mining protests (broad definition including environmental protests) on mineral deposits and commodity price index. Dependent variable for all models is the count of protests in a municipality-year.

	Dependent variable:					
	Mining Protests					
	(1)	(2)	(3)	(4)	(5)	(6)
Index:Deposits	−0.002			−0.001		
	(0.001)			(0.0004)		
Index:Deposits (Dummy)		−0.038			−0.035**	
		(0.024)			(0.014)	
Log Index:Log Deposits			−0.004			−0.002
			(0.003)			(0.001)
Index:Deposits:NGO	0.001*			0.0003*		
	(0.0004)			(0.0001)		
Index:Dep. Dummy:NGO		0.018*			0.015**	
		(0.009)			(0.006)	
Log Index:Log Deposits:NGO			0.002**			0.001**
			(0.001)			(0.0004)
Index:NGO	0.004	0.006		0.004	−0.001	
	(0.006)	(0.004)		(0.003)	(0.003)	
Log Index:NGO			−0.001			−0.001
			(0.001)			(0.001)
Index:Log GDP				0.002	0.002	
				(0.005)	(0.005)	
Index:Rural				−0.004	−0.007	
				(0.012)	(0.011)	
Index:Log Muni Area				0.004	0.005*	
				(0.003)	(0.003)	
Index:Coast				0.041	0.038	
				(0.037)	(0.037)	
Log Index:Log GDP						0.001
						(0.001)
Log Index:Rural						−0.0002
						(0.002)
Log Index:Muni Area						0.0005
						(0.0004)
Log Index:Coast						0.005
						(0.005)
Year and Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
State:Index Interaction	No	No	No	Yes	Yes	Yes
Municipalities	5543	5543	5543	5429	5429	5429
Observations	77,602	77,602	77,602	76,006	76,006	76,006
Adjusted R^2	−0.074	−0.075	−0.074	−0.076	−0.076	−0.076
Note:						*p<0.1; **p<0.05; ***p<0.01

Table III: Linear regression models of mining protests (narrow definition) on NGO presence (logged), mining deposits, and commodity price index (triple interaction model). Dependent variable for all models is a count of protests against mining in a municipality-year.

	Dependent variable:	
	Mining Protests	
	(1)	(2)
Index:Deposits (Dummy)	0.016***	0.019**
	(0.005)	(0.008)
Index:Dep. Dummy:Alignment	−0.005	
	(0.015)	
Index:Dep. Dummy:Margin		−0.019
		(0.029)
Alignment	0.001*	
	(0.0004)	
Index:Alignment	−0.005**	
	(0.003)	
Dep. Dummy:Alignment	0.0003	
	(0.002)	
Margin		0.002*
		(0.001)
Index:Margin		−0.014
		(0.010)
Dep. Dummy:Margin		0.001
		(0.004)
Year and Municipal FE	Yes	Yes
State:Index Interaction	No	No
Municipalities	5168	5168
Observations	72,345	72,345
Adjusted R^2	−0.082	−0.082
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table IV: Triple interaction models with mineral deposits (indicator), commodity price index, and political opportunity variables from previous election (alignment of mayor with president and mayor's margin of victory). Dependent variable for all models is a count of protests against mining in a municipality-year (narrow definition).