The natural resource curse revisited: Theory and Evidence from India*

Amrita Dhillon† Pramila Krishnan‡ Manasa Patnam § Carlo Perroni¶

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Abstract

In 2000, three of the largest states of India, with some of the largest endowments of natural resources in the country, were split to create three new states. We exploit the consequent dramatic change in the distribution of resources to examine the interplay between political change and the concentration of resources. We construct a theoretical framework to understand the potential outcomes in this setting and examine how secessions affect economic outcomes in the newly formed states. This framework is designed to account for two effects: the first, which is independent of the endowment of natural resources derives from the smaller size of each state post break up which makes administration easier; while the second derives from the increased concentration of natural resources in the breakaway states relative to the rump. We employ a sharp regression discontinuity design to estimate the causal effect of secession and concentrated resources on growth and inequality outcomes at the sub-regional level. We find that while the effect of secession is generally favourable, constituencies rich in resources see a relative worsening of outcomes in both activity and inequality. We attribute this local resource curse to political economy effects.

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†Presenting author: Dept of Political Economy, Kings College, London. Email: amrita.dhillon@kcl.ac.uk.

‡University of Cambridge

§CREST-ENSAE.

¶University of Warwick.

1 Introduction

There is now an enormous literature on the natural resource curse with both theory and empirics concentrated on the relationship across countries (Deacon 2011, Frankel et al. 2012, Van der Ploeg 2011). There is now more evidence that the curse might operate more locally, within countries, but relative to the cross-country evidence, this remains relatively thin (Aragón and Rud 2013). At the cross-country level, the blame for the curse has fallen on poor institutions and the enervating influence of resources on institutions due to the availability of large and tempting rents ((Mehlum et al. 2006), Robinson et al. 2006). But this in turn has opened up the issue of the kinds of institutions that matter and their relationship to natural resources. An important open question is how the effects of resources play out under different institutional structures.

We take advantage of the break up of states within India in 2000 and exploit the consequent dramatic change in the distribution resources to examine the interplay between political change and the concentration of resources. These states between themselves contain a large share of point source minerals in India; the breakup coincided with the rump states left with little or no resources while the new states acquired the lion's share of resources. In brief, we are able to contrast the impact of being freed from the curse relative to acquiring control of a high concentration of resources. In doing so, we bring together two seperate literatures:the first, that on political economy of natural resources and the second, the implications of redrawing political boundaries and decentralisation. The main effects of secession or drawing new boundaries within a federal structure is that states become smaller and new political units are created. Given the fixed spatial distribution of natural resources, this in turn must change the relative concentration of resources within states.

We present a stylised model of how secessions affect economic outcomes in the newly formed states. This framework is designed to account for two effects: the first, which is independent of the endowment of natural resources derives from the smaller size of each state post break up which makes administration easier; while the second derives from the unequal distribution of natural resources across the newly formed states relative to the rump states. We characterise the effects of the unequal distribution in two ways. First, we have a positive effect arising from the change in the comparative allocation of revenues from natural resources, so that after secession the states end up controlling comparatively greater or smaller proportion of natural resources than before. Second, we have a negative effect arising from changes in incentives to govern well. The latter is driven by a higher concentration of natural-resource rich areas in a new state that raise the political influence of those controlling the

natural resources and adversely affect 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 alo 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. We take this model to data on economic activity at the level of local political constituencies to test the main predictions. We demonstrate that secession is a force for better outcomes and all constituencies do better on average across all six states, post breakup. However, constituencies which are rich in natural resources[1] do relatively worse - there is a local curse that flares up within the new political structures created upon breakup. Our empirical design, which exploits the breakup of states, allows us to focus on the political economy channel, narrows the range of suspects and rules out fixed structural explanations .

There are of course many potential explanations for the natural resource curse at both local and national levels. The role of dutch disease or volatility induced by fluctuations in commodity prices are but two possible explanations and there are others that examine the diversion away from human capital accumulation and entrepreneurial activity. Our focus lies in understanding the effects of concentrated resources consequent on a sharp political change and thus allows us to examine how important this explanation might be for the effects that we find. In brief, we are able to test whether political economy effects are important in explaining the local resource curse and are able to confirm that they do.

2 Literature review

The literature on secession focuses entirely on the breakup of countries and the re-drafting of external borders. For instance, Bolton and Roland (1997) show that state separation occurs when there is substantial variation in income distributions across regions due to the possibility of small efficiency gains. Alesina and Spolaore (1997) compare the economic advantages of unification to the political costs of a public good provision that is less close to the preferences of the majority and find that democratization leads to secession and to an inefficiently high number of countries, while economic integration increases the incentive for political separation. The empirical literature on reorganization of states has focused on electoral gains or losses or the pattern of public expenditure and transfers that result on break-

[1]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.

up or unification. A study on Ghana (Miguel and Zaidi 2003) uses school expenditure data and find support for the hypothesis that central government funds are targeted to districts that support the ruling party. This suggests an increase in the share of transfers to local governments of newly formed states after break-up. Chakrabarti and Roy (2007) analyze the change in electoral voting patterns due to state reorganization in India. Using state-level election data they find that voting patterns of Madhya Pradesh, the rump state and Chhattisgarh, the breakaway state differed significantly after break-up. They argue that pre breakup, voting patterns were aligned with the preferences of the majority and post break up, the new state exhibits different preferences. Our interest lies in examining the consequences of the breakup and re-alignment for economic outcomes; the literature suggests that this may well increase welfare but local capture remains a possibility. Indeed, the addition of natural resources to this mix makes this more than plausible. We now turn to a brief summary of the literature on the local natural resource curse and the potential implications in our context.

The literature on the local resource curse is not as extensive as that on the resource curse at the national level (see Aragona et al. (2015) for a careful review). The main category of explanation relies on the interplay between local political institutions and local fiscal windfalls from natural resources. Clearly, such windfalls could have both positive and negative effects: positive effects might include improved provision of local public goods if revenues accrue locally and politicians are responsive to local interests, while negative effects might be driven by lack of political responsiveness and capture of rents. The empirical evidence is not heartening: revenue windfalls can leave public good provision unaffected (Caselli and Michaels 2013) and lead instead to corruption and perhaps to worse political candidates (Brollo et al. 2013). Targeted re-distribution where politicians make transfers to a key group of voters to retain power (or simply buy votes) can also result in lower welfare (Khemani 2013). The key political institutions that matter are local political institutions and rules for fiscal decentralisation. As we explain below, in the Indian context both of these loom large in the case of natural resources.

2.1 Context

We examine the difference in local outcomes across states in the context of the breakup of four states in India, the first three in 2001 and the most recent in 2014[2]. Since the breakup of the three large states of Bihar, Madhya Pradesh and Uttar Pradesh in 2000, and the most recent

[2]In what follows, we concentrate on the three states that broke up in 2000 and use the breakup in 2014 to validate our predictions.

breakup of Andhra Pradesh in 2014, there has been much debate about whether the new, smaller states have done better in both governance and economic performance (Bhandari and Roychowdhury 2011). For instance, the particular success of Bihar relative to the past has been attributed to the zeal of the Chief Minister, Nitish Kumar, while the relatively weak performance of Jharkhand has been variously attributed to the poor and corrupt leadership there and to the large mining rents available. In brief, speculation about how these states have fared has ranged from the Great Man[3] theory of development to the curse of natural resources and the efficiency of governing smaller states.

It is useful to discuss the rationale for state re-organisation in India in the context of the breakup of states. The original basis as laid out in the State Reorganisation Act of 1956 was along linguistic boundaries. The case of the most recent re-organisation is a departure from this principle; the main divisions along which the states were reorganised was ethnic and social, with two of the new states (Jharkhand and Chattisgarh) containing large tribal populations that have seen themselves as ethnically distinct and socially neglected[4]. The boundaries of these three new entities have never been in dispute however; there are clear geographical divisions in each of the cases that have determined the boundaries. Furthermore, the demand for the creation of the new states is not recent and social movements that have focused on statehood have been in play since the late 60's and early 70's (Tillin 2011). Arguably, not all these movements were centred around statehood but they did centre around demanding more local representation and local management of natural resources, both mines and forests[5].

The political context for our analysis centres 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 29 state assemblies are elected in a first past-the-post system. The leader of the majority party or coalition is responsible for

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

[4]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 2012).

[5]Tillin (2011) writes that: "All three of the regions that became states in 2000 saw the emergence of distinctive types of social movement in the early 1970s: Chipko, the people's forestry movement in the Uttarakhand hills; the trade union movement among miners, the Chhattisgarh Mines Shramik Sangh; and the worker-peasantry movement in Jharkhand led by the Jharkhand Mukti Morcha (JMM). These regions were all distinguished from the remainder of their parent states by their distinctive ecology and concentration of natural resources. In all three cases, the issues raised by social movements related primarily to the role of the state in the management of natural resources and the rights of local communities to substantive economic inclusion."

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 and local public goods, infrastructure. The focus here is the mining sector which sees 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. Property rights in land have historically been owned by the states but since the mid 1990s the mining sector has seen increased privatisation. State budgets benefit from the royalties but the rates are set by the central government. However, there is no requirement for the royalties and returns from mining to accrue to local areas and the entire proceeds accrue to the state budget[6] (Narain 2015).

The issues relating to royalty on major minerals in India are somewhat different from those in most of the other countries. The Mines and Minerals (Development and Regulation) Act 1957 empowers the Union government to take under its control the regulation of mines and the development of minerals. The prices, distribution and royalty of major minerals are governed and fixed by the Central Government while royalties accrues to the States. 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 Thus, in India, the system of fixing royalties is not a simple affair. Low royalty rates and their infrequent revision has become an important irritant in the realm of Centre-State financial relations. While the Centre is under no compulsion to periodically revise royalty rates, the States often plea for an upward revision of the rates on the ground that they lose heavily if these rates are not commensurate with the revision in the administered prices of minerals.

The Inter-State Council acts to coordinate fiscal regimes across states. The recent decisions (ref?) to implement a uniform floor rate for sales and value-added taxes and to withhold a fraction of Central Plan assistance from States which do not adopt the uniform floor rate was an attempt to unify tax regimes and prevent potential conflict and competition in tax

[6]The previous government of India had proposed a draft Mines and Mineral Development and Regulation Bill, 2011, which had provided for a 26 per cent share in mining profits for local communities, which would have been a substantial change in policy. The new government has instead proposed an amendment to the original Bill of 1957, which in turn 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.

regimes across states.

2.2 Politics and resource extraction

The politics of resource extraction in India thus takes on a different flavour from that in other federal states. In the case of natural resources, fiscal windfalls occur at the state level and power resides at the state level even for provision of public goods. In particular, the provision of education, health and rural electrification is firmly under state control.We can therefore expect that there will be distributional impacts of resource booms. Local level patron client networks are the lens through which voters decide outcomes, creating a value for the intermediaries who buy votes. In this setting, one would expect that local level patrons can exercise their power over votes and gain rents in return. When state level politicians want to increase their rents they have to collude with local intermediaries to be able to satisfy voters at the same time. In return for the votes local intermediaries get a share of the rents (Prakash et al. 2014; Asher and Novosad 2011; Vaishnav 2011; Khemani 2013).

How does the bribing work? For instance in 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." (Reuters special report 2013[7]). 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."

3 Political secession, natural resource revenues, and vote trading

This section describes a simple, stylised theoretical framework for modelling how secessions affect economic outcomes in the newly formed states. This framework is designed to account for two effects: (i) the smaller size of each state post break up which presumably makes administration easier: this effect is independent of natural resources. The literature on secession has identified various trade-offs from secession (refs). Having larger states may be

[7] http://graphics.thomsonreuters.com/13/05/IndiaCoalMafia.pdf

efficient when there are spillovers between jurisdictions, while on the other hand smaller states create better representation and accountability due to greater homogeneity of preferences. We claim that the size of the three states we consider was too large to benefit from internalising any spillovers. We reproduce Figure 5 from the Economist which compares Indian states to various countries in the world, to make this point.

(ii) the unequal distribution of natural resources. The latter has unequal effects on the old and new states in terms of the potential royalties from natural resources. However, smaller states are also more prone to elite capture, thus the larger potential royalties may not translate into higher *actual* royalties. We categorize the effects of the unequal distribution of (a) a first effect arising from the change in the comparative allocation of revenues from natural resources, whereby after secessions the newly formed states and the surviving states end up controlling comparatively greater or smaller proportion of natural resources than before (this being one of the main reasons for secession); (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 those controlling the natural resources and adversely affect policies and economic outcomes in relation to other activities not related to natural resources – both in natural-resource rich areas and in other areas of the state. As we shall show, these two effects work in opposite directions, and 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 Secession and the revenues from natural resources

A first effect of secession by a state s (effect (a) above) is to change the discretionary funds from natural resource royalties potentially available at the state level, and this percolates down to the constituency level. 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 and each yield a potential level r in royalties from natural resources, which are distributed equally across all constituencies, yielding per-jurisdiction revenues of $r\,q$, which translate into public goods $G = r\,q$ valued at $\mu\,G$. If a fraction s of those constituencies secede and form a new state, with a higher fraction of those being natural resource rich the change in per-constituency revenues for the seceding constituencies equals r times the change in q. So, if q increases (i.e. the new state contains a higher proportion of natural resource rich constituencies), there is a potential gain from secession.

Figure 1: Shantytown near mine (Guardian 2015)

Figure 2: Home of Gang leader (Reuters 2012)

3.2 Secession and vote sales

A second effect (effect (b)) stems from how a change in the concentration of natural resources shapes concessions made to natural-resource related interests under political competition. We make the following assumptions:

A1. The presence of natural resource rents leads to emergence of local mafias that control rents. Such mafias are relatively less prevalent in NR poor areas. Indeed, we may argue that mafia arise in contexts where property rights are poorly defined, as in the case of the mining areas, however in the poorer areas we argue that property rights are not as valuable and therefore we observe a lower presence of local mafia. Using the presence of criminal politicians as evidence of mafia control, we show in Table XX that he likelihood of an MP with a criminal record winning is significantly and positively related to the density of mines at the Parliamentary Constituency level.

A2. Collusion of state level politicians is required to maintain the mafiosi. Such collusion is even easier when the mafia don is a politician himself. We saw in the discussion above that states have ownership rights to onshore minerals although they are subject to regulation by central govt. States grant licences and leases, the Mines and Minerals Development and Regulation Act 1957 empowers state and central govt. officers to enter and inspect any mine at anytime. Thus, extracting minerals from these areas requires a degree of collusion- perhaps the police turns a blind eye to illegal activity or perhaps leases are given to relatives (refer the quote above).

A3. Mafia leaders create worse outcomes than other leaders. So natural resource rich constituencies have worse economics outcomes. Prakash et al ((**?**)) show that criminal politicians create worse outcomes than non-criminal politicians.

It follows from assumption A2, that there is a "political bargain" to be struck between state level politicians and the local level 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. We focus on a scenario with two parties, which can buy votes from local political entrepreneurs (sellers) in return for policy concessions to those sellers, the "price" paid for the votes. These concessions raise rents for the local sellers but worsen welfare for other citizens both in the natural-resource rich areas and in other areas, making them politically costly for the buyer in relation to those votes that have not been secured from the seller. Sellers engage in bilateral bargaining with buyers, which determines the price of votes. We first present a pure strategy Nash equilibrium of the game where the price of votes is determined. Next, we show how the price of votes changes when the number of sellers changes, thus capturing the effect of secession.

3.2.1 Single seller (decentralised outcome)

There is a given unit mass of citizens/voters. Each voter has an ex-ante ideal point on ideology/policy, denoted by $z_i \in [-1/2, 1/2] \equiv Z$. The distribution of ideology across voters is uniform over the support Z. There are two parties, L and R, competing for a state-level election. We assume that the L party has an exogenously specified platform of $-1/2$ while the R party has an exogenously specified platform of $1/2$. A voter's utility is quadratically decreasing in the distance of policy from her ideology, i.e. the payoff levels a voter i obtains if L and R are elected are respectively $U_i^L = -(-1/2 - z_i)^2$, and $U_i^R = -(1/2 - z_i)^2$. Thus ideology, z_i, represents a direct effect on the individual voter's payoff of R defeating L, 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 $z_i + s$, so that the share of votes for L and R are respectively given by $\frac{1}{2} - s$ and $\frac{1}{2} + s$.[8] In the absence of vote trading, the probability of the L party winning is therefore the probability that $s < 0$, and the probability of the R party winning by the probability that $s > 0$, both of which are equal to $1/2$ given the assumed distribution of shocks.[9]

[8]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.

[9]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.

In a given state, there is a proportion q of local natural-resource rich 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).[10] We assume that the given tranche of votes, v, can only be delivered to a single party for a price x, which consists of targeted concessions to the sellers, such as, for example, a relaxation of restrictions and policing of abuses by those exploiting the natural resources locally, delivered to the seller if the vote buyer wins the election, and entailing a loss of utility equal to $\lambda\, x$, $1 > \lambda > 0$, for the remaining $1 - v$ voters in each NR rich constituencies, with voters in the remaining $1-q$ constituencies experiencing a lower loss of $\rho\, x$, where $0 < \rho < \lambda$.

The winning party, $j \in \{L, R\}$, obtains political rents, W, which we assume to be unity without loss of generality. Each party $j \in \{L, R\}$ thus aims at maximising expected political rents, $P_j^W W$, 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 j for a price x is $P_j^W x$.

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 will consider first a scenario where there is a single seller controlling votes v votes in each of the q natural resource rich districts (normalizing the total number of districts to unity),[11] and then extend it to the case where there are two sellers. We focus on subgame perfect equilibria of this game. Proofs are given in the appendix.

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

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

Indeed, whenever $P_{jB}^W(x) \geq 1/2$, each buyer has a weakly dominant strategy to accept the offer: it is strictly dominant to accept the offer if $P_{jB}^W(x) > 1/2$. To see this, notice that

[10][?? Add discussion of where this control comes from in terms of real-world institutional setup, i.e. a local leader can exert pressure on local voters in one direction or the other through a social network based on tribal/ethnic links, through favours, intimidation, etc.]

[11]For the purpose of our arguments, working with non-integer numbers entails no loss of generality.

the payoff of buyer 1 when he accepts the offer, given that buyer 2 does not, is P_{jB}^W and if he rejects the offer he gets $\frac{1}{2}$. If buyer 2 accepts the offer then his payoff from accepting is $\frac{1}{2}P_{jB}^W + \frac{1}{2}(1 - P_{jB}^W)$ while if he rejects then his payoff is $1 - P_{jB}^W$. In both cases, he prefers to accept the offer as long as $P_{jB}^W \geq 1/2$.

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

Claim 4: *The unique payoff maximising price for the seller is* $\tilde{x}(q)$ *– as defined in Claim 3. This is increasing in* q, v*, and decreasing in* ρ*.*

These result imply that an increase in q will raise 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 number of sellers increases in the NRR states post break up and the fraction q also goes up. It could be that competition between sellers reduces the price of votes. On the other hand, the increase in q makes each vote more valuable than before. We show that the first change has no effect on the price of votes while the second effect increases the price. Competition between buyers ensures that buyers prefer to buy the whole set of votes. The marginal gain from buying from both sellers is bigger than the marginal cost fixing the other buyer's action. Moreover there is no equilibrium where one buyer chooses to reject all offers with price $x \leq \tilde{x}$ and one buyer accepts.

Of course, there are more vote sellers than just one. We next extend our results to sellers from two constituencies, assuming that each seller has $v(2) = v/2$ votes to sell. We denote with n_j the number of sellers from which party j accepts offers. As in the case with one seller, the only pure strategy equilibria are the fully symmetric ones where both buyers accept offers from both sellers or where both buyers reject both sellers. Moreover the subgame perfect price for the full tranche of votes v remains the same as before. Extension to more than two constituencies follows the same logic.

Claim 5: *Let the number of sellers be* $n = 2$*, and* $2v(2) = v$*. There exists a symmetric equilibrium where each seller sets a price* $\tilde{x}_2(q)$ *such that* $2\tilde{x}_2(q) = \tilde{x}(q)$ *for all* q*, and such that both buyers bid for all votes,* v*.*

Claim 6: *Let the number of sellers be $n = 2$, and $2v(2) = v$. There does not exist a symmetric equilibrium such that each buyer only accepts votes $v(2) = v/2$.*

There are also asymmetric equilibria (from the buyers' point of view) possible, which can be categorized into: (1) $n_1 = 2, n_2 = 1$; (2) $n_1 = 2, n_2 = 0$; (3) $n_1 = 1, n_2 = 0$ (plus their mirror images). Below, we show that none of these equilibria exist. Thus the only possible symmetric equilibria are where both buyers accept both sellers' offers or where both reject both sellers offers. Indifference occurs when $x = \tilde{x}(q)$. Since the equilibria with rejection exists because the space of "prices" x is continuous, we ignore the rejection equilibria and assume that when indifferent buyers will accept rather than reject.

Claim 7: *Suppose $x < \tilde{x}(q)$. Then, there does not exist a pure strategy asymmetric (for buyers) equilibrium where buyer 1 accepts offers from n_1 sellers and buyer 2 from n_2 sellers and $n_1 \neq n_2$.*

The intuition behind the result of Claim 5 in relation to the price of votes is the following: our setting is symmetric and we look only at symmetric equilibria. In this class of equilibria the price of buying $v/2$ votes is $x/2$ where x is the price for v votes. However $P^W_{jB}(v/2) < (1/2)P^W_{jB}(v)$. The marginal gain in P^W_{jB} is higher than the marginal cost, fixing the other player's action. This is why it cannot be an equilibrium for buyers to accept less than the full quota of votes v from all sellers. The result depends on the assumption that the total votes for sale is fixed at v. Adding more sellers then does not affect the equilibrium price of votes.

3.3 Welfare before and after secession

Combining the analysis of the previous two subsections, we are now in a position to derive conclusions as to the effects of secession on welfare.

As in the discussion at the beginning of Section (3) making states smaller is assumed to lead to increased efficiency in administration. We represent this effect in terms of a welfare component $A(s)$, where s measures the size of the state and where $A'(s) < 0$. $A(s)$ thus captures the costs of a large population size; e.g. in the 2011 Census, Bihar has a population of 103 million while Jharkhand has a population of 32 million: it is hard to argue that larger size is beneficial for economies of scale.

Welfare of a representative citizen in a natural resource rich (NRR) constituency, gross of the idiosyncratic component z and of the ideology shock component (both of which vary with the identity of the office holder), can then be expressed as $W^R(s) = A(s) + (\mu\, r\, q - \lambda\tilde{x}(q))$. The corresponding level of welfare in a natural resource poor constituency is $W^P(s) = A(s) + (\mu\, r\, q - \rho\tilde{x}(q))$.

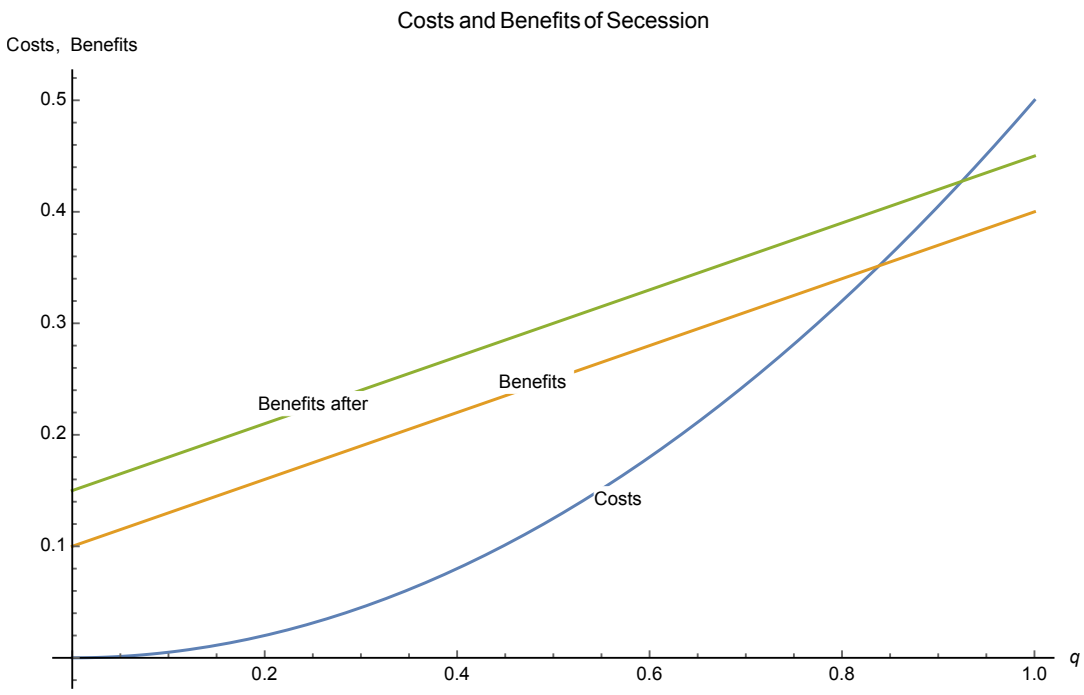
Recall that we assumed $1 > \lambda > \rho$ and $v < \frac{1}{2}$. We make the following additional assumptions for expositional convenience:

Parametric Assumption A1: $\lim_{q\to 0} \tilde{x}(q) = 0$ and $\lim_{q\to 1} > (A(s) + \mu r)/\lambda$.

Parametric Assumption A2: $1 - \rho/\lambda < v < 1/2$.

Assumption A1 means that secession is always good if there are no NRR constituencies. Secession is always bad if a state has only NRR constituencies. We make this assumption for convenience only. Assumption A2 ensures that $\tilde{x}(q)$ is convex.

In the figure below, the convex line represents the costs of elite capture $\lambda\tilde{x}(q)$ while the benefits are linear (denoted by the orange line): higher q corresponds to higher revenues from natural resources: μr. The intercept is $A(s)$ assumed positive. When secession happens, the benefits line shifts up (the green line) due to the smaller size of states. The maximum welfare for a representative citizen is reached at the point q^* which is approximately 0.4 on the graph (assumptions A1 and A2 together imply that there exists a unique point $q^* \in (0, 1)$). Suppose that we start before break up, at a point like $q_0 = 0.2$. Then if $q_1 \leq q^*$, it is easy to see that net benefits increase with an increase in q, as long as it is below q^* and vice versa, if it is above q^*.



In the following let q_0 and q_1 denote the levels of q before and after secession. Let$\hat{q} = \{q \mid \tilde{x}'(\hat{q}) = \mu r\}$.

Claim 8: *Consider an NRR constituency. $W^R(s)$ is decreasing in v, s, and increasing in ρ, λ. Suppose secession leads to an increase in q from q_0 to q_1. Then $W^R(s)$ increases with secession if $q^* > q_1 > q_0$ and decreases if $q_0 > q^*$. Suppose secession leads to a decrease in q from q_0 to q_1. Then $W^R(s)$ increases with secession if $q^* < q_1 < q_0$ and decreases if $q_0 < q^*$. If $\mu r > \tilde{x}'(q)$ then too, there are only positive effects from state secession. The latter happens when $q \leq \hat{q}$.*

The proof is obvious from the graph above. The welfare effects for NRP constituencies are similar.

Thus, if starting from an initial state size s_0 with a fraction q_0, of NRR constituencies, a state breaks up into two smaller parts, s_1, s_2, each with fractions of NRR constituencies q_1, q_2, and if q decreases for state s_1 after secession, then the effect of the break up on s_1 can be categorized into: (i) a positive effect $A'(s)$ coming from the smaller size; (ii) a negative effect coming from the loss of revenues of the NRR constituencies, $-\mu r$; and (iii) a positive effect coming from the lower costs of elite capture $\tilde{x}'(q)$. When the positive effects from higher q as

well as the smaller state size outweigh the negative effects of elite capture then we have that total welfare increases and vice versa. As Claim 8 above shows, this is likely to happen when $q_1 - q_0$ is sufficiently low. Notice that NRR constituencies do worse than NRP constituencies before and after break up- this follows from our assumption $\lambda > \rho$.

The model's predictions can be summarized as follows:

P1 Natural resource rich constituencies can do worse than natural resource poor constituencies in the same state before and after break up.

P2 Consider a state where q decreases to $q_1 < q_0$ after secession. When $q_1 - q_0$ is sufficiently small, then all constituencies do better post break up. This follows from the positive effects of smaller state size and the negligible effect of change in q.

P3 Consider a state where q increases to $q_1 > q_0$ after secession. When $q_1 - q_0$ is sufficiently small, then all constituencies do better post break up. This follows from the positive effects of smaller state size and the negligible effect of change in q. Moreover if $q_1 > \hat{q}$ then all constituencies do worse post break up.

4 Empirical Strategy

We examine the difference in local outcomes across states in the context of the breakup of four states in India, the first three in 2001 and the most recent in 2014. The political context for our analysis centres on the role of state legislative assemblies. India has a federal structure, with both national and state assemblies. Members of the 29 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 and local public goods, infrastructure. The focus here is the mining sector and here there is 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. Property rights in land have historically been owned by the states but since the mid 1990s, the mining sector has seen increased privatisation. State budgets benefit from the royalties but the rates are set by the central government. 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. The

Inter-State Council acts to coordinate fiscal regimes across states. The recent decisions (ref?) to implement a uniform floor rate for sales and value-added taxes and to withhold a fraction of Central Plan assistance from States which do not adopt the uniform floor rate was an attempt to unify tax regimes and prevent potential conflict and competition in tax regimes across states.

5 Data

We use two main sources of data in examining the relationship between natural resources and economic outcomes. First, we rely on luminosity[12] data to proxy the evolution of outcomes between 1992-2010, thus capturing the period 1992-2001, pre break-up and 2002-2010, the period post break-up. We use luminosity data as a proxy for economic activity (see Henderson et al., 2012; Chen and Nordhaus, 2011; Kulkarni et al., 2011, Alesina et al, 2012) to construct the outcome variables, both as a sum of lights within Assembly Constituencies (ACs) and also construct (Gini) measures of local inequality. 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[13].

There are two main reasons we rely on luminosity data, despite the fact that it is a proxy for economic activity and incomes rather than a more desirable measure based on household surveys. The first is that panel data on households, by assembly constituencies[14], that could capture the evolution of incomes or consumption, pre- and post breakup do not exist. The second reason is that despite the measurement difficulties inherent in the use of

[12]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.

[13]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, 2013).

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

such a proxy there is evidence to suggest that luminosity is strongly correlated with standard socio-economic outcomes and we offer corroborative evidence below. In brief, we use data on income, wealth and education from the National Election Survey (2004) which surveys voters at the constituency level to examine the correlation of standard economic indicators with luminosity. Papers by Chaturvedi et al (2011) and Bhandari and Roychaudhury (2013) examine this correlation at the district level in India. A related issue is whether luminosity data account 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 adopt compares relative levels of luminosity across similar areas across the boundary and the inability to measure absolute levels should not matter. NB(The key concerns in the use of such data are variation in the price of electricity and local differences in the propensity to use lights at night. We also have data for each year and state of local prices but the main concerns should be dissipated given that we use regression discontinuity techniques and compare areas around state boundaries.)

The second 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 76 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[15]. 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 X is a map of mineral deposit locations in the eight 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.

[15]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.

6 Identification and Estimation

To identify the effect of state breakup on development outcomes we use satellite data on night-time light density. OLS estimates, simply regressing the treatment indicator on the outcome variable would return biased parameter estimates because of unobservable selection issues.

In order to derive causal estimates, we make use of geographic discontinuity in the boundaries of each pre-breakup state and employ a regression discontinuity method to identify the parameters of interest. For each geographic location (grid or AC), assignment to treatment was determined entirely on the basis of their location. This key features of the state break-up 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 8.

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 define treatment as:

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

The discontinuity in the treatment status implies that local average treatment effects ($LATE$) are nonparametrically identified (Hahn, Todd, and Van der Klaauw 2001). Essentially we will 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):

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

where Y_{it} is the satellite light density of constituency i in year t; D_i is the constituency's distance to the state boundary. An important feature to note in the above-mentioned design is that the discontinuity is geographical, i.e., it separates individuals in different location based on a threshold along a given *distance boundary*. Using Eq. (2) to estimate the causal effect would ignore the two-dimensional spatial aspect of the discontinuity. This is because the *boundary line* can be viewed as a collection of many points over the entire distance spanned by the boundary. An individual located north-west of the boundary is not directly comparable to an individual located south-east of the boundary. For the comparison to be

accurate, each 'treatment' individual must be matched with 'control' individuals who are in close proximity to their own location *and* the boundary line.

We address this issue in two ways. Firstly, we divide the boundary for each state into a collection of points defined by latitude and longitude spaced at equal intervals of 1500 kilo-meters. 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, such that only AC's within close proximity of each other are compared[16].

6.0.1 Estimation

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) and choosing a bandwidth $w_{ics}^{RDD} = \frac{1}{h} K \frac{f(D_{ics})}{h}$ where K is chosen to be a kernel function such that it would fit linear regression functions to the observations within a distance h on either side of the discontinuity. A panel fixed effects estimators around the distance thresholds, h, is equivalent to use a uniform kernel for local linear regression suggested by Hahn, Todd, and Van der Klaauw 2001. For observations such that $ZD_{ics} \in [150 - h, 150 + h]$ we compute the following OLS-FE estimates:

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

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

$V_{it} = \begin{pmatrix} \mathbb{1}_{[D_i < d]} \times Post_t \times (D_i - d) \\ \mathbb{1}_{[D_i \geq d]} \times Post_t \times (D_i - d) \end{pmatrix}$. The regressors V_{it} are introduced to avoid asymptotic bias in the estimates (Hahn, Todd, and Van der Klaauw 2001, Imbens and Lemieux 2008). Standard tests remain asymptotically valid when regressors V_{it} are added in regressions.

[16] 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.

7 Results

In what follows, we define states that have broken away as being "treated" by the act of secession. This is not the usual definition of a "treatment" admittedly; post breakup, the rump state The notion 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.

We begin with a simple summary of the difference in luminosity, after breakup in Table 3 and 4. The variable Post captures the trend across states post breakup while Post*Treatment captures the difference between the new and rump states on average, post breakup. In brief, while all states experience trend increase in luminosity, it is also clear that on average, new states did better than the rump, with a differential in luminosity of 35%. Table 4 examines the heterogeneity across states; 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 Chattisgarh relative to Madhya Pradesh. A similar exercise in Tables 6 and 7, 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. (Could explain by the number of electrified villages âĂŞ a kind of public good with Bihar investing faster and Jharkhand not at all âĂŞ data from India stat).

In Table 5, we begin our investigation in earnest. The proximate reason for the heterogeneity in outcomes is the enormous difference in natural resources and as explained earlier, Jharkahnd obtained almost all of the resources relative to Bihar upon breakup while Uttarakhand does not have very much in point source resources. The breakup of Madhya Pradesh did mean that a substantial part of resources accrued to the new state of Chattisgarh but Madhya Pradesh remains one of the natural resource rich states nevertheless. We examine whether the presence of mineral deposits in assembly constituencies affords part of the explanation for the heterogeneity across states that we see. Table 5 demonstrates that ACs with a high concentration of deposits do relatively worse post breakup. Given the enormous concentration in Jharkhand compared to all of the other states, this in turn suggests that the heterogeneity across states is driven largely by the variation in natural resource endowments. In Table 8,we examine this using the Gini coefficient in luminosity within ACs and find a

similar result; inequality rises in mineral rich ACs relative to mineral poor ACs, post breakup. Note that this implies a local natural resource curse in all states;however, the relative scale of natural resource endowments in Jharkhand simply tips aggregate outcomes in that state into relatively poorer performance.

7.1 Robustness/persuasion

Table 9 examines the role of another proximate candidate, the Marxist (Naxalite) rebellions in these states. This is clearly endogenous but we ask whether the presence of active conflict in these states affects the conclusions above. It is clear from Table 9 that the role of conflict in the state matters not. It is certainly the case that mineral rich areas are also areas where conflict has been high but extraction of rents has continued unabated. It is certainly plausible that the relationship we find here has fuelled conflict but the fact the mineral producing areas have actually expanded in production across states suggests that causal impacts on conflict require deeper explanations. (*needs backing*)

Finally, we examine the case of the latest state to breakup, the southern state of Andhra Pradesh which broke up into the new state of Telengana in 2014. We treat is 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 are in Table 10 and 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. (*We need the Gini here.*) We also attempt an alternative placebo by artificially moving back the date of secession to 1996. This in turn produces no effect. (*Table required*)

8 Conclusion

We exploit the breakup of three of the largest states in India, with some of the largest concentration of mineral resources and examine whether secession improved economic outcomes, both in terms of the levels of activity and in terms of redistribution. We began by investigating average performance of each of the new entities both pre-2000, before breakup and post breakup. We use data on luminosity as a proxy for the evolution of economic activity at the

sub-regional level for the period 1992-2010. We also obtained data on the location and value of mining deposits across the three states, with a view to examining the importance of rents from point-source natural resources. In order to identify the effect of state breakup on both economic activity and inequality, 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 outcomes.

Our first and basic result is that while all states experience a trend increase in luminosity, it is also clear that, on average, new states did better than the rump, with a differential in luminosity of 35%. It is also clear that the effects are heterogeneous.This led us to explore reasons for the heterogeneity and the obvious candidate is that of the heterogeneity in the distribution of natural resources. Given that the distribution of resources remains the same within states before and after break up, the main change should be found in the creation of a new political entity and the consequent changes in attribution of rents in the new breakaway states. We thus conjectured that the negative outcomes observed in the new states of Jharkhand and Chattisgarh might be related to the change in political outcomes brought about by the breakup, along with the distribution of natural resources between the old and new states. To examine this conjecture, we investigated differences in outcomes at the assembly constituency (AC) level across the three states. We obtained a striking result that banished other possibilities to the back of the queue: in brief, the heterogeneity in outcomes (both in aggregate activity and local inequality at the AC level) is mirrored in the differences in outcomes by ACs with a large concentration of mineral deposits relative to ACs with little or no resources. In other words, the concentration of resources weakens economic outcomes and seems to generate higher local inequality in ACs with a large concentration of resources, post breakup. Our explanation is tied to the role of concentrated and highly valuable mineral resources and to the interplay of state level and local political structures at the level of the assembly constituency. To formalize our arguments, we offer a stylised theoretical framework for modelling how secessions affect economic outcomes in the newly formed states. This framework is designed to account for two effects: the first, which is independent of the endowment of natural resources derives from the smaller size of each state post break up which makes administration easier; while the second derives from the unequal concentration of natural resources across the breakaway states relative to the rump states.

We characterise the effects of the unequal distribution in two ways. First, we have a positive effect arising from the change in the comparative allocation of revenues from natural resources, so that after secession the states end up controlling comparatively greater or smaller proportion of natural resources than before. Second, we have a negative effect arising from changes in incentives to govern well. The latter is driven by a higher concentration of natural-

resource rich areas in a new state that raise the political influence of those controlling the natural resources and adversely affect 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 alo 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. When the breakup is accompanied by a sufficiently large increase in the fraction of assembly constituencies with natural resources, the prediction is that this negative effect dominates.The institutional structures in India imply that political power resides at the state level rather than the local level, so that the political bargain between local-level elites and state-level elites must be a key part of the story, and a similar 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.

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.

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A Appendix

Proof of Claim 1:

Focus on L party and a given realisation of the shock s. If the L party buys the v votes that are for sale in a fraction q of constituencies, the utility that each voter whose vote is not for sale receives if L is elected becomes $-(-1/2-(z+s))^2-\lambda\, x$ if the voter resides in a natural resource rich constituency. The voter who is indifferent between L and R in the natural resource rich constituency under realization s is then $\tilde{z}' = -s-\lambda\, x/2$. The vote share of the remaining $1-v$ votes in the q natural resource rich constituencies that will be cast for L is therefore $1/2-s-\lambda\, x/2$. For a voter residing in a natural resource poor constituency, utility if L is elected becomes $-(-1/2-(z+s))^2-\rho\, x$, and so the indifferent voter in those constituencies is $\tilde{z}'' = -s-\rho\, x/2$. The vote share in the $1-q$ natural resource poor constituencies that will be cast for L is therefore $1/2-s-\rho\, x/2$. Thus the total vote share of the L party, conditional on L buying $q\, v$ votes at a price x, is therefore $V_{LB} = q\, v + q\,(1-v)\big(1/2-s-\lambda\, x/2\big) + (1-q)\big(1/2-s-\rho\, x/2\big)$.

The probability of L winning if L buys the votes is the probability that $V_{LB} \geq \frac{1}{2}$. This equals the probability that $s \leq \tilde{s}$, where $\tilde{s}$ is the value of s for which $V_{LB} = 1/2$, i.e. $\tilde{s} = (1/2)\big(q\,(v-\lambda\, x\,(1-v)) - (1-q)\rho\, x\big)/(1-q\, v)$. For the given uniform distribution of ideology shocks, s, over the support $[-1/2, 1/2]$, this probability equals $\tilde{s}-(-1/2) = \tilde{s}+1/2$. The derivation for R is symmetrically identical and leads to the same result.

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 $1-P^W_{jB} > (1-P^W_{jB})/2 + P^W_{jB}/2$. This requires $P^W_{jB} < 1/2$ – a contradiction.

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 $\tilde{x} = \frac{q\, v}{\rho\,(1-q)+\lambda\, q\,(1-v)}$. Each buyer rejects the offer rather than accepting iff $P^W_{jB} \leq 1/2$.

Proof of Claim 4:

The first part of the claim follows immediately from the previous claim by backward induction. Comparative statics effects are derived as follows: $\frac{\partial \tilde{x}}{\partial q} = \frac{v}{\rho\,(1-q)+\lambda q\,(1-v)} - \frac{q\,v\,(-\rho+\lambda(1-v))}{(\rho\,(1-q)+\lambda q\,(1-v))^2}$. This is equivalent to $\frac{v(\rho\,(1-q)+\lambda q\,(1-v))}{(\rho\,(1-q)+\lambda q\,(1-v))^2} - \frac{q\,v\,(-\rho+\lambda(1-v))}{(\rho\,(1-q)+\lambda q\,(1-v))^2} = \frac{v\rho}{(\rho\,(1-q)+\lambda q\,(1-v))^2} > 0$. Note that $\frac{\partial^2 \tilde{x}}{\partial q^2} = \frac{2v\rho(\rho-\lambda(1-v))}{(\rho\,(1-q)+\lambda q\,(1-v))^3}$. Similarly, $\frac{\partial \tilde{x}}{\partial v} = \frac{q}{\rho\,(1-q)+\lambda q(1-v)} + \frac{\lambda q^2 v}{(\rho\,(1-q)+q\,(1-v))^2} = \frac{q\rho\,(1-q)+\lambda q^2}{(\rho\,(1-q)+q\,(1-v))^2} > 0$,
$\frac{\partial \tilde{x}}{\partial \rho} = -\frac{q\,v(1-q)}{(\rho\,(1-q)+\lambda q\,(1-v))^2} < 0$, $\frac{\partial \tilde{x}}{\partial \lambda} = -\frac{q^2\,v(1-v)}{(\rho\,(1-q)+\lambda q\,(1-v))^2} < 0$.

Proof of Claim 5:

Denote the price at which each seller sells as $\frac{x}{2}$. A necessary condition for this equilibrium is that $P^W_{jB}(\frac{v}{2}) \geq \frac{1}{2}$, or $x \leq \frac{q\,v}{\rho\,(1-q)+\lambda\,q\,(1-v)} \equiv \tilde{x}_2(q)$. We have to show that: (1) $\frac{1}{4}P^W_{jB}(v) + \frac{1}{2}P^W_{jB}(\frac{v}{2}) + \frac{1}{4}(1 - P^W_{jB}(v)) \geq \frac{1}{2}P^W_{jB}(\frac{v}{2}) + \frac{1}{2}(1 - P^W_{jB}(v))$; and (2) $\frac{1}{4}P^W_{jB}(v) + \frac{1}{2}P^W_{jB}(\frac{v}{2}) + \frac{1}{4}(1 - P^W_{jB}(v)) \geq (1 - P^W_{jB}(v))$. We now show that $(1 - P^W_{jB}(v)) < P^W_{jB}(\frac{v}{2})$, so that constraint (1) is binding. Note that $P^W_{jB}(\frac{v}{2}) = \frac{1}{2} + (1/2)\big(\frac{1}{2}\left(q\,(v - \lambda\,x\,(1-\frac{v}{2})) - (1-q)\,\rho\,x\right)\big)/(1-\frac{q\,v}{2})$ and $P^W_{jB} = (1/2) + (1/2)\big(q\,(v - \lambda\,x\,(1-v)) - (1-q)\,\rho\,x\big)/(1-q\,v)$. Hence, we need to show that $1 - \big((1/2) + (1/2)\big(q\,(v - \lambda\,x\,(1-v)) - (1-q)\,\rho\,x\big)/(1-q\,v)\big) \leq \frac{1}{2} + (1/2)\big(\frac{1}{2}\big(q\,(v - \lambda\,x\,(1-\frac{v}{2})) - (1-q)\,\rho\,x\big)\big)/(1-\frac{q\,v}{2})$, or, equivalently, that

$$\frac{1}{2}\left(q\left(v - \lambda\,x\left(1-\frac{v}{2}\right)\right) - (1-q)\,\rho\,x\right) / \left(1-\frac{q\,v}{2}\right) \geq 0.$$

This is equivalent to $x \leq \tilde{x}_2(q)$. Constraint (1) is thus the binding constraint. This constraint can be re-written as $P^W_{jB}(v) \geq \frac{1}{2}$, i.e. $x \leq \tilde{x}(q)$.

Proof of Claim 6:

We prove this by contradiction. Suppose that there exists such an equilibrium. This requires the following conditions to be met: (1) given that buyer 2 has accepted $v(2)$ from 1 seller, buyer 1 also prefers to accept $v(2)$ from one seller (chosen at random) to accepting both; (2) given that buyer 2 has accepted $v(2)$ from 1 seller, buyer 1 also prefers to accept $v(2)$ from one seller (chosen at random) to rejecting both.

Conditions (1) and (2) translate into the following inequalities:

$$\frac{1}{4}P_{jB}^{W}\left(\frac{v}{2}\right)+\frac{1}{4}\left(1-P_{jB}^{W}\left(\frac{v}{2}\right)\right)+\frac{1}{4}\geq\frac{1}{2}\left(\frac{1}{2}\right)+\frac{1}{2}\left(P_{jB}^{W}(v)\right) \tag{4}$$

$$\frac{1}{2}P_{jB}^{W}\left(\frac{v}{2}\right)+\frac{1}{4}\left(1-P_{jB}^{W}\left(\frac{v}{2}\right)\right)+\frac{1}{4}\geq 1-P_{jB}^{W}\left(\frac{v}{2}\right) \tag{5}$$

(4) is equivalent to $\frac{1}{4}\geq\frac{1}{2}P_{jB}^{W}(v)$. But $x\leq\tilde{x}_2(q)$ implies that $P_{jB}^{W}(v)>\frac{1}{2}$. Thus the RHS is strictly bigger than 1/4, and this inequality can never be satisfied. A contradiction.

Proof of Claim 7:

Suppose $n_1=2, n_2=0$. Then we have (1) $P_{jB}^{W}(v)\geq\frac{1}{2}$, i.e. buyer 1 prefers accepting both to rejecting both, given that buyer 2 rejects both. (2) $P_{jB}^{W}(v)\geq P_{jB}^{W}\left(\frac{v}{2}\right)$,i.e. buyer 1 prefers accepting to accepting one and rejecting one. (3) $(1-P_{jB}^{W}(v))\geq\frac{1}{2}(\frac{1}{2})+\frac{1}{2}(1-P_{jB}^{W}(v))$, i.e. buyer 2 prefers rejecting both to accepting one and rejecting one given that buyer 1 accepts both. (4) $(1-P_{jB}^{W}(v))\geq\frac{1}{4}P_{jB}^{W}(v)+\frac{1}{2}P_{jB}^{W}((\frac{v}{2})+\frac{1}{4}(1-P_{jB}^{W}(v))$, i.e. buyer 2 prefers rejecting both to accepting both. Clearly (1) and (3) contradict each other. (3) cannot be satisfied if $x<\tilde{x}(q)$.

Suppose that $n_1=2, n_2=1$. Then we have (1a) Buyer 1 prefers to accept both than accept one and reject one given that buyer 2 rejects one and accepts one. If he accepts both given that buyer 2 accepts one we have:

	$S1$	$S2$
$S1$	$\frac{1}{2}P_{jB}^{W}(v)+\frac{1}{2}\left(\frac{1}{2}\right)$	$\frac{1}{2}P_{jB}^{W}(v)+\frac{1}{2}\left(\frac{1}{2}\right)$
$S2$	$\frac{1}{2}P_{jB}^{W}(v)+\frac{1}{2}\left(\frac{1}{2}\right)$	$\frac{1}{2}P_{jB}^{W}(v)+\frac{1}{2}\left(\frac{1}{2}\right)$

If he accepts one and rejects one given that buyer 2 does the same we get:

	$S1$	$S2$
$S1$	$\frac{1}{2}P_{jB}^{W}(\frac{v}{2})+\frac{1}{2}\left(1-P_{jB}^{W}(\frac{v}{2})\right)$	$\frac{1}{2}$
$S2$	$\frac{1}{2}$	$\frac{1}{2}P_{jB}^{W}(\frac{v}{2})+\frac{1}{2}\left(1-P_{jB}^{W}(\frac{v}{2})\right)$

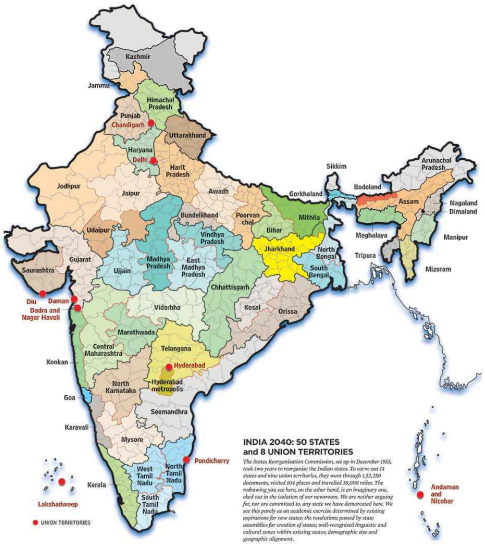
Therefore we have: (1a) $\frac{1}{2}P_{jB}^{W}(v)+\frac{1}{2}\left(\frac{1}{2}\right)\geq\frac{1}{2}\left(\frac{1}{2}\right)+\frac{1}{2}\left(\frac{1}{2}P_{jB}^{W}(\frac{v}{2})+\frac{1}{2}\left(1-P_{jB}^{W}(\frac{v}{2})\right)\right)$.

(2a) Buyer 1 prefers accepting both to rejecting both given that buyer 2 rejects one and accepts one: $\frac{1}{2}P_{jB}^{W}(v)+\frac{1}{2}\left(\frac{1}{2}\right)\geq 1-P_{jB}^{W}\left(\frac{v}{2}\right)$. (3a) Buyer 2 prefers rejecting one to accepting both given that buyer 1 accepts both: $\frac{1}{2}\left(\frac{1}{2}\right)+\frac{1}{2}(1-P_{jB}^{W}(v))\geq\frac{1}{4}P_{jB}^{W}(v)+\frac{1}{2}P_{jB}^{W}((\frac{v}{2})+\frac{1}{4}(1-P_{jB}^{W}(v))$. (4a)

Buyer 2 prefers accepting one and rejecting one to rejecting both, given that buyer 1 accepts both: $\frac{1}{2}\left(\frac{1}{2}\right) + \frac{1}{2}(1 - P_{jB}^{W}(v)) \geq (1 - P_{jB}^{W}(v))$. Notice that (1) and (4) are the same and are equivalent to $P_{jB}^{W}(v) \geq \frac{1}{2}$, while (2) and (3) together imply that $1 - P_{jB}^{W}(v) \geq P_{jB}^{W}((\frac{v}{2}) \geq \frac{3}{4} - P_{jB}^{W}(v)$: this holds iff $1 - P_{jB}^{W}(v) \geq \frac{3}{4} - P_{jB}^{W}(v)$, i.e. $P_{jB}^{W}(v) \leq \frac{1}{2}$: a contradiction to $x < \tilde{x}(q)$.

Suppose that $n_1 = 1, n_2 = 0$. (1b) Buyer 1 prefers accepting one and rejecting one to reject both given that buyer 2 rejects both: $P_{jB}^{W}(\frac{v}{2}) \geq \frac{1}{2}$. (2b) Buyer 1 prefers accepting one and rejecting one to accepting both given that buyer 2 rejects both: $P_{jB}^{W}(\frac{v}{2}) \geq P_{jB}^{W}(v)$ (3b) Buyer 2 prefers rejecting both to accepting one and rejecting one given that buyer 1 accepts one and rejects one: $1 - P_{jB}^{W}(\frac{v}{2}) \geq \frac{1}{2}\left(\frac{1}{2}\right) + \frac{1}{2}\left(\frac{1}{2}P_{jB}^{W}(\frac{v}{2}) + \frac{1}{2}\left(1 - P_{jB}^{W}(\frac{v}{2})\right)\right)$. (4b) Buyer 2 prefers rejecting both to accepting both given that buyer 1 accepts one and rejects one: $1 - P_{jB}^{W}(\frac{v}{2}) \geq \frac{1}{4}P_{jB}^{W}(v) + \frac{1}{2}P_{jB}^{W}((\frac{v}{2}) + \frac{1}{4}(1 - P_{jB}^{W}(v))$. Clearly (2b) cannot hold when $x \leq \tilde{x}(q)$.

Figure 3: Projected States in India in 2040



Source: Outlook Magazine

Figure 4: Boundaries of new states in India 2001

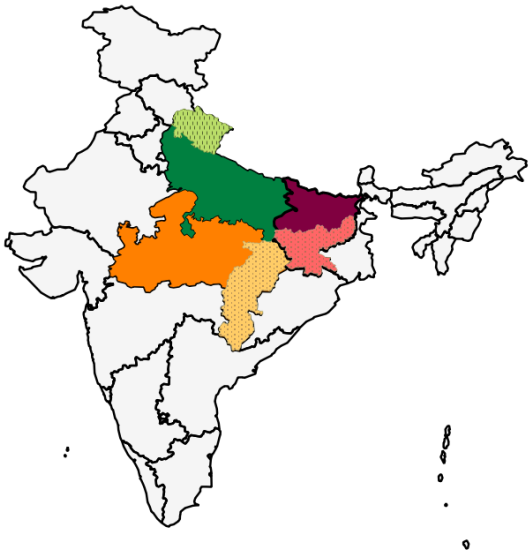
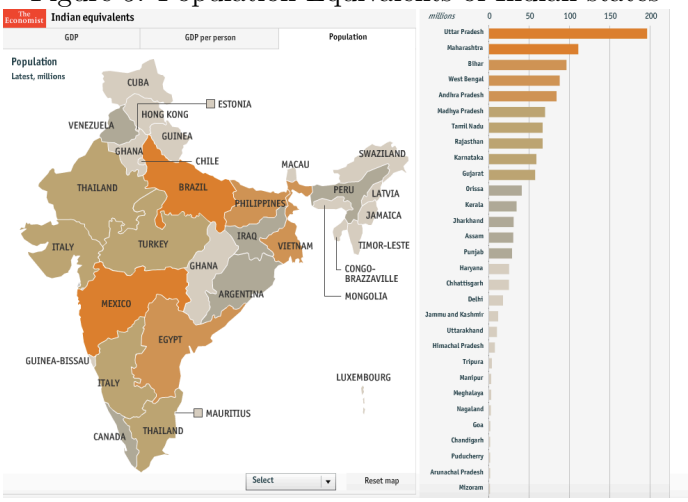


Figure 5: Population Equivalents of Indian states



Source: Economist

Figure 6: Night lights in India

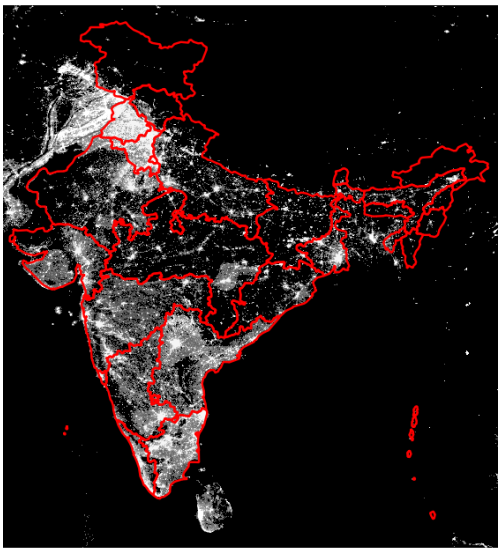


Figure 7: Mineral deposits distribution in new states

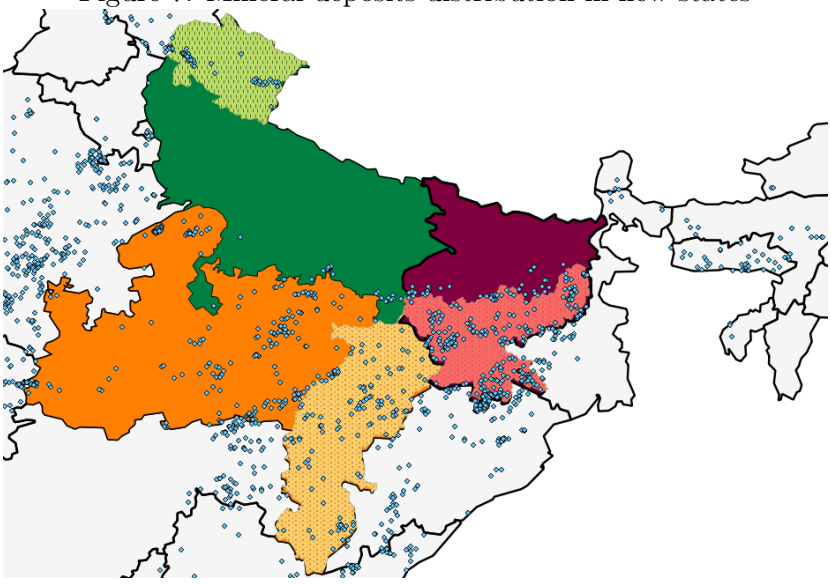
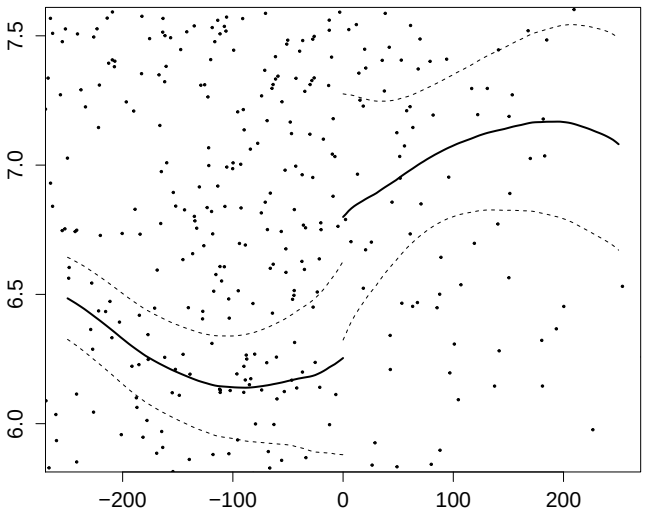
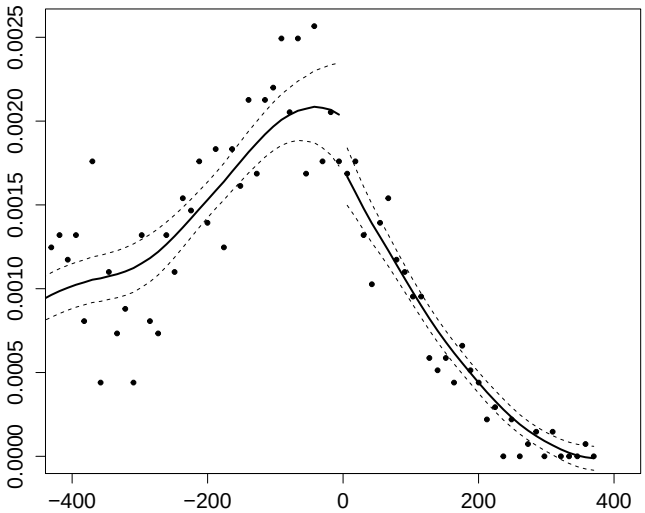


Figure 8: Light Intensity after Secession



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

Figure 9: 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.

Table 1: Endowment of Natural resources across States

Combined State *(pre 2001)*	**Proportion of Mine Regions**	**Split states** *(post 2001)*	**Proportion of Mine Regions**	**Change** *(Post-Pre)*
Bihar	0.20	Bihar	0.05	-0.15
		Jharkhand	0.65	**0.44**
Madhya Pradesh	0.40	Madhya Pradesh	0.35	-0.05
		Chattisgarh	0.54	**0.14**
Uttar Pradesh	0.05	Uttar Pradesh	0.02	-0.03
		Uttaranchal	0.23	**0.17**

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

Table 3: Electricity Prices and State Break-Up

	Electricity Tariff	Electricity Tariff
Post × Treat	-9.91	-10.40
	(9.44)	(8.582)
Post	325.39***	325.64***
	(15.50)	(14.06)
Treat	-2.54e-13	-20.63**
	(6.03)	(8.17)
[1em] Year F.E.	Yes	Yes
State F.E.	No	Yes
# Observations	122	122
R2	0.95	0.97

Table 4: RDD estimates of state break-up on **Log Light Intensity**

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Treat	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	20232	9720	11970	13608
R2	0.123	0.186	0.188	0.182

Table 5: RDD estimates of state break-up on **Log Light Intensity**

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Treat × Bihar	0.421***	-0.855***	-0.639***	-0.644***
	(0.101)	(0.237)	(0.192)	(0.180)
Post × Treat × MP	0.477***	-0.324	0.175	0.305*
	(0.050)	(0.284)	(0.203)	(0.169)
Post × Treat × UP	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	20232	9720	11970	13608
R2	0.136	0.210	0.210	0.205

Table 6: RDD estimates of state break-up on **Log Light Intensity**

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Treat	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 × Treat × Mineral	-0.388	-2.758***	-2.313**	-1.739**
	(0.735)	(0.951)	(1.001)	(0.842)
# Observations	20232	9720	11970	13608
R2	0.123	0.187	0.188	0.183

Table 7: RDD estimates of state break-up on **Log Gini**

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Treat	-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	19521	9227	11381	12958
R2	0.156	0.271	0.263	0.265

Table 8: RDD estimates of state break-up on **Light Gini**

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Treat × Bihar	-0.060***	0.007	-0.006	-0.013
	(0.007)	(0.016)	(0.014)	(0.013)
Post × Treat × MP	-0.127***	-0.132***	-0.140***	-0.147***
	(0.012)	(0.026)	(0.023)	(0.021)
Post × Treat × UP	-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	19521	9227	11381	12958
R2	0.156	0.271	0.264	0.266

Table 9: RDD estimates of state break-up on **Light Gini**

	OLS	RDD		
		BW 150	BW 200	BW 250
Post × Treat	-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 × Treat × Mineral	0.141**	0.149***	0.174***	0.171***
	(0.065)	(0.050)	(0.057)	(0.052)
# Observations	19521	9227	11381	12958
R2	0.156	0.271	0.264	0.266

Table 10: RDD estimates of **Log Light Intensity**, controlling for conflict

	BW 150	BW 150	BW 150
Post × Treat	0.382**		0.409**
	(0.163)		(0.163)
Post × Treat × Bihar		-0.994***	
		(0.223)	
Post × Treat × MP		-0.342	
		(0.281)	
Post × Treat × UP		1.430***	
		(0.201)	
Post	2.084***	2.233***	2.069***
	(0.193)	(0.185)	(0.193)
Post × Mineral			1.627**
			(0.777)
Post × Treat × 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 × Treat × Conflict	-0.046	0.055*	-0.042
	(0.030)	(0.028)	(0.030)
# Observations	9720	9720	9720
R2	0.187	0.211	0.188

Table 11: RDD estimates of **Log Light Intensity**, with spatially adjusted errors

	BW 150	BW 150	BW 150
Post × Treat	0.348***		0.381***
	(0.103)		(0.104)
Post × Treat × Bihar		-0.855***	
		(0.155)	
Post × Treat × MP		-0.324**	
		(0.149)	
Post × Treat × UP		1.444***	
		(0.109)	
Post			
Post × Mineral			1.626***
			(0.530)
Post × Treat × Mineral			-2.758***
			(0.635)
Observations	9720	9720	9720
R2	0.042	0.070	0.043

Table 12: RDD estimates of placebo break-up on **Log Light Intensity**

	BW 150	BW 200	BW 250
Post × Treatment	0.021	0.038	0.068
	(0.118)	(0.106)	(0.101)
Post	1.672***	1.633***	1.595***
	(0.217)	(0.193)	(0.176)
Post × Mineral	-7.319	-1.346	3.162
	(10.292)	(9.359)	(8.828)
Post × Treatment × Mineral	0.075	1.694	-2.677
	(15.336)	(9.322)	(8.802)
# Observations	4662	5364	6012
R2	0.221	0.230	0.215

Table 13: RDD estimates of placebo break-up on **Light Gini**

	BW 150	BW 200	BW 250	
Post × Treatment		-0.006	-0.005	0.004
		(0.022)	(0.021)	(0.018)
Post		-0.285***	-0.277***	-0.279***
		(0.025)	(0.023)	(0.021)
Post × Mineral		-1.141	-0.337	0.088
		(2.898)	(2.425)	(2.385)
Post × Treatment × Mineral	-2.578	0.386	-0.013	
	(4.489)	(2.422)	(2.384)	
# Observations	4542	5229	5870	
R2	0.526	0.529	0.529	