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## Abstract

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JEL Classification: C72, D72, H77, O13, O43, Q34

Keywords: Natural Resources and Economic Performance, Political Secession, Fiscal Federalism



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

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## 1 INTRODUCTION

The literature on the natural resource curse can be broadly divided into two camps: that which claims there is an unconditional resource curse (e.g., Sachs and Warner 2001, Gylfason 2001, Leite and Weidmann 1999) and more recently that which views the resource curse as being conditional on the quality of institutions (see Lane et al. 1999, Acemoglu and Robinson (2006), Mehlum et al. 2006, Caselli and Tesei 2015). While the latter is now the prevalent view, there is little evidence as yet on which precise institutional channels matter. In this paper, we exploit the break up of three of the biggest Indian states, comprising areas with some of the largest endowments of natural resources in the country, to explore how changes in electoral accountability – driven by the spatial distribution of natural resources post break up – explains differences in growth and inequality. The question of how to develop institutions to harness the positive effects of natural resources is an important one for economic development, as the evidence shows that poorer countries rely much more on natural capital (see van der Ploeg 2011).

Our context is the break up, in 2000, of three of the largest Indian states – Uttar Pradesh, Madhya Pradesh, and Bihar – respectively equivalent in population size, post breakup, to Brazil, Turkey and Philippines. The post breakup experience has given rise to an intense debate about whether the new, smaller states have done better in governance and economic performance (Kale et al. 2010), and about the potential consequences of further demands for secession.[1] Answers have been many: success for some of the new states has been attributed to the zeal of policy-makers, while weak performance in others has been variously attributed to poor and corrupt leadership and to the large mining rents available. In brief, speculation about how these states have fared has ranged from the Great Man theory of development[2] to the curse of natural resources and to intrinsic efficiency advantages in the governance of smaller states.

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 state boundaries and size, but also in a dramatic change in the distribution and concentration of natural resources across new and rump states: rump states were left with a far smaller share of those resources while the new states acquired the lion's share.[5] In what follows, we exploit these parallel changes in political structure and comparative natural resource endowments to examine the link between electoral accountability and natural resources.

We begin our discussion by presenting a stylized model of how secessions affect economic outcomes in the newly formed states. This framework is designed to account for two effects, both deriving from

[1]The article "India Redrawn" in Outlook Magazine (http://www.outlookindia.com/article/india-redrawn/279690) describes the proposed division of India into 50 states compared to the current 25, which makes this discussion both pertinent and important.

[2]This is attributed to the historian Thomas Carlyle (1840) who wrote "The history of the world is but the biography of great men."

[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.

[5]The borders of the new states have always been well-defined as will be discussed later. Figure 2 shows the new borders and the states after breakup.

the unequal distribution of natural resources across the newly formed states relative to the rump states. We characterize the effects of the unequal distribution in two ways. First, we should see a positive effect arising from the change in the comparative allocation of income from natural resources, so that after secession the states end up controlling a comparatively greater or smaller proportion of natural resources than before. Second, there might be a negative effect arising from changes in incentives to govern well. This is driven by a higher concentration of natural resource rich constituencies in a new state, which raises the political influence of those controlling the natural resources and adversely affects economic outcomes, both in natural resource rich areas and in other areas of the state. We show that these two effects work in opposite directions. When the negative effect dominates, it produces a net fall in welfare in the natural resource rich areas of the new states that are also relatively natural resource rich; and by the same mechanism, an increase in welfare in the natural resource rich areas of the rump states that are now relatively poor in natural resources overall.

We then proceed to document average performance of each of the new entities both pre-2000 (before breakup) and after. We use data on the evolution of luminosity as a proxy for the evolution of economic activity at the sub-regional level for the period 1992-2010 together with data on mining deposits across the states, with a view to examining the importance of rents from point-source natural resources. We rely on geographic discontinuity at the boundaries of each state pre-breakup, which allows us to employ a sharp regression discontinuity design to estimate the causal effect of secession on growth and inequality.

Figure 1 displays the distribution of luminosity across India in 2008; the poorer northern and central regions in which our three states are located stand out for their low levels of luminosity relative to the rest of India. Our first and main finding is that, while all states experience a trend increase in luminosity, on average new states did better than the rump states, with a differential in luminosity of 35 percent. It is also clear that the effects are heterogeneous; the average positive effect is driven by Uttarakhand relative to its rump state of Uttar Pradesh, with a strong negative effect of Jharkhand relative to the rump state Bihar, and a milder negative effect of Chhattisgarh relative to Madhya Pradesh.

Figure 2 shows the states post break up, with the rump states retaining their names (Bihar, Madhya Pradesh and Uttar Pradesh), while the split-offs are Jharkhand, Chhattisgarh and Uttarakhand. Figure 3 describes the dramatic uneven spatial distribution of resources; note that Jharkhand acquired control of most deposits relative to its rump, Bihar; while Chhattisgarh has a large share, its rump Madhya Pradesh retains a considerable amount. Uttarakhand and Uttar Pradesh do not have much in the way of point source resources and thus offer a counterpoint to the other two sets of states. Given that the distribution of resources remains unchanged within states before and after break up, the main change lies in the creation of a new political entity and the consequent changes in the relative political weight of natural resource rich areas following the change in relative concentration brought about by secession – e.g. Jharkhand ends up not only with the lion's share of natural resources from Bihar, but also inherits a particular spatial distribution that we show is linked to electoral accountability.

Our empirical design, which exploits the breakup of states, isolates the effects of political structure from other potential determinants, and thus allows us to focus on the political economy channel. We focus on differences in outcomes at the assembly constituency (AC) level across the states.[6] We obtain

[6]There are two main levels of government in India; the first is the federal level, where parliamentary representatives are elected from (parliamentary) constituencies, within state; the second is the state level, where representatives to state assemblies are elected from assembly constituencies which are demarcated separately.

a striking result: the heterogeneity in outcomes (both in aggregate activity and local inequality at the AC level) is mirrored in the differences in outcomes by ACs in states where, post break up, a large fraction of ACs have valuable mineral deposits relative to similar ACs in states which end up with a small fraction of ACs which have valuable mineral deposits post break up. In other words, a high density of ACs that are rich in mineral resources in a state weakens economic performance, and these effects are much larger in ACs which are rich in mineral deposits. This variation in ACs with deposits, together with the enormous concentration of natural resource rich ACs in Jharkhand relative to Bihar potentially explains the heterogeneity in aggregate or state-level outcomes. Our explanation thus hinges on the spatial concentration of natural resources across states and the interplay of state and local political structures at the level of the assembly constituency.

These findings show that, overall, secession is a force for economic growth, as all constituencies do better on average across all six states post breakup. However, constituencies in states with a higher proportion of natural resource rich ACs post break up do relatively worse relative to their rump – suggesting that there is a local curse that flares up within the new political structures created upon breakup and that is related to the change in the political weight of resource rich ACs in the new states. The channel for this effect is that resource rich ACs suffer from various types of "rent grabbing" activities which create negative spillovers on other constituencies. Such activities are politically sanctioned by the state government in return for electoral benefits from local leaders. When secession leads to a higher relative weight of such constituencies, the extent of politically sanctioned rent grabbing increases, leading to worse outcomes for all constituencies in the state. The paper thus provides a link between electoral accountability at the state level and the spatial distribution of natural resources.

There are of course many alternative potential explanations for the natural resource curse at both local and national levels. 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) might be another. Unless there was a dramatic change in commodity prices or in volatility at the same time as the break up, such structuralist explanations fail to explain why outcomes changed post break up. A serious limitation of earlier empirical studies of the link between institutions and the natural resource curse is that they relied on cross-country comparisons. The more recent literature (e.g. Caselli and Michaels 2013, Loayza, Mier y Teran, and Rigolini 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.

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 and 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 lead to worse 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 and perhaps also inefficiently high current extraction at the expense of the future. 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 until 2011 for most minerals[7] We focus instead on a particular set of institutions that are most likely to be affected by the potential for large rents: electoral accountability. Second, we examine these institutions in a democracy where power and revenues are concentrated not at the local but the state level (in contrast to Peru for instance). Note that, while like other within-country studies, this in a context where larger, federal institutions remain the same, sub-regional institutions are changed by the creation of new states thus changing electoral accountability.

The remainder of the paper is organized as follows. Section 2 presents the institutional context for our study. Section 3 presents the theoretical setup for examining the effects of secession. Section 4 presents the data used for analysis and lays out the identification strategy for estimating the effect of breakup. Section 5 reports the empirical results and section 6 concludes.

## 2 The institutional context

The basis on which state borders were originally drawn by the State Reorganisation Act of 1956 was along linguistic boundaries. This criterion, however, tended to ignore other ethnic and social boundaries, leading to large tribal populations in some states seeing themselves as ethnically distinct and socially neglected. The case of the most recent re-organisation is a departure from this linguistic principle; the main divisions along which the states were re-organized was ethnic and social, particularly in the case of Jharkhand and Chhattisgarh.[8,9] 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.

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 historically made consistent demands for secession, demands that have progressively gained prominence since 1947. 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.[10] The second explanation relates to the changing federal election context

[7]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.

[8]This has also fuelled discontent and the growth of Marxist movements that have taken to open rebellion. Indeed, the new states are also the scene of armed conflict which has been ongoing since the 1970s and has flared up sharply since re-organisation (Kapur, Gawande, and Satyanath Forthcoming).

[9]Linguistic divisions still matter: the languages spoken in these states, while variations on Hindi, have been treated as separate languages. Chhattisgarhi, the regional form of Hindi spoken in the plains areas of Chhattisgarh has recently been declared the state language, while part of the demand for separation from Bihar was based on tribal languages spoken there being different from the Hindi spoken in Bihar while Uttarakhand claimed differences based on dialects in Kumaon and Garhwal.

[10]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

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 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".[11] 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.

This list of explanations flags two potential difficulties for the analysis that follows, each of which we discuss below. 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) discusses a memorandum to the State reorganisation commission in 1955 asking for a separate state of Jharkhand, naming the 6 districts in Bihar which were eventually separated from Bihar in 2000 (Hazaribagh, Ranchi, Palamu, Singhbhum, Santhal Parganas and Dhanbad, then Manbhum).[12] 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 18 districts where Chhattisgarhi was spoken and again, these district borders have remained the same since independence.[13]

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 but again at the head of a coalition government but by this time there was 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,[14] by this time there was little political opposition anywhere to

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."

[11] 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.

[12] 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.

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

[14] 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).

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. 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. 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.

The political context for our analysis centers on the role of state legislative assemblies, which are responsible for governance at the state level. 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 and setting up a team of ministers to govern the state. States have executive, fiscal and regulatory powers over a range of subjects that include education, health, infrastructure and law and order.

With respect to natural resource extraction, there is an overlap in authority between the central government and state governments, 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" which 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.[15] Thus, there are 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.

Figure 4, taken from Chakraborty (2014), displays the share of mining in state level domestic product since 2004 for the two sets of states with a large share of revenues from mining – for these states revenues vary from 0.1 per cent and 5 per cent for the rump states of Bihar and Madhya Pradesh, to an average of 10 per cent for their split-offs, Jharkhand and Chhattisgarh. Table 1 describes the key minerals in the two split-off states of Jharkhand and Chhattisgarh and highlights the fact that these two states have 45 per cent of the reserves in iron ore and coal and 18 per cent of copper reserves (Chakraborty and Garg 2015, Indian Bureau of Mines 2008). Despite the enormous share of minerals

[15] 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.

in their portfolios, both Jharkhand and Chattisgarh actually display a rather low share of revenue from minerals, a fact that we exploit in our theoretical framework below. The low importance of official revenues relative to potential revenues and the consequent importance of illegal mining is largely due to the institutional structure of rents from minerals.

The split of authority between the Centre and State provides an explanation for the large scale of illegal mining observed in these and other mineral rich states. The royalty rates set by the central government were 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 were an average of 2 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). Another major incentive for illegal mining is evading environmental regulations by operating outside the areas given clearance by the Centre – as the authority for policing resides in the State while the Centre decides on the areas that can host mining activity. All of this has led to conflict between Centre and State about the weak policing and monitoring by state governments.[16]

Given this institutional context, the politics of resource extraction in India takes on a different flavour from that seen in other federal states. In the case of natural resources, fiscal windfalls 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, state level politicians rely on local level patron client networks to stay in power. Our model presents a picture of the political bargain between state legislature and local level leaders, and shows how the bargaining outcome changes with secession.

## 3 Political secession, natural resources and vote trading

This section presents a simple, stylised theoretical framework to describe how the spatial distribution of natural resource deposits affects economic outcomes in the newly formed states. Our unit of analysis is the assembly constituency (AC) which represents a legislative seat at the state. When secession takes place we are left with a very heterogeneous spatial distribution across states post break up (see Fig. 2). The geographical re-distribution of mineral resources across states has unequal effects on the old and new states in terms of the potential revenues from natural resources. At the same time, many of the resource rich ACs are also more prone to elite capture or to being adversely affected by "rent grabbing" activities linked to natural resources. We categorize the effects of the unequal distribution of resources into (a) a first effect arising from the change in the comparative allocation of revenues from natural resources, whereby after secession the newly formed states and the surviving states end up controlling comparatively greater or smaller proportion of natural resources than before; (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 higher bargaining power of local elites in natural resource rich ACs adversely affects policies and economic outcomes in the state– both in natural-resource rich areas and in other areas of the state

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

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.

### 3.1 Government revenues from natural resources

A first effect of secession by a state 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).

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 level $tr$ of government revenues 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 poort (NRP) constituencies. Then a a high density of NRR ACs (a high $q$) transalates 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 constituencies to secede to form a state that contains a higher proportion of natural resource rich constituencies in comparison with the original state.

### 3.2 Votes for sale

A second effect (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 starting from the following premises:

P1. The presence of natural resource rents leads to "rent grabbing" activities, such as emergence of local political entrepreneurs that control rents, either legally or illegally (see e.g. Mehlum et al. 2006 for a theory of crowding out of entrepreneurship in manufacturing to politics in the presence of mineral rents). Legal rent grabbing consists of comparatively less efficient producers successfully securing resource extraction rights. Illegal rent grabbing activities are relatively less prevalent in poorer areas, and mainly consist of illegal mining. Costs to citizens from all of these forms of rent grabbing activities include income loss from lower production efficiency, environmental degradation, road accidents due to overloaded trucks on the roads, worse law and order etc.[17]

[17] 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

P2. Vote buying or electoral fraud[18] takes place relatively more in the mineral rich areas. One reason why electoral fraud is more prevalent in NRR ACs is that the returns from selling votes to individual political entrepreneurs are much higher in such constituencies, and such "criminal politicians" who have a comparative advantage in buying votes, being e.g. union bosses, also dominate politics. In areas where there no natural resources, both selection and moral hazard suggests much less electoral fraud.[19] Put another way, the combination of a natural base of unionized workers and the availability of easy pickings from mining activity leads to higher incentives for electoral fraud or lower accountability in the NRR ACs relative to others.

The data seem to support both P1 and P2. Using the presence of criminal politicians as evidence of rent grabbing, we show in Table 2 that the likelihood of an MP with a criminal record being elected is significantly and positively related to the density of mines at the Parliamentary Constituency level. The State Election Survey for Jharkhand in 2005 posed questions to individual voters about whether there were any malpractices at voting time in their assembly constituency. This was also the first election after breakup of these two states in 2000 and thus of significance. In table 3, we examine the correlation between being in a mineral rich constituency and reporting malpractices, including payment for votes[20]. We find a strong and significant relationship between both reports of malpractice and the intensity of malpractice in mineral rich constituencies within districts of the state, based on answers to the questions of whether individual voters thought there had been malpractices and whether they thought these were serious. Indeed, there is extensive evidence that election malpractices are correlated with natural resource rents. For instance The Economic Times and the Observer Foundation in India held a panel discussion on the role of coal and other resources in election expenditures in 2012 (see: http://bit.ly/1ntfQDx). They quote one of the panelists thus: "According to Sahoo, increasingly, they are not extracting rent from programmes that are politically beneficial like NREGA and PDS. Instead, he adds, they are moving to minerals and natural resources. [See: http://bit.ly/1V1lsiE.] This is a form of corruption the common man stays more or less oblivious to".

P3. The nexus of rent grabbing and political collusion creates worse outcomes in mineral rich constituencies. We showed suggestive evidence for assumption A2, that NRR areas are more likely to be ruled by criminal politicians. Prakash et al. (2014) show that criminal politicians create worse outcomes than non-criminal politicians. Using data on luminosity and a similar identification strategy to that used in this paper, they 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

[18]The Election Commission of India, an independent body with the authority to monitor electoral fraud lists a number of ways in which politicians attempt to circumvent the rules governing election spending in India. These include: (i) Paying cash as an incentive for not casting vote by the committed voters of other rival candidate, monitored by the display of the voter's finger without indelible ink after polling; (ii) Cash given in advance before notification of election to the local leaders for distribution among voters; (iii) Cash given through community feasts under the plate or banana leaf; (iv) Cash given to leaders of rival political parties or rival candidates not to seriously campaign in elections; (v) Cash given to village headman for ensuring votes (see the instructions for Master Trainers for election monitoring at:http://bit.ly/1SxRyE6).

[19]See e.g. Brollo et al 2013, which shows corruption going up due to opportunism and selection effects when there are windfall revenues to Brazilian municipalities.

[20]The political parties and candidates routinely spend huge amount of money on intermediaries to buy votes. While the upper limit of election spending for candidates contesting for MPs and MLAs are Rs. 2.5 million and Rs. 1 million respectively, the current trend as captured by several studies and acknowledged by the Election Commission that candidates spend 20-30 times more than the limits. According to an estimate from Centre for Media Studies (CMS), political parties and candidates spent a whopping Rs. 100,000 million (including Rs.30,000 million by the Election Commission) in the last Lok Sabha elections (see: http://bit.ly/1ntfQDx).

criminal politicians won narrowly, spent 19% less on public goods for the poor. Again as Sahoo (http://bit.ly/1V1lsiE) emphasizes, "...most important consequence of an expensive electioneering process is the growing criminalisation of democratic space and governance institutions. Since money becomes the prime mover, political parties desperate for victory are compelled to nominate mostly those candidates who can generate big money to fund the election expenses. Consequent to this trend is the influx of a large number of criminals and people with dubious records to the high seats of power."

P4. Collusion with state-level politicians is required to sustain these rent grabbing activities. As discussed in Section (2), states have ownership rights to onshore minerals, although they are subject to regulation by central government. States grant licences and leases: 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.[21]

From P2 and P4, it follows that there is a "political bargain" to be struck 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. We model this political deal as a bargaining game between vote sellers at the local level and vote buyers or parties at the state level.

*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 locatead 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 $z_i + s$.[22]

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

[21]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

[22]This incumbency related shock could be thought of, for example, as being linked with 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.

$s > 0$, both of which are equal to $1/2$ given the assumed distribution of shocks.[23]

*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).[24] 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 Section A.1 in the appendix.

We assume that the given tranche of votes, $v$, can only be delivered to a single party for a price $x$.[25] This price consists of targeted concessions to 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 – i.e. *rent grabbing*. This price can be delivered to the seller only if the vote buyer wins the election.

The rationale for modelling vote trading as only occurring in NRR constituencies 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.[26]

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, $\lambda x$, 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 $\rho q$. Then 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

[23]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 makes no difference to the analysis.

[24]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.

[25]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.

[26]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.

NRR constituency constituency from the $L$ party being elected under shock $s$ is now given by $U_i^L = -(-1/2 - z_i + s)^2 - (\lambda + \rho q)x$, [27] 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 $L_P = \rho q x/2$.

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 $P_L^W x$.

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.

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

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

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

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

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 $P_L^W \geq 1/2$:

**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* $\rho$.

An increase in the density of natural resources, as measured by $q$, will, through a political channel, raises $x$ and thus lower welfare for individuals (other than the vote sellers) in the natural resource rich constituencies as well as in the natural resource poor constituencies, albeit to a lesser extent. The intuition for this result is that as the proportion of NRR constituencies becomes larger – and the proportion

[27] 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.

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.[28]

*Bargaining*

The results of Proposition 1 carry over to more general bargaining protocols. Under sequential bargaining with alternating offers (Rubinstein 1982), let $U^S(x) = \Phi(x)x$ and $U^B(x) = \Phi(x) - 1/2$, and let $\left(U^S(x_S), U^B(x_S)\right)$ denote the offer made by the seller, and $\left(U^S(x_B), U^B(x_B)\right)$ 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:

$$x_S = \tilde{x}\,\frac{1+\delta\left(1+\delta-\sqrt{1+\delta(2+\delta-4q\,v(1-q\,v))}\right)/(2v\,q)}{1+\delta+\delta^2}. \tag{3}$$

This is increasing in q.

Effects of an increase in the density of natural resources on $x$ are then summarized in the following result:

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

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 $P_L^W$).[29]

*Multiple buyers and sellers*

A question that follows naturally from the above discussion is whether these results crucially depend on the assumed "market structure". In particular, does the conclusion that $\tilde{x}$ is increasing in $q$ still apply if there are multiple buyers or multiple sellers who do *not* act as a single seller?

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. (This is shown in Section A.2 in the appendix.)

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 suppose that sellers simultaneously post prices $x_1, x_2, \ldots x_N$, 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

[28] 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.

[29] Qualitatively analogous results are obtained under Nash bargaining.

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

$$P_L^W = \frac{1}{2} + \frac{1}{2(1-qv)} \Big(qv - q(1-v)\big(\lambda x_i + \rho\big(x_i + (N-1)x_0\big)q/N \\ -(1-q)\big(\rho\big(x_i + (N-1)x_0\big)q/N\Big). \tag{4}$$

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.

### 3.3 State breakup

Our previous analysis can be used to draw conclusions about the consequences of state break up. 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.[30] The corresponding expressions for $B$ are symmetrically identical.

*State breakup and the price of votes*

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.

Notice that in the single state analysis $\rho$ 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 $\rho$ from $q_U$ to $q' = q_A$ and from $\rho$ to $\rho' = (N_A/N_U)\rho < \rho$. Then, by Propositions 1 and 2, the effect of the breakup on $x_A$ through

[30] 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 $\gamma$ the higher is the effect of spillovers across state borders.

$q$ 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 $\rho$ will always be positive as long as $\rho > 0$ – since $\tilde{x}$ is decreasing in $\rho$ 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 $\rho$ 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 $\rho$ dominates the negative effect of lower $q$. Hence with secession, the effect of $q_A \leq q_U$ on $x_A$ dominates the effect of a smaller $\rho$ if $x_A(\rho', q_A) \leq x_U(\rho, q_U)$, which is true iff $N_A/N_U > (1-q_U v)/(1-q_A v)$. Thus, we have the following proposition:

**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 $N_A/N_U > (1-q_U v)/(1-q_A v)$, and $x_A \geq x_U$ otherwise.*

*Welfare effects of state breakup*

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

$$\Delta U_A^{NRP} = -\rho \left( \frac{N_A}{N_U} q_A x_A + \gamma \frac{N_B}{N_U} q_B x_B - q_U x_U \right), \tag{7}$$

$$\Delta U_A^{NRR} = -\lambda (x_A - x_U) + \Delta U_A^{NRP}, \tag{8}$$

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 $\gamma$, the size of 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 $\gamma$ is sufficiently small, this mechanical "small is beautiful" effect can always dominate any other effect. A scenario that provides a natural benchmark is where $\gamma$ just offsets the voting externality brought about by secession – as reflected from the implied reduction from $\rho$ to $\rho' < \rho$ in the voters' decision. Specifically, with reference to a symmetric scenario with $q_A = q_B = q_U$, and where $U$ is broken up into two identically sized states with $N_A = N_B = N_U/2$, the level of $\gamma$ that ensures that the breakup has no effect on welfare in NRP constituencies is identified by the condition

$$\frac{1+\tilde{\gamma}}{2} \tilde{x}\big(q_U, \rho_U/2\big) = \tilde{x}\big(q_U, \rho_U\big); \tag{9}$$

this gives

$$\tilde{\gamma} = 2 \frac{\tilde{x}\big(q_U, \rho_U\big)}{\tilde{x}\big(q_U, \rho_U/2\big)} - 1 = \lambda \frac{1-v}{v} \tilde{x}\big(q_U, \rho_U\big). \tag{10}$$

For a scenario with $\gamma = \tilde{\gamma}$, we can then derive a clear prediction about the welfare effect of state breakup. Letting $q_B = 2q_U - q_A$ (since $q_A + q_B = 2q_U$) replacing the expression for $\tilde{\gamma}$ into (7), differentiating the resulting expression with respect to $q_A$, and evaluating the resulting derivative at $q_A = q_B = q_U$, we find that $\Delta U_A^{NRP}$ is decreasing in $q_A$.

With this normalization, the breakup of a state into equally sized states lowers welfare in the NRP constituencies of the new state 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). In NRR constituencies, state breakup unambiguously lowers welfare if $q_A > q_U$; if $q_A < q_U$ it unambiguously raises welfare if $N_A/N_U = 1/2 > (1 - q_U v)/(1 - q_A v)$ (and thus $x_A < x_U$), and has an ambiguous effect otherwise.[31]

As discussed in Section (3.1), 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 decrease in $q$ tends to lower it.[32]

### Summary of theoretical predictions

The model's predictions can be summarized as follows:

1. If government revenues from natural resources are comparatively small, then 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 comparatively large, this conclusion can be reversed.

2. A decrease in natural resource density in a breakout state in comparison with the parent state (a lower $q$ post breakup) is more likely to raise welfare in the new state the larger the new breakout state is relative to the parent state. An increase in natural resource density in a breakout state in comparison with the parent state (a higher $q$ post breakup) is more likely to lower welfare the smaller the breakout state is relative to the parent state.

3. When secession results in an increase in natural resource density in the breakout state (a higher $q$ post breakup), NRR constituencies do worse post break up relative to NRP constituencies within the same state (and it is possible for NRR constituencies to experience a loss while NRP constituencies experience a gain). When secession results in a decrease in natural resource density in the breakout state (a lower $q$ post breakup), NRR constituencies do comparatively better post breakup relative to NRP constituencies within the same state (and it is possible for NRR constituencies to experience a gain while NRP constituencies experience a loss).

The intuition for prediction (1) is the same as for our main theoretical prediction in Proposition 1- that in the case of two equally sized break up states the effect of higher $q$ is to lower welfare, because

[31] If $q_A < q_U$ but $x_A > x_U$, then, under the given normalization of $\gamma$, 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 $U_A^{NRR}$.

[32] 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.

of the improved bargaining position of vote sellers at the constituency level and consequently higher $x$. Prediction (2) explains what happens if the size of the break up states is unequal. If there is a decrease in $q$ in a new state, it is a force to lower $x$ because the relative weight of the voters in NRP areas increases as in the main theoretical prediction - however if the state is smaller than before, the NRP voters may tend to care less (reducing accountability) because there are fewer spillovers from the fewer NRR areas. So when the new state is sufficiently large, the effect of the spillovers will be small and our main theoretical prediction holds. Similarly, in the case of an increase in $q$, the effect of $x$ on welfare in NRP areas is mitigated if the state is too small because of spillovers, but this causes $x$ to go up even more, reinforcing the predictions of Proposition 1. Prediction (3) is related to the fact that if $q$ goes up, and $x$ increases, NRR areas suffer a higher loss relative to NRP areas (see equation (7)), and if the new state is small enough- so that spillovers are lower post break up- we may have that NRP areas are better off while NRR areas are worse off after break up.

## 4 Empirical strategy

Based on our predictions above, the average effect on ACs in new states will depend on whether the positive effects in states where $q$ increases outweighs the negative effects of worse governance. If we look at the sub-sample of resource rich constituencies, the effects will be negative in ACs of states which end up with a much larger $q$, and they will be worse relative to resource poor ACs within the same state,[33] as well as relative to resource rich ACs in the rump states.

Our findings are anticipated in Table 4, where we describe both our measure of $q$ as introduced in the model above and the differential growth rates across breakaway and rump states over time. First, note that Jharkhand, the breakway from Bihar now has 65 percent of assembly constituencies (ACs) with mineral deposits, compared with the rump Bihar, left with 5 percent of ACs with mineral deposits. Chattisgarh has 54 percent of ACs, thus is endowed relative to its rump of Madhya Pradesh with 35 percent, while Uttarakhand has 23 percent relative to its rump Uttar Pradesh with barely 2 percent of ACs with mineral deposits.

The second part of the table presents the levels and changes in growth rates from district level data used by the Planning Commission of India to predict changes in state level gross domestic product. We do not have access to the dis-aggregated data and hence these figures serve as the benchmark for our predictions based on data on luminosity rather than domestic product. The predictions here suggest that Jharkhand grows *slower* than its rump state of Bihar; while the other two breakaway states fare better. Chattisgarh grows a bit faster than its rump but the difference is not substantial, while Uttarakhand gains substantially relative to its rump Uttar Pradesh. In sum, we see considerable heterogeneity and a pattern that seems negatively correlated with increased resource endowments. As a preview to our results, this is also the pattern we see reproduced in our analysis below.

[33]This follows from our prediction P3 that rent grabbing spillovers have worse effects in the resource rich ACs post break up.

### 4.1 Data

We examine differences in local outcomes across states in the context of the breakup of three states in India in the year 2000. Later as a placebo check, we also examine the differences in outcomes for a fourth, more recent, state breakup (the states of Andhra Pradesh and Telangana) which broke up in 2014. We use two main sources of data in examining the relationship between natural resources and economic outcomes. First, we rely on luminosity[34] 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 economic activity (see Henderson et al. 2011; Chen and Nordhaus 2011; Kulkarni et al. 2011; Alesina et al. 2015) 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.[35]

There are three main reasons why we rely on luminosity data. The first is that panel data on households, by assembly constituencies[36] 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. Table 5 describes the correlations we observe between luminosity and AC level measures of wealth, income and education. The correlation with wealth is about 0.6, while that with income and education lies between 0.4 and 0.45.[37] 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 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

[34]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.

[35]We are grateful to Asher and 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).

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

[37]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.

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.[38] The third (and most important) reason 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.

Still, concerns undoubtedly remain about the difficulties in the interpretation of this variable. A key concern in the use of such data are variation in the price of electricity and local differences in the propensity to use lights at night. To examine this, we use available data on electricity prices by state and year and examine their evolution across states. The data are an unbalanced panel and the results are presented in Table 7. The results suggest 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.

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.[39] 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. Figure 3 is a map of mineral deposit locations in the six states considered. 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 geographical 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.

Apart from these two main sets of data, we use several other data sources to strengthen our analysis. To corroborate our measure of night-time lights as a good proxy as well as to examine the correlation between mineral areas and election malpractices, we use post-poll survey data on voting outcomes from the National and State Election Survey conducted by Lokniti. We also estimate the effect of state breakup on household level outcomes to support our findings from the night-time lights data. For this exercise, 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

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

[39]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.

identification strategy, described in the next subsection. Appendix A.3 provides further details on these data sources.

### 4.2 Identification and estimation

In what follows, we define states that have broken away as being "treated" by the act of secession. Admittedly, this is not the usual definition of a "treatment": post breakup, the rump state is also a new creation. The idea behind viewing only the new state as being "treated" is 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. The various Acts of Reorganisation for each state specify the division of the local civil service and administrative institutions, the sharing of assets and liabilities, and the organisation of the assemblies for the new states. The key point is that the rump states saw no reorganisation apart from the loss of territories and thus a lower population and smaller administration. 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) to identify the parameters of interest. 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 5, where local polynomial estimates of the light intensity around the distance to the threshold, before and after breakup, are displayed. Figure 6 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 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 heartening 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

$$T_i = \mathbb{1}_{[D_i \geq d]}. \tag{11}$$

The discontinuity in the treatment status implies that local average treatment effects (*LATE*) are non-parametrically identified (Hahn, Todd, and Van der Klaauw 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)

$$\tau_a = \lim_{g \to d^+} \mathbb{E}[Y_{it} \mid D_i = g] - \lim_{g \to d^-} \mathbb{E}[Y_{it} \mid D_i = g] = \mathbb{E}[Y_{it}(1) - Y_{it}(0) \mid D_i = d], \tag{12}$$

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 Eq. (12) 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.[40]

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 with a difference-in-difference framework.

With this in mind, the specification we estimate is:

$$Y_{it} = \alpha_i + \beta_t + \gamma T_i \times Post_t + \delta^{'} V_{it} + \varsigma_s \times Post_t + \varepsilon_{it}, \tag{13}$$

where $Y_{it}$ is the satellite light density of grid $i$ in year $t$. $\alpha_i$ 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 $\varsigma_s$ (interacted with $Post_t$ to account for the panel dimension). $\alpha_i$ and $\beta_t$ represent constituency and time fixed effects respectively; and where the $V_{it}$ are defined as

$$V_{it} = \begin{pmatrix} \mathbb{1}_{[D_i < d]} \times Post_t \times (D_i - d) \\ \mathbb{1}_{[D_i \geq d]} \times Post_t \times (D_i - d) \end{pmatrix}. \tag{14}$$

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 in regressions.

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 offer several bandwidths in our

[40] 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.

analysis, based on the optimal bandwidth calculations of Imbens and Kalyanaraman (2011). With the selected bandwidths, we then compute the following OLS-FE estimates using observations lying within the respective distance thresholds.

## 5 Results

### 5.1 Descriptive evidence and validity of identifying assumptions

We begin by validating the basis for our strategy by examining the evolution of luminosity across the six states, both overall and between border areas in Figure 7. 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 6 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 AC's 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 particularly scheduled tribes and language 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 use the data 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. Table 5 examines the differentials between border areas before breakup to check if these household variables are different across border areas. We conclude they are not, apart from the availability of drinking water which is just significant at the 10 percent level. Note, however, that our difference-in-difference strategy does aim to control for fixed pre breakup differences such as water availability – this is less of a threat to identification than time varying differences such as incomes.

To explore 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 7 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. It is clear that settlements over time, since the border was drawn, 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.

### 5.2 RDD ESTIMATES

We now present results from our identification strategy, exploiting the spatial discontinuity around state borders. Recall that we define states that have broken away as being "treated" by the act of secession.

We begin with the overall effect of state breakup on the difference in luminosity in Table 8. 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 Ac's across all six states. The naive 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.

However, there may be concerns that there are other unobservables linked to state borders that might bias the OLS estimates. To mitigate this concern, 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 2011). 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.

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. Using data from the India Household Development Survey (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. Table 9 presents these results. Overall we find positive effects of breakup on all household level outcomes, mirroring our results from Table 8 which uses luminosity as an outcome variable. Specifically, we find that households in new states saw an increase of INR 3737.45 (approx. USD 50) in their total income and a 15% increase in their access to piped water.

Next, we examine heterogeneity in the overall new state effect, across the affected states. Table 10 shows that the average positive effect is driven by Uttarakhand relative to its rump state of Uttar

Pradesh, with a strong negative effect of Jharkhand relative to the rump state Bihar and an insignificant effect of Chhattisgarh relative to Madhya Pradesh. The proximate reason for the heterogeneity in outcomes is the enormous difference in natural resources and as explained earlier, Jharkhand obtained almost all of the resources relative to Bihar upon breakup while Uttarakhand does not have very much in point source resources. As a result, the state pair of Bihar and Jharkhand witnesses a large change in the distribution of its natural resources (indicated in the table by 'high $\Delta q$') whereas the state pair of Uttar Pradesh and Uttarakhand saw little change in the distribution of their natural resources ('low $\Delta q$'). 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 (we classify it, therefore, as a 'moderate $\Delta q$' state pair). The table shows that outcomes deteriorate, post-breakup, in the state-pair of Bihar-Jharkhand relative to other state pairs. This result is in line with the theoretical prediction that secession reduces the welfare in states that receive a high proportion of natural resource (the variable $q$). On the other hand, state pairs that saw little to moderate change in $q$ see better outcomes after breakup.

The pattern of results reported in Table 10 suggest a non-linear effect of the change in natural resource endowment on growth outcomes as indicated by the theory. To verify this non-linear effect, we also report results from a specification that examines, directly, the effect of $q$ on the luminosity. We include both the variable $q$, which is time-varying as a result of secession, as well as its square. Note that the initial distribution of natural resources across states is differenced out, using our fixed effects estimator. To recover the effect of $q$ we exploit, therefore, only the change in distribution of natural resources brought about by state secession. Table 11 reports results from this specification; we find, in line with the theoretical prediction, that the effect of $q$ on luminosity is non-linear (concave). The effect of $q$ on luminosity is initially positive but after a certain threshold (approximately 0.32), turns negative.

A similar exercise in Tables 13-15, examining the effect of state breakup on the Gini coefficient of inequality in luminosity produces a similar result; it suggests that while inequality fell post breakup in the new states on average relative to the rump, Jharkhand moves differently, with a rise in inequality relative to Bihar.

We now examine whether the presence of mineral deposits in assembly constituencies affords part of the explanation for the heterogeneity across states that we see. Table 12 shows how post-breakup effects are shaped by natural resources. It demonstrates that ACs with a high concentration of deposits do relatively worse if they are in the new states, post breakup. Given the enormous concentration in Jharkhand relative to it's rump, compared to all of the other state pairs, this in turn suggests that the heterogeneity across state pairs is driven largely by the variation in natural resource endowments.

In Table 16, we examine this using the Gini coefficient[41] 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.

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

### 5.3 Robustness checks

In this section we examine 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 17 presents our main results with spatially adjusted standard errors and shows that our results are robust to the presence of arbitrary spatial correlation.

Next, Table 18 examines the role of conflict, primarily from Marxist (Naxalite) rebellions, in driving the state secession results. We ask whether the presence of active conflict in these states affects economic activity around the same time when state borders were redrawn. It may also be the case, that, since, mineral rich areas are also areas with heightened violence and conflict, the negative mineral resource effect we find, reflects merely the effect of conflict on economic activity. To investigate this, we include a measure of conflict, as proxied by the number of Maoist related incidents, as a control in all specifications. Table 18 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 19, 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 particular effect of local mineral endowments that might independently have been affected post 2001 by a change in prices or rents over time.[42]

### 5.4 Political channels

The results of our main regression exercise point quite strongly to the conclusion that the interplay between natural resources and secession operates through a specific political channel - electoral accountability. To find additional evidence that can corroborate this interpretation, we can look at some

[42] 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.

more implications of the theoretical analysis. The theory revolves around showing how the reduction in political accountability through vote buying allows more rent grabbing activity to take place. In the analysis we do 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.

We may 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 a scenario where there are multiple sellers, as discussed in the theoretical session; and suppose that there are two NRR constituencies, 1 and 2, both with the same fraction, $v$, of votes for sale. If 100% of the voters in AC 1 always support the incumbent irrespective 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 we expect outcomes to be worse post break up, relative to non-aligned or non-swing ACs.

To validate this prediction, Table 20 reports results which are directly consistent with the theoretical predictions: the negative effects (on growth and inequality, respectively) of governance changes in the resource rich ACs for states which experience an increase in $q$ post break up are exacerbated when these ACs are aligned or swing.

## 6 Concluding remarks

In this paper we 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 secession improved economic outcomes, both in terms of the levels of activity and in terms of redistribution. The parallel changes induced by secession in the political structure and in the comparative concentration of natural resources enables us to examine whether the link between natural resources and economic outcomes at the local level flows arises from the interplay between natural resources and politics. Our empirical results are consonant with the predictions of our theoretical framework, indicating that effects flow through an electoral accountability channel.

The accountability channel here 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 limited incentives to police rent grabbing by local groups. In this context, the political bargain between local-level elites and state-level elites becomes 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 paper takes various federal and state level institutions as given- e.g 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 with other countries e.g. Peru (Loayza, Mier y Teran, and Rigolini 2013) where part of the revenues from mineral deposits go to the local area, may provide some interesting insights into which of the particular institutions could be changed to minimize negative welfare effects on citizens as well as inefficient extraction.

The new government has proposed an amendment to the original Bill of 1957, which has a rather convoluted provision for sharing of benefits in local communities. It proposes the establishment of District Mineral Foundations (DMFs) in areas affected by mining related operations. The object of this foundation is to work for the "interests and benefits of persons and areas affected by mining related operations". Holders of mining leases are to pay the DMF an amount, not exceeding one-third of the royalty in the case of new leases and equivalent to the royalty in case of old leases. The amendment allows state governments to set the rules for the foundation and determine its composition (Narain 2015). These new institutional arrangements might well be the key to the improved performance of 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 dismissed. Our paper suggest that state division in the presence of substantial natural resource endowments may be particularly susceptible to the curse.

A direct implication of our analysis is that welfare outcomes in natural resource rich areas would improve if the response to demands for secession were met by fiscal redistribution towards the seceding states rather than creating new political entities. Of course this may create its own problems of moral hazard. Another implication is to redraw constituency borders to make it more costly to buy votes in natural resource rich constituencies.

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# A APPENDIX

## A.1 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

$$\begin{cases} x = \dfrac{v}{\lambda\,(1-v) + \rho\,(1 - v\,q)}; \\ r(1-q)\,x - c = 0. \end{cases} \tag{15}$$

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 $\alpha$ their *concentration* within the state. Replacing this expression into the above system of equations and solving for $x$ and $q$, we obtain

$$\begin{cases} \tilde{x} = \dfrac{(\alpha - \rho\,c)\,v}{\alpha(\lambda+\rho) - \alpha(\lambda + \rho/2)v - \rho\,\overline{r}\,v}; \\ \tilde{q} = \dfrac{(\alpha/2 + \overline{r})\,v - (\lambda\,(1-v) + \rho)\,c}{(\alpha - \rho\,c)\,v}. \end{cases} \tag{16}$$

In an interior solution with $\tilde{q} \in (0,1)$, both $\tilde{x}$ and $\tilde{q}$ are increasing in $\overline{r}$ and decreasing in $\alpha$; 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.

## A.2 TWO BUYERS

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.

**Claim 1**: *If a party, $j$, secures the votes that are for sale, paying a price $x$, the probability of $j$ winning is* $P^W_{jB} = (1/2) + (1/2)\big(qv - q(1-v)\lambda x - (1-q)\rho q x\big)/(1-qv)$.

*Proof of Claim 1*: This follows from symmetry between the two parties.

**Claim 2**: *Assume $x \geq 0$ and s.t. $P^W_{jB} \geq 1/2$. There does not exist an equilibrium where only one buyer accepts the seller's offer.*

*Proof of Claim 2*: Suppose that there is such an equilibrium, where buyer $j$ accepts and buyer $-j$ rejects. If buyer $-j$ has rejected, then, accepting gives buyer $j$ an expected payoff of $P^W_{jB}$, whereas rejecting gives $j$ an expected payoff of $1/2$ (each competitor wins and gets rents $W = 1$ with probability $1/2$). Thus it is optimal for $j$ to accept if and only if the price is such that $P^W_{jB} \geq 1/2$ (i.e., $\tilde{s} \leq 0$ for $L$ and $\tilde{s} \geq 0$ for $R$). Similarly, it is strictly optimal for buyer $-j$ to reject the offer – given that buyer $j$ has accepted it – if and only if $1-P^W_{jB} > (1/2)\left(1-P^W_{jB}\right)+(1/2)P^W_{jB}$. This requires $P^W_{jB} < 1/2$ – a contradiction.

Indeed, whenever $P^W_{jB}(x) \geq 1/2$, each buyer has a weakly dominant strategy to accept the offer: it is strictly dominant to accept the offer if $P^W_{jB}(x) > 1/2$. To see this, notice that the payoff of buyer 1 when he accepts the offer, given that buyer 2 does not, is $P^W_{jB}$ and if he rejects the offer he gets $1/2$. If buyer 2 accepts the offer then his payoff from accepting is $(1/2)P^W_{jB}+(1/2)\left(1-P^W_{jB}\right)$ while if he rejects then his payoff is $1-P^W_{jB}$. In both cases, he prefers to accept the offer as long as $P^W_{jB} \geq 1/2$.

**Claim 3**: *Suppose the seller posts a price $x \leq \tilde{x}(q)$; then there exists a pure-strategy equilibrium where both buyers accept. If $x \geq \dfrac{v}{\lambda(1-v)+\rho(1-qv)} \equiv \tilde{x}$, then there is an equilibrium where both buyers reject.*

*Proof of Claim 3*: Given the previous claim, each buyer accepts the offer rather than rejecting it if and only if $P^W_{jB} \geq 1/2$. Solving for the value of $x$ that makes the inequality binding, we obtain $x = \tilde{x}$. Each buyer rejects the offer rather than accepting iff $P^W_{jB} \leq 1/2$.

**Claim 4**: *The unique payoff maximising price for the seller in the symmetric pure strategy equilibrium is $\tilde{x}$.*

*Proof of Claim 4*: This follows immediately from the previous claims by backward induction.

### A.3 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 AC's, 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 Lokniti (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[43] 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 20). 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[44] 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, Schulz, and Vig (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 neighborhoods 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 analyzed states, between the years of 1992 and 2009. This data is obtained from the Election Commission of India.

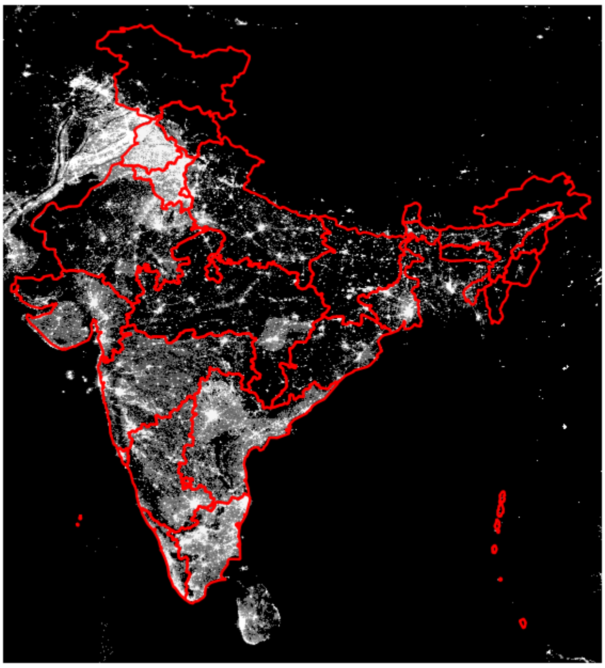
Human Demographics: We use data on district-level migration and literacy from the two census waves conducted in 1991 and 2001. This data is available at the census of India website.

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.

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

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

Figure 1: Density of Night-time Lights in India

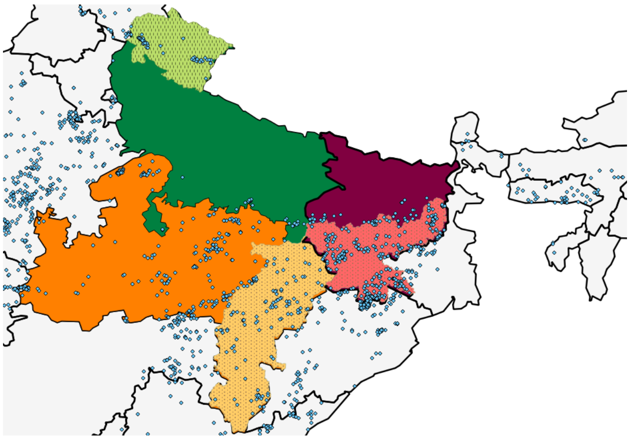


**Note:** The figure shows the density of night-time lights in India for the year 2008, as measured by the DMS P-OLS. The map of India, showing administrative divisions, is overlaid on top.

Figure 2: States Reorganization in 2001

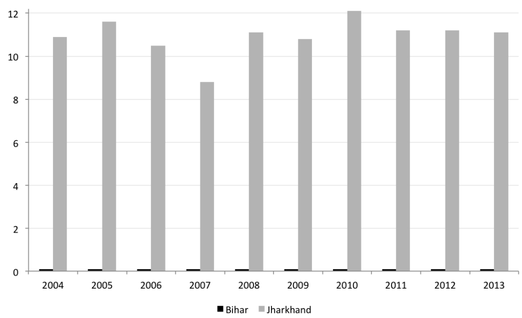

**Note:** The figure shows the actual breakup of states in 2001. Ares shaded by dots represent newly created states; these are the states of Jharkhand, Chhattisgarh and Uttarakhand which broke away from Bihar, Madhya Pradesh and Uttar Pradesh respectively.

Figure 3: Distribution of Mines Across Reorganized States

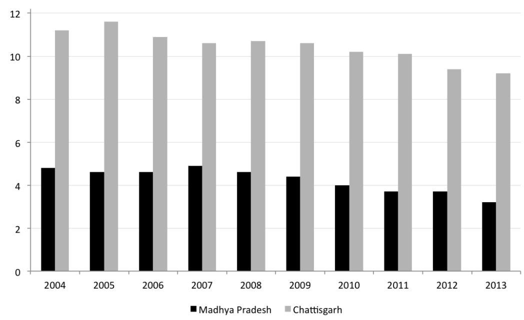


**Note:** The figure shows the distribution of mine deposits in India, across the states that were reorganized in 2002. Mine deposits are indicated by tiny circles.

Figure 4: Mining Revenue as a Share of State GDP



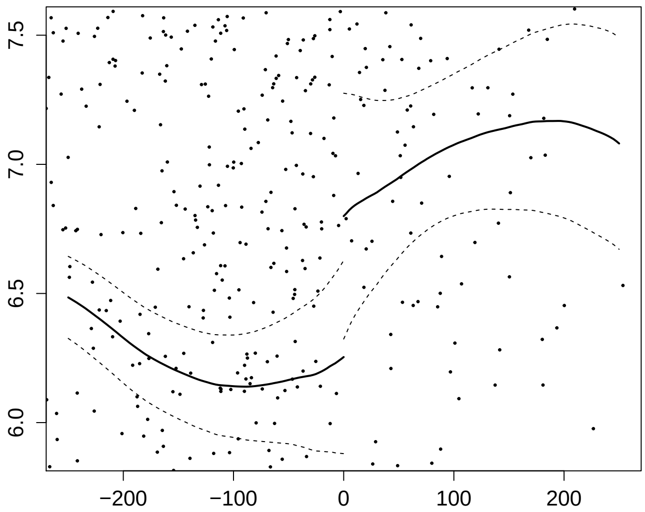

(a) Bihar-Jharkhand **(High q)**




(b) Madhya Pradesh-Chhattisgarh **(Low q)**

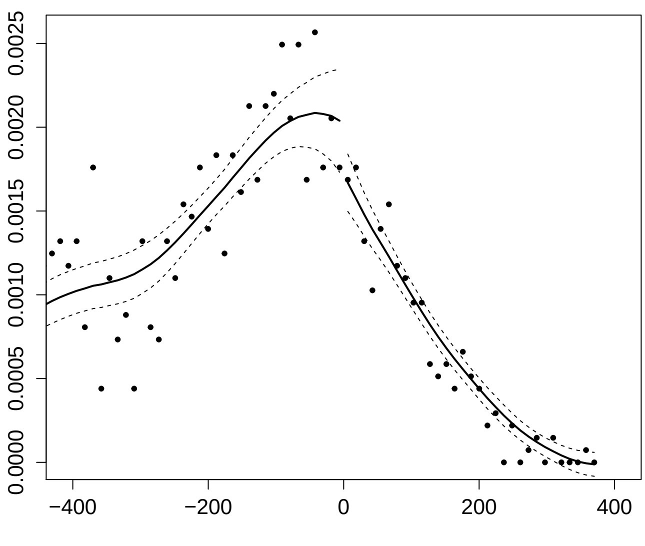
These figures report the time series of mining revenues as a share of state GDP, for the state pairs Bihar-Jharkhand **(High q)** and Madhya Pradesh-Chhattisgarh **(Low q)** . *Source: CSO, Govt of India (various years)*.

Figure 5: Light Intensity after Secession



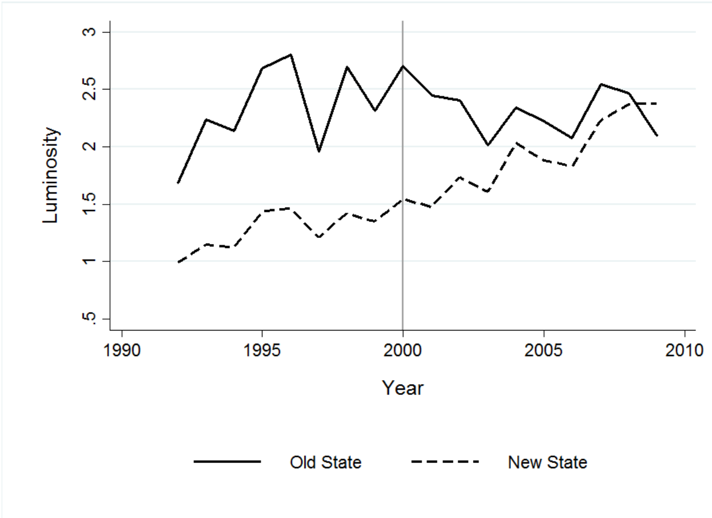

**Note:** The figure plots the local polynomial estimates of the light intensity around the threshold distance.

Figure 6: RD Validity: Density Smoothness Test for Distance to State Boundary

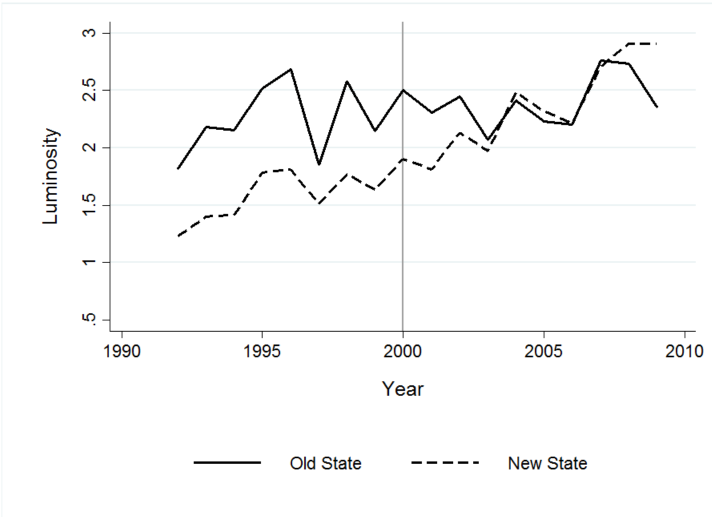



**Note:** The figure plots test for density smoothness proposed by (McCrary 2008). The distances are normalized, such that positive values indicate distances for new states while negative values indicate distances for old states.

Figure 7: Light Intensity Trends, Before and After BreakUp




(a) **Average Luminosity across all 6 States**




(b) **Average Luminosity in border areas across all 6 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 1: Mineral Reserve Shares (state's share as percentage of all-India reserves)

| Mineral | Jharkhand (High q) | Chhattisgarh (Low q) |
|---|---|---|
| Coal | 26.76 | 17.2 |
| Iron Ore | 25.71 | 18.4 |
| Copper Ore | 18.49 | 5.15 |
| Bauxite | 4.21 | 10.95 |
| Graphite | 7.48 | 35.59 |
| Kyanite | 5.53 | 15.14 |

This table reports the state's share of each mineral, as a percentage of all-India reserves.
Source: Indian Minerals Yearbook 2013 and Coal Directory of India 2013-14.

Table 2: Criminal Politicians and Natural Resources

| | Winning MP Criminal | Winning MP Criminal |
|---|---|---|
| # Mines | 3.65* | |
| | (0.191) | |
| Mine Density | | 2.787** |
| | | (1.105) |
| # Observations | 179 | 179 |
| *R2* | 0.01 | 0.02 |

This table reports the correlation between criminal politicians in a **parliamentary constituency** and its mineral resource endowment. The dependent variables is binary, taking the value 1 if the winning candidate of the constituency (MP) has a criminal record, zero otherwise. *# Mines* is the total number of mines within a parliamentary constituency; *Mine Density* is the proportion of assembly constituencies, within a parliamentary constituency, that have at least one mine. Standard errors are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 3: Voting Malpractices and Mineral Rich Constituencies

| | Whether Malpractice | | Intensity of Malpractice | |
|---|---|---|---|---|
| | Logit | Logit | OLS | Ordered Logit |
| Mineral | 0.118*** | 0.284*** | 0.576*** | 6.268*** |
| | (0.004) | (0.074) | (0.098) | (2.399) |
| District FE | Yes | Yes | Yes | Yes |
| Household Controls | No | Yes | Yes | Yes |
| Observations | 642 | 626 | 705 | 705 |
| $R^2$ | 0.16 | 0.18 | 0.21 | 0.17 |

This table reports the correlation between election malpractices, as perceived by sampled households from the State Election Survey, and mineral rich constituencies in the state of Jharkhand in 2004. The dependent variable for Columns (1)-(2) is a binary indicator for whether a household witnessed any electoral malpractice or election irregularities while voting in the state election; the dependent variable for Columns (3)-(4) is an ordered indicator for the extent to which a household witnessed any electoral malpractice or election irregularities, ranging from 0 (no malpractice) to 3 (several malpractices). Household controls include fixed effect for various income categories, whether a household has access to television and telephone/mobile-phone, caste affiliation and a dummy for rural location. *Mineral* refers to the total quality of mines within each AC. Marginal effects are reported for logit specifications; odds-ratios are reported for the ordered logit specification. Standard errors clustered at the AC level are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 4: Endowment of Natural resources and Growth across States

| | Proportion of Mines (**q**) | | | Average Growth Rate (Planning Commission) | | |
|---|---|---|---|---|---|---|
| | Pre-breakup | Post-breakup | Post-Pre difference | Pre-breakup | Post-breakup | Post-Pre difference |
| *State Pair 1:* | | | | | | |
| Bihar | 0.2 | 0.05 | −0.15 | 4.9 | 11.4 | 6.5 |
| Jharkhand (New state) | | 0.65 | **0.44 (+)** | 3.6 | 6.3 | **2.7 (-)** |
| *State Pair 2:* | | | | | | |
| Madhya Pradesh | 0.4 | 0.35 | −0.05 | 4.7 | 7.6 | 2.9 |
| Chhattisgarh (New State) | | 0.54 | **0.14 (+)** | 3.1 | 8.6 | **5.5 (+)** |
| *State Pair 3:* | | | | | | |
| Uttar Pradesh | 0.05 | 0.02 | −0.03 | 4 | 6.8 | 2.8 |
| Uttarakhand (New State) | | 0.23 | **0.17 (+)** | 4.6 | 12.3 | **7.7 (+)** |

This table reports the level and change in the proportion of mine regions (AC's) 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 5: Descriptive Statistics

*Luminosity Correlations (HH level NES Data):*

| | Mean AC Wealth | Mean AC Income | Mean AC Education |
|---|---|---|---|
| Mean AC Luminosity | 0.59*** | 0.45*** | 0.40*** |

*Pre-Breakup Differential in Border Districts (HH level IHDS Data):*

| Variable | Old State | New States | Difference |
|---|---|---|---|
| Income | 4,624.45 | 4340.2 | 284.25 (0.75) |
| HH Size | 5.87 | 5.56 | 0.315 (1.41) |
| IMR Rate | 0.0776 | 0.0776 | 0.0005 (0.03) |
| Water Availability | 0.937 | 0.888 | 0.048* (1.99) |
| Food Expenditure | 143.51 | 135.80 | 7.703 ( 0.99) |
| # Observations (only pre-breakup) | 287 | 233 | |

The first panel of the table reports the correlation coefficient between (the average) luminosity in an AC and its (average) wealth, income and education. AC level averages of wealth, income and education are calculated for a sample of AC's based on household survey responses obtained from the National Election Survey (NES) data. The third panel of the table reports balancing checks for some household level indicators observed in the India Household Development Survey Data (IHDS) data. The sample is restricted to households residing within districts around the border of each state (pre-breakup). The indicators 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). T-statistics for the differences, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 6: 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 |

This 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 AC's lying withing 150km of the state borders. Similarly, BW 200 and 250 refer to the sample of AC's lying withing 200km and 250km respectively of the state borders.

Table 7: Electricity Price, Demographics and State Breakup

| | State Electricity Tariff | | Border District Demographics, Census (2001-1991) | |
|---|---|---|---|---|
| | | | Percentage Literate | Percentage SC/ST |
| Post × New State | −9.91 | −10.40 | −0.07 | 0.005 |
| | (9.44) | ( 8.58) | (0.04) | (0.04) |
| Post | 325.39*** | 353.46*** | −0.08*** | 0.14*** |
| | (15.50) | (14.56) | (0.03) | (0.03) |
| Year F.E. | Yes | Yes | NA | NA |
| District/State F.E. | No | Yes | Yes | Yes |
| Observations | 122 | 122 | 63 | 63 |
| *R2* | 0.95 | 0.97 | 0.58 | 0.67 |

This table reports results for the effect of breakup on electricity tariff (column 1 & 2) and demographics (column 3 & 4). Data on electricity tariff is provided at an annual level for each state. Census data on demographics is available for two periods, 1991 and 2001, at the district level. The analysis in column 3 & 4 is restricted to districts around the border of each state (after breakup). *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 8: 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 |

This 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 dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 9: 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 |

This 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 10: RDD estimates of state breakup on **Log Light Intensity**

| | OLS | RDD | | |
|---|---|---|---|---|
| | | BW 150 | BW 200 | BW 250 |
| Post × New State × Bihar (high $\Delta q$) | 0.421*** | −0.855*** | −0.639*** | −0.644*** |
| | (0.101) | (0.237) | (0.192) | (0.180) |
| Post × New State × MP (moderate $\Delta q$) | 0.477*** | −0.324 | 0.175 | 0.305* |
| | (0.050) | (0.284) | (0.203) | (0.169) |
| Post × New State × UP (low $\Delta q$) | 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 |

This table reports the heterogeneous effect of breakup on the log of total luminosity in each AC. The heterogeneity captures the differences in mineral endowment ($q$) received by each new state after breakup (indicated in parentheses). The change in the share of mineral rich AC's, $\Delta q$, is reported in Table (4) for each state pair. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 11: RDD estimates of state breakup on **Log Light Intensity**

| | OLS | RDD | | |
|---|---|---|---|---|
| | | BW 150 | BW 200 | BW 250 |
| $q$ | 0.147 | 9.933*** | 10.955*** | 10.770*** |
| | (1.199) | (1.302) | (1.400) | (1.431) |
| $q^2$ | 0.996 | -16.467*** | -17.550*** | -17.285*** |
| | (1.547) | (2.021) | (2.121) | (2.167) |
| Observations | 20,232 | 9,720 | 11,970 | 13,608 |
| $R^2$ | 0.107 | 0.209 | 0.207 | 0.200 |

This table reports the effect of the change in mineral resource endowment (as a result of the state breakup) on the log of total luminosity in each AC. $q$ refers to the share of mineral-rich AC's in each state; it is time-varying as a result of the state breakup which altered the measure of $q$. The change in the share of mineral rich AC's, $\Delta q$, is reported in Table (4) for each state pair. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's on either side of the border for the analysis. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 12: 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 |

This 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 dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 13: 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 |

This table reports results for the effect of breakup on the gini (inequality) of luminosity in each AC. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 14: RDD estimates of state breakup on **Light Gini**

| | OLS | RDD | | |
|---|---|---|---|---|
| | | BW 150 | BW 200 | BW 250 |
| Post × New State × Bihar (high $\Delta q$) | −0.060*** | 0.007 | −0.006 | −0.013 |
| | (0.007) | (0.016) | (0.014) | (0.013) |
| Post × New State × MP (low $\Delta q$) | −0.127*** | −0.132*** | −0.140*** | −0.147*** |
| | (0.012) | (0.026) | (0.023) | (0.021) |
| Post × New State × UP (moderate $\Delta q$) | −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 |

This table reports the heterogeneous effect of breakup on the gini (inequality) of luminosity in each AC. The heterogeneity captures the differences in mineral endowment ($q$) received by each new state after breakup (indicated in parentheses). The change in the share of mineral rich AC's, $\Delta q$, is reported in Table (4) for each state pair. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 15: RDD estimates of state breakup on **Light Gini**

| | OLS | RDD | | |
|---|---|---|---|---|
| | | BW 150 | BW 200 | BW 250 |
| $q$ | 0.068 | -0.340*** | -0.411*** | -0.397*** |
| | (0.083) | (0.125) | (0.122) | (0.122) |
| $q^2$ | -0.317*** | 0.575*** | 0.635*** | 0.590*** |
| | (0.111) | (0.179) | (0.176) | (0.177) |
| Observations | 20,232 | 9,720 | 11,970 | 13,608 |
| $R^2$ | 0.107 | 0.209 | 0.207 | 0.200 |

This table reports the effect of the change in mineral resource endowment (as a result of the state breakup) on the gini (inequality) of luminosity in each AC. $q$ refers to the share of mineral-rich AC's in each state; it is time-varying as a result of the state breakup which altered the measure of $q$. The change in the share of mineral rich AC's, $\Delta q$, is reported in Table (4) for each state pair. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's on either side of the border for the analysis. Standard errors, clustered at the AC level, are reported in parentheses. * indicates significance at 10%; ** at 5%; *** at 1%.

Table 16: 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 |

This table reports results for the effect of breakup on the gini (inequality) of luminosity in each AC. The specification includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 17: 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 × New State × Bihar (high $\Delta q$) | | −0.855*** | |
| | | (0.155) | |
| Post × New State × MP (moderate $\Delta q$) | | −0.324** | |
| | | (0.149) | |
| Post × New State × UP (low $\Delta q$) | | 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 |

This 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. The heterogeneity captures the differences in mineral endowment ($q$) received by each new state after breakup (indicated in parentheses). The change in the share of mineral rich AC's, $\Delta q$, is reported in Table (4) for each state pair. All specifications includes, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 18: 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 × New State × Bihar (high $\Delta q$) | | −0.994*** | |
| | | (0.223) | |
| Post × New State × MP (moderate $\Delta q$) | | −0.342 | |
| | | (0.281) | |
| Post × New State × UP (low $\Delta q$) | | 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 |

This 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. The heterogeneity captures the differences in mineral endowment ($q$) received by each new state after breakup (indicated in parentheses). The change in the share of mineral rich AC's, $\Delta q$, is reported in Table (4) for each state pair. All specifications include, AC fixed effects, year fixed effects, border segment interacted with the post dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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 19: 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 |

This 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 (4 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 dummy and controls for distance to the border by treatment status. BW refers to the area bandwidth, used for selecting AC's 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%.

Table 20: Breakup, Political Channels and Luminosity

| | 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 |

This 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 dummy 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%.