Electoral Accountability and the Natural Resource Curse: Theory and Evidence from India*

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ABSTRACT

Exploiting the formation of new Indian states in 2001, we show that the effects of the state breakup at the subnational constituency level differ systematically across natural resource rich and natural resource poor areas. State breakup changed state borders of existing states with concomitant changes in state level natural resource endowments and state-level political institutions, but left constituency borders and the location of natural resource endowments unchanged. These findings thus indicate that the relationship between resource abundance and economic outcomes flows, at least in part, through a political channel. We describe a simple model of political collusion between state politicians and local rent-seekers that provides a novel characterization of this political channel and can account for the relationship we see in the data between how breakup changes the proportion of natural resource rich constituencies in the newly formed states and how natural resource abundance shapes post-breakup economic outcomes within constituencies.

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1 INTRODUCTION

The "curse" of natural resources on economic development (Sachs and Warner 2001) has been widely documented, but there is still no clear consensus about its underlying causes. While a number of explanations have been proposed that have little to do with institutions,[1] the literature is converging to the view that whether a curse arises depends on the quality of institutions (Lane et al. 1999, Leite and Weidmann 1999, Acemoglu and Robinson 2006, Mehlum et al. 2006, Mehlum et al. 2011, Caselli and Tesei 2016), and, specifically, political institutions (e.g., Robinson et al. 2006; Brollo et al. 2013). Uncovering clear evidence of a link between the curse and political institutions in cross-country comparisons, however, remains challenging.

This paper exploits the formation of new states in India in 2001 to study how the effects of the state breakup on local economies vary in accordance with the spatial distribution of natural resources within the newly formed states. State breakup changes state borders and state-level natural resource endowments, but leaves constituency borders and natural endowments at the local economy level unchanged.[2] A key feature of the breakup was that two of the original states contained a significant share of India's natural resources,[3] and these were concentrated within specific geographical areas.[4] The breakup thus resulted not only in a change in the size and boundaries of states (Figure 1), but also in a dramatic change in the distribution and concentration of natural resources across new and rump states, with the new states acquiring the lion's share (Figure 2): in one case one of the new states inherits almost all the resource-rich areas post breakup; in another case, the original state is natural resource rich but the newly-formed states each inherit a comparable share of natural resource rich areas; in a third case, natural resources are sparse in the original state pre breakup.

Using a regression discontinuity design we examine differential effects of the breakup across new and old states by examining the evolution of economic activity, proxied by luminosity, for 1,124 constituencies, comparing outcomes across the new state borders for 186 constituencies that are natural resource rich and for 938 constituencies that are not, over the period 1992-2010. The results we obtain are striking and seem to banish purely economic based explanations to the back of the queue: in brief, the heterogeneity in outcomes (both in local economic activity and local inequality at the constituency level) is mirrored in the differences in the natural resource endowments at the local level and in the distribution of natural resources across the newly-formed states. Specifically, natural resource rich constituencies perform comparatively worse when the new state they belong to inherits a large fraction of the natural resource rich constituencies of the original state; comparative economic outcomes for natural resource poor constituencies, on the other hand, are less affected by changes in political boundaries. This empirical exercise is similar in spirit to that of Michalopoulos and Papaioannou (2014), who use the quasi experimental effect of the colonial boundaries that partitioned over 200 ethnic groups across two or more countries; but while they use this approach to show that state borders do not matter, here

[1]The role of Dutch disease or of volatility induced by fluctuations in commodity prices are but two possible explanations (see Stevens 2003) while diversion away from human capital accumulation and entrepreneurial activity (Gylfason 2001, Torvik 2002, Perroni and Proto 2010) might be another.

[2]The borders of the new states have always been well-defined as will be discussed later.

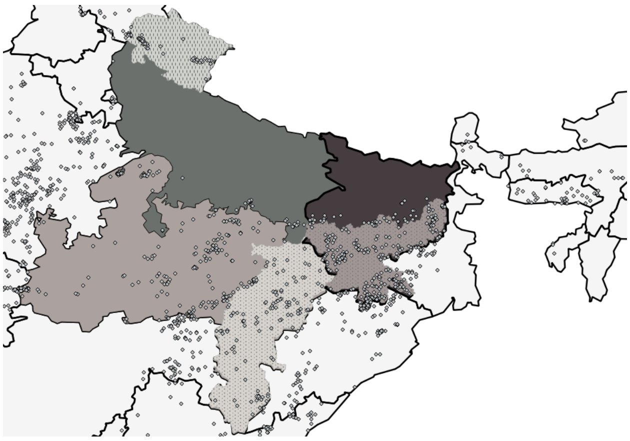
[3]India is the largest producer of mica, second largest in chromites and barites, third largest in coal and lignite, fourth largest in iron ore, fifth largest in bauxite and crude steel and eighth largest in the world in aluminium. Two of the three states we study contain forty-five per cent of the reserves in iron ore and coal and eighteen per cent of copper (see Indian Bureau of Mines 2008, and TERI 2001).

[4]Resources are usually classified as point and dispersed resources, the former being the most easily appropriated. Our focus in this paper is on minerals which are point source resources.

Figure 1: Reorganization of states in 2001

The figure shows the breakup of states in 2001. Areas shaded by dots represent newly created states; these are the states of Jharkhand, Chhattisgarh and Uttarakhand, which broke away from Bihar, Madhya Pradesh and Uttar Pradesh respectively.

Figure 2: Distribution of mines across reorganized states



The figure shows the distribution of mine deposits in India, across the states that were reorganized in 2002. Mine deposits are indicated by small circles.

we show that changes in political boundaries *do* matter.

Our findings lend fresh within-country support to the prevailing view of the natural resource curse as being conditional on institutions. The patterns we observe, with effects of a political breakup varying in line with the change in the overall proportion of natural resource rich constituencies in the newly-formed states, points to a political-economy link between natural resources and governance outcomes. The federal institutions in India are such that the local-level political entities are much weaker than state-level governments, with the latter controlling the allocation of exploitation rights and being responsible for law and order in exploitation areas; at the same time, state governments do not have a significant stake in natural resource revenues, because royalty rates are set by the federal government and have been historically very low.[5] The combination of these institutional features results in a situation where handing out favours to local resource rent seekers carries little opportunity cost for state governments, and where there are therefore strong incentives for state-level politicians to hand out natural resource-related favours in exchange for political support.

We describe a theoretical model that builds on this picture and that is able to account for the patterns that emerge from our empirical analysis. The theory predicts that, post breakup, those constituencies that are exposed to states with a higher fraction of NRR constituencies will do worse relative to NRR constituencies in states that are exposed to a lower fraction of NRR constituencies than before. This is because a higher proportion of NRR constituencies reduces the relative political cost of engaging in an exchange of votes for favours in NRR constituencies, which in turn lowers political accountability and boosts rent grabbing activities in those constituencies. This explanation of the resource curse is novel, and highlights how the "effective quality" of institutions in relation to natural resources extraction is not only a consequence of how those institutions are designed but is also shaped by the broader context in which those institutions are embedded.

There have been several studies focusing on the direct links between political outcomes and natural resources. For instance, case study evidence (Karl 1997) suggests that resource rents change the political climate in the host country. Another study (Brollo et al. 2013) has focused on the relationship between political opportunism and corruption with windfall gains from oil in municipalities in Brazil. Our study is most closely related to this strand of literature. We add to this literature in three ways. First, we examine how the spatial distribution of mineral deposits affects economic outcomes via a political channel rather than how windfall gains in public office affect political and economic outcomes. In our setting, corruption in inefficient in the sense that collusion between local and state level elites leads to a loss of potential revenue as well as social costs on the rest of the economy. Secession was associated with a change in the distribution of mineral deposits across states and potentially large revenue differences, but the latter is not as important in the story for India given the low royalty rates. In interpreting our results, we focus instead on how the change in the distribution of potential natural resource rents across states may have affected electoral accountability. Second, we examine an institutional setting where powers in matters relating to natural resource extraction are concentrated not at the local but the state level (in contrast to Peru, for instance).

A serious limitation of earlier empirical studies of the link between institutions and the natural

[5]The royalty rates on minerals remained unchanged since October 2004 and were revised upward in 2011. The key minerals affected in these states were iron ore and bauxite. The royalties on coal remained low and based on weight. Between 2004 and 2011, royalties on iron ore were a flat rate based on weight, which was changed to that based on the market value, while for bauxite, royalties went from zero to 25 percent for use apart from that in aluminium and for exports. See The Wall Street Journal (August 12 2009, http://www.wsj.com/articles/SB125006823591525437). Also see Indian Bureau of Mines 2011.

resource curse is that they relied on cross-country comparisons. The more recent literature (e.g. Caselli and Michaels 2013, Loayza et al. 2013) does much to obviate this problem by focusing on within-country studies. Our paper combines the advantages of within-country studies – primarily the relative homogeneity of culture, history and institutions – with the opportunity to investigate the role of political institutions through the institutional changes that have been brought about by secession.

The remainder of the paper is organized as follows. Section 2 describes the institutional context, presents the data used for analysis and lays out the identification strategy for estimating the effect of breakup. Section 3 reports the empirical results, and Section 4 presents a simple theoretical setup capable of rationalizing these results. Section 5 concludes.

2 Institutions, data, and estimation strategy

2.1 The institutional context

India has a federal structure, with both national and state assemblies. Members of the twenty-nine state assemblies are elected in a first past-the-post system. The leader of the majority party or coalition is responsible for forming the state government. States have executive, fiscal and regulatory powers over a range of subjects that include education, health, infrastructure and law and order.

There is an overlap in authority between the federal government and state governments in the management of natural resource extraction, with both exerting regulatory authority: major minerals such as coal and iron ore are regulated by the central government, while minor minerals are entirely under state control as laid down in the Mines and Minerals Development and Regulation (MMDR) Act of 1957. State budgets benefit from the royalties but rates are set by the central government, which sets royalty rates rates on output as well as any "dead rent" that accrues in the absence of extraction, and also decides on environmental clearances for mining. Property rights on land reside in the states, which are the legal owners of all major mineral resources (except uranium), and claim all royalties (but do not control the rates). The main power of the states derives from the legal authority to grant licenses. However, there is no requirement for the royalties and returns from mining to accrue to local areas and the entire proceeds accrue to the state budget.[6] There are thus three players involved in royalty on minerals: the Central Government which fixes the royalty rate, mode and frequency of revision; the State Government, which collects and appropriates royalty; and the lessee who might be in either the public or private sector sector and who pays the royalty according to the rates and terms fixed by the Centre to the State.

The split of authority between federal and state agencies with respect to the management of natural resources means that the effects of policy decision of each level are not fully internalized. The royalty rates set by the central government are widely seen as being inefficiently low, lowering incentives for states to allocate extraction rights to efficient operators and to police illegal mining, since royalties from mining contribute so little to their budgets: royalty revenues in these states, as a percentage of [XX WHAT ?], averaged to two percent in 2009, while the mining sector's share of state domestic product ranged between 9 and 13 percent for Jharkhand and Chattisgarh (Chakraborty 2014). The fact that the authority for policing resides with the state governments while the federal government decides

[6] The previous government of India had proposed a draft Mines and Mineral Development and Regulation Bill, 2011, which had provided for a 26 per cent share in mining profits for local communities, which would have been a substantial change in policy.

on which areas can host mining activity produces incentives to evade environmental regulations by operating outside the areas given clearance by the federal government. All of this has led to conflict between Centre and State about the weak policing and monitoring by state governments.[7]

Given this institutional context, the politics of resource extraction in India takes on a different flavour from that seen in other federal states. Fiscal windfalls from natural resources occur at the state level and power resides at the state level. In particular, as mentioned before, the provision of education, health, law and order and rural electrification is firmly under state control. Thus, if illegal mining takes place at the constituency level, it is quite likely to be with the collusion of state level politicians. In turn, under a first past-the-post system, local-level politicians must rely on local level patron client networks to stay in power.

Tillin (2013) explores how the breakup of existing states in 2000 came about. She suggests four possible explanations. The main explanation proffered is that of distinct cultural identities in the breakaway areas that have consistently made demands for secession, demands that have progressively gained prominence since 1947. The basis on which state borders were originally drawn by the State Reorganisation Act of 1956 was along linguistic boundaries, but this criterion tended to ignore other ethnic and social boundaries, leading to large tribal populations in some states seeing themselves as ethnically distinct and socially neglected.[8] Arguably, not all these demands were centered around statehood but they did involve claims for more local representation and local management of natural resources, both mines and forestries.[9] The second explanation relates to the changing federal election context since 1989, when the leading coalition partner, the Bharatiya Janata Party (BJP), favoured granting statehood to boost their popularity in the areas concerned. Thirdly, Tillin suggests that natural resources were a factor: private interests might have considered it easier to increase resource extraction and intensify production in a smaller jurisdiction, which she terms "extension of capitalist interests".[10] A final explanation is that the sheer size of the old states made them difficult to govern and that the breakup was attractive to the central government as it meant better governance and more ease of administration – as well as an acknowledgment of local identities.

[7]See an article which discusses the difficulties of Centre-State coordination in policing at: http://bit.ly/1OHFIRM.

[8]It should be noted, however, that some of the sharp distinctions along ethnic, social and linguistic lines, maintained post-independence, have been reduced in time, since migration and changing demographics have meant more homogeneity particularly along existing sub-regional or district borders – this point is explored in further detail below when we examine the balancing of characteristics along the boundary.

[9]Tillin (2013) writes "All three of the regions that became states in 2000 saw the emergence of distinctive types of social movement in the early 1970s: Chipko, the people's forestry movement in the Uttarakhand hills; the trade union movement among miners, the Chhattisgarh Mines Shramik Sangh; and the worker-peasantry movement in Jharkhand led by the Jharkhand Mukti Morcha (JMM). These regions were all distinguished from the remainder of their parent states by their distinctive ecology and concentration of natural resources. In all three cases, the issues raised by social movements related primarily to the role of the state in the management of natural resources and the rights of local communities to substantive economic inclusion."

[10]Tillin (2013) summarizes the views, both pre and post breakup, of Tata Steel, the major investor in Jharkhand, and that of other industrialists. Tata Steel was happier with a larger state where "politicians were farther away in Bihar" and less likely to meddle, while others favoured a smaller state where they hoped there would be better law and order and less corruption. However, seven years after secession, things were perhaps even worse in the new state according to them. In brief, there were clearly mixed views and far from the urge to expand resource extraction, issues of infrastructure, electricity provision and law and order loomed large in favouring breakup and evaluating its success.

2.2 Data

We examine differences in local outcomes across states in the context of the breakup of three states in India in the year 2000. We use two main sources of data in examining the relationship between natural resources and economic outcomes. First, we rely on luminosity[11] data to proxy the evolution of outcomes between 1992-2010, thus capturing the period 1992-2001, pre breakup and 2002-2010, the period post breakup. We use data on the evolution of luminosity as a proxy for the evolution of economic activity (see Henderson et al. 2011; Chen and Nordhaus 2011; Kulkarni et al. 2011; Alesina et al. 2016) and use it to construct measures of changes in the outcome variables – both an index of aggregate luminosity within Assembly Constituencies (ACs) and a (Gini) index of local inequality in luminosity. The data consist of imaging of stable lights obtained as a global annual cloud free composite where the ephemeral lights from fires and other sources are removed and the data are averaged and quantified in six bits, which in turn might result in saturation for urban settings but does mean that dimmer lights in rural settings are captured. Each grid (1 sq km) is assigned a digital number (DN) ranging from 0 to 63 and luminosity is measured as the DN3/2. The luminosity of an area is thus obtained as a sum of lights over the gridded area which in our case is defined as the assembly constituency. We use GIS data on the administrative boundaries of states and assembly constituencies to enable the aggregation within constituencies.[12]

There are three main reasons why we rely on luminosity data. The first is that panel data on households, by assembly constituencies[13] that could capture the evolution of incomes or consumption pre and post breakup does not exist. The second reason is that, despite the measurement difficulties inherent in the use of such a proxy, there is convincing evidence to suggest that luminosity is strongly correlated with standard socio-economic outcomes. We offer corroborative evidence of this below; in brief, we use data on income, wealth and education from the National Election Survey in the year 2004, which surveys voters at the constituency level to examine the correlation of standard economic indicators with luminosity. The correlation with wealth is about 0.6, while that with income and education lies between 0.4 and 0.45.[14] This relationship also holds at the more aggregate level of the district: Chaturvedi et al. (2011) and Bhandari and Roychowdhury (2011) examine this correlation at the district level in India and find similar effects. A related question is whether luminosity data accounts for rural activity. As explained above, while [XX WHAT DOES THIS MEAN - DOES IT MEAN THAT WE CANNOT CAPTURE CHANGES IN URBAN LIGHTS BEYOND SOME THRESHOLD?] urban lights might reach saturation because of the methods used to quantify the data on luminosity, it also allows dimmer lights to be captured in rural, electrified areas. However, as we will argue later, the empirical strategy we adopt compares relative levels of luminosity across similar areas across the boundary and the inability to measure absolute levels should not matter. We restrict our analysis to the years 1992-2010 because constituency borders have been re-drawn since then.[15] The third (and most important) reason

[11]The night time image data is obtained from the Defense Meteorological Satellite Program Operational Linescan System (DMS P-OLS). The DMSP satellites collect a complete set of earth images twice a day at a nominal resolution of 0.56 km, smoothed to blocks of 2.8 km (30 arc-seconds). The data, in 30 arc-second resolution (1km grid interval), covers 180° West to 180° East longitude and 65° North to 65° South latitude.

[12]We are grateful to Sam Asher and Paul Novosad who provided the geographic data necessary for matching electoral constituencies to mineral deposits which in turn comes from the MLInfomap Pollmap dataset, which contains digitized GIS data based on maps published by the Election Commission of India (Asher and Novosad 2016).

[13]Districts are at a higher level of aggregation than assembly constituencies.

[14]The National Election Survey collects information from voters in each parliamentary constituency. To obtain the correlations, we aggregate the night-time lights data to the parliamentary constituency level.

[15]The boundaries for constituencies were fixed in 1976 but new boundaries based on the 2001 census figures were meant

for relying on luminosity evidence is that our identification strategy focuses on *changes* in outcomes rather than levels. This means that sources of persistent heterogeneity across ACs in the relationship between luminosity levels and levels of economic activity are not a concern.

To corroborate our measure of night-time lights, we use data from two waves (1992 and 2004) of the India Human Development Survey (IHDS). Finally we also use data from the Census of India, state election results (obtained from the Election Commission of India) and state electricity prices (obtained from India Stat) to support our identification strategy, described in the next subsection. Appendix A provides further details on these data sources.

The second set of data we use are data on the location, type and size of mineral deposits from the Mineral Atlas of India (Geological Survey of India, 2001). Minerals are grouped into nine categories and each commodity is classified by size which is proportional to the estimated reserve of the deposit. The atlas comprises seventy-six mapsheets on a generalized geological base and three size categories of mineral deposits that vary by mineral. The definition of the size categories for each commodity is in terms of metric tons of the substances of reserves contained before exploitation or actual output. In sum, we have data on the centroid latitude and longitude, mineral type, and associated size class.[16]

Since size categories represent different ranges of reserve depending on the minerals, combining mineral type with the size ranges gives us an approximate measure of the amount of deposits. We use data on deposits rather than the location of mines in operation to avoid issues of endogeneity inherent in such analysis. The location of deposits is strictly of geological origin, and the location was mapped before 1975 and hence its exploration cannot be said to be controlled by subsequent political and economic incentives or institutional factors. It also avoids the difficulties inherent in other commonly used measures such as the share of resource incomes or royalties in state incomes. [XX A BIT MORE ON WHAT THESE DIFFICULTIES ARE (UNLESS IT'S OBVIOUS) AND WHY WE DON'T USE PRICES? ALSO WHAT ABOUT VARIATION IN VALUE OF MINERAL DEPOSITS?]

2.3 Identification and estimation

In what follows, we conventionally define the states that have broken away as those "treated" by the act of secession. Admittedly, post breakup, the rump state is also a new creation and is thus affected by the treatment. So, what we are actually picking up are the differential effects of the treatment (secession) between old and new states.[17]

The list of explanations Tillin (2013) offers for the 2001 breakup flags two potential difficulties in looking at secession as a true natural experiment. The first relates to how borders between the rump state and the breakaway state were determined. This turns out not to be an issue at all because the boundaries of these three new entities have never been in dispute; the areas comprising the new states were separate entities before independence from British rule in 1947. For instance, Sharma (1976)

to be re-drawn. This was mandated by the Delimitation Act of 2002 which constituted a delimitation commission to redraw the constituency boundaries, However, there was substantial delay in compiling the necessary data and in creating the new boundaries, the first election with redrawn boundaries was only held in Karnataka in 2008. Consequently, the period between 1976 and 2009 in these states had fixed constituencies boundaries allowing for the comparison of luminosity across time.

[16] We are particularly grateful to Sam Asher for sharing his data obtained from the Mineral Atlas and to officials at the Geological Survey of India, Bangalore for clarifying the observations on size.

[17] This convention is also consistent with the idea that the rump state retains the old institutions and government structures while the new state must create new structures, even if similar to those in the rump state. Rump states saw no reorganization apart from the loss of territories and thus a lower population and smaller administration.

discusses a memorandum to the State reorganization commission in 1955 asking for a separate state of Jharkhand, naming the six districts in Bihar which were eventually separated from Bihar in 2000 (Hazaribagh, Ranchi, Palamu, Singhbhum, Santhal Parganas and Dhanbad, then Manbhum).[18] The Uttarakhand Kranti Dal, the regional party formed in 1979 for a separate hill state was determined to unite the eight hill districts in a separate entity. The borders of Uttarakhand were thus determined by the borders of the eight hill districts that maintained their separate identity on the basis of geography and cultural distinctiveness; again, these borders were not in dispute. The borders of Chhattisgarh comprised the eighteen districts where Chhattisgarhi was spoken, and, again, these district borders have remained the same since independence.[19]

The second potential difficulty pertains to the timing of the breakup. This timing was determined by the success of the BJP at the National elections in 1998. The BJP had led a minority government in 1996 and had promised to grant statehood to the three new states if it was returned to power. It was returned again at the head of a coalition government, but by this time there was a general consensus both at national and state levels: the other leading party of the Congress was in support, as were the state assemblies of the full states before breakup. While there might have been a initial spurt of political activity by the BJP,[20] by this time there was little political opposition anywhere to the demands for statehood. In fact, these demands had grown less vociferous since the early 1990s because it was clear that all the major parties were in accord. Part of this unanimity lay in the fact that all three new states lie well within the external boundaries of India and thus posed little threat to the Union of India, and, equally important, it was clear that there was no political gain to any of the parties in opposing secession. It might be thought that the timing of breakup was related to particular advantages of the party in power at the Centre; however, given the consensus across parties and the fact that state assemblies pre breakup gave their willing assent to the breakup without much dissent, this also turns out to be a non-issue. Finally, given that we concentrate on the role of resources, it should be emphasized that the prices of minerals played little part in the timing: mineral prices worldwide see a surge only after 2004, four years after breakup. In summary, neither the borders of the states nor the timing of breakup can be traced to any particular economic or political advantage for the breakaway states.

In order to identify the effect of state breakup on development outcomes, we make use of geographic discontinuity at the boundaries of each pre-breakup state and employ a Regression Discontinuity Design (RDD). For each geographic location (grid or AC), assignment to "treatment" (or new state) was determined entirely on the basis of their location. This key feature of the state breakup allows us to employ a sharp regression discontinuity design to estimate the causal effect of secession on growth and inequality outcomes. Such a discontinuity is clearly supported by Figure 3, where local polynomial estimates of the light intensity around the distance to the threshold, before and after breakup, are displayed. Figure 4 assesses the validity of the identifying assumption with the McCrary (2008) test for breaks in the density of the forcing variable at the treatment boundary with negative distances to state boundary for old states and positive distances for new states. The figure clearly shows that the density

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[18]It was the case that the borders were formally decided so as to include the districts that consisted of 'Scheduled Areas' as defined in the Constitution, which in turn may have followed the Simon commission of 1930 that defined certain 'partially excluded areas'. The list of scheduled areas (which are still mentioned as part of the old states) is available at the Ministry of Tribal affairs website here http://tribal.nic.in/Content/StatewiseListofScheduleAreasProfiles.aspx.

[19]Since 2012, these borders have been redrawn to give nine new districts.

[20]The BJP and its previous incarnation, the Bharatiya Jan Sangh had always opposed any state breakup until the 1990s and therefore their agreement was perhaps of note only because of the change; other leading parties had by then allowed that this was desirable (see Mawdsley 2002).

does not change discontinuously across the boundary suggesting that for the window around the coverage boundary there seems to be no manipulation. This is to be expected given the firm exogeneity of the borders, but it is reassuring all the same.

We define a variable, D_i, as the distance to the geographic boundary d that splits each of these geographic location between old and new states. We then define an indicator for each AC for belonging to the new state as

$$T_i = \mathbb{1}_{[D_i \geq d]}. \tag{1}$$

The discontinuity in the treatment status implies that local average treatment effects (*LATE*) are non-parametrically identified (Hahn et al. 2001). Essentially we compare outcomes of constituencies on either side of the geographic border that determined treatment assignment. Formally, the average causal effect of the treatment at the discontinuity point is then given by (Imbens and Lemieux 2008)

$$\tau_a = \lim_{g \to d^+} \mathbb{E}[Y_{it} \mid D_i = g] - \lim_{g \to d^-} \mathbb{E}[Y_{it} \mid D_i = g] = \mathbb{E}[Y_{it}(1) - Y_{it}(0) \mid D_i = d], \tag{2}$$

where Y_{it} is the satellite light density of constituency i in year t; D_i is the constituency's distance to the state boundary.

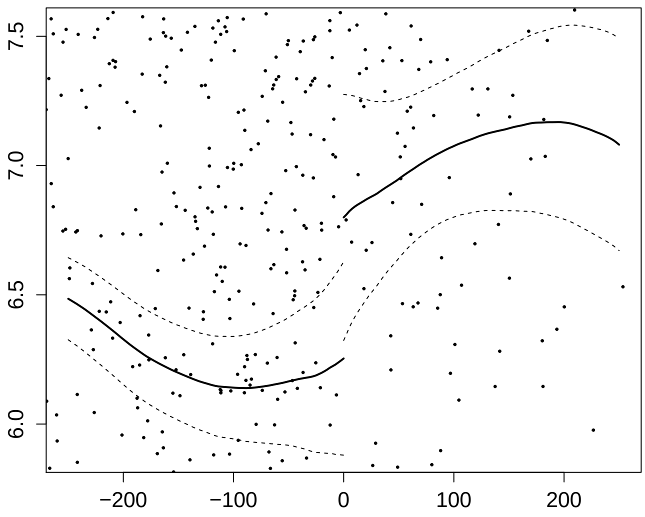
An important feature to note in the above-mentioned design is that the discontinuity is geographical, i.e., it separates individuals in different location based on a threshold along a given *distance boundary*. Using (2) to estimate the causal effect would ignore the two-dimensional spatial aspect of the discontinuity. This is because the *boundary line* can be viewed as a collection of many points over the entire distance spanned by the boundary. An individual located north-west of the boundary is not directly comparable to an individual located south-east of the boundary. For the comparison to be accurate, each "treatment" individual must be matched with "control" individuals who are in close proximity to their own location *and* the boundary line. We address this issue in the following ways. We divide the boundary for each state into a collection of points defined by latitude and longitude spaced at equal intervals of 15 kilometers. We then measure the distance of each grid or AC to the boundary and include polynomials of distance and its interactions with the treatment variable. We condition on the post-breakup interacted, line-segment fixed effects in all the specifications, so that only ACs within close proximity of each other are compared.[21]

The local average treatment effect can be estimated using local linear regression by including polynomials of distance to the boundary (controlling for line segment fixed effects) to a sample of units contained within a bandwidth distance h on either side of the discontinuity.

We additionally exploit the time dimension of our data as an additional source of identification. The identification strategy described so far exploits differences across nearby bordering units, post state breakup to investigate the effect of breakup. Even then, it is possible that there is an underlying administrative discontinuity at the border cutoff in the absence of breakup, since the geographical border was laid distinctly around existing districts. To address this issue, we use the observed *jump* in outcomes to difference out such *fixed*, initial differences between units on either side of the border. Our identifying assumption is, therefore, that the jumps at the cutoff are not changing over time in the absence of treatment, so that the differenced local Wald estimators will be unbiased for the local average treatment effect. Essentially our overall identification strategy combines the RDD design with

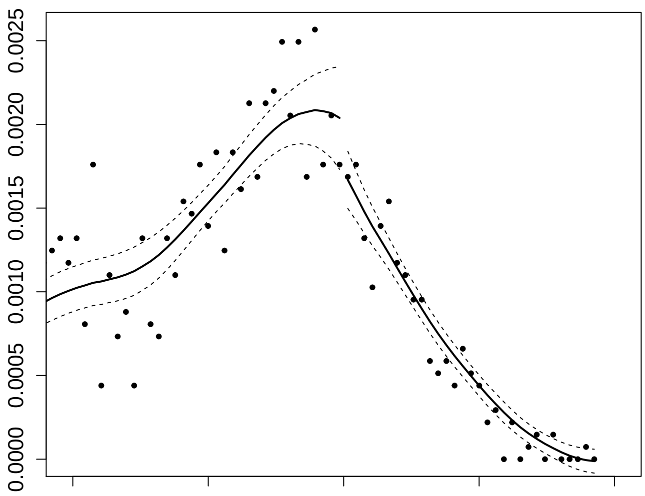
[21] See Black (1999) who first discussed the use of the boundary segments in a regression discontinuity framework. For a recent application, see Dell (2010), who extends the approach to incorporate a semi-parametric regression discontinuity design.

Figure 3: Light intensity after secession



The figure plots the local polynomial estimates of the light intensity around the threshold distance.

Figure 4: RD validity: Density smoothness test for distance to state boundary



The figure plots test for density smoothness proposed by (McCrary 2008). The distances are normalized, such that positive values indicate distances for new states while negative values indicate distances for old states.

a difference-in-difference approach.

With this in mind, the specification we estimate is:

$$Y_{it} = \alpha_i + \beta_t + \gamma T_i \times Post_t + \delta' V_{it} + \varsigma_s \times Post_t + \varepsilon_{it}, \tag{3}$$

where Y_{it} is the satellite light density of grid i in year t. α_i is the fixed effect for each AC. The variable of interest, the new state effect, is denoted by the interaction of T_i, being located in the new state, and $Post_t = \mathbb{1}_{[t \geq 2001]}$. We control for boundary-segment fixed effects ς_s (interacted with $Post_t$ to account for the panel dimension). α_i and β_t represent constituency and time fixed effects respectively; and where the V_{it} are defined as

$$V_{it} = \begin{pmatrix} \mathbb{1}_{[D_i < d]} \times Post_t \times (D_i - d) \\ \mathbb{1}_{[D_i \geq d]} \times Post_t \times (D_i - d) \end{pmatrix}. \tag{4}$$

The regressors V_{it} are introduced to avoid asymptotic bias in the estimates (Hahn et al. 2001, Imbens and Lemieux 2008). Standard tests remain asymptotically valid when regressors V_{it} are added.

A panel fixed-effects estimators around the distance thresholds, h, is equivalent to use a uniform kernel for local linear regression suggested by Hahn et al. (2001). We employ several bandwidths in our analysis, based on the optimal bandwidth calculations of Imbens and Kalyanaraman (2012). With the selected bandwidths, we compute OLS-FE estimates using observations lying within the respective distance thresholds.

3 Estimation Results

3.1 Descriptive evidence and validity of identifying assumptions

We begin by validating the basis for our estimation strategy by examining the evolution of luminosity across the six states, both overall and between border areas in Figure C1 (in Appendix C). As the figure indicates, before breakup, the areas constituting the new states were similar in trend to the rump but the levels of activity are substantially lower. After 2000, it is clear that on average the trends have changed; both overall and across border areas in particular, activity in new states is rising faster, to overtake the old states on average by the end of the period. It is also clear that the trends in new and old states do not diverge immediately upon breakup but do so around 2003 which is consistent with the fact that elections to new assemblies and the definitive changes in governance does not take place in the same year. Uttarakhand's first assembly elections were held in 2002, followed by Chhattisgarh in 2003, and Jharkhand in 2005. The first assemblies were constituted on the basis of the holders of seats in the relevant ACs in the joint assembly in the states before breakup.

Before presenting our results, we briefly summarize all the relevant variables that we use for the analysis. Table C1 (in Appendix C) disaggregates the summary statistics by different samples that we use for analysis. Crucial to our identification is the spatial discontinuity induced by the state secession. For this reason we compare ACs lying within a certain distance threshold of the newly created state borders. We therefore report the mean and standard deviation of all variables, by each distance threshold (bandwidth) sample. The table shows that the distribution of most variables remain similar across the different samples. Mineral quality, however, increases slightly close to the border (at BW 150 km).

The spatial discontinuity design we use compares ACs across borders, with the basic notion that differences in patterns of local activity, controlling for trends before breakup can only be attributed to differences by state rather than differences due to local environment and geography effects. This in turn depends on the variation in observable attributes including human and physical geography. The demarcation of the borders here are historical, based on ethno-linguistic differences as they were present in 1947 at independence, or even earlier. If the historical demarcation implies a different settlement by these groups today, this in turn might pose a threat to identification. To examine this, we used information from the IHDS on household size, incomes and consumption expenditures, together with measures of health, proxied by infant mortality and public goods, proxied by the availability of drinking water, to check if these variables were different across border areas before breakup. We conclude they are not, apart from the availability of drinking water which was significantly different at the 10 percent level. Irrespectively, our difference-in-difference strategy does control for fixed pre-breakup differences such as water availability – this is less of a threat to identification than time varying differences, such as those arising from income variations.

To account for potential differences in human geography, we use data from the census to examine whether there are significant differences in the concentration of scheduled tribes and castes and literacy rates across border areas as well as the previously discussed effect on electricity tariffs. Table C2 summarizes the details of this exercise, comparing differences across boundaries. While there are trend increases in concentration of scheduled tribes post 2000, we do not find a significant difference across states. [XX CHECK THE FOLLOWING SENTENCE.] It is clear that, since the border was drawn, re-settlements over time have affected the relative strength of settlements and there has been spillovers in settlements across borders. Census data since 1881 have shown a gradual decline of tribal populations in Jharkhand and Chhattisgarh. The main reason is low birth rates and high mortality rates among the tribes as well as the loss of traditional land. Both Bihar and Madhya Pradesh, the rump states saw an increase in the share of the ST population between 2001 and 2011, while their split-offs, Jharkhand and Chhattisgarh saw a stagnation in this share; however, they harbour a large absolute share of between 26 and 31 percent.

3.2 RDD ESTIMATES

We begin with the overall effect of state breakup on the difference in luminosity in Table 1. The variable *Post* captures the trend across states post breakup while '*Post*×*New State*' captures the difference between the new and rump states on average, post breakup. The first column reports the OLS estimate of breakup for the entire sample of ACs across all six states. The naïve OLS specification suggests that while all states experience trend increase in luminosity, it is also clear that on average, new states did better than the rump.

There may be concerns that there are other unobservables linked to state borders that might bias the OLS estimates. To address these concerns, we present RDD estimates in columns (2)-(4) with differing bandwidths. We choose three bandwidths with distance thresholds of 150km, 200km and 250km throughout our analysis. We choose these thresholds based on our calculations of the optimal bandwidth (Imbens and Kalyanaraman 2012). Our calculations indicate an average optimal bandwidth of 181.36, across all post-breakup years. Its year-wise value ranges from 165.04 to 204.32, all values lying well within our chosen bandwidth span. The RDD estimates suggest the same pattern of results as the OLS albeit with a much smaller positive growth effect for the new state. We find that the new states did better than the rump, with a differential in luminosity of 35 percent. Effects on inequality are in line with level effects. Table 2 reports results of effects of state breakup on the Gini coefficient

Table 1: RDD estimates of state breakup on log light intensity

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × New State	0.824***	0.348**	0.647***	0.669***
	(0.094)	(0.168)	(0.150)	(0.143)
Post	0.944***	2.050***	2.148***	2.172***
	(0.079)	(0.194)	(0.191)	(0.187)
Observations	20,232	9,720	11,970	13,608
R^2	0.123	0.186	0.188	0.182

The table reports results for the effect of breakup on the log of total luminosity in each AC. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 2: RDD estimates of state breakup on light Gini

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × New State	−0.110***	−0.067***	−0.081***	−0.087***
	(0.008)	(0.017)	(0.015)	(0.014)
Post	0.007	−0.092***	−0.077***	−0.077***
	(0.006)	(0.013)	(0.011)	(0.010)
Observations	19,521	9,227	11,381	12,958
R^2	0.156	0.271	0.263	0.265

The table reports results for the effect of breakup on the Gini (concentration) of luminosity in each AC. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

of inequality in luminosity: inequality decreases in all states, and more so in the new states.

In order to validate the luminosity measure, our proxy for economic growth, we also present the effect of state breakup on various household level outcomes (Table C3). Using data from the IHDS we examine the effect of breakup on a few development indicators of sample households located in districts that lie along the border of the old and new state. We use two rounds of data on the same household, utilising information from the 1992 (pre breakup) and 2005 (post breakup) survey, to form a household level balanced panel. The outcomes we examine are per-capita income, infant mortality, water availability and monthly food expenditure. Overall we find positive effects of breakup on all household level outcomes, mirroring our results from Table 1 which uses luminosity as an outcome variable. Specifically, we find that households in new states saw an increase of INR 3737.45 (approx. US$50) in their total income and a 15 percent increase in their access to piped water.[22]

Outcomes improved in all the new states. However, if we next look at how breakup affects outcomes separately in each of the new states, by using a specification where the single *New State* indicator is replaced by state-specific indicators (Tables 3 and 4), a mixed picture takes shape. Effects in new states are comparatively better than those in rump states for Uttarkhand and comparatively worse for Jharkhand and Chhattisgarh, and these differences are strongly significant. This stark differences are matched by an equally stark variation in how the natural resource rich (NRR) regions were distributed between the rump state and the new state post break up. Figure 2 shows the spatial distribution of natural resources pre and post break up. Table 5 shows the spatial distribution of Natural Resource Rich (NRR) Assembly Constituencies (ACs) pre and post break up. The Bihar-Jharkhand state pair witnessed a large change in the distribution of natural resources upon breakup, with Jharkhand (the new state) obtaining almost all of the resources relative to Bihar. The breakup of Madhya Pradesh did mean that a substantial part of resources accrued to the new state of Chhattisgarh but Madhya Pradesh remains one of the natural resource rich states nevertheless. Finally, the Uttar Pradesh-Uttarkhand state pair saw little change in the distribution of their natural resources upon breakup. So, breakup raised the proportion of NRR ACs in the newly-formed states of Jharkhand and Chhattisgarh (more so for Jharkhand than for Chhattisgarh) and left it unchanged in the new state of Uttarkhand (the proportion of point source mineral resources in the old state is very small, at 0.02%). The patterns in evidence in Tables 3 and 4 suggest that secession produces comparatively worse outcomes in those states that experience an increase in the proportion of ACs that are natural resource rich. These patterns allude to an institutions-dependent resource curse (a “conditional” curse in the sense of Caselli and Tesei 2016).

There are of course other possible reasons that might explain the different effects of breakup across states and that have nothing to do with natural resources, and it is clearly not possible to derive any clear inferences on the basis of only three cases. However, comparing effects across ACs can provide a more solid corroboration of the role of natural resource abundance. State-level results still hide a considerable degree of heterogeneity across ACs. As a significant proportion of the ACs in the affected states are natural resource rich – and indeed the fact that natural resources were more highly concentrated in some areas was one of the main drivers of secession ambitions, a natural question to ask is whether the presence of mineral deposits in assembly constituencies affords part of the explanation for the heterogeneity across states that we see.

[22] Changes in luminosity could also be driven by changes in the price of electricity. To examine this, we use available data on electricity prices by state and year (an unbalanced panel) and examine their evolution across states. Results of panel regressions suggests that, while there were trend increases in prices across states, there are no significant differences between new and old states. Note that such concerns should also be dissipated by the fact that we use regression discontinuity techniques and compare areas around state boundaries.

Table 3: RDD estimates of state breakup on log light intensity

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Jharkhand (new state)	0.421***	−0.855***	−0.639***	−0.644***
	(0.101)	(0.237)	(0.192)	(0.180)
Post × Chhattisgarh (new state)	0.477***	−0.324	0.175	0.305*
	(0.050)	(0.284)	(0.203)	(0.169)
Post × Uttarakhand (new state)	1.746***	1.444***	1.784***	1.805***
	(0.253)	(0.202)	(0.217)	(0.220)
Post	0.944***	2.198***	2.282***	2.287***
	(0.079)	(0.187)	(0.183)	(0.179)
Observations	20,232	9,720	11,970	13,608
R^2	0.136	0.210	0.210	0.205

The table reports the heterogeneous effect of breakup on the log of total luminosity in each AC. The specification includes AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 4: RDD estimates of state breakup on light Gini

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Jharkhand (new state)	−0.060***	0.007	−0.006	−0.013
	(0.007)	(0.016)	(0.014)	(0.013)
Post × Chhattisgarh (new state)	−0.127***	−0.132***	−0.140***	−0.147***
	(0.012)	(0.026)	(0.023)	(0.021)
Post × Uttarakhand (new state)	−0.148***	−0.106***	−0.119***	−0.120***
	(0.015)	(0.020)	(0.019)	(0.018)
Post	0.007	−0.103***	−0.086***	−0.084***
	(0.006)	(0.011)	(0.010)	(0.009)
Observations	19,521	9,227	11,381	12,958
R^2	0.156	0.271	0.264	0.266

The table reports the heterogeneous effect of breakup on the Gini (concentration) of luminosity in each AC. The specification includes AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 5: Endowments of natural resources across states

	Proportion of Mine Regions	
	Pre-breakup	Post-breakup
State Pair 1:		
Bihar	0.2	0.05
Jharkhand (new state)		0.65
State Pair 2:		
Madhya Pradesh	0.4	0.35
Chhattisgarh (new state)		0.54
State Pair 3:		
Uttar Pradesh	0.05	0.02
Uttarakhand (new state)		0.23

The table reports the level and change in the proportion of mine regions (ACs) after state reorganization, as well as the level and change in growth rate (measured by gross state domestic product), for each state. Figures for the annual growth rate of each state are calculated by the planning commission in India. (+) indicates that the figures for the new state increased relative to the old state; (-) indicates that the figures for the new state decreased relative to the old state.

Table 6: RDD estimates of state breakup on log light intensity

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × New State	0.838***	0.381**	0.674***	0.693***
	(0.098)	(0.168)	(0.152)	(0.146)
Post	0.944***	2.037***	2.140***	2.168***
	(0.079)	(0.194)	(0.191)	(0.187)
Post × Mineral	−0.246	1.626**	1.599*	0.968
	(0.418)	(0.773)	(0.844)	(0.631)
Post × New State × Mineral	−0.388	−2.758***	−2.313**	−1.739**
	(0.735)	(0.951)	(1.001)	(0.842)
Observations	20,232	9,720	11,970	13,608
R^2	0.123	0.187	0.188	0.183

The table reports results for the effect of breakup on the log of total luminosity in each AC. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state; *Mineral* refers to the total quality of mines within each AC. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 7: RDD estimates of state breakup on light Gini

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × New State	−0.112***	−0.070***	−0.084***	−0.089***
	(0.008)	(0.017)	(0.015)	(0.014)
Post	0.007	−0.091***	−0.077***	−0.076***
	(0.006)	(0.013)	(0.011)	(0.010)
Post × Mineral	−0.059	−0.065	−0.100**	−0.095**
	(0.056)	(0.041)	(0.048)	(0.042)
Post × New State × Mineral	0.141**	0.149***	0.174***	0.171***
	(0.065)	(0.050)	(0.057)	(0.052)
Observations	19,521	9,227	11,381	12,958
R^2	0.156	0.271	0.264	0.266

The table reports results for the effect of breakup on the Gini (concentration) of luminosity in each AC. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state; *Mineral* refers to the total quality of mines within each AC. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 6 shows how local post-breakup effects are shaped by local natural resources. While ACs with a high concentration of deposits do relatively better across all states, they do worse in comparative terms if they are in the new states, post breakup. In Table 7, we carry out the same decomposition for the Gini coefficient[23] in luminosity within ACs and find a similar result; inequality rises in mineral rich ACs in new states relative to mineral rich ACs in old states, post breakup. So, while natural resource rich ACs do better than natural resource poor ACs on average following the break, and ACs in new states do better on average relative to ACs in rump states, natural resource rich ACs do comparatively worse in the new states. Since the identification strategy we employ isolates the effects of state breakup from the effects of other possible concurrent factors, these results show that these effects come from an interaction between state breakup and natural resource endowments at the AC level, with the interaction effect operating differently in the new states and the rump states. In turn, since these effects follow directly from state breakup, our results clearly point to a political channel having to do with natural resources.

3.3 Robustness checks

We examined the sensitivity of our results to variations in the estimation approach and to the inclusion of additional controls. We start by accounting for spatial correlation in our dependent variable and apply a spatial correction (Conley 1999) to our method of inference. Table C4 presents our main results with spatially adjusted standard errors and shows that our results are robust to the presence of arbitrary spatial correlation.

Next, we investigated the role of of conflict, primarily from Marxist (Naxalite) rebellions, in driving the state secession results. Mineral rich areas are also areas with heightened violence and conflict, and so the mineral resource effects we find may merely reflect developments in active conflicts in these states around the same time when state borders were redrawn. To investigate this, we include a measure of conflict, as proxied by the number of Maoist rebels-related incidents, as a control in all specifications. Table C5 shows that our results are not affected by this inclusion; furthermore, while the coefficient on the conflict variable is negative throughout, it is mostly statistically insignificant. Column (3) presents results on the effect of mineral resources post breakup on economic activity, after controlling for conflict. Here again, we find that our results are robust to controlling for the incidence of conflict.

We also carried out two placebo-style checks. First, we artificially move back the date of secession to 1996, four years before the actual breakup occurred. Columns (1)-(3) present results from this exercise; we find throughout that the *Post×New State* effect is statistically insignificant, suggesting that the positive discontinuity in outcomes for new states, only started revealing itself after the states were formally split in 2000. In the second instance, we examine the effect of a false, 2001 breakup on luminosity in the southern states of Andhra Pradesh (AP) and Telangana whose breakup occurred only in 2014. We take this as a placebo and ask whether the results here mimic those of the other three states if we pick the date of breakup as 2001. Our concern is that the effect of concentrated resource endowments might have occurred with or without breakup if for instance an increase in returns from mining or opportunities to extract rents had changed for some reason post 2001. These results, in columns (4)-(6) of Table C6, strongly support the notion that breakup matters. There is as before a strong positive trend in outcomes post 2001, but there is no particular effect of the pretended "treatment" nor any

[23]We calculate the Gini coefficient by measuring the inequality in light intensity across all 1km grids contained withing each AC.

particular effect of local mineral endowments that might independently have been affected post 2001 by a change in prices or rents over time.[24]

4 Political secession, natural resources and vote trading

Our empirical results show that the economic performance of NRR and NRP ACs was differentially affected by state breakup. The identification strategy we have employed in deriving these results isolates the effects of state breakup from the effects of other possible concurrent factors, and thus clearly points to a political channel being at work. But it does not directly tell us what this political channel might be. We find, however, clear evidence of an interaction between breakup and natural resource abundance at the local level. Additionally, the heterogeneous patterns across states suggest that the proportion of NRR ACs plays a role in this political transmission mechanism. This section discusses a stylized political-economy theoretical framework that account for these findings.

Secession is modelled simply as a change that affects the proportion of ACs that are natural resource rich within the resulting states. We categorize the effects of this change into (a) a first effect arising from how the reallocation of natural resource endowments changes the allocation of government revenues from natural resources – not only revenues from mineral royalties, which, as we already noted, are quite small, but also revenues from the taxation of all activities that are directly and indirectly associated with natural resource extraction; (b) a second effect arising from changes in governance outcomes, whereby a higher concentration of natural-resource rich areas in a new state may raise the political influence of the rent grabbing elites in natural resource rich ACs. In turn, the political bargaining power of local elites in natural resource rich ACs can affect policies and economic outcomes in the state – both in natural-resource rich areas and in other areas of the state via negative spillovers.

In the theoretical discussion that follows, we show how these two effects work in opposite directions, and that it is possible for the latter to dominate the former, producing a net fall in welfare in the natural-resource rich areas of the new, natural-resource richer states; and possibly, by the same mechanism, in an increase in welfare in the natural-resource rich areas of the old, natural resource poorer states.

4.1 Government revenues from natural resources

A first effect of secession by a state (effect (a)) is to change private income from natural resources and from activities related to the natural resources and any associated government revenues at the state level (effect (a) above). Note that revenues accrue to government not just from royalties. Suppose that there is a continuum of constituencies of mass one, each having identical population. A fraction $q \in (0,1)$ of those constituencies are natural resource rich (NRR) and each yield a potential level r in private income, as well as a level tr $(t \in (0,1))$ of government revenue from natural resources, which we assume is distributed equally across all constituencies, yielding per-jurisdiction government revenues of trq in both NRR and natural-resource poor (NRP) constituencies. Then a high density of NRR ACs (a high q) translates into a comparatively high level of provision of public goods, which benefits all constituencies – including NRR constituencies, which see a smaller fraction of their revenues being redistributed towards NRP constituencies – and therefore there are incentives for a subset of

[24]This result holds even when pooling the “placebo” sample with the original six states sample and testing for the effect of new state interacted with placebo sate pair. The coefficient on this interaction is statistically insignificant.

constituencies to secede to form a state that contains a higher proportion of natural resource rich constituencies in comparison with the original state.

4.2 VOTES FOR SALE

A second effect of secession (effect (b)) stems from how a change in the concentration of natural resources shapes concessions made to local natural-resource related interests under political competition. We model this effect drawing on the following stylized facts for India.

Natural resource rents give rise to local forms of "rent grabbing", both legal and illegal. Legalized rent grabbing consists of comparatively less efficient producers successfully securing resource extraction rights. Illegal rent grabbing is relatively less prevalent in poorer areas, and mainly consists of illegal mining. [XX EVIDENCE?] Collusion of local "rent grabbing entrepreneurs" with corrupt state-level politicians is required to sustain this. As discussed in Section 2.1, states own rights to onshore minerals, although they are subject to federal regulation. States grant licences and leases, and the Mines and Minerals Development and Regulation Act 1957 empowers state and central government officers to enter and inspect any mine at any time. Thus, illegally extracting minerals from these areas requires a degree of endorsement from the state – e.g. the police turning a blind eye to illegal activity, or favouritism in allocating leases.[25] And indeed there is evidence that politicians elected in NRR ACs are more likely to be corrupt: in a sample of 179 Parliamentary Constituencies (electing federal level MPs), the likelihood of politician with a criminal record being elected is increasing with the density of mines in that constituency (the coefficient from a simple OLS specification is positive and significant at the 5% level). There is also evidence that vote buying and electoral fraud takes place relatively more in the mineral rich areas: using survey responses from the State Election Survey for Jharkhand in 2005, which posed questions to individual voters about perceptions of voting malpractices, and running a logit specification of perceived voting malpractice within a district against the number of mines within that district, including district fixed effects and controls for household characteristics, gives a coefficient of 0.28 that is significant at the 1% level.

All of the above points to a bargain being struck, in NRR ACs, between state-level politicians and the local level political entrepreneurs who, through either persuasion or coercion of local voters, are able to deliver a certain volume of votes to whichever candidate or party they choose in exchange for concessions in the form of illegal activities. This exchange of votes for favours in NRR areas generates social costs stemming from rent grabbing activities – costs ranging from losses in production efficiency and a deterioration of law and order, to environmental degradation and road accidents due to overloaded trucks.[26] There is also direct evidence (Prakash et al. 2014) that ACs with criminal politicians (which,

[25] In 2014 the Supreme court ruled that more than 214 out of 218 coal licences awarded by governments between 1993-2010 were illegal (BBC News at `http://www.bbc.co.uk/news/world-asia-india-29339842`).

[26] Take, for example, the case of coal: "It is a murky subculture that entwines the coal mafia, police, poor villagers, politicians, unions and Coal India officials. Coal workers pay a cut to crime bosses to join their unions, which control access to jobs, according to law-enforcement and industry officials. Unions demand a 'goon tax' from buyers, a fixed fee per tonne, before loading their coal. Buyers must bribe mining companies to get decent-quality coal. The mafia pays off company officials, police, politicians and bureaucrats to mine or transport coal illegally.... Corruption is largely local: "The rackets include controlling unions and transport, manipulating coal auctions, extortion, bribery and outright theft of coal. Popularly known as the 'coal mafia', their tentacles even reach into state-run Coal India, the world's largest coal miner, its chairman told Reuters." From Reuters Special Report 2013, available at `http://graphics.thomsonreuters.com/13/05/IndiaCoalMafia.pdf`. For a theory of crowding out of entrepreneurship in manufacturing to politics in the presence of mineral rents, see Mehlum et al. (2006). Also note that the local vote sellers and state level vote buyers do not have to be different people: collusions is obviously even easier if they are one and the same.

as we have shown, are more prevalent in NRR ACs) experience comparatively worse outcomes.[27] The reason why this exchange of votes for favours should happen comparatively more in NRR ACs is that the state-level government controls the allocation of rights for the exploitation of natural resources as well as the enforcement of exploitation rights, but, as discussed earlier, because of the low royalty rates that are set by the federal government, the implications of these decisions for state-level revenues are negligible. Thus the state-level government has control over something that is highly valuable to local operators but involves little economic opportunity cost for state budgets, making it an ideal currency to be spent in votes-for-favours transactions. Natural-resource poor (NRP) constituencies lack such currency.[28]

We model this deal as a bargaining game in NRR ACs between vote sellers at the local level and vote buyers or parties at the state level, where favours are the price of votes. Favours generate negative economic spillovers on the rest of the economy, which erode political support in a segment of the electorate. These political costs must be balanced against the political gains from directly securing votes from the vote sellers. As we shall see, the balance between these political costs and benefits changes as the proportion of NRR ACs changes. Specifically, an increase in the proportion of NRR ACs translates into an increase in the equilibrium price of votes (higher favours for the local vote sellers), and thus into a deterioration in economic outcomes for both NRR and NRP ACs.

Policy preferences

In this section, we focus on the sale of votes from a local-level monopoly seller (or equivalently multiple local sellers perfectly colluding) to the incumbent party at the state level. We later discuss how these results are robust with respect to alternative assumptions.

There is a given unit mass of citizens/voters. Each voter has an ex-ante ideal point on ideology/policy space, denoted by $z_i \in [-1/2, 1/2] \equiv Z$. A voter's utility is quadratically decreasing in the distance of policy from her ideology, i.e. the payoff levels a voter i obtains from policy i' is $-(i-i')^2$. The distribution of ideology across voters is uniform over the support Z.

There are two parties, L (the incumbent) and R (the challenger), competing for a state-level election. The L party has an exogenously specified platform located at $-1/2$ in ideology space, while the R party has an exogenously specified platform located at $1/2$. The payoff levels a voter i obtains if L and R are elected are respectively $U_i^L = -(-1/2 - z_i)^2$, and $U_i^R = -(1/2 - z_i)^2$, with the voter with the median ideology ($z_i = 0$) being indifferent between the two political contestants. Additionally, there is an incumbency-related ideology shock, s, with uniform support $[-1/2, 1/2]$, that shifts the ex-post ideology of voter z_i to $z_i + s$.[29] For a given ideology shock, s, the share of votes for L and R are therefore respectively given by $1/2 - s$ and $1/2 + s$. In the absence of any vote trading, the probability of the L party winning is therefore the probability that $s < 0$, and the probability of the R party winning is the probability that $s > 0$, both of which are equal to $1/2$ given the assumed distribution of shocks.[30]

[27]Using data on luminosity and a similar identification strategy to that used in this paper, that study demonstrate that the election of criminally accused candidates leads to 5 percent lower GDP growth per year on average. Chemin (2011) shows that districts where criminal politicians won narrowly, spent 19% less on public goods for the poor.

[28]This can be seen as an extreme case of a more general scenario where vote trading can take place in all constituencies but comparatively more so in natural-resource rich ones.

[29]This incumbency related shock could be thought of, for example, as being linked to a common but unpredictable assessment by voters of the incumbent's performance while in office. s is a shock in favour of the R party.

[30]We can assume that if $s = 0$ each of the two parties wins with equal probability; but since this is a measure zero event, it

The winning party, $j \in \{L,R\}$, obtains political rents, W, which we assume to be unity without loss of generality. The incumbent party thus aims at maximising expected political rents, $P_j^W W = P_j^W$, where P_j^W is the probability of party j winning, given the vote trading outcome. The seller's expected payoff if votes are sold to party L (the incumbent) for a price x is $P_L^W x$.

The price of votes

In a given state, there is a proportion q of local natural-resource rich (NRR) constituencies where a local leader has full control of a fraction, $v \in (0,1/2)$ of the total votes (through intimidation or persuasion, the local leader can fully determine which single party those votes will be cast for).[31] In the rest of this section, we take q as exogenous; an extension in which the economic calculation linking natural resources and the presence of votes for sale is explicitly modelled, and where the proportion, q, of ACs where vote sales take place is endogenized on the basis of the value of natural resources is discussed in Appendix B.

We assume that the given tranche of votes, v, can only be delivered to a single party for a price x.[32] This price consists of targeted concessions facilitating rent grabbing by the sellers, such as, for example, the allocation of exploitation rights as well as a relaxation of restrictions and policing of abuses by those exploiting the natural resources illegally. This price can be delivered to the seller only if the vote buyer wins the election.

The favours that are delivered in exchange for votes, however, entail a political opportunity cost for the incumbent. Rent grabbing activities generate a loss in the constituency for those who do not partake in them, as well as negative spillovers for other constituencies. These losses only occur upon delivery of the promised payment if the party buying the votes is elected, and therefore translate into a loss of votes for the party that buys votes, which has the same effect as that of an ideology shift towards the R party among all those voters who do not sell their votes. The extent of this shift depends on the extent of spillovers – which in turn this depends on q and x. A NRR constituency experiences some negative effect, λx, in its own backyard but also some negative spillovers, $\rho q x$, from other affected NRR constituencies in the state. On the other hand, a NRP constituency only experiences the negative spillover ρq. Because of this asymmetry, an increase in the proportion, q, of NRR constituencies makes vote buying more attractive, raising the price of the votes that are available for sale:

Proposition 1: *Consider the a single (collusive) seller making a take-it-or-leave-it offer to a single buyer. The unique payoff maximizing price for the seller is* $\tilde{x} = \dfrac{v}{\lambda(1-v)+\rho(1-qv)}$. *This price is increasing in q and decreasing in ρ.*

(The proof is in Appendix B.)

Allowing for multiple buyers or sellers does not change conclusions. (This is shown in Appendix B.) The results of Proposition 1 also carry over to a scenario where neither party has all the bargaining

makes no difference to the analysis.

[31] These local leaders are often union bosses who control how much mining can be carried out via control over transport and workers. Having more than one seller in an AC will complicate the analysis. Competition between sellers within a constituency would change the distribution of rents between sellers and buyers, but would not change how the equilibrium price of votes changes.

[32] The assumption that the total amount of votes for sale is limited is also plausible given that there is a well functioning Election Commission that is responsible for preventing electoral fraud.

power. Under sequential bargaining with alternating offers (Rubinstein 1982), we obtain the following result:

Proposition 2: *The equilibrium level of x under sequential bargaining is increasing in q and decreasing in ρ. The corresponding equilibrium values of P_L^W are also increasing in q and decreasing in ρ.*

(The proof is in Appendix B.)

Qualitatively analogous results obtain under Nash bargaining.

Thus, an increase in the density of natural resources, as measured by q, will, through a political channel, raise x and thus lower welfare for individuals (other than the vote sellers) in the NRR constituencies as well as in the NRP constituencies, albeit to a lesser extent. The intuition for this result is that as the proportion of NRR constituencies becomes larger – and the proportion of NRP constituencies becomes smaller – the positive voting gains from vote buying in NRR constituencies increasingly come to dominate the purely negative political spillovers in NRP constituencies, and so the net political value of vote buying (and hence the maximum price that can be paid for it) increases.[33]

4.3 State breakup

The preceding analysis can be used to draw conclusions about the consequences of state breakup.

Consider a unified state, U, with N_U constituencies, a fraction q_U of which are NRR constituencies. When the unified state breaks up into the two new states A and B, each with N_A and N_B constituencies, each respectively with proportions q_A and q_B of NRR constituencies, utility for a citizen, i, in NRP and NRR ACs in state A is respectively

$$U_{iA}^{NRP} = K_{iA} - \rho \frac{N_A}{N_U} q_A x_A - \gamma \rho \frac{N_B}{N_U} q_B x_B. \tag{5}$$

$$U_{iA}^{NRR} = U_{iA}^{NRP} - \lambda x_A, \tag{6}$$

where K_{iA} is a constant representing the ideological component of utility that does not depend on x_A; and where $\gamma \leq 1$ reflects a possible mitigating effect on transboundary spillovers coming from the separation of state institutions.[34] The corresponding expressions for B are symmetrically identical. Voting choices in A only have an effect on x_A, and so only the terms that involve x_A in (5) and (6) are relevant for voting choices. Thus, in order to derive conclusions about how breakup affects x_A and x_B, we can simply focus on the effects that are captured by the first two terms in the above expressions, whereas when characterizing the welfare effects of the breakup, all terms must be accounted for.

In the single state analysis of the preceding section, ρ was fixed. With state secession, spillovers due to $x > 0$ change. Thus the predicted effect on x of the breakup – i.e. the predicted gap between x_U and x_A – coincides with the predicted effect in the model of a *combined* change in q and ρ from

[33]In mechanical terms, the effect of vote buying on the buyer's probability of re-election flowing from effects in NRP is negative. In an outcome where the overall net effect from NRP and NRR constituencies is zero (i.e. $P_L^W = 1/2$), the net effect of vote buying in NRR constituencies (where votes are secured) must be positive. Then, as the proportion of NRR constituencies increases, the overall net effect for a given price (x) becomes positive, and so the maximum price that can be paid rises.

[34]Breakup need not in itself affect the extent of the spillover. It is however plausible that it might; e.g. if separate states have separate police forces, and spillovers flow through the corruption of police officers within the police force, then secession would provide some degree of isolation. The higher is γ the higher is the effect of spillovers across state borders.

q_U to $q' = q_A$ and from ρ to $\rho' = (N_A/N_U)\rho < \rho$. Then, by Propositions 1 and 2, the effect of the breakup on x_A through q will be positive or negative depending on whether q_A is greater than or less than q_U, and the effect of the breakup on x_A through ρ will always be positive as long as $\rho > 0$ – since $\tilde{x}$ is decreasing in ρ and since $\rho' < \rho$; this second effect arises because in a smaller state voters only internalize a fraction of the overall spillovers. This amounts to voters' calculations in a single-state scenario being made as though ρ was $\rho' < \rho$.

Then, if $q_A > q_U$ the overall effect on $\tilde{x}_A$ will always be positive – both because the state is smaller than before and voters do not internalize the spillovers from other states and because of the increase in q; if $q_A \leq q_U$, it can be positive or negative, depending on whether the positive effect of ρ dominates the negative effect of a lower q:

Proposition 3: *Following breakup: (i) if $q_A \geq q_U$, then $x_A > x_U$; (ii) if $q_A < q_U$ then $x_A < x_U$ if $N_A/N_U > (1-q_U\nu)/(1-q_A\nu)$, and $x_A \geq x_U$ otherwise.*

(The proof is in Appendix B.)

We are now in a position to draw conclusions concerning the welfare effects of secession. The welfare effects for state A that stem from politically sanctioned rent grabbing, as measured by the last two terms in (5) and (6), in comparison with the pre-breakup situation are $\Delta U_A^{NRP} = -\rho\left((N_A/N_U)\,q_A x_A + \gamma(N_B/N_U)\,q_B x_B - q_U x_U\right)$, and $\Delta U_A^{NRR} = -\lambda(x_A - x_U) + \Delta U_A^{NRP}$, respectively in NRP and NRR constituencies. Welfare effects then depend on how q_A changes in comparison with q_U, and the size of A – which in turn determines the size of $\rho' = (N_A/N_U)\rho$ – and on γ, the extent of the spillovers from the neighbouring state. If separation brings about an abatement in the trans-boundary spillover ($\gamma < 1$), then secession can improve welfare by giving a degree of isolation – and if γ is sufficiently small, this mechanical "small is beautiful" effect can always dominate any other effect.

A scenario that provides a natural benchmark is where γ just offsets the voting externality brought about by secession – as reflected from the implied reduction from ρ to $\rho' < \rho$ in the voters' decision. With reference to a symmetric scenario where U is broken up into two identically sized states with $N_A = N_B = N_U/2$, the spillover level, $\tilde{\gamma}$, that makes welfare in an NRP constituency unchanged following breakup when $q_A = q_B = q_U$ is identified by the condition $(1/2)(1+\tilde{\gamma})\,\tilde{x}\big(q_U,\rho_U/2\big) = \tilde{x}\big(q_U,\rho_U\big)$. Under the normalization $\gamma = \tilde{\gamma}$ (i.e. in a scenario where with a uniform concentration of NRR constituencies, breakup produces no direct effect on welfare in NRP constituencies), we can then derive a clear prediction about the welfare effect of state breakup: the breakup of a state into equally sized states lowers welfare in the NRP constituencies of the new state A if $q_A > q_U$, and raises it if $q_A < q_U$ (i.e. under the same conditions that come into play in Proposition 1).[35] In NRR constituencies, state breakup unambiguously lowers welfare if $q_A > q_U$; if $q_A < q_U$ it unambiguously raises welfare if $N_A/N_U = 1/2 > (1-q_U\nu)/(1-q_A\nu)$ (and thus $x_A < x_U$), and has an ambiguous effect otherwise.[36]

As discussed in Section (4.1), secession also produces effects that flows through the redistribution of government revenues from the taxation of income from natural resources. This effect can be measured by $\mu(q_A - q_U)\,tr$, where $\mu > 0$ is the (constant) marginal valuation for publicly provided goods, and t is the rate of income taxation. Through this effect, and increase in q tends to raise welfare and a

[35] The condition identifying $\tilde{\gamma}$ gives $\tilde{\gamma} = 2\,\tilde{x}(q_U,\rho_U)/\tilde{x}(q_U,\rho_U/2) - 1 = \lambda\big((1-\nu)/\nu\big)\,\tilde{x}(q_U,\rho_U)$. Substituting this into the expression for ΔU_A^{NRR}, letting $q_B = 2q_U - q_A$ (since $q_A + q_B = 2q_U$) , differentiating the resulting expression with respect to q_A, and evaluating the resulting derivative at $q_A = q_B = q_U$, we find that ΔU_A^{NRP} is decreasing in q_A.

[36] If $q_A < q_U$ but $x_A > x_U$, then, under the given normalization of γ, there is a positive effect on the component of U_A^{NRR} that coincides with U_A^{NRP}, and a negative effect on the term $-\lambda x_A$ in U_A^{NRR}.

decrease in q tends to lower it.[37]

The effects on welfare for NRR ACs and NRP ACs is ambiguous. A higher q produces losses in both NRR and NRP ACs through its effect on governance outcomes, as well as a positive effect associated with the redistribution of government revenues from natural resources. If government revenues from natural resources are small, the first effects will dominate the second. If government revenues from natural resources are comparatively large, this conclusion can be reversed. As the negative effects on local governance outcomes from a higher q are larger in the NRR ACs than in NPR ACs ($\lambda > \rho$), it is also possible for NRP ACs to experience a net welfare gain and for NRR ACs to experience a net loss.

The model's predictions can thus be summarized as follows. Secession is more likely to raise welfare in the breakout state if natural resource density in the breakout state is lower in comparison with the parent (rump) state (q is lower post breakup), and more likely to lower welfare in the breakout state if natural resource density in the breakout state is higher in comparison with the parent state (q is higher post breakup). If government revenues from natural resources are sufficiently small, effects of the breakup on outcomes are also more likely to be less favourable in NRR ACs than in NRP ACs if q is lower post breakup. Conclusions are reversed if breakup results in a lower q. These predictions are in line with the patterns we see in our RDD estimates.

To find more direct empirical support for the interpretation that the interplay between NRR density at the local level and breakup operates through a political accountability channel, we can look for evidence that the interaction is dependent on politically relevant characteristics that vary across ACs. Our previous theoretical discussion did not distinguish between ACs whose elected representative is aligned with the state government and those where that is not the case; or between those ACs that are "swing" ACs – in the sense that the fraction of voters who firmly support either party (partisan voters) is small – and those where voters firmly support one party. However, we may plausibly expect that if the locally elected politician is aligned with the incumbent party, this could make it easier to buy votes for the state level party, whereas if the local elected politician is not aligned with the incumbent party, a vote-for-favours transaction might be less feasible. We may also expect votes to be comparatively more valuable in "swing" ACs. To see this, consider an asymmetric variation of our symmetric setup, in which there are two NRR constituencies, 1 and 2, both having the same fraction, v, of votes for sale, but featuring electorates with different median ideologies. If 100% of the voters in AC 1 always support the incumbent irrespectively of whether or not votes are bought, then the votes that are for sale in AC 1 have no value (or equivalently, they can be had for free), and therefore, an asymmetric equilibrium with constituency-specific "prices" x_1 and x_2 will always feature $x_1 = 0$. On the other hand, if 100% of the voters in AC 1 always support the challenger, then it may be prohibitively costly for the local seller to procure votes (i.e. there would be no votes for sale in that AC), and so again we would have $x_1 = 0$. Thus, if resource rich ACs are aligned or swing ACs we expect outcomes to be worse post breakup, relative to non-aligned or non-swing ACs.

Results of RDD estimates that includes this further interactions are presented in Table 8. These results are directly consistent with our theoretical predictions: the negative effects (on growth and inequality, respectively) of breakup in the resource rich ACs for states which experience an increase in q post breakup are exacerbated when these ACs are aligned or swing.

[37]There may be other effects of the breakup on welfare that are independent of the endowment of natural resources – effects that our analysis abstracts from. For example, the smaller size of each state post breakup might make administration easier, as well as allowing a better representation of the electorate.

Table 8: Interactions with political indicators

Panel A - Dependent variable: log light intensity

	Swing Cutoff: 2%	Swing Cutoff: 5%	Political Alignment
Post × New State	0.397**	0.383**	0.340**
	(0.187)	(0.194)	(0.164)
Post × New State × Mineral	−0.507	−0.396	−1.335*
	(0.823)	(0.808)	(0.778)
Post × Mineral × Swing	1.783**	2.676***	
	(0.826)	(0.747)	
Post × Mineral × Alignment			0.978
			(0.617)
Post × New State × Mineral × Swing	−4.278**	-4.454**	
	(2.003)	(2.033)	
Post × New State × Mineral × Alignment			-1.973*
			(1.183)
Observations	11,034	11,034	9,195
R^2	0.183	0.183	0.136

Panel B - Dependent variable: light Gini

	Swing Cutoff: 2%	Swing Cutoff: 5%	Political Alignment
Post × New State	−0.071***	−0.067***	−0.071***
	(0.018)	(0.018)	(0.016)
Post × New State × Mineral	0.103**	0.086**	0.098**
	(0.043)	(0.043)	(0.040)
Post × Mineral × Swing	−0.157**	−0.204***	
	(0.069)	(0.072)	
Post × Mineral × Alignment			−0.121**
			(0.058)
Post × New State × Mineral × Swing	0.898***	0.865***	
	(0.247)	(0.269)	
Post × New State × Mineral × Alignment			0.181*
			(0.105)
Observations	10,532	10,532	8,831
R^2	0.253	0.253	0.242

The table reports results for the effect of breakup on the log of light intensity (Panel A) and the Gini of luminosity (Panel B) within each AC, for a distance bandwidth of 200 km. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. All specifications also control for all possible interaction combinations, not reported, but which are mostly insignificant. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state; *Mineral* refers to the total quality of mines within each AC; *Swing* refers to whether the margin of victory in the pre-breakup election year for less than 2% (Column 1) or 5% (Column 2); *Alignment* is a (time-varying) binary indicator for whether the constituency's winning candidate belongs to the (leading) ruling party of the state. The specification in Column 3, uses only observations prior to delimitation in 2008. Standard errors clustered at the AC level are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

5 Concluding remarks

In this paper we have exploited the breakup of three of the largest states in India, comprising areas with some of the largest concentration of mineral resources in the country, to examine whether there is a natural resource curse in states that inherit a large share of the natural resource deposits, both in terms of the levels of activity and in terms of redistribution. The parallel changes induced by state breakup in the political structure and in the comparative concentration of natural resources offers within-country evidence about whether the link between natural resources and economic outcomes at the local level flows arises from the interplay between natural resources and political institutions. Our estimation results suggest that there is no unconditional curse either at the state level nor at the local level. However, when states get a very large share of natural resources (i.e. the difference in the proportion of NRR areas between the new state and rump state is over a threshold) then we do see a natural resource curse at the local level.

Ourc conclusions are thus is in line with the broad view that the curse is conditional on the "quality" of institutions (Lane et al. 1999, Acemoglu and Robinson 2006, Mehlum et al. 2006, Mehlum et al. 2011, Caselli and Tesei 2016), and that, accordingly, the question of how to develop institutions to harness the positive effects of natural resources is an important one for economic development, as poorer countries rely comparatively more on natural capital (see van der Ploeg 2011). However, it is not immediately clear why and through which mechanism state breakup should affect institutional quality. We argue that a plausible channel for the effects we observe is a reduction in electoral accountability in new states that inherit a large fraction of NRR areas relative to the rump state, a conjecture that is consistent with the patterns we see in the data.

The accountability channel we describe operates in a context where political power resides at the state level but where the power to influence voters resides at the local level, and where states have no control over royalty rates and thus have limited direct incentives to oppose rent grabbing by local groups. In this context, we suggest that the political bargain between local-level elites and state-level elites is a key part of the story, and a given increase in local natural resource rents at the state level can thus lead to better or worse outcomes depending on how the political bargain changes. Our interpretation reflects the distinctive features of the Indian institutional context – the way property rights for natural resources are allocated between the three layers of government, the way that royalties are set, the way revenues from natural resources are divided between the three layers and the majoritarian election rules. Comparing the Indian case with with other institutional setting – e.g. Peru (Loayza et al. 2013) where part of the revenues from mineral deposits go to the local area – could provide interesting insights as to how crucially the effects that we find for the Indian case depend on the particular institutions.

A direct implication of our analysis is that welfare outcomes in natural resource rich areas could improve if the response to demands for secession were met by higher fiscal redistribution towards the areas that threaten to secede, rather than by creating new political entities (although, of course, this may create a moral hazard problem). Another implication is that adverse effects could be mitigated by redrawing constituency borders so as to reduce the weight of NRR areas within individual ACs and so make it more difficult to buy a large fraction of the total votes. Finally, changing the current allocation of decision powers with respect to mineral concessions and royalty rates, as well as the way public revenues from natural resources are allocated across state and local communities, may be an effective way of mitigating the curse.[38]

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[38] The federal government that was instated in 2014 has proposed an amendment to the original Bill of 1957 that would address some of the problems we have mentioned – principal amongst them the excessive separation between the powers to set royalty rates and the powers to grant concessions – establishing District Mineral Foundations (DMFs) in areas affected by mining related operations (see Narain 2015). These new institutional arrangements might well hold the key to improved performance for areas with concentrated resources that might succumb to a local natural resource curse otherwise. However, the incentives for local capture of the DMFs cannot be readily discounted.

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A DATA SOURCES

In this section we describe in detail the axillary data used for the analysis.

National and State Election Study 2004: The survey is conducted by the CSDS. The survey interviews respondents immediately after polling and enumerates information on the political behaviour, opinion and attitudes of voters alongside their demographics. The survey uses a dummy ballot box for capturing the respondent's voting choice wherein respondents were asked to mark their voting preference on a dummy ballot paper and drop it in a dummy ballot box. Sampling for the survey is carried out using a multi-stage stratified random sampling design. The first stage involves stratified sampling of Assembly Constituencies by state proportional to their size. In the second stage, polling Stations are sampled from each of these ACs, again proportional to electorate size. In the final stage respondents are selected from the Electoral Rolls provided by the Election Commission. Respondents are sampled by the Systematic Random Sampling (SRS) method, which is based on a fixed interval ratio between two respondents in the polling booth. More information on the sampling and questionnaire modules of the 2004 NES can be found in Team (2004).

AC and PC Maps: The Assembly Constituency (AC) and the Parliamentary Constituency (PC) map, shape files were obtained from the Election Commission of India website (http://eci.gov.in/). This data was cleaned and geo-referenced using projections provided by Sandip Sukhtankar[39] and INRM Consultants, New Delhi. Note that the AC maps for Uttarakhand are only available post delimitation. However, only a small fraction of constituencies are affected by the delimitation procedure in Uttarakhand and are results are robust to dropping these constituencies (see table 8). Distances to the boundary for each AC was calculated by taking the centroid of each AC polygon and measuring its Euclidean distance to the state boundary line. Finally, we also divide the entire boundary line into segments which we include as fixed effects in our specifications.

Data on Conflict: The data on the conflict as measured by Maoist incidents is compiled by[40] Gomes (2015) and comes from four different sources: Global Terrorism Database (GTD) I: 1970-1997 & II: 1998-2007; Rand-MIPT Terrorism Incident database (1998-present); Worldwide Incidents tracking system (WITS); National Counter Terrorism Centre (2004-2007); South Asia Terrorism Portal (SATP).

Data on Criminal Politicians: Data on criminal politicians in India is taken from Fisman et al. (2014) who compile this information from candidate affidavits. These are held on the the GENESYS Archives of the Election Commission of India (ECI) and the various websites of the the Chief Electoral Officer in each state. The archives provide scanned candidate affidavits (in the form of pictures or pdfs) for all candidates.

Household Panel Data, IHDS: We use data from two waves (1992 and 2004) of the India Human Development Survey (IHDS). This is a nationally representative survey of 41,554 households in 1,503 villages and 971 urban neighbourhoods across India. Data are publicly available through ICPSR. For more details on the survey see Desai et al. (2007).

State Election Results: We use the results of all state elections held in the six states analyzed, between the years of 1992 and 2009. This data is obtained from the Election Commission of India.

Human Demographics: We use data on district-level migration and literacy from the two census waves conducted in 1991 and 2001. This data is available at the census of India website.

Electricity Prices: Data on electricity tariff is compiled at an annual level for each state by India Stat.This data is sourced from the annual reports on the working of state electricity boards and electricity departments as well as the Planning Commission reports.

[39] Retrieved from http://www.dartmouth.edu/ sandip/data.html

[40] We are very grateful to Joseph Flavian Gomes for sharing his data on district level conflict in India.

B PROOFS

PROOF OF PROPOSITION 1

As only one buyer (the incumbent party, L) can buy votes, the votes on sale have no alternative use, and so if the buyer has all the bargaining power and can make a take-it-or-leave-it offer to the vote sellers, then it will be able to buy the votes at a price $x = 0$. On the other hand, if only the incumbent party, L, can buy votes, but the sellers have all the bargaining power *and operate as a single seller* (i.e. they collude), then the take-it-or-leave-it offer price can be derived as follows.

The overall effect for a NRR constituency from $x > 0$ is given by $(\lambda + \rho q)x$, whereas the effect for a NRP constituency is given by $\rho q x$. The utility of voters in a NRR constituency constituency from the L party being elected under shock s is now given by $U_i^L = -(-1/2 - z_i + s)^2 - (\lambda + \rho q)x$, [41] and a voter i is therefore indifferent between the L and R parties (i.e. $U_i^L = U_i^L$) iff $-(-1/2 - z_i + s)^2 - (\lambda + \rho q)x = -(1/2 - z_i + s)^2$. This gives the cutoff ideology conditional on shock s as $\hat{z}^{NRR} = -(\lambda + \rho q)x/2 - s$, and in an NRP constituency the cutoff ideology is $\hat{z}^{NRP} = -\rho q x/2 - s$. The vote share of the L party among the $1 - v$ voters in q NRR constituencies who do not sell their votes is then given by $\hat{z}^{NRR} + 1/2 = 1/2 - (1/2)(\lambda + \rho q)x/2 - s$. The loss of votes due to $x > 0$ in an NRR constituency is $L_R = (\lambda + \rho q)x/2$. The vote share of the L party among the voters in each of the $1 - q$ NRP constituencies is given by $\hat{z}^P + 1/2$, and the loss of votes in an NRP constituency due to $x > 0$ is $L_P = \rho q x/2$.

Suppose that party L buys the qv votes at price x in a state. The total vote share conditional on shock s is given by $V_{LB} = qv + q(1 - v)(1/2 - s - L_R) + (1 - q)(1/2 - s - L_P)$. The L party wins if $V_{LB} \geq 1/2$, i.e. iff $qv + (1/2 - s)(1 - qv) + q(1 - v)(-L_R) + (1 - q)(-L_P) \geq 1/2$, or

$$\frac{qv}{2} - \frac{q(1-v)\lambda x}{2} - (1-qv)\frac{\rho q x}{2} \ \geq\ s(1-qv). \tag{7}$$

Using the fact that s is uniformly distributed on $[-1/2, 1/2]$, the probability of winning is

$$P_L^W = \frac{1}{2} + \frac{1}{2(1-qv)}\big(qv - q(1-v)\lambda x - \rho q x(1-qv)\big) \equiv \Phi(x). \tag{8}$$

Then, the maximum price the buyer is willing to pay is that for which $\Phi(x) = 1/2$, which gives $x = v / \big(\lambda(1-v) + \rho(1-qv)\big) \equiv \tilde{x}$. The seller's payoff, $P_L^W x = \Phi(x)x$, reaches a maximum at $x = 2\tilde{x}/(3qv)$, which, for $v \leq 1/2$, is always greater than $\tilde{x}$. Thus, $\tilde{x}$ is the value of x that maximizes the seller's payoff subject to the constraint $P_L^W \geq 1/2$.

TWO BUYERS OR TWO SELLERS

If both the L and the R party can buy votes from a single seller where the seller makes a simultaneous take it or leave it offer to the buyers, $\tilde{x}$ remains unchanged. Suppose that both parties can buy votes. The sequence of actions is as follows. The seller posts a price. Each buyer can accept or reject the price. If both buyers accept the offer, the votes are sold, at the posted price, to one of the buyers selected at random. If one buyer accepts while the other buyer rejects, the accepting buyer gets the votes. If both buyers reject the offer, another offer can subsequently be made according to the same protocol. We focus on subgame perfect equilibria of this game.

Allowing for multiple sellers also does not change conclusions, as the following discussion demonstrates. Suppose that there is a mass, q, of N NRR equal-sized constituencies, each of them having mass q/N; and

[41] Note that we ignore spillovers from other constituencies which are not in the state, as voters are instrumental and do not include those in the calculation since they cannot affect those spillovers.

suppose that sellers simultaneously post prices $x_1, x_2, ...x_N$, and make a take it or leave it offer to the buyer. Each seller chooses its price given the conjectured prices of the other sellers. If the seller of a single NRR constituency, i, sells v votes for a price x_i, while all other sellers in NRR constituencies post a price x_0 (assuming symmetry), the loss of votes (among the $1-v$ voters in the NRR districts) to the incumbent in constituency i is $(1/2)\big(\lambda x_i + \rho\big(x_i + (N-1)x_0\big)q/N\big)$. In the NRP constituencies, the loss of votes is $(1/2)\rho(x_i + (N-1)x_0)q/N$. Hence the probability of winning is

$$\begin{aligned} P_L^W &= \frac{1}{2} + \frac{1}{2(1-qv)} \quad \Big(qv - q(1-v)\big(\lambda x_i + \rho(x_i + (N-1)x_0\big)q/N \\ &\qquad -(1-q)\big(\rho(x_i + (N-1)x_0\big)q/N\Big). \end{aligned} \tag{9}$$

The best offer from the perspective of seller i is then that which makes the above expression equal to $1/2$ (the buyer's reservation value), given the other sellers' choice, x_0. Solving for this optimal x_i, as a function of x_0, and then focusing on a symmetric solution with $x_i = x_0$, we obtain a value $\tilde{x}$ that is the same as that with full collusion. The intuition for this result is that each seller, no matter how small, acts as a monopolist for its votes against the given buyer's total reservation payoff of $1/2$.

PROOF OF PROPOSITION 2

Let $U^S(x) = \Phi(x)x$ and $U^B(x) = \Phi(x) - 1/2$, and let $\big(U^S(x_S), U^B(x_S)\big)$ denote the offer made by the seller, and $\big(U^S(x_B), U^B(x_B)\big)$ the offer made by the buyer. If the seller is the first mover, an equilibrium corresponds to the solution of the two equations: $U^B(x_S) = \delta U^B(x_B)$ and $U^S(x_B) = \delta U^S(x_S)$. A solution gives:

$$x_S = \tilde{x}\,\frac{1 + \delta\left(1 + \delta - \sqrt{1 + \delta(2 + \delta - 4qv(1-qv))}\right)/(2vq)}{1 + \delta + \delta^2}. \tag{10}$$

This is increasing in q. Thus, when some of the surplus accrues to the buyer (the incumbent party, L), an increase in the density of natural resources (a higher q) can make the incumbent's position more secure (it raises P_L^W).

ENDOGENOUS q

Suppose than in any AC, $i \in [0,1]$, there is a cost c for delivering v votes to the buyer. ACs are indexed so that the unit value of natural resources, $r(i)$, is increasing in i. Then the vote seller will deliver votes from a given AC, i, iff $r(i)x > c$, and will not deliver any votes from that AC otherwise. Since $r'(i) > 0$, if $r(0)x < c$ and $r(1)x > c$, there will be a cutoff point $\underline{i}(x)$ such that there will be votes for sale only in ACs $i > \underline{i}$, and so $q = 1 - \underline{i}(x)$. The seller's take-it-or-leave it offer, x, together with the proportion, q, of ACs involved in vote sales is then identified by the two conditions

$$\begin{cases} x = \dfrac{v}{\lambda(1-v) + \rho(1-vq)}; \\ r(1-q)x - c = 0. \end{cases} \tag{11}$$

For the sake of simplicity, in the rest of our discussion we assume $r(i) = r_0 + \alpha i$, but the arguments can be generalized to any schedule $r(i)$ s.t. $r'(i) > 0$. The mean level of r is $\overline{r} = r_0 + \alpha/2$; solving for r_0, we can then express $r(i)$ as $r(i) = \overline{r} + \alpha(i - 1/2)$, where $\overline{r}$ can be interpreted as reflecting the *density* (average value) of natural resources in the state, and α their *concentration* within the state. Replacing this expression into the above system of equations and solving for x and q, we obtain

$$\begin{cases} \tilde{x} = \dfrac{(\alpha - \rho\, c)\, v}{\alpha(\lambda + \rho) - \alpha(\lambda + \rho/2)v - \rho\, \overline{r}\, v}; \\[2ex] \tilde{q} = \dfrac{(\alpha/2 + \overline{r})\, v - (\lambda\,(1 - v) + \rho)\, c}{(\alpha - \rho\, c)\, v}. \end{cases} \tag{12}$$

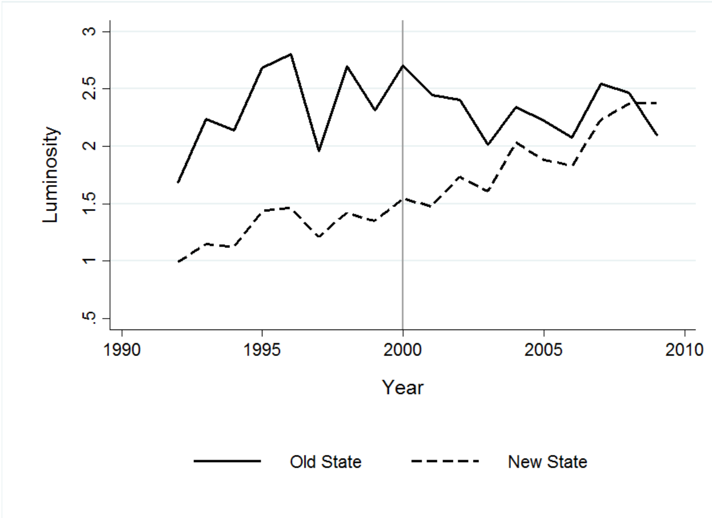
In an interior solution with $\tilde{q} \in (0, 1)$, both $\tilde{x}$ and $\tilde{q}$ are increasing in $\overline{r}$ and decreasing in α; i.e. an increase in the density of natural resources leads to more votes-for-favours transactions and more rent grabbing, whereas an increase in their concentration has the opposite effect.

Proof of Proposition 3

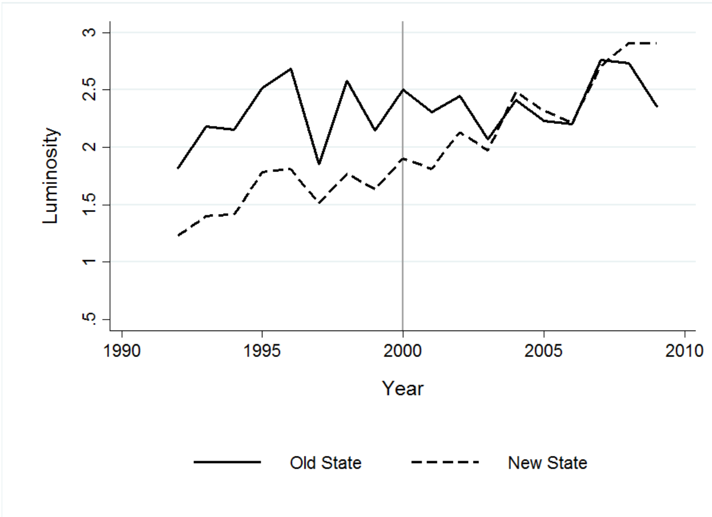
With secession, the effect of $q_A \leq q_U$ on x_A dominates the effect of a smaller ρ if $x_A(\rho', q_A) \leq x_U(\rho, q_U)$, which is true iff $N_A/N_U > (1 - q_U v)/(1 - q_A v)$.

C ADDITIONAL TABLES AND FIGURES

Figure C1: Light intensity trends, before and after breakup



(a) Average Luminosity Across All Six States



(b) Average Luminosity in Border Areas Across All Six States

These figures report the time series of average luminosity across each of the six reorganized states of India. Figure (a) shows the trends for the entire area spanned by each state, whereas Figure (b) shows the trends for only areas lying within 150 km of new state boundaries. In each figure, the solid black line represents the combined average luminosity for old states whereas the dotted line represents the combined average luminosity for new states. Average luminosity is measured by taking the average across value of the the satellite measure (digital number ranging from 0 to 63) over the 1km by 1km gridded area of each state.

Table C1: Descriptive statistics

	Full Sample			BW 150			BW 200			BW 250		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Log Luminosity	20232	6.589	2.260	9720	6.188	2.635	11970	6.164	2.582	13608	6.248	2.524
Luminosity Gini	20232	0.674	0.258	9229	0.707	0.254	11970	0.716	0.249	13608	0.706	0.253
Mineral Quality	20232	0.006	0.050	9720	0.011	0.068	11970	0.010	0.064	13608	0.009	0.061
# of Mines	20232	0.165	0.372	9720	0.191	0.393	11970	0.189	0.392	13608	0.188	0.391
# Conflict Occurrences	20232	0.353	2.613	9720	0.424	1.748	11970	0.417	2.091	13608	0.408	2.166

The table reports summary statistics for the main variables used in our regression analysis. There are 202,32 AC-year observations in the full sample of our data. We also report summary statistics for the sample relevant to each bandwidth (referred to as 'BW') used for the regression discontinuity analysis. BW 150 refers to the sample of ACs lying withing 150km of the state borders. Similarly, BW 200 and 250 refer to the sample of ACs lying withing 200km and 250km respectively of the state borders.

Table C2: Demographics and state breakup

	Border District Demographics, Census (2001-1991)	
	Proportion Literate	Proportion SC/ST
Post × New State	−0.07	0.005
	(0.04)	(0.04)
Post	−0.08***	0.14***
	(0.03)	(0.03)
Observations	63	63
R2	0.58	0.67

The table reports results for demographics. Census data on demographics is available for two periods, 1991 and 2001, at the district level. The analysis in column is restricted to districts around the border of each state (after breakup) and uses sistrict/state fixed effects. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state. Robust standard errors are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table C3: Effect of breakup on household indicators

	Per-capita Income	Infant Mortality	Water Availability	Food Expenditure
Post × New State	3,737.451**	0.093	0.158**	45.249
	(1462.780)	(0.099)	(0.080)	(41.714)
Post	93.374	−0.130	0.022	174.202***
	(719.003)	(0.083)	(0.021)	(26.988)
Household F.E.	Yes	Yes	Yes	Yes
State Dummy × Post	Yes	Yes	Yes	Yes
Observations	1,040	839	1,040	1040
R^2	0.128	0.062	0.106	0.495

The table reports results for the effect of breakup on various household indicators obtained from the IHD household survey. The sample is restricted to households residing within districts around the border of each state (pre and post breakup). The outcome variables are: *Per-capita Income* which is the household size adjusted total income of a household (in rupees); *Infant Mortality* is the infant mortality rate of the household (reported only for households with children); *Water Availability* is the binary response to the survey question “Is the availability of drinking water normally adequate?”; *Food Expenditure* is the monthly food expenditure of a household (in rupees). The specification includes household fixed effects and state dummies (all 6 states) interacted with the post-breakup indicator. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state. Standard errors, clustered at the household level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table C4: RDD estimates of log light intensity, with spatially adjusted errors

	BW 150	BW 150	BW 150
Post × New State	0.348***		0.381***
	(0.103)		(0.104)
Post × Jharkhand (new state)		−0.855***	
		(0.155)	
Post × Chhattisgarh (new state)		−0.324**	
		(0.149)	
Post × Uttarakhand (new state)		1.444***	
		(0.109)	
Post			
Post × Mineral			1.626***
			(0.530)
Post × New State × Mineral			−2.758***
			(0.635)
Observations	9,720	9,720	9,720
R^2	0.042	0.070	0.043

The table reports results for the effect of breakup on the log of total luminosity in each AC. All specifications include AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state; *Mineral* refers to the total quality of mines within each AC. Spatially adjusted standard errors are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table C5: RDD estimates of log light intensity, controlling for conflict

	BW 150	BW 150	BW 150
Post × New State	0.382**		0.409**
	(0.163)		(0.163)
Post × Jharkhand (new state)		−0.994***	
		(0.223)	
Post × Chhattisgarh (new state)		−0.342	
		(0.281)	
Post × Uttarakhand (new state)		1.430***	
		(0.201)	
Post	2.084***	2.233***	2.069***
	(0.193)	(0.185)	(0.193)
Post × Mineral			1.627**
			(0.777)
Post × New State × Mineral			−2.620***
			(0.945)
Conflict	−0.369	−0.389	−0.372
	(0.259)	(0.256)	(0.259)
Post × Conflict	0.359	0.357	0.362
	(0.262)	(0.259)	(0.262)
Post × New State × Conflict	−0.046	0.055*	−0.042
	(0.030)	(0.028)	(0.030)
Observations	9,720	9,720	9,720
R^2	0.187	0.211	0.188

The table reports results for the effect of breakup on the log of total luminosity in each AC. Effects of breakup for each state-pair are also reported. All specifications include AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup i.e., year 2001 onwards: *Treat* is an indicator for the newly created state; *Mineral* refers to the total quality of mines within each AC; *Conflict* measures the total number of conflict occurrences, by year, within each AC. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table C6: RDD estimates of placebo breakup on log light intensity

	Placebo Breakup 1996			Placebo Breakup AP		
	BW 150	BW 200	BW 250	BW 150	BW 200	BW 250
Post × New State	−0.140	0.134	0.131	0.021	0.038	0.068
	(0.200)	(0.191)	(0.175)	(0.118)	(0.106)	(0.101)
Post	2.524***	2.610***	2.684***	1.672***	1.633***	1.595***
	(0.307)	(0.298)	(0.292)	(0.217)	(0.193)	(0.176)
Post × Mineral	0.409	0.679	0.026	−7.319	−1.346	3.162
	(1.149)	(1.107)	(0.849)	(10.292)	(9.359)	(8.828)
Post × New State × Mineral	−0.912	−1.146	−0.628	0.075	1.694	−2.677
	(1.363)	(1.292)	(1.107)	(15.336)	(9.322)	(8.802)
Observations	4,320	5,320	6,048	4,662	5,364	6,012
R^2	0.183	0.196	0.197	0.221	0.230	0.215

The table reports results for placebo effects. We investigate: (i) in columns 1-3, the effect of a placebo state breakup on luminosity in the pre breakup year of 1996 (four years before the actual breakup occurred); and (ii) in columns 4-6, the effect of a 2001 placebo-breakup on luminosity in the states of Andhra Pradesh (AP) and Telangana (whose breakup occurred only in 2014). The dependent variable for all specifications is the log of total luminosity in each AC. All specifications include, AC fixed effects, year fixed effects, border segment interacted with the *Post* indicator and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting ACs on either side of the border for the analysis. *Post* refers to the years after breakup; *Treat* is an indicator for the newly created state; *Mineral* refers to the total quality of mines within each AC. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.