The Effects of Malapportionment on Economic Development: Evidence from India's 2008 Redistricting

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Abstract

Does malapportionment or the unequal formal representation of people in legislatures affect economic development? Answering this question is critical for assessing the welfare costs of unequal representation. We argue that representation might affect development as the desire for reelection incentivizes legislators to further the development of their constituencies, and as voters hold politicians to account for doing so. Using data from a natural experiment due to redistricting, we show that a 10% increase in representation causes a 0.5% increase in light output, which is 25% of the average annual increase in light output. Reapportionment attenuates this effect. Consistent with the theory, the data suggest that the effect of representation is concentrated in constituencies with influential legislators and electorates. The paper advances our understanding of the welfare consequences of unequal representation.

Keywords: malapportionment, redistricting, India, development

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The empirical case against malapportionment or the unequal formal representation of people in legislatures is incomplete. Although a voluminous literature examines the effects of unequal representation on coalition formation (Bhavnani 2016; Lee 2000), the distribution of resources (Ansolabehere et al. 2002; Galiani et al. 2016; Horiuchi and Saito 2003), and public policy (Ardanaz and Scartascini 2013), we know of no work that examines its effects on economic development. Understanding whether and why malapportionment affects economic development is critical for assessing the welfare costs of unequal representation.

In this paper, we build on the distributive politics literature (see Golden and Min 2013 for a review) to argue that unequal representation might affect developmental outcomes. We focus on two important reasons that this could be the case. First, politicians might wish to improve the development outcomes of their constituencies in order to be reelected. And second, voters might work to ensure that politicians are held accountable for the delivery of better development. As we detail below, the operation of both mechanisms might be increasing in representation.

To test our argument, we examine the effects of malapportionment on night light output across India's administrative districts, measured using satellites. India is an appropriate case because although the degree of malapportionment is around the world average (Samuels and Snyder 2001), the country has substantial sub-national variation in the degree of unequal political representation (Bhavnani 2016). Focusing on India also allows us to leverage abrupt changes in the degree of representation due to redistricting. We find that a 10% increase in representation increases light output by 0.5%, which is the equivalent of 25% of the average annual increase in light output. We also find that reapportionment attenuates the effect of malapportionment. Lastly, the data weakly suggest that the benefits of increased representation are concentrated, as suggested by the theory, in places with legislators and electorates that we have a priori reasons to believe are influential.

1 How malapportionment affects development

Building on Golden and Min (2013), we focus on two of the many reasons that malapportionment could affect development. First, to take a top-down perspective, politicians frequently try to secure their reelection by targeting particular constituencies for benefits that, in turn, might impact development. For example, in the context of India, Baskaran et al. (2015) shows that politicians boost the supply of electricity to constituencies aligned with the ruling party or coalition. Min (2015) shows this to be the case particularly around elections. The operation of this mechanism will be increasing in formal representation, as more legislators will exert more effort to improve development outcomes.

In parliamentary systems such as India, legislators from governing coalitions and/or the cabinet might be particularly able to influence development outcomes. Representation in governing coalitions is likely to be important as the coalition formation process empowers small parties to extract concessions from formateurs, which might help them to secure development benefits for their constituents. Representation in the cabinet might be also be important as the executive frequently dominates the legislature. In short, representation might affect economic development by allowing powerful legislators to affect development outcomes.

Second, to take a bottom-up view, voters hold politicians to account when they are empowered. For example, Besley and Burgess (2002) shows that India's central government is more likely to respond to food shortfalls in states with more informed electorates. The operation of this mechanism will also be increasing in formal representation, as voters with more representatives have more opportunities to hold politicians to account. Certain types of voters—such as those that are literate and informed—might be especially able to hold politicians to account.

2 Malapportionment in India's states

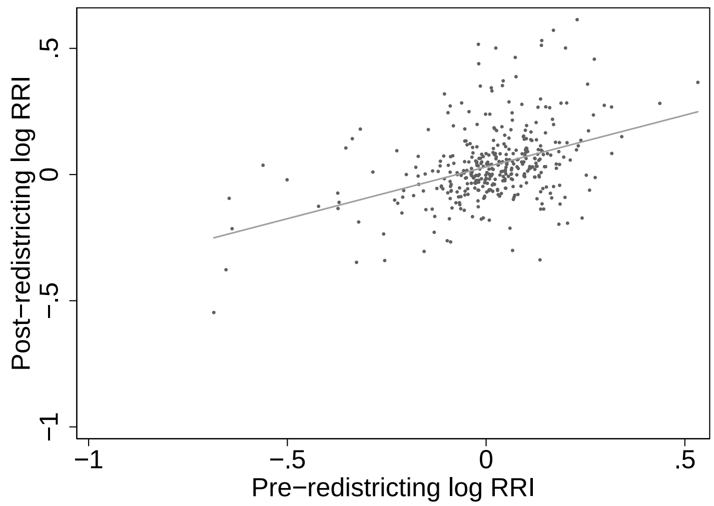
The Indian constitution secures for its citizens one-person one-vote. In the country's state legislatures, which are the focus of this paper, this is ensured by providing for a universal franchise and decadal "delimitation" or redistricting. The country's 29 states are divided into administrative districts, with relatively fixed boundaries. These administrative districts are divided into single-member assembly constituencies that elect Members of the Legislative Assemblies to state legislatures. During delimitation, each administrative district within a state is assigned single-member seats or constituencies in proportion to share of the state population. However, the Indian government froze redistricting in 1976, thereby causing an increasing degree of malapportionment across the country for the next several decades. The freeze in redistricting was lifted in 2008, equalizing representation within state legislatures.

Following the literature, we may measure the degree of malapportionment across India's districts using the relative representation index or RRI. The RRI is calculated as the seats per capita in a district divided by the seats per capita in the state ($v_{d,s,t}/\overline{v}_{s,t}$, where v is the seats per capita in the district, $\overline{v}$ is the seats per capita in the state, and d, s, and t denote the district, state and year, respectively). Due to data constraints, we calculate the RRI using the number of registered voters in each district, rather than population.[1] Districts with RRIs greater than one are overrepresented, those with RRIs less than one are underrepresented, and districts whose RRI equals one give people a vote equal to the average. Figure 1 plots the log RRI before and after redistricting, illustrating the fact that the degree of malapportionment across India's administrative districts was substantially reduced after redistricting (the slope of the fitted line is less than one).

Bhavnani (2016) argues that the 1976 freeze in redistricting was implemented for apolitical and non-partisan reasons, to not reward high population growth states with additional representation. Consistent with this argument, the freeze was instituted at a time of widespread paranoia about population growth in India, which also led to forced sterilizations. Furthermore, simulations suggest the freeze did not increase the seat shares of the Congress party that instituted it (Bhavnani 2016). Lastly, the redistricting that did occur in May 2008 does not evince signs of partisanship (Iyer and Shivakumar 2012). Given this, we use the redistricting of 2008 as a natural experiment with which to examine the effects of representation. Our strategy parallels the use of redistrictings elsewhere as natural experiments (Ansolabehere et al. 2002; Horiuchi and Saito 2003).

[1] More specifically, the Election Commission of India releases data on the number of registered voters, and not the population, of each district in election years. Reassuringly, population figures from the 2001 census are highly correlated with the number of registered voters in the election temporally closest to 2001 ($\rho > 0.95$). This is perhaps not surprising in India since the state rather than citizen is responsible for voter registration. At least one other work that uses registered voters rather than population to measure malapportionment (Bhavnani 2016).

Figure 1: The Relative Representation Index across India's districts before and after redistricting



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Notes: The line of best fit has slope 0.4.

3 Empirical strategy and data

To measure economic development at the subnational level, we employ median night light output for the villages in each of India's administrative districts, as made available at http://india.nightlights.io/. The district is the appropriate unit of analysis because this is the level at which most administrative decisions, including on the electrification of villages, are made. Night light output has been increasingly used as a proxy for economic development (Chen and Nordhaus 2011; Henderson et al. 2012).[2] Using a sample of developing countries, Henderson et al. (2012) estimates that the elasticity of GDP growth with respect to light output growth is 0.3. Light output data have the advantage of being collected by satellite, objectively, and without the problems of survey non-response and political interference. They are therefore particularly useful in developing country contexts, and for measuring economic growth for subnational units for which GDP growth figures are not typically available. In the context of India, light output is a particularly appropriate measure of development, as over 260 million Indians lack access to electricity. The median light output

[2]Night light output has also been used as a measure of electrification (Baskaran et al. 2015; Min 2015). Since night lights are the result of the *supply* and *demand* for electricity, we follow a broad literature in economics cited above to think of it as a measure of economic development rather than electrification. Obviously, the two are highly correlated.

measure varies between 0–63. Districts with more electrified villages have higher values.

The key independent variable employed is the logarithm of the previously-introduced relative representation index (RRI) for each administrative district in India. To calculate the effect of representation on economic development, we estimate:

$$Y_{d,s,t} = \alpha + \beta RRI_{d,s,t} + \gamma X_{d,s,t} + \delta_{s,t} + \eta_{d,s} + \varepsilon_{d,s,t} \quad (1)$$

where Y is log light output, RRI is the Relative Representation Index, X is a set of controls, including lagged log light output and the logarithm of the number of registered voters, which could directly affect public goods, $\delta_{s,t}$ are state-year fixed effects, $\eta_{d,s}$ are district fixed effects and ε is a normally distributed error term. d indexes administrative districts, which are nested within states (s), and t indexes time. Standard errors are clustered by state-year. The estimate of interest is β, the effect of changes in the RRI on changes in light output.

Using this strategy, the causal effect of changes in the RRI is statistically identified using the abrupt change in the number of seats across districts due to redistricting. This is the case since although changes in RRI could be due to changes in registered voters or seats in states, or due to changes in registered voters or seats in districts, the first three of these possibilities are controlled for in the analysis. The number of the registered voters and seats in states are controlled for using state-year fixed effects, and the number of registered voters in districts are controlled for directly. The variation in the RRI that remains then is simply due to the change in the number of seats in districts due to redistricting.

The data used in this paper span 2004–2012, and are summarized in Online Appendix Table 1. The data sources are noted in the appendix. Redistricting took effect in May 2008, and applied to all elections held from then on.

4 Malapportionment affects development

To start with, we use OLS to examine the correlation between log light output and the log RRI, controlling for the number of registered voters and lagged light output (regression 1 of Table 1). The controlled correlation is negative and weakly statistically significant, at the 10% level. This regression fails to control for the many confounds that state-year and district fixed effects would absorb. We include these in regression 2, and thereby implement equation 1. This regression suggests that the causal estimate of the effect of changes in malapportionment due to redistricting on log light output is statistically and substantively significant. A 10% increase in representation causes a 0.5% increase in light output. Since the mean annual increase in light output is 2%, this change is equivalent to approximately 25% of annual light output growth.[3] Since the elasticity of GDP growth with respect to light output is estimated to be 0.3 (Henderson et al. 2012), this suggests a GDP growth rate increase of 0.6%.

Having established the causal effect of representation on light output, we examine the effects of redistricting on the effects of the RRI. To do so, we add the interaction of the RRI with a dummy for post-delimitation elections (the uninteracted effect of the post-delimitation dummy is absorbed by the state-year fixed effects). This analysis, presented in regression 3, suggests that the causal effect of the RRI is attenuated after redistricting. The estimated effect of the RRI post-redistricting (the sum of the first two coefficients in the regression) is statistically indistinguishable from zero. In other words, the equalization of representation blunts its effects.

In Online Appendix Table 2, we show that our main results are robust to a number of changes. They are robust to respecifying the dependent variable as the proportionate change in light output (regression 1), to respecifying the independent variable as log seats, which is arguably more easily interpretable than the RRI (regression 2), or to replacing the log RRI with the RRI and its squared (regression 3), and to dropping the lagged value of log light output (concerns of Nickell bias might warrant dropping the term; regression 4). The estimated effect is also robust to including post-

[3]Our results are consistent both with reapportionment redistributing development across districts and also with it increasing overall levels of development in the state. Ascertaining which of these is the case would require a different (state- rather than district-level) research design.

Table 1: Does malapportionment affect light output?

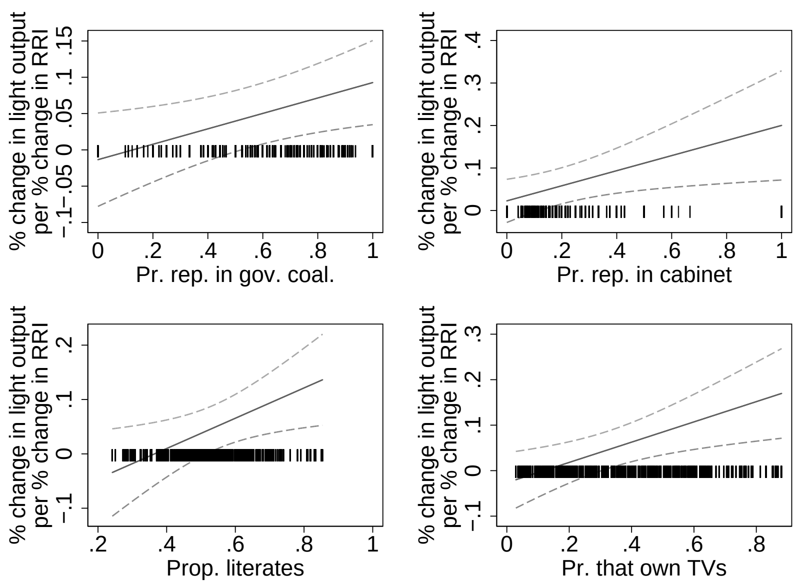
	1	2	3
Ln Relative Representation Index (RRI)	-0.0269* (0.0156)	0.0506** (0.0217)	0.0644** (0.0249)
Ln RRI x Post-redistricting			-0.0783* (0.0403)
Ln registered voters	0.0156*** (0.00380)	0.0451*** (0.0168)	0.00691 (0.0234)
Lagged ln light output	0.964*** (0.00660)	0.230*** (0.0433)	0.227*** (0.0433)
State-year fixed effects?	N	Y	Y
District fixed effects?	N	Y	Y
Observations	3421	3421	3421
Adjusted R-squared	0.87	0.96	0.96

Notes: The dependent variable is ln light output. Standard errors, clustered by state-year from regression 2 on, in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

treatment controls for the proportion of representatives that are members of governing coalitions and cabinets, and literacy (regression 5).

As argued previously, malapportionment might affect development outcomes for top-down, strategic reasons, as politicians work to develop their constituencies. An observable implication of this mechanism is that the effects of additional representation should be particularly discernible in districts with powerful legislators. To test this possibility, we interact the proportion of state legislators in governing coalitions and cabinets with the RRI (regressions 1 and 2 of Online Appendix Table 3). Note this analysis does not purport to be causal. We are merely examining whether the effects of the RRI that we have established are concentrated in the districts suggested by the theory. Both interactions are positive and statistically significant, suggesting that does indeed malapportionment boost light output largely in districts with high proportions of representatives in governing coalitions and the cabinet. The first two plots in Figure 2 map the variation in the effect of representation on light output as the proportion of state legislators in governing coalitions and the cabinet vary. It suggests that the RRI boosts light output in the approximately 60% of district-years that have more than half of their state legislators in governing coalitions, and in the approximately 35% of district-years that have 15% or more of their state legislators in cabinets. So while malapportionment affects development outcomes, it particularly does so when state legislators are in governing coalitions and cabinets.

Figure 2: The effect of malapportionment on light output as the proportion of representatives in the governing coalition and cabinet vary, with 95% confidence interval



Notes: The coefficients underlying the plots are from regressions 1–4 of Online Appendix Table 3. The rug plots display the distribution of proportion of representatives in the governing coalition and cabinet, and the proportion of literates and the rural population that owns TVs. See text for details.

The second mechanism that we test is that representation affects light output bottom-up, as voters hold politicians to account. Since districts with high literacy and TV ownership rates should be particularly able to hold politicians to account (these factors could work via a number of channels, including by emboldening citizens, by making them aware of, or able to, demand their rights, and by improving their access to information), we should expect the positive effects of increased representation to particularly hold in these contexts. To test these possibilities, we interact the predetermined district literacy rate from 2001 (regression 3) and TV ownership rates (unfortunately, these data are only available from 2007/08; regression 4) with the log RRI. Both interaction terms are positive and statistically significant. Marginal effects are plotted in the last two plots of Figure 2, which suggests that greater representation increases light output in the 46% of districts with literacy rates greater than 55%, and in the 50% of districts where at least 30% of the population owns TVs. In regression 5, we control for the four mechanisms tested here simultaneously. Unfortunately, doing so substantially weakens the evidence in favor of all the mechanisms, possibly due to collinearity.

5 Conclusion

In this paper, we argued that malapportionment might affect economic development. Using a natural experiment due to India's 2008 redistricting, we demonstrated that increases in representation increase light output, and that reapportionment attenuates the effects of representation. Weaker evidence suggests that the positive effect of greater representation is concentrated in constituencies with legislators and electorates that we have a priori reasons to believe will be influential. Malapportionment is ubiquitous and is, to an extent, unavoidable. We now know that in one important context, it has substantial welfare consequences.

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Online Appendix for “The Effects of Malapportionment on Economic Development: Evidence from India’s 2008 Redistricting”

Data sources

- Light output: Light output data for the median village in each district-month-year were downloaded from http://india.nightlights.io/ in February 2016. Most district-month-years had multiple measures of median light output, taken by different satellites. The median light output for each district-year was calculated in two steps. First, for each district-month-year, light output was set to the median light output as measured across multiple satellites. Second, for each district-year, light output was set to the median of the 12 monthly light output measures for that year.

- Ln registered voters: Linearly imputed using data on the registered number of voters in each district in election years. Underlying data are from Bhavnani, Rikhil R., 2014, “India National and State Election Dataset,” doi:10.7910/DVN/26526, Harvard Dataverse, V2.

- Ln Relative Representation Index (RRI): Calculated using data from Bhavnani (2014) and registered voters data, calculated as above.

- Prop. of representatives in the largest party: From Bhavnani (2014).

- Prop. of representatives in the cabinet: Coded using “Who’s Who” directories, state government websites and responses to Right to Information requests.

- Prop. of representatives in the governing coalition: Imputed from cabinet data.

- Prop. literates: The data used in the robustness tests are linearly interpolated using literacy data from the 2001 and 2011 censuses. The data used to test the mechanisms by which representation might work are predetermined, from 2001.

- Prop. that own TVs: From the 2007/08 District Level Household and Facility Survey.

Online Appendix Table 1: Summary statistics

	Mean	Std. Dev.	Min.	Max.
Ln light output	1.28	0.40	0.48	3.30
Prop. change in light output	0.02	0.15	-0.54	0.89
Ln Relative Representation Index (RRI)	0.03	0.16	-1.00	0.92
Ln registered voters	13.95	0.71	10.01	16.99
Prop. of representatives in the governing coalition	0.64	0.27	0.00	1.00
Prop. of representatives in the cabinet	0.12	0.15	0.00	1.00
Prop. literates, imputed	0.60	0.11	0.29	0.90
Prop. literates, 2001	0.53	0.12	0.24	0.85
Prop. that own TVs	0.35	0.21	0.03	0.88

Online Appendix Table 2: Robustness tests

Dependent variable:	Prop. change in light output	Ln light output			
	1	2	3	4	5
Ln Relative Representation Index (RRI)	0.0506**			0.0655***	0.0513**
	(0.0217)			(0.0233)	(0.0219)
Ln registered voters	0.0451***	-0.00134	0.0414**	0.0519***	0.0471***
	(0.0168)	(0.0146)	(0.0193)	(0.0179)	(0.0168)
Lagged ln light output	-0.770***	0.228***	0.230***		0.230***
	(0.0433)	(0.0433)	(0.0434)		(0.0437)
Ln seats		0.0491**			
		(0.0221)			
RRI			0.120**		
			(0.0512)		
RRI squared			-0.0318*		
			(0.0185)		
Prop. of representatives in the governing coalition					0.0159
					(0.00994)
Prop. of representatives in the cabinet					0.0135
					(0.0203)
Prop. literates					-0.374
					(0.228)
State-year fixed effects?	Y	Y	Y	Y	Y
District fixed effects?	Y	Y	Y	Y	Y
Observations	3421	3441	3421	3421	3421
Adjusted *R*-squared	0.73	0.96	0.96	0.96	0.96

Notes: Standard errors, clustered by state-year, in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix Table 3: What are the mechanisms by which malapportionment affects light output?

	1	2	3	4	5
Ln Relative Representation Index (RRI)	-0.0135	0.0227	-0.102	-0.0264	-0.0832
	(0.0328)	(0.0259)	(0.0671)	(0.0336)	(0.0720)
Ln RRI x Prop. of representatives from the governing coalition	0.106**				0.0739
	(0.0453)				(0.0469)
Prop. of representatives in the governing coalition	0.0156				0.0122
	(0.0101)				(0.0102)
Ln RRI x Prop. of representatives in the cabinet		0.178**			0.129
		(0.0761)			(0.0799)
Prop. of representatives in the cabinet		0.0248			0.0210
		(0.0191)			(0.0201)
Ln RRI x Prop. literates			0.279**		-0.00204
			(0.118)		(0.161)
Ln RRI x Prop. that own TVs				0.223***	0.203*
				(0.0816)	(0.107)
Ln registered voters	0.0465***	0.0446**	0.0389**	0.0357**	0.0375**
	(0.0169)	(0.0175)	(0.0171)	(0.0178)	(0.0183)
Lagged ln light output	0.228***	0.224***	0.229***	0.228***	0.222***
	(0.0435)	(0.0432)	(0.0434)	(0.0433)	(0.0435)
State-year fixed effects?	Y	Y	Y	Y	Y
District fixed effects?	Y	Y	Y	Y	Y
Observations	3421	3421	3421	3421	3421
Adjusted *R*-squared	0.96	0.96	0.96	0.96	0.96

Notes: The dependent variable is ln light output. In regression 3–5, the uninteracted effects of literacy and TV ownership are absorbed by the district fixed effects. Standard errors, clustered by state-year, in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.