Where Does The Buck Stop?
Economic Conditions & Electoral Outcomes

POL-2094-1: Data Science for Social Science Research

Group 1: Shashwat Agarwal, Karnav Popat

Introduction

Voters' retrospective evaluations of their democratically elected leaders' performance is the cornerstone of democratic accountability *(Ashworth)*. Retrospective voting describes this phenomenon of voters holding their leaders accountable for conditions during their term at the ballot box *(Plescia & Kritzinger)*. An abundance of literature works from this anticipated relationship of voting preferences responding to retrospective outcomes and establishes the significant role of retrospective voting in determining electoral performance *(Lewis-Beck, 1988) (Suri)*. An intuitive component of retrospective voting is that elected officials should be rewarded for economic growth in their term and punished for economic underperformance *(Kramer) (Lewis-Beck & Stegmaier)*.

There is a great deal of nuance to be investigated in the nature of economic voting in developing countries such as India. Scholarship in the area has focused on establishing the existence of retrospective economic voting in state elections, but many of the research questions which have yielded meaningful insights in countries such as the United States have not been investigated in India. One prominent direction of inquiry is whether voters are meaningfully more affected by the condition of the local economy as opposed to the economy of their state or the nation as a whole. Additionally, recent work *(Benedictis-Kessner & Warshaw)* has found that voters hold elected officials accountable for the economy at all levels of government, at the top as well as down the ballot.

We set out to investigate whether the effect of retrospective economic voting can be observed in Indian state elections based on economic conditions at the local (assembly constituency) level, and to establish whether Indian voters attribute responsibility for the local economy to their representative, their state's ruling government, or to the national ruling government. To accomplish this, we followed methodology inspired by *Dash & Ferris* and *Benedictis-Kessner &*

Warshaw to study the hypothesis across 30 years of elections in 15 major Indian states. We constructed a lagged panel dataset at the assembly constituency level with data representing electoral outcomes and sociotropic economic conditions, and used a regression model with fixed effects at the state level to study the correlation.

We found a significant but extremely small effect of economic conditions in the previous year on electoral outcomes at the constituency level for the time period under study. We delved further into the results and found that while the results are small but significant for the dataset at large, recent elections fail to exhibit predicted stronger impact of economic conditions compared to earlier decades, contrasting with the findings in *Vaishnav & Swanson*. We do find support for the hypothesis that the Indian economic voter is myopic, as laid out in *Dash & Ferris*, and that the state government is primarily held responsible for declines in citizens' economic welfare, rather than specific constituency-incumbents or the national government.

Literature Review

Two simple models of retrospective voter behaviour have been advanced to study how the decision to cast the vote among a range of parties is made *(Kramer)*. The first theory holds that each voter calculates their expected utility under the rule of each contesting party, based partly on retrospective record and party on prospective stance, and simply votes for the candidate and platform that maximises their utility. The second, simpler theory holds that the voter evaluates the performance of the incumbent government based on their retrospective record, and votes for the incumbents if they are satisfied or against them if they are not.

The advantage of this second model is that it reduces the problem of quantifying our dependent variable (electoral outcome) to a single number for each election: the incumbents' share of the

total votes. While some research designs have opted to use a binary variable that simply records whether the incumbent government was returned to power or not, it has been well-established *(Healy & Lenz, 2017)* that measuring changes in vote share better reflects changing preferences. However, its relevance to our use-case is limited because it primarily captures two-contestant elections such as those found in the United States *(Fair)*. As a result, it is important to also capture the overall utility calculation inherent to voting preferences, as suggested by the first model.

One way to do this is by using electoral volatility *(Dash & Ferris)*. Electoral volatility is a measure of the degree of change in voting preferences between two elections *(Sarkar & Dash)*. It represents a lower bound on the percentage of voters who changed their vote from one party to another. This is important because it captures the full extent of vote shifting indicated by the utility maximisation of the first model. While it might seem counterintuitive to consider shifts in votes from one opposition party to another, it is important to remember that, under the utility maximisation model, changes in retrospective factors affect the value that the voter attributes to every party, not just the incumbent. For example, If the economy suffered during a particular electoral term, priorities in voters' minds during the next election will shift to reflect their financial reality, and the value they attribute to each party's platform (and therefore, each party's vote share) will be adjusted.

There are two perspectives on the mechanism by which retrospective economic conditions impact voter preferences. A broad consensus has settled on the "sociotropic" view of economic voting as the causal channel *(Kiewiet & Lewis-Beck) (Lewis-Beck & Stegmaier)*, which states that economic voting tends to occur based on perception of the wider economy rather than personal economic circumstances. While this seems selfless, *Kinder & Kiewiet* assert that it is not so: "Alternatively, sociotropic voting may be totally self-interested. Prototypical sociotropic

voters may … use information about the national economic condition as a superior indicator of the government's ability to promote (eventually) their own economic welfare—and incidentally that of their fellow citizens as well".

The counter-perspective is that economic voting is "egocentric", more commonly called pocketbook voting, which states that voters primarily rely on their perception of their own financial conditions to make retrospective electoral decisions. While this is not the consensus position *(Kiewiet & Lewis-Beck)*, recent work has found that there is as much support, if not more, for pocketbook voting across countries *(Healy et al.) (Suri)*. However, literature measuring the effect of the local economy tends to focus on sociotropic voting, since pocketbook voting intrinsically has no dimension of locality or non-locality.

After surveying literature on the channels through which economic voting takes place, we can arrive at our hypothesised mechanism: that the Indian voter going to assembly polls takes note of recent economic and infrastructural development (or lack thereof) in his immediate vicinity, and accordingly judges whether the performance of the incumbent government has been satisfactory. Since he holds the state government responsible for his welfare *(Vaishnav & Swanson)*, it is the state's ruling party who bears the brunt of punishment or reward at the polls.

Hypotheses of retrospective economic voting have been tested across a variety of elections and electorates. The effect has been found to vary quite significantly across time, electorate, and methodology *(Powell & Whitten) (Duch & Stevenson)*. There are a number of theoretical nuances that have been proposed and tested - whether voters decide on the basis of national economic condition or personal circumstances *(Healy et al.)*, whether they are myopic, i.e, whether they care about conditions across the term or immediately before the election *(Wlezien) (Healy & Lenz, 2014)*, and whether they care about the economy across the country or only in

their vicinity *(Healy & Lenz, 2017)*. While the theoretical perspective on economic voting seems inherently sound, empirical evidence for specific mechanisms has been murky, and has also shown that it is certainly not universal, if it exists at all.

Table 1 illustrates some of the most influential empirical works on retrospective economic voting, many of which primarily look at American elections. We can see that the vast majority of findings support its existence in the United States, and some cross-country analyses have found for it across the world.

Table 1: Key works on retrospective economic voting

Year of Publication	Author(s)	Electorate	Independent variable	(Main) Dependent variable	Result
1971	Kramer	USA	Incumbent vote share	Per capita income	Significant support
1975	Arcelus & Meltzer	USA	Incumbent vote share	Various economic aggregates	No support
1978	Fiorina	USA	Incumbent vote share	Egocentric survey data	No support
1978	Fair	USA	Incumbent vote share	Net Domestic Product	Significant support
1988	Lewis-Beck	USA	Incumbent vote share	Egocentric survey data	Weak support
1993	Powell & Whitten	Cross-country	Incumbent vote share	GDP growth rate	Weak support
2005	Duch & Stevenson	Cross-country	Survey	Egocentric survey data	Weak support
2008	Brender & Drazen	Cross-country	Incumbent Yes/No	GDP per capita growth rate	Support (only in developing countries)
2012	Nadeau & Lewis-Beck	Europe	Incumbent Yes/No	Egocentric survey data	Weak support
2017	Healy et al	Sweden	Survey	Household disposable	Significant support

				income	
2020	Benedictis-Kessner & Warshaw	USA	Incumbent vote share	Income per capita growth rate	Significant support

Although the economic voting hypothesis has primarily been investigated in, and found the most purchase in, the United States, it has been theorised to hold sway in democracies around the world. Relatively recent evidence that it could be particularly influential in developing countries *(Brender & Drazen)*, with the rational backing that economic growth and development is most visible in these countries, has led to a spate of research in the area.

For India, the authoritative works are *Does Good Economics Make for Good Politics? Evidence from Indian States* by Vaishnav & Swanson and *Economic Performance and Electoral Volatility: Testing the Economic Voting Hypothesis on Indian States, 1957–2013* by Dash & Ferris. Both report findings that support the existence of retrospective, sociotropic economic voting in India assembly elections. The authoritative works on economic voting in India are laid out in Table 2:

Table 2: Retrospective economic voting in India

Year of Publication	Author(s)	Electorate	Independent variable	(Main) Dependent variable	Result
2008	Nooruddin & Chibber	India (states)	Incumbent vote share	Fiscal space	Weak support
2011	Gupta & Panagariya	India (Lok Sabha)	Incumbent vote share	GDP and income per capita growth	Significant support
2015	Vaishnav & Swanson	India (states)	Incumbent Yes/No & vote share	NDP per capita growth	Weak support
2018	Dash & Ferris	India (states)	Electoral	NDP per capita	Weak support

			volatility	growth	
2021	Ray & Varughese	Karnataka & West Bengal	Incumbent vote share	Egocentric survey data	Significant support

However, while *Dash & Ferris* (and indeed, the other literature focused on the Indian context) attempt to further answer some of the questions that have been raised about the hypothesis in the Indian context, many are yet to be investigated. By virtue of being the diverse, multi-level democracy that India is, there is great scope for investigation into exactly how, and at what level, economic voting takes hold. *Vaishnav & Swanson* argue that state elections are the "primary venues for electoral contestation", and other literature in the field *(Ray & Varughese)* has similarly focused on state governments. They reason that India's political culture, and the proliferation of the welfare state, disposes voters to expect the state government to be invested in the personal welfare of each citizen - the expectation of citizens' economic welfare is therefore laid at the feet of the state governments, and not the centre.

There is, however, a great deal of uncertainty about whether economic voting can be accurately measured, particularly in a country like India. One prominent concern is that there is strong partisan bias in perceptions of economic circumstance in an electoral context *(Kiewiet & Lewis-Beck)*. Voters with established political biases will view the same economic conditions differently depending on whether their preferred party is in power; equally, when there is no overwhelming evidence for economic success or failure, voters may simply interpret economic conditions based on their pre-decided political preferences *(Healy et al.)*. This effect is expected to be even worse for a developing country such as India, where the vast majority of the population are poorly informed on economic specifics. As Sircar puts it, some citizens vote on "vikaas" and some on "vishwaas", but each is strongly influenced by the other. As a result, any study - such as ours - of the sociotropic variant of the hypothesis which doesn't incorporate

survey data on voter preferences as well as controls for partisan bias should be treated with caution.

Our primary area of inquiry is whether voters hold elected officials responsible specifically for the local economy, and in a multi-level democracy such as ours, at what level this responsibility is allocated. The authoritative work in this regard is Benedictis-Kessner and Warshaw: *Accountability for the Local Economy at All Levels of Government in United States Elections*, which explores accountability for the local economy by down-ballot candidates at the country level for 50 years of elections in the United States. In the Indian context, Ray & Varughese: *Economic voting in multi-level contexts: Evidence from Kerala and West Bengal in India* lays most of the theoretical groundwork for our analysis by using survey data to explore how the state-level incumbent is held more responsible for economic circumstances than the national incumbent.

Based on this work, we can craft an empirical strategy that uses constituency-level data to examine how growth in the local economy affects support for incumbents at each level of governance. We hypothesise that retrospective, sociotropic economic voting exists in India, and that the state of the local economy immediately before the election plays an important role in shaping voters' perceptions of economic circumstances.

Data

To facilitate our analysis, we'll need to construct a panel dataset at a very granular (assembly constituency) level. For each assembly election, we'll measure the electoral outcome as well as retrospective local economic circumstances. To construct this dataset, we'll use data from six sources: the Trivedi Center for Political Data, the Election Commission of India, Raphael Susewind (KCL), the Defense Meteorological Satellite Program (DMSP)/Operational Linescan

System (OLS), the Visible Infrared Imaging Radiometer Suite (VIIRS), and the Ministry of Statistics & Programme Implementation Central Statistical Office.

Dependent Variable: Electoral Outcomes

To measure electoral outcomes, we'll follow the two models outlined by *Kramer* and applied to the Indian context by *Gupta & Panagariya*. As a result, we'll require two separate measures of electoral outcomes, one for each model. All of the data that we'll use to construct these measures is sourced entirely from the TCPD's Assembly Elections dataset, via the Lok Dhaba portal. This records all votes received by every candidate in every assembly constituency in every assembly election from 1961 to 2023.

To measure electoral outcomes based on the first (utility-maximising) model, we'll use electoral volatility. The conventional measure of electoral volatility is the Pedersen index, which is calculated as below:

$$\frac{\sum_{p=1}^{n} V_{pt} - V_{p(t-1)}}{2}$$

The Pedersen index as a measure of electoral volatility was first suggested in the context of European party systems *(Pedersen)*. It is an index from 0 to 100 that measures the degree of vote-shifting from one election to the other; specifically, it is a lower bound on the percentage of voters who must have shifted their vote from one party to another.

Taken over a longer period of time, it indicates the fickleness of an electorate and the strength of the contemporary party system *(Sarkar & Dash)*. Taken between one election and the next, it

excellently captures our conception of utility maximisation by measuring the degree to which preferences have changed. Electoral volatility is an established indicator of voting preferences, and has been used in literature on Indian electoral outcomes with a variety of indicators that measure the health of democracy and the determinants of an election: not just democratic participation *(Heath & Ziegfeld)*, but also economic policy and development *(Nooruddin & Chibber)*.

To measure electoral outcomes based on the second (incumbency) model, we'll use the vote share of the incumbent party (not candidate). Existing literature has trivially calculated the vote share of the incumbent as exactly what it sounds like: the percentage of the total votes cast in each election which were given to the party which was in power at the time. However, since we want to measure the difference in outcomes at each level of governance, we'll take three separate incumbent vote shares.

The first is the true incumbent vote share, which is the proportion of votes received in this election by the party which won the seat in the last election. The second is the state-level incumbent party's vote share, which is the proportion of votes received in this election by the party which won the most seats in the state assembly in the previous election.[1] The third is the national incumbent's vote share, which is the proportion of votes received in this election by the party which was ruling the centre[2] in the previous election. Note that this is somewhat different from the incumbent vote share analysis performed by most existing literature, which have only

[1] Note that, naturally, the party which won the most seats in the election is not necessarily the party(s) which formed government, and therefore should more appropriately be considered the "incumbent(s)". However, when analysing 30 years of 27+ states, it was computationally unfeasible for us to manually flag the incumbent parties for each term for each state. A manual look at the larger states revealed that this formula does hold for the majority of elections.

[2] We defined the national ruling party as the Prime Minister's party. While most central governments are formed by coalitions, once again it would've been somewhat unfeasible to flag each regional party in each ruling coalition, particularly with the smaller parties that formed the United Front and the later Congress governments, and the parties that joined, left and rejoined the coalitions.

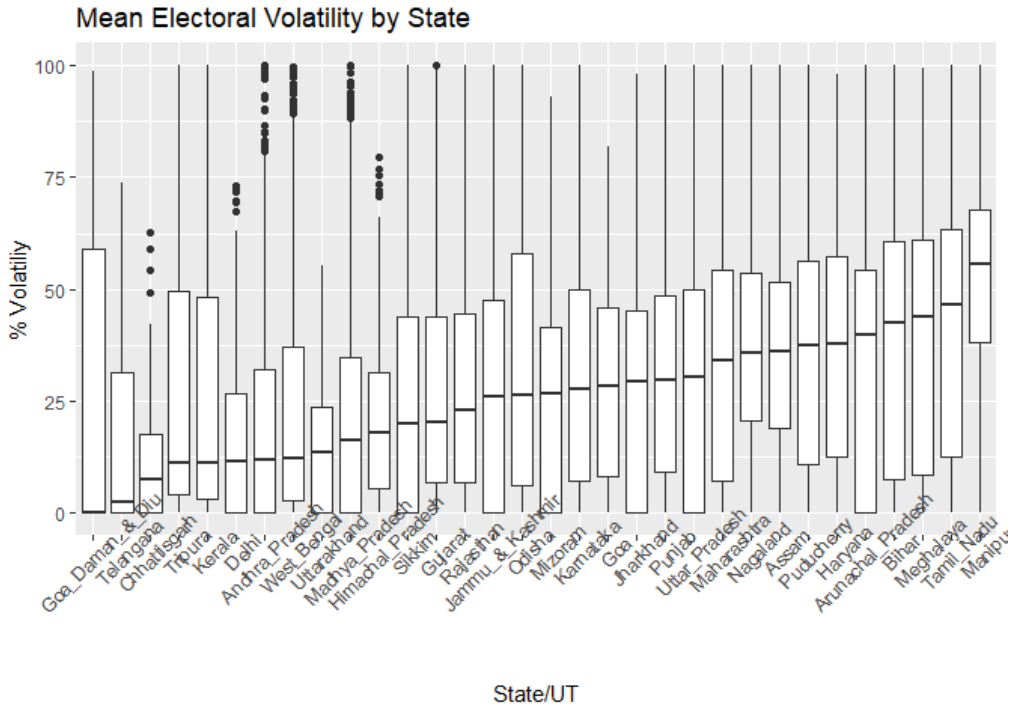
one incumbent to measure, but our methodology is consistent with *Benedictis-Kessner & Warshaw*.

We therefore have four measures to calculate with which to capture our dependent variable. We'll do this with the TCPD assembly election dataset. First, we'll aggregate the votes by party rather than candidate[3]. We'll also leave out elections that were voided by re-election and elections before 1980. We restrict our analysis to this time period partly because it's only after the Emergency that Indian electoral volatility stabilised, but more importantly because the granular satellite data we'd like to use is not available before this time. Table 3 describes our dataset after aggregating and filtering.

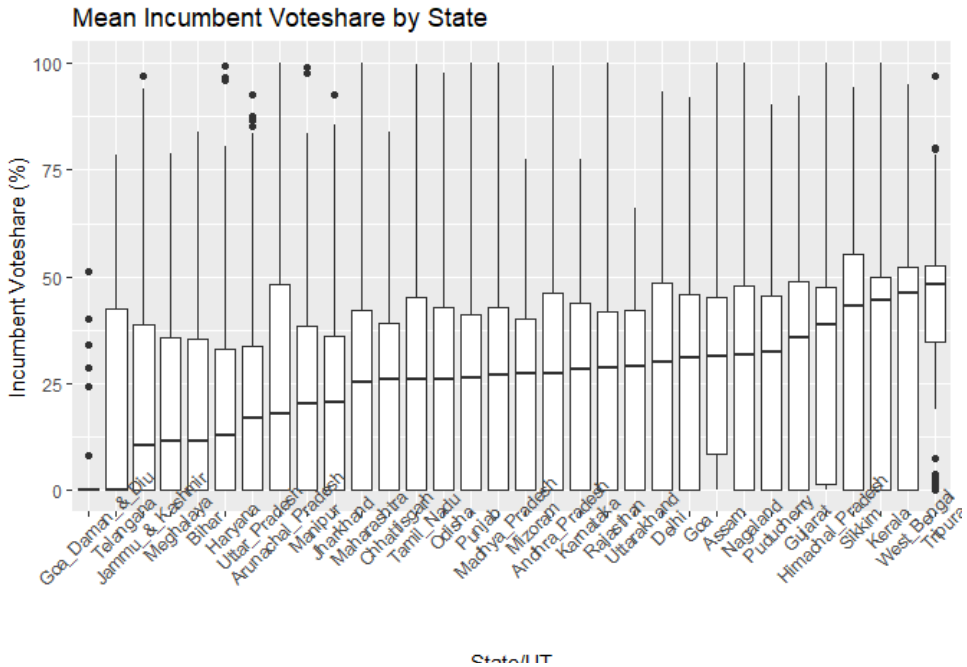
To actually calculate our measures, we'll first add flags for the parties which won each election at the constituency, state, and national level. The state winner is determined to be the party which won the most constituencies, while the national winner is flagged manually for each central government. We can then lag these flags by one election to arrive at equivalent flags for incumbency. We then create new columns holding the percentage share of the vote for each incumbent party in each election, which represents our first three measures. We widen the dataframe by party, which allows us to calculate the change in vote share for each party between each two elections. Based on the formula for the Pedersen index, we can now calculate the electoral volatility for each election. This gives us our fourth measure. Table 4 describes our dependent variable dataset after processing.

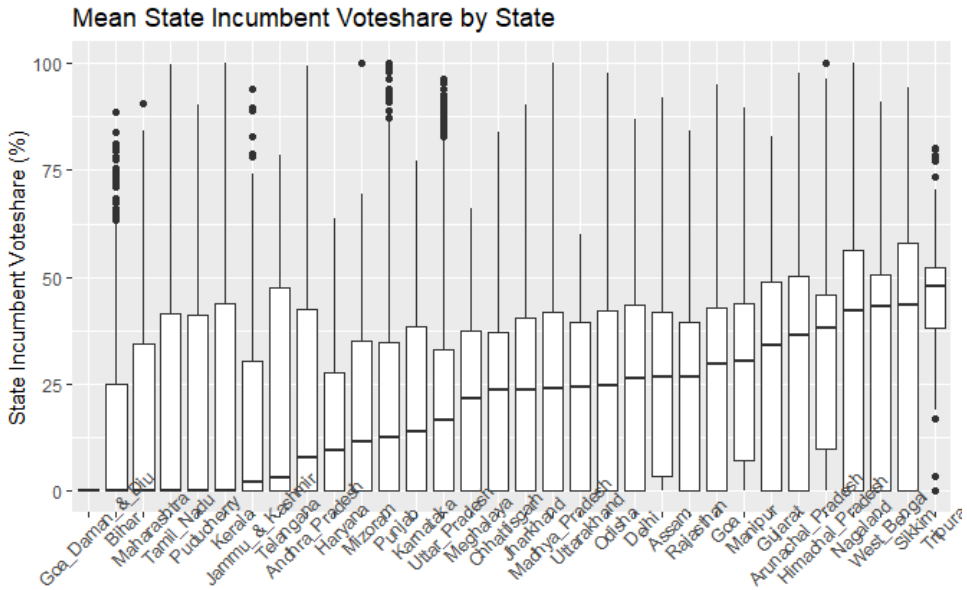
[3] We considered performing this analysis at the candidate level rather than the party level, since it captures meaningful information about the attribution of responsibility (an incumbent running the same constituency from the same party is not nearly the same as a new candidate from the same party). We chose not to do so primarily because the large amount of churn among assembly candidates would've meant a far larger count of NAs and far higher volatility figures. Additionally, the literature we consulted (Benedictis-Kessner & Warshaw and Ray & Varughese) proceeds at the party level, not the candidate level.

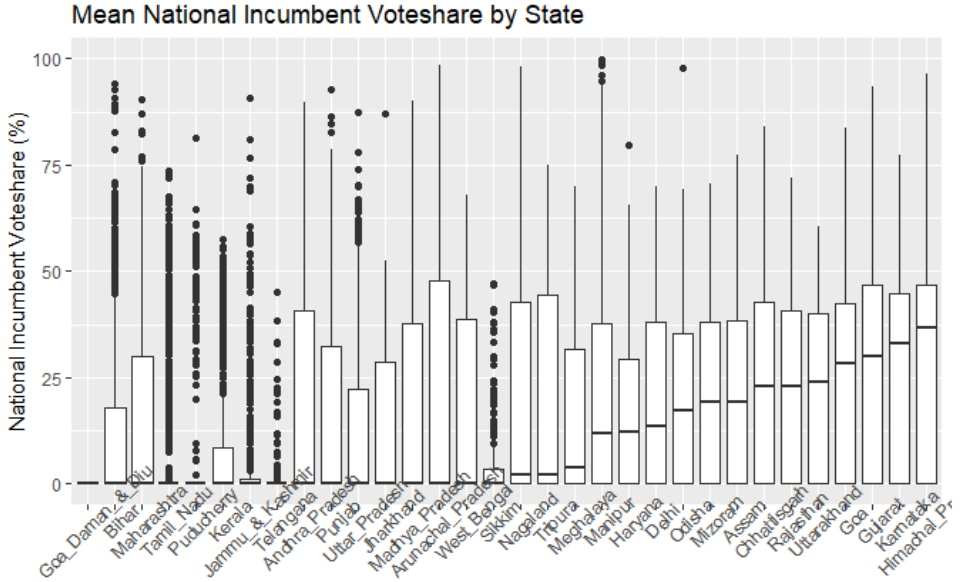
Taking a look at the data, there doesn't seem to be a clear regional trend in volatility. The lowest mean volatility arises from states which only existed for short periods of time: Telangana and Chattisgarh, followed by Tripura, Kerala and Delhi which do tend to be more stable. The most volatile states seem to be Manipur and Tamil Nadu, which is consistent with their electoral reputation (Tamil Nadu, for example, famously changes hands between the DMK and AIDMK). The few instances of extremely high volatility, largely in Andhra Pradesh and Uttarakhand, are presumably the result of data errors because of delimitation.



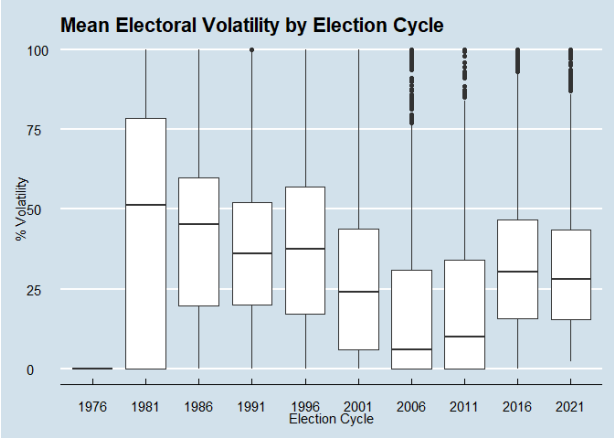
Similarly looking at the incumbent votes share measures, the results are in line with traditional electoral narratives. West Bengal is a great state to be incumbent in locally and at the state level, presumably because of the long and steady rule of first the CPI(M) and now the AITC. Similar interpretations follow for Gujarat, Himachal Pradesh, and the like. The depiction of national incumbent vote share probably exposes the inadequacy of our definition of national incumbent as the Prime Minister's party, since we wouldn't have flagged, for example, the Left Front in Bengal or the DMK in Tamil Nadu.

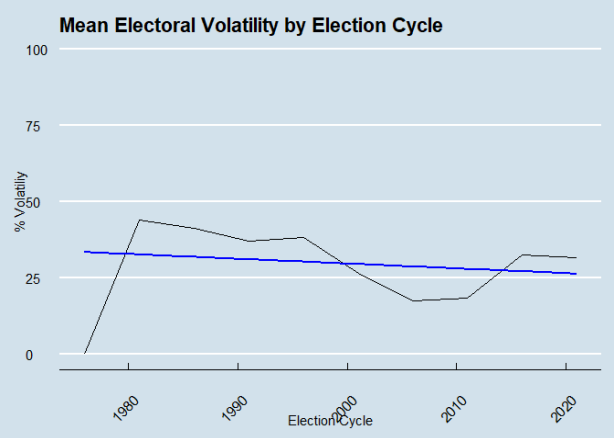

Mean Incumbent Voteshare by State
Incumbent Voteshare (%)
100
75
50
25
0
Goa_Daman_&_Diu
Telangana
Jammu_&_Kashmir
Meghalaya
Bihar
Haryana
Uttar_Pradesh
Arunachal_Pradesh
Manipur
Jharkhand
Maharashtra
Chhattisgarh
Tamil_Nadu
Odisha
Punjab
Madhya_Pradesh
Mizoram
Andhra_Pradesh
Karnataka
Rajasthan
Uttarakhand
Delhi
Goa
Assam
Nagaland
Puducherry
Gujarat
Himachal_Pradesh
Sikkim
Kerala
West_Bengal
Tripura


Mean State Incumbent Voteshare by State
State Incumbent Voteshare (%)
100
75
50
25
0
Goa_Daman_&_Diu
Bihar
Maharashtra
Tamil_Nadu
Puducherry
Kerala
Jammu_&_Kashmir
Telangana
Andhra_Pradesh
Haryana
Mizoram
Punjab
Karnataka
Uttar_Pradesh
Meghalaya
Chhattisgarh
Jharkhand
Madhya_Pradesh
Uttarakhand
Odisha
Delhi
Assam
Rajasthan
Goa
Manipur
Gujarat
Arunachal_Pradesh
Himachal_Pradesh
Nagaland
West_Bengal
Sikkim
Tripura


Mean National Incumbent Voteshare by State
National Incumbent Voteshare (%)
100
75
50
25
0
Goa_Daman_&_Diu
Bihar
Maharashtra
Tamil_Nadu
Puducherry
Kerala
Jammu_&_Kashmir
Telangana
Andhra_Pradesh
Punjab
Uttar_Pradesh
Jharkhand
Madhya_Pradesh
Arunachal_Pradesh
West_Bengal
Sikkim
Nagaland
Tripura
Meghalaya
Manipur
Haryana
Delhi
Odisha
Mizoram
Assam
Chhattisgarh
Rajasthan
Uttarakhand
Goa
Gujarat
Karnataka
Himachal_Pr

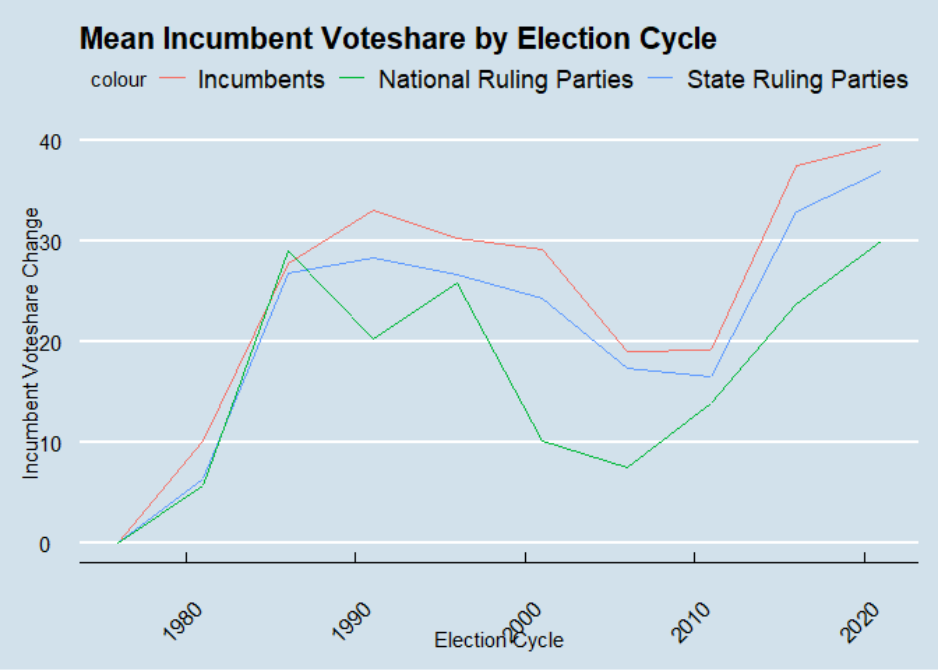
Looking at the temporal trend, we can explore the popular narrative that volatility and anti-incumbency has reduced over time in India *(Kumar) (Kumar et al.)*. Plotting volatility across electoral cycles[4] reveals that the popular narrative is, for once, backed by the data: Volatility has largely gone down since the 80s, barring a small increase over the last two cycles (possibly indicative of the NDA's inroads in states such as West Bengal).





Similarly, incumbents seem to be doing better and better over the past few decades. While a state incumbent party could only expect, on average, a little less than 29% of the vote in the 1985 cycle, it could expect more than 36% in the 2015 cycle. The fact that the three incumbent measures move so closely together probably indicates a high degree of overlap among the seats in question.

[4] Since each state's assembly election doesn't necessarily take place in the same year, we clubbed them to 5-year electoral cycle. For example, the electoral cycle of 2006 refers to all state elections from 2006 to 2010.



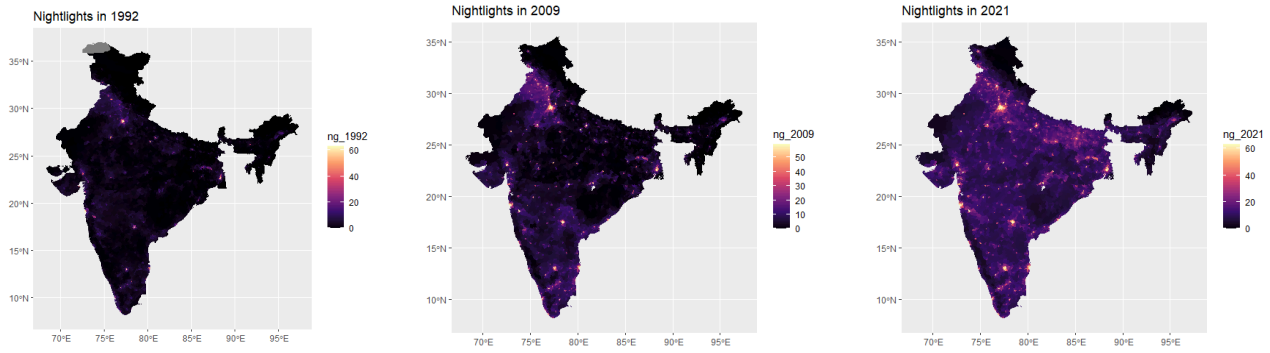
Independent Variable: Economic Conditions

For our independent variable, we use night-time light (NTL) data as a proxy, from the Defense Meteorological Satellite Program (DMSP)/Operational Linescan System (OLS) for the period 1991-2013 and the Visible Infrared Imaging Radiometer Suite (VIIRS) on the Suomi National Polar-orbiting Partnership satellite for the period 2013-2021. Since data from the two satellites needs to be harmonized, we use the dataset created by *Li et al (2020)*.

The use of night-time lights to proxy economic activity is well-established, and night-time light growth has been found to correlate well with GDP growth *(Bhandari & Roychowdhury)*. To map this data to our unit of analysis, which is assembly elections, we use shapefiles of India's assembly constituencies. Delimitation was implemented on these in 2008, so we'll use separate shapefiles for before- and after- delimitation. For constituencies prior to delimitation, we use the

shapefiles depicting constituencies in 2008, provided by the Election Commission of India and prepared by *Sandip Sukhtankar*. For constituencies post-delimitation, we use the shapefiles depicting constituencies in 2014, prepared by *Raphael Susewind*.

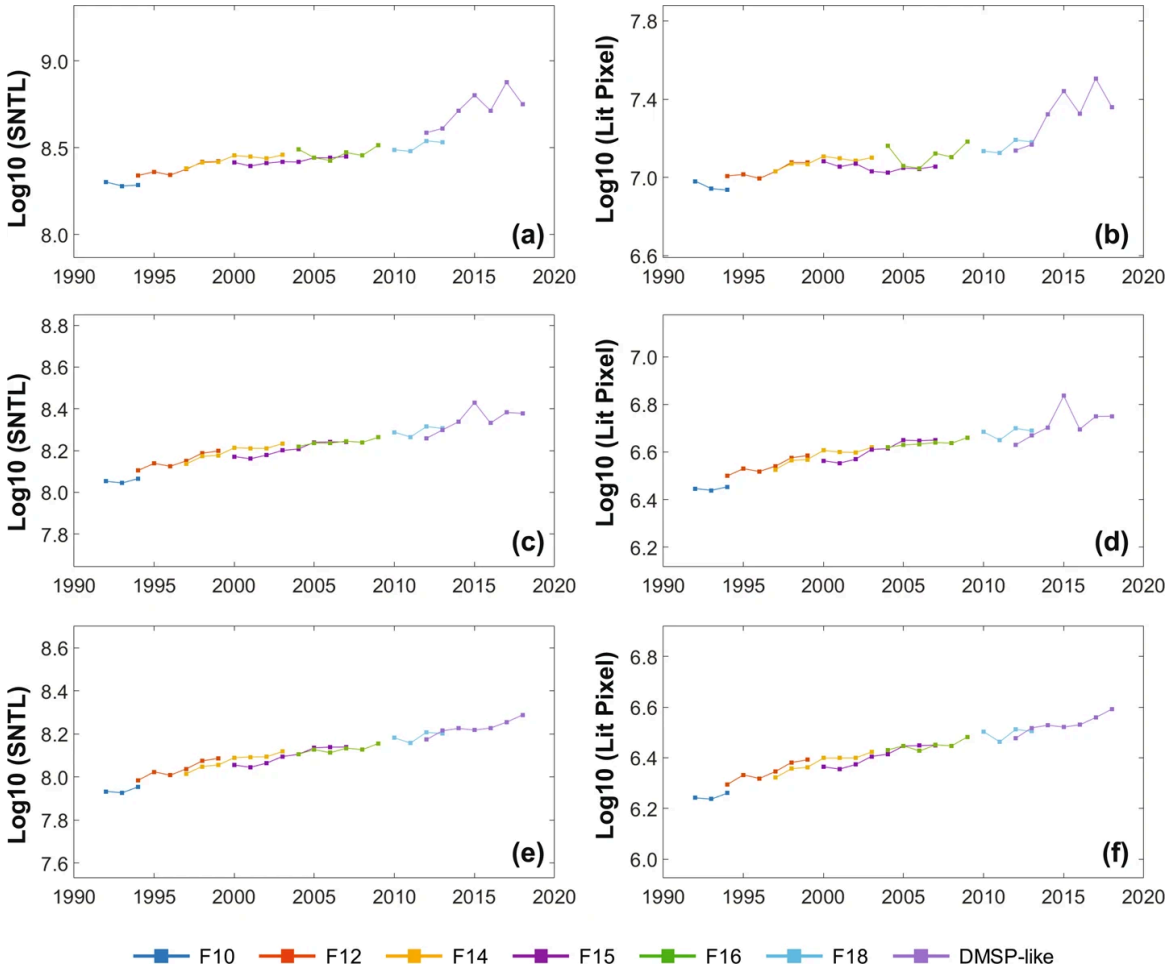
To extract the nightlights data from its raster (pixel) format to our unit of analysis (assembly constituencies), we'll clip the data to the extent of our shapefiles, then extract it by calculating the mean luminosity for each constituency's polygon. Note that we have two series of satellite data separated at 2013 and two shapefiles separated at 2008, so we'll perform three separate extractions for the three combinations. We can then widen the dataframes to get nightlights data for each constituency for each year, then clean and combine them into one single nightlights dataframe. Table 5 describes our nightlights dataset.



A look at the data confirms that it is about as expected: large parts of the country remain in darkness until very recently, while bright lights are clustered around major cities and towns, particularly the sprawling NCR.

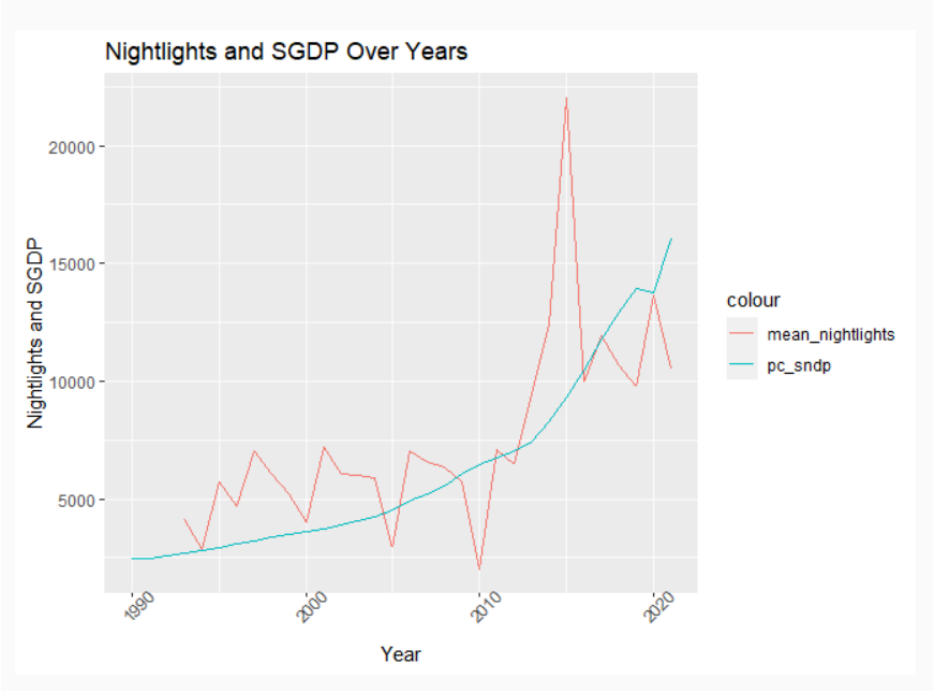
One concern that must be addressed is the temporal trends. NTL data in a developing country like India can often suffer from discontinuities due to slight changes in satellite sensitivity. While the *Li et al.* NTL dataset has been harmonized to construct a single temporally-consistent series from 1992-2018 (later extended to 2021), the harmonization has been done at the global

scale. India represents a problematic zone for the satellite data because, particularly in the first two decades, most of the country had little to no night-time light.



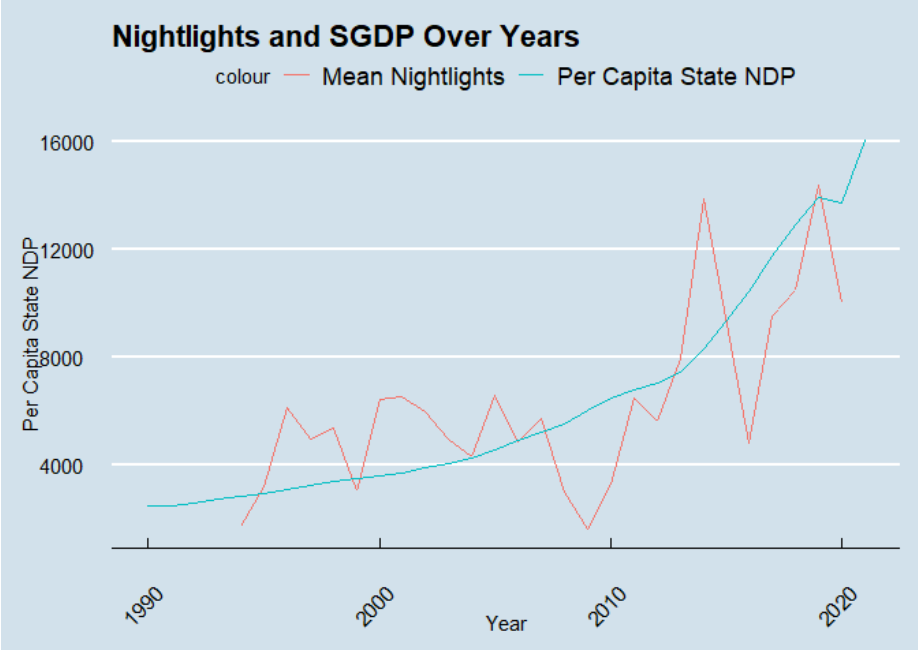
These are the dataset's global temporal trends considering pixels greater than 7 ((a) and (b)), 20 ((c) and (d)) and 40 ((e) and (f)) respectively. As can be observed from the temporal trends, the harmonization fails at low light levels, particularly for the VIIRS data in recent years. This means that the harmonized data for India after 2013 is inconsistent across years, which is particularly unfortunate for us because we expect our effect to be strongest in those years. We tackle this in two ways: first, we normalize the outlier years to approximate some ground truth, and second, we smoothen the data by taking, for each year, the rolling mean of the past three years of nightlights instead of just that year's nightlights data.

For the ground truth based on which we smoothen nightlights for each year, we take the Per Capita Net State Domestic Product at state- and year-level granularity. Plotting mean nightlights against mean NSDP per capita for all of India from 1992 to 2021, compiled from the CSO data and deflated to 1980 dollars[5]:



It's clear that the primary outliers are in and around 2015, where there seems to be an extreme and unjustified rise in luminosity, followed by an equally extreme fall in 2016. While we initially hypothesized that this could be due to the effects of demonetization, a look at global luminosity values confirmed that it was a result of misharmonization. We therefore remove outliers (beyond the interquartile range), with the resultant output:

[5] Note that this chart depicts the unlagged dataset while the chart below represents the lagged dataset, so the figures don't match exactly. Extracting and pivoting the nightlights raster dataset takes about 4-6 hours on our machines, which left us unable to provide exactly equivalent before- and after- charts.



As we can see, this is a much better representation of what we'd like to capture.

Panel Dataset

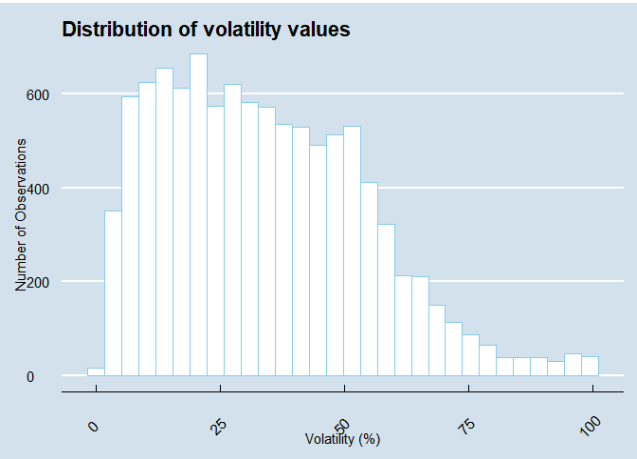
To conduct our analysis, we'll need to create a panel dataset of constituency elections with nightlights data. To do so, we'll merge the two datasets based on state and constituency name using the LCS method of fuzzy matching. To ensure no duplicates or dropped observations arise from delimitation or the creation of new states, we'll match each year's data individually then compile it into one panel dataset.

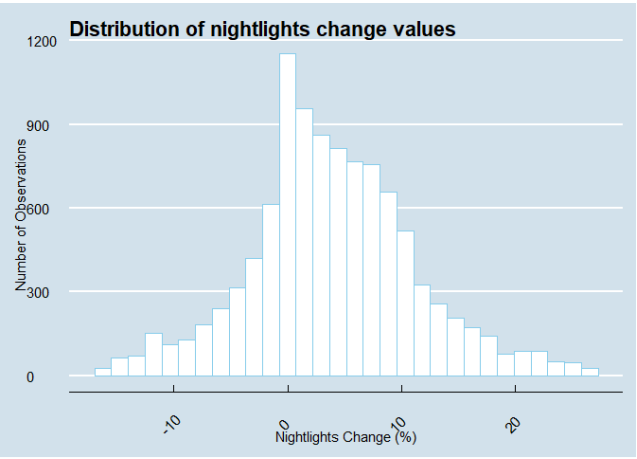
We can now calculate the metrics with which we'll compare our measures of electoral outcomes. While we could just use the NTL luminosity values, we're more interested in the percentage growth rate rather than the absolute NTL values. Additionally, to test the myopic voter hypothesis, we want to calculate measures across different lengths of time before the election. As

mentioned earlier, we also want to eliminate the effect of outliers, so we'll be taking a rolling mean of three years for each year instead of just that year's value.

As a result, our final calculation is the percentage change in the rolling mean of three years of nightlights compared to the same rolling mean calculated in the previous year, three years ago, and five years (one electoral tenure) ago *(Benedictis-Kessner & Warshaw)*. We'll calculate these measures for the year preceding each constituency's election year, since our theory focuses entirely on retrospective conditions. This gives us a lagged panel dataset where each observation (constituency election) has four measures of electoral outcomes for each election and three measures of economic conditions in the year preceding the election. Table 6 describes this final panel dataset.

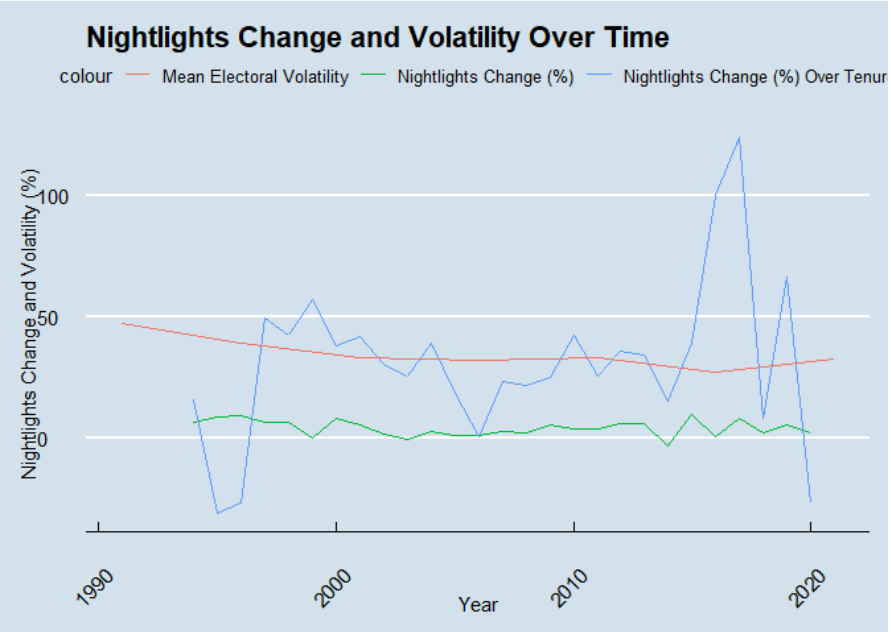
We can perform a sanity check by looking at the distribution of values in this dataset. Volatility seems to vary fairly uniformly between 0-50 and falls off afterward, which makes theoretical sense. Percentage change in nightlights[6] is centred around 0, is heavily left-skewed, and falls off steeply around the 10% mark, which is also in line with expectation.



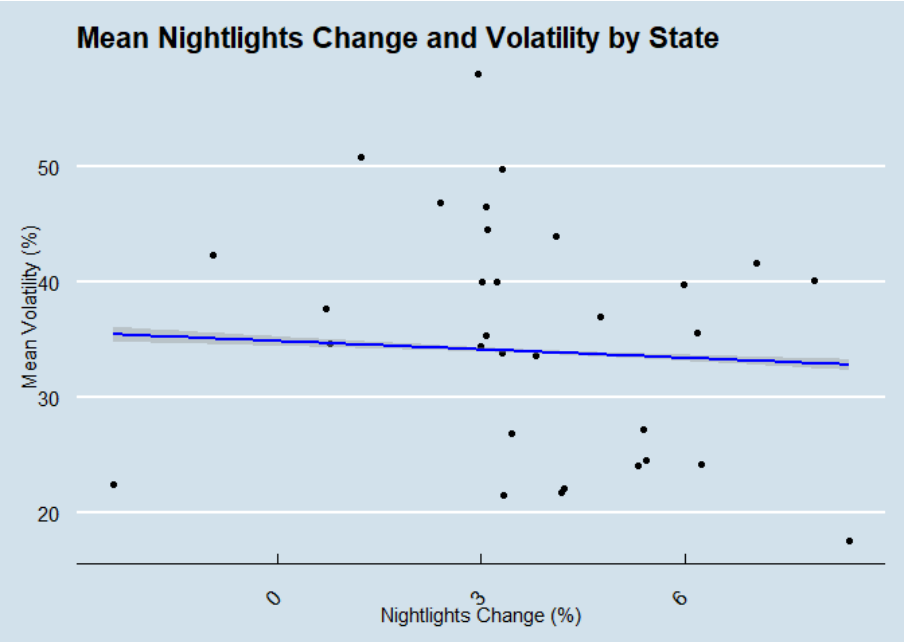


[6] Note that from here on, we'll refer to "percentage change in the rolling mean of nightlights over the past three years compared to the same rolling mean measured in the previous year" as "percentage change in nightlights".

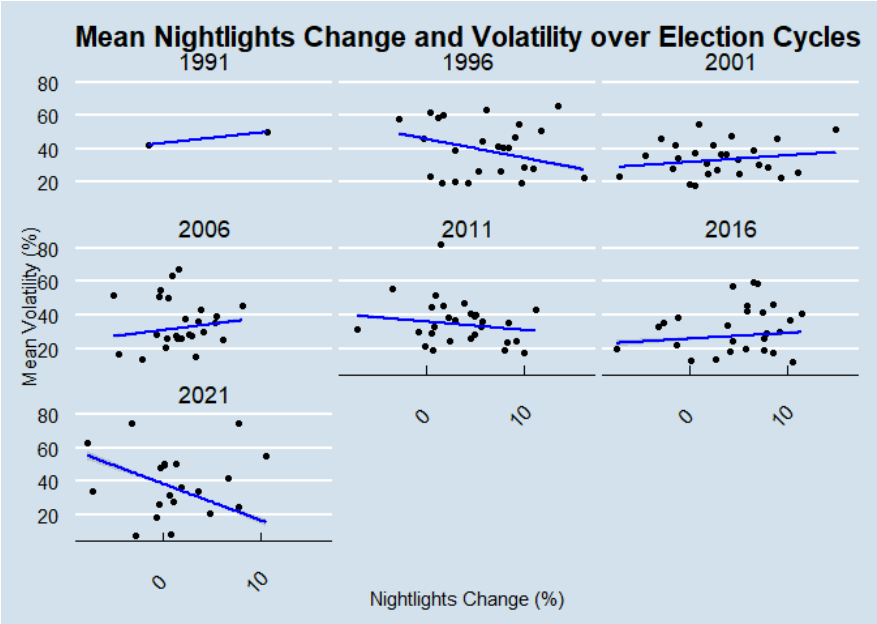
Visualising volatility and nightlights change over time, we see that volatility witnesses a small decrease over time, as observed below, while nightlights change over the past year is quite consistent and over tenure jumps only twice - a steep fall on the onset of the pandemic, and a steep rise in 2015, which is at least partly because of the issue with our NTL data.



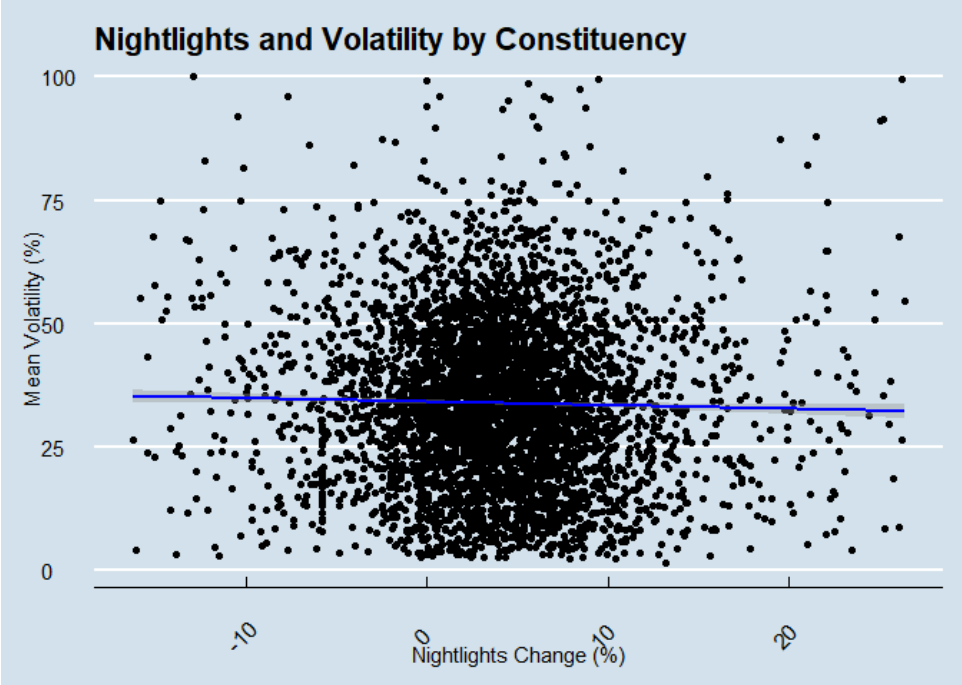
We could also take a look at the correlation between nightlight change and volatility across all elections by state. A strong positive correlation here would be a very bad sign for our hypothesis. The small negative correlation is much more favourable for our analysis to go forward, and the clustering of the states near the 3-10% growth mark is also as expected.

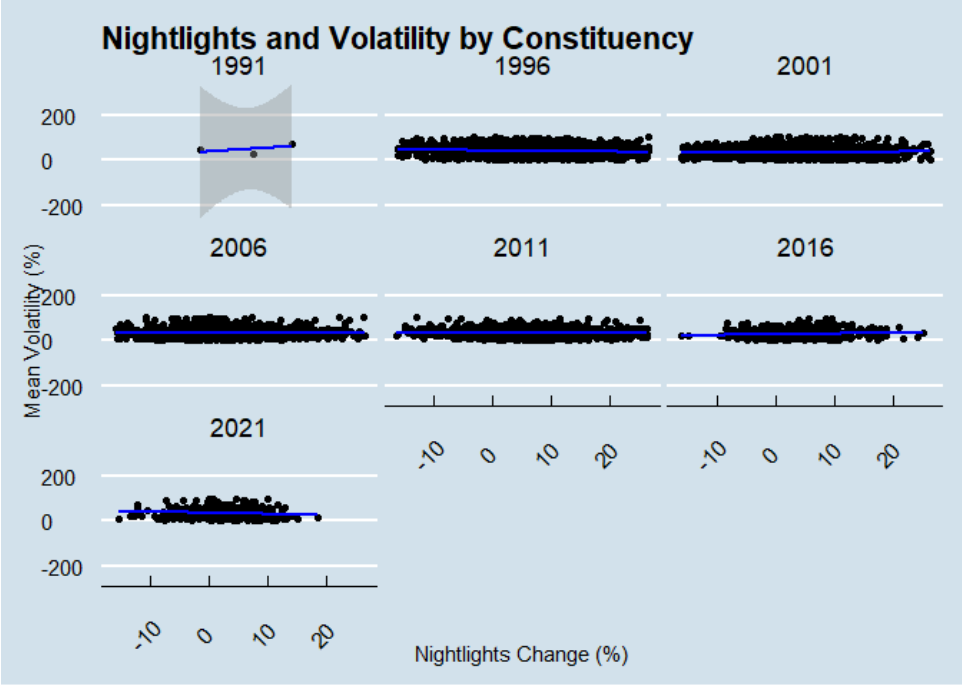


Looking at the same graph for each election cycle individually, a weak trend can be interpreted in support of Gupta & Panagariya's assertion that economic voting has emerged as a significant factor in recent decades, though this could very well be confirmation bias on our part.



However, if we now look at the same data aggregated by constituency instead of state, the trend vanishes, possibly indicating that our hypothesis, that voters value growth in the local economy over sociotropic growth, is incorrect. Breaking down the correlation across electoral cycles similarly reveals that the trend has shifted towards the positive for all electoral cycles.





This could be an indicator that economic voting holds at the state level but not necessarily at the individual constituency level. However, only after controlling for other determinants and fixed effects can we make any claim.

Controls

We should note here that we'll be using three electoral determinants of electoral volatility - Change in Effective Number of Parties, Change in Turnout Percentage, and Number of Electors - to control for political confounders. The use of these metrics as controls is well-established *(Heath & Ziegfeld)* and is in line with existing literature *(Dash & Ferris)* which has used electoral volatility in the context of economic voting.

Empirical Strategy

To test our claim, we'll use a regression with fixed effects using the following specification:

$$y_{i,t} = \alpha_0 + \alpha_1(X1)_{i,t} + \alpha_1(X2)_{i,t} + \gamma_t + \gamma_i + \varepsilon_{i,t}$$

Where *y* denotes our four measures of electoral outcomes, X1 denotes our three measures of economic growth, X2 denotes other (electoral) correlates of electoral outcomes, γ_t denotes the election year and γ_i denotes state-level fixed effects. We'll run the model with and without electoral controls to investigate the strength of the correlation under both scenarios.

Discussion

We'll first test our model on all of India for all of the elections in our dataset. Before implementing the full model, we'll have a look at the results for a basic model with only

election-year and state-level fixed effects without controls. We'll discuss the eight key results here, while the remaining results can be found in the RMarkdown file[7].

```
##
## Election Year and State Fixed-Effects with 1 Year Nightlights Change
## ================================================================================================
##                                                Dependent variable:
##                                -----------------------------------------------------------
##                                volatility  incumb_share state_incumb_share nat_incumb_share
##                                    (1)         (2)             (3)               (4)
## ------------------------------------------------------------------------------------------------
## percent_change_p3                -0.068       0.052           0.085             -0.032
##                                  (0.034)     (0.034)         (0.033)           (0.032)
##                                 p = 0.046**  p = 0.127      p = 0.012**        p = 0.321
##
## ------------------------------------------------------------------------------------------------
## Observations                      10,292       10,292          10,292            10,292
## R2                                 0.150       0.077           0.126             0.268
## Adjusted R2                       -0.528       -0.658          -0.570            -0.316
## F Statistic (df = 50; 5727)     20.164***    9.613***        16.559***         41.862***
## ================================================================================================
## Note:                                                          *p<0.1; **p<0.05; ***p<0.01
```

```
##
## Election Year and State Fixed-Effects with Tenure Nightlights Change
## ================================================================================================
##                                                Dependent variable:
##                                -----------------------------------------------------------
##                                volatility incumb_share state_incumb_share nat_incumb_share
##                                    (1)         (2)             (3)               (4)
## ------------------------------------------------------------------------------------------------
## percent_change_p3_t              -0.004      -0.00003         0.005             -0.010
##                                  (0.006)     (0.006)         (0.006)           (0.006)
##                                 p = 0.466   p = 0.997       p = 0.351         p = 0.078*
##
## ------------------------------------------------------------------------------------------------
## Observations                      10,292       10,292          10,292            10,292
## R2                                0.149       0.077           0.125             0.268
## Adjusted R2                       -0.529       -0.658          -0.571            -0.315
## F Statistic (df = 50; 5727)     20.082***    9.563***        16.432***         41.920***
## ================================================================================================
## Note:                                                          *p<0.1; **p<0.05; ***p<0.01
```

[7] Note that coefficients for state-level fixed effects and election year are omitted from all outputs simply because they'd consume 60+ rows.

Looking at the coefficients for our model without electoral controls, the results are in line with our expectation. The sign of the coefficient between our percentage change in nightlights and electoral volatility is negative throughout, indicating that volatility tends to decrease with economic growth, as suggested by literature (Kramer). The relationship is significant at the 5% level for change over the last year, at the 10% level for change over 3 years, and not significant for change over the tenure. Similarly, the coefficient is highest for the last year, and reduces successively for 3 years and tenure, which lends credence to the hypothesis that voters care only about immediate-term economic conditions (Wlezien).

However, the coefficients are extremely small - a coefficient of -0.068 for the first model indicates that a 1 percent increase in nightlights translates to less than one-tenth of a percent decrease in volatility. More legibly, decreasing volatility by 1 percentage point would require additional nightlight growth of almost 15 percentage points.

Similarly, looking at incumbent vote share at different levels, our results are largely in line with expectations. The sign of the coefficient is consistently positive for all three durations of nightlight change, indicating that the state ruling party is rewarded for success with the local economy (significant at the 5% level for change over the last year). Interestingly, for all three durations, the sign of the coefficient is negative for the national incumbent's vote share (significant at the 1% and 10% levels respectively for 3 years and tenure). This lends support to Ray & Varughese's argument that voters are less likely to vote for the national incumbent when the sub-national incumbent delivers on the economic front.

However, once again the coefficients are extremely small - a 1 percent increase in nightlights translates to a 0.085 percentage point increase in the state ruling party's vote share. What is more concerning with this analysis is that the adjusted R squared is negative, indicating that the

model is significantly overparameterized, despite the acceptably large number of observations. While the R squared value is also quite low (0.15), this is in line with literature - Dash & Ferris reported an R squared value consistently lower than 0.3, with significantly more correlates.

We can now test our claim with our entire model, incorporating temporal control as well as controls for electoral correlates.

```
##
## Full Model with 1 Year Nightlights Change
## ================================================================================
##                                          Dependent variable:
##                            ---------------------------------------------------
##                            volatility  incumb_share state_incumb_share nat_incumb_share
##                                (1)         (2)             (3)               (4)
## --------------------------------------------------------------------------------
## percent_change_p3            -0.071       0.041           0.085            -0.051
##                              (0.035)     (0.035)         (0.034)          (0.033)
##                             p = 0.046**  p = 0.249      p = 0.015**       p = 0.122
##
## delta_ENOP                    0.061       -1.690          -1.440           -1.027
##                              (0.220)     (0.218)         (0.214)          (0.206)
##                             p = 0.783  p = 0.000***    p = 0.000***     p = 0.00000***
##
## delta_Turnout                -0.023       0.055           -0.023           0.018
##                              (0.019)     (0.019)         (0.018)          (0.017)
##                             p = 0.218  p = 0.004***     p = 0.198        p = 0.298
##
## Electors                     -0.00000     0.00001         0.00000          0.00003
##                              (0.00001)   (0.00001)       (0.00001)        (0.00001)
##                             p = 0.543   p = 0.310       p = 0.572       p = 0.00005***
##
## --------------------------------------------------------------------------------
## Observations                   9,398       9,398           9,398            9,398
## R2                             0.144       0.095           0.144            0.285
## Adjusted R2                   -0.521       -0.608          -0.521           -0.270
## F Statistic (df = 52; 5288)  17.083***   10.698***       17.088***        40.555***
## ================================================================================
## Note:                                                *p<0.1; **p<0.05; ***p<0.01
```

```
##
## Full Model with Tenure Nightlights Change
## ================================================================================
##                                          Dependent variable:
##                            ---------------------------------------------------
##                            volatility incumb_share state_incumb_share nat_incumb_share
##                               (1)         (2)             (3)               (4)
## --------------------------------------------------------------------------------
## percent_change_p3_t           0.001       -0.004          0.010             -0.015
##                              (0.006)     (0.006)         (0.006)           (0.006)
##                             p = 0.927   p = 0.574       p = 0.090*       p = 0.012**
##
## delta_ENOP                    0.077       -1.698          -1.464            -1.009
##                              (0.220)     (0.218)         (0.214)           (0.205)
##                             p = 0.726  p = 0.000***    p = 0.000***     p = 0.00000***
##
## delta_Turnout                 -0.024      0.056           -0.024            0.020
##                              (0.019)     (0.019)         (0.018)           (0.017)
##                             p = 0.193  p = 0.003***     p = 0.185         p = 0.243
##
## Electors                     -0.00000    0.00001         0.00000           0.00003
##                             (0.00001)   (0.00001)       (0.00001)         (0.00001)
##                             p = 0.509   p = 0.292       p = 0.547       p = 0.00005***
##
## --------------------------------------------------------------------------------
## Observations                  9,398       9,398           9,398             9,398
## R2                            0.143       0.095           0.143             0.286
## Adjusted R2                   -0.523      -0.608          -0.522            -0.269
## F Statistic (df = 52; 5288) 16.994***   10.676***       17.018***         40.661***
## ================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

Happily, the results remain largely the same - the sign remains negative throughout for volatility and national incumbent voteshare, and positive throughout for the state incumbent, with the sole exception of volatility against nightlights change over tenure, which flips to positive 0.001 (not significant). The signs of coefficients for our controls are also in line with the signs reported by Dash & Ferris, though only change in ENOP is consistently significant (at 1% level) for us - an increase in effective number of parties by one translates to about a 1% decrease in vote share for all incumbent parties.

Based on the number of observations per state, it makes sense to exclude states for which only one or two elections or less than 100 constituencies are available. To replicate Dash & Ferris, we'll analyse only the 15 major states which make up more than 90% of India's population[8] from 1991 to 2011 (the end of their analysis). Table 7 describes this restricted dataset.

```
##
## Election Year and State Fixed-Effects with 1 Year Nightlights Change - 15 States
## ================================================================================
##                                          Dependent variable:
##                            ---------------------------------------------------
##                            volatility incumb_share state_incumb_share nat_incumb_share
##                               (1)         (2)             (3)               (4)
## --------------------------------------------------------------------------------
## percent_change_p3             -0.001      0.020           0.014             -0.023
##                              (0.047)     (0.049)         (0.048)           (0.042)
##                             p = 0.985   p = 0.683       p = 0.768         p = 0.581
##
## --------------------------------------------------------------------------------
## Observations                  6,139       6,139           6,139             6,139
## R2                            0.235       0.099           0.111             0.350
## Adjusted R2                   -0.556      -0.833          -0.808            -0.323
## F Statistic (df = 30; 3017) 30.929***   11.042***       12.572***         54.139***
## ================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

[8] Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal

```
##
## Full Model with 1 Year Nightlights Change - 15 States
## ================================================================================================
##                                                 Dependent variable:
##                             ---------------------------------------------------------------
##                             volatility  incumb_share  state_incumb_share nat_incumb_share
##                                (1)          (2)              (3)               (4)
## ------------------------------------------------------------------------------------------------
## percent_change_p3             -0.014       0.020            0.030             -0.040
##                              (0.048)      (0.049)          (0.048)           (0.042)
##                             p = 0.764    p = 0.688        p = 0.533         p = 0.342
##
## delta_ENOP                    -0.295       -1.371           -1.258            -1.320
##                              (0.285)      (0.295)          (0.286)           (0.252)
##                             p = 0.301  p = 0.00001***   p = 0.00002***    p = 0.00000***
##
## delta_Turnout                 0.015        -0.050           -0.097            0.036
##                              (0.023)      (0.024)          (0.023)           (0.021)
##                             p = 0.522   p = 0.036**     p = 0.00004***      p = 0.081*
##
## Electors                      0.00000      0.00001          0.00001           0.00003
##                              (0.00001)    (0.00001)        (0.00001)         (0.00001)
##                             p = 0.885    p = 0.231        p = 0.212       p = 0.0003***
##
## ------------------------------------------------------------------------------------------------
## Observations                   5,926        5,926            5,926             5,926
## R2                             0.230        0.119            0.135             0.372
## Adjusted R2                    -0.619       -0.853           -0.819            -0.321
## F Statistic (df = 33; 2818) 25.496***    11.502***        13.301***         50.543***
## ================================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

Note that this seems to change very little, except that we now fail to achieve significance across the board. The coefficients for volatility retain their negative signs for all duration of retrospective change, and the coefficients for state incumbent vote share retain their negative sign. One change is that the coefficient for national incumbent vote share is now positive for the 3 year and tenure duration under both models, but doesn't come close to significance in either.

Our controls have largely the same coefficients, while the R squared value is somewhat higher, and the adjusted R squared value is still negative and greater in value.

Finally, let's look at a smaller period of time where we expect the effect to be strongest: the economy was an important talking point during the 2006 electoral cycle, and our data exploration also revealed that cycle to have the strongest negative correlation between nightlight change and volatility, which makes it a natural contender. Table 8 describes this dataset.

```
##
## Election Year and State Fixed-Effects with 1 Year Nightlights Change - 2 Cycles
## ================================================================================
##                                          Dependent variable:
##                             ---------------------------------------------------
##                             volatility incumb_share state_incumb_share nat_incumb_share
##                                (1)         (2)             (3)               (4)
## --------------------------------------------------------------------------------
## percent_change_p3             -0.001      0.020           0.014             -0.023
##                              (0.047)     (0.049)         (0.048)           (0.042)
##                             p = 0.985   p = 0.683       p = 0.768         p = 0.581
##
## --------------------------------------------------------------------------------
## Observations                  6,139       6,139           6,139             6,139
## R2                            0.235       0.099           0.111             0.350
## Adjusted R2                   -0.556      -0.833          -0.808            -0.323
## F Statistic (df = 30; 3017) 30.929***   11.042***       12.572***         54.139***
## ================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

```
##
## Full Model with 1 Year Nightlights Change - 2 Cycles
## ================================================================================================
##                                                 Dependent variable:
##                                ---------------------------------------------------------------
##                                volatility  incumb_share  state_incumb_share nat_incumb_share
##                                   (1)          (2)              (3)               (4)
## ------------------------------------------------------------------------------------------------
## percent_change_p3                -0.014       0.020            0.030             -0.040
##                                 (0.048)      (0.049)          (0.048)           (0.042)
##                                p = 0.764    p = 0.688        p = 0.533         p = 0.342
##
## delta_ENOP                       -0.295       -1.371           -1.258            -1.320
##                                 (0.285)      (0.295)          (0.286)           (0.252)
##                                p = 0.301  p = 0.00001***   p = 0.00002***    p = 0.00000***
##
## delta_Turnout                     0.015        -0.050           -0.097            0.036
##                                 (0.023)      (0.024)          (0.023)           (0.021)
##                                p = 0.522   p = 0.036**     p = 0.00004***      p = 0.081*
##
## Electors                         0.00000      0.00001          0.00001           0.00003
##                                 (0.00001)    (0.00001)        (0.00001)         (0.00001)
##                                p = 0.885    p = 0.231        p = 0.212       p = 0.0003***
##
## ------------------------------------------------------------------------------------------------
## Observations                      5,926        5,926            5,926             5,926
## R2                                0.230        0.119            0.135             0.372
## Adjusted R2                      -0.619       -0.853           -0.819            -0.321
## F Statistic (df = 33; 2818) 25.496***    11.502***        13.301***         50.543***
## ================================================================================================
## Note:                                                          *p<0.1; **p<0.05; ***p<0.01
```

The results here are, surprisingly, largely the same as the results under discussion previously - once again we fail to achieve significance, retain the expected signs, and the R squared values indicate that our model fails to explain much of the variation in voting preferences. While we would have expected stronger results for these cherry-picked election cycles, it's possible that a combination of the smaller sample size as well as uneconomic political factors specific to the time muddy the relationship.

Limitations

On the empirical front, our analysis is constrained by several factors - the absence of significant granular data at the assembly constituency prevents us from utilising the measures of economic conditions typically used by literature on sociotropic economic voting - Growth in Per Capita NDP, Growth in Per Capita Income, etc. While NTL is conventionally an adequate proxy for economic growth, and the high-visibility economic development it captures is suitable for our hypothesis, it is certainly not a perfect proxy.

Additionally, delimitation and the frequent creation of new states during our period of study led to significant loss of data, reducing us to only about 10,000 constituency elections - less than half of the total elections conducted during our period of study. Similarly, severely low luminosity in large parts of India led to data quality issues with our NTL independent variable dataset, which led to many constituencies being dropped.

Finally, we are unable to examine many of the nuances that should be used to examine results on economic voting - without rich survey data to accompany our analysis, for example, it is impossible to make a statement on how voters actually perceive economic growth in their constituency over these time periods, and whether this is influenced by partisan bias. Similarly, we can't make any contribution to the literature on the role of sociotropic versus pocketbook voting in India.

Conclusion

Nevertheless, our paper serves as a valuable addition to the growing consensus on the existence of retrospective economic voting in the multi-level context in India. To our knowledge, we are the first to conduct analysis on the impact of the local economy on voting behaviour in India,

and the first to conduct a large-scale analysis of the differing effect of economic voting on sub-national incumbents against national incumbents.

We find that there is a small but statistically significant effect of local economic conditions on voting patterns at the assembly level in India. We find that better retrospective economic conditions correspond to slightly lower volatility in the immediately subsequent election, and to a slightly higher proportion of votes going to the party incumbent at the state level. We find that the Indian voter is indeed myopic, since economic conditions in the year immediately preceding the election have a significantly stronger influence than economic conditions over the previous tenure. Additionally, we find some evidence for the hypothesis advanced by Ray & Varughese that voters reward the state-ruling party for better local economic conditions, to the detriment of the national ruling party.

Works Cited

Ananay Agarwal, Neelesh Agrawal, Saloni Bhogale, Sudheendra Hangal, Francesca Refsum Jensenius, Mohit Kumar, Chinmay Narayan, Basim U Nissa, Priyamvada Trivedi, and Gilles Verniers. 2021. “TCPD Indian Elections Data v2.0", Trivedi Centre for Political Data, Ashoka University.

Arcelus, Francisco &. Meltzer Allan H. “The Effect of Aggregate Economic Variables on Congressional Elections.” ideas.repec.org, 1975, ideas.repec.org/a/cup/apsrev/v69y1975i04p1232-1239_24.html.

Ashworth, Scott. “Electoral Accountability: Recent Theoretical and Empirical Work.” Annual Review of Political Science, vol. 15, no. 1, June 2012, pp. 183–201. https://doi.org/10.1146/annurev-polisci-031710-103823.

Bhandari, Laveesh, and Koel Roychowdhury. “Night Lights and Economic Activity in India: A Study Using DMSP-OLS Night Time Images.” Proceedings of the Asia-Pacific Advanced Network, vol. 32, no. 0, Dec. 2011, p. 218. https://doi.org/10.7125/apan.32.24.

Brender, Adi, and Allan Drazen. “How Do Budget Deficits and Economic Growth Affect Reelection Prospects? Evidence From a Large Panel of Countries.” ˜the œAmerican Economic Review, vol. 98, no. 5, Nov. 2008, pp. 2203–20. https://doi.org/10.1257/aer.98.5.2203.

Central Statistics Organisation, Ministry of Statistics and Programme Implementation, Government of India. (2013). Economic Census of India. Retrieved from http://microdata.gov.in/nada43/index.php/catalog/ECO.

Dash, Bharatee Bhusana, and J. Stephen Ferris. “Economic Performance and Electoral Volatility: Testing the Economic Voting Hypothesis on Indian States, 1957–2013.” Party Politics, vol. 27, no. 6, May 2020, pp. 1105–19. https://doi.org/10.1177/1354068820923706.

De Benedictis-Kessner, Justin, and Christopher Warshaw. “Accountability for the Local Economy at All Levels of Government in United States Elections.” American Political Science Review, vol. 114, no. 3, Mar. 2020, pp. 660–76. https://doi.org/10.1017/s0003055420000027.

Duch, Raymond M., and Randy Stevenson. “Context and the Economic Vote: A Multilevel Analysis.” Political Analysis, vol. 13, no. 4, 2005, pp. 387–409. JSTOR, http://www.jstor.org/stable/25791824. Accessed 7 May 2024.

Fair, Ray C. “The Effect of Economic Events on Votes for President.” ˜the œReview of Economics and Statistics, vol. 60, no. 2, Apr. 1978, p. 159. https://doi.org/10.2307/1924969.

Fiorina, Morris P. “Economic Retrospective Voting in American National Elections: A Micro-Analysis.” American Journal of Political Science, vol. 22, no. 2, 1978, pp. 426–43. JSTOR, https://doi.org/10.2307/2110623. Accessed 7 May 2024.

Gupta, Poonam, and Arvind Panagariya. “Growth and Election Outcomes in a Developing Country.” Economics and Politics, vol. 26, no. 2, pp. 332–54. https://doi.org/10.1111/ecpo.12038.

Healy, Andrew, et al. “Digging Into the Pocketbook: Evidence on Economic Voting From Income Registry Data Matched to a Voter Survey.” ˜the œAmerican Political Science Review, vol. 111, no. 4, Sept. 2017, pp. 771–85. https://doi.org/10.1017/s0003055417000314.

Healy, Andrew, and Gabriel S. Lenz. “Substituting the End for the Whole: Why Voters Respond Primarily to the Election-Year Economy.” American Journal of Political Science, vol. 58, no. 1, 2014, pp. 31–47. JSTOR, http://www.jstor.org/stable/24363467. Accessed 7 May 2024.

Healy, Andrew, and Gabriel Lenz. “Presidential Voting and the Local Economy: Evidence From Two Population-Based Data Sets.” ˜the œJournal of Politics/˜the œJournal of Politics, vol. 79, no. 4, Oct. 2017, pp. 1419–32. https://doi.org/10.1086/692785.

Heath, Oliver, and Adam Ziegfeld. “Electoral Volatility and Turnout: Party Entry and Exit in Indian Elections.” The Journal of Politics, vol. 80, no. 2, Apr. 2018, pp. 570–84. https://doi.org/10.1086/694782.

Jensenius, Francesca R., and Pavithra Suryanarayan. “Party System Institutionalization and Economic Voting: Evidence From India.” ˜the œJournal of Politics/˜the œJournal of Politics, vol. 84, no. 2, Apr. 2022, pp. 814–30. https://doi.org/10.1086/716297.

Kiewiet, D. Roderick, and Michael S. Lewis‐Beck. “NO MAN IS AN ISLAND: SELF-INTEREST, THE PUBLIC INTEREST, AND SOCIOTROPIC VOTING.” Critical Review (New York, N.Y. Online)/Critical Review, vol. 23, no. 3, Sept. 2011, pp. 303–19. https://doi.org/10.1080/08913811.2011.635868.

Kinder, Donald R., and D. Roderick Kiewiet. Economic Grievances and Political Behavior: The Role of Personal Discontents and Collective Judgments in Congressional Voting. 1 Aug. 1979, papers.ssrn.com/sol3/papers.cfm?abstract_id=1156487.

Kramer, Gerald H. “Short-Term Fluctuations in U.S. Voting Behavior, 1896-1964.” *The American Political Science Review*, vol. 65, no. 1, 1971, pp. 131–43. *JSTOR*, https://doi.org/10.2307/1955049. Accessed 7 May 2024.

KUMAR, RADHIKA. “Upstaging Anti-Incumbency.” *Economic and Political Weekly*, vol. 48, no. 24, 2013, pp. 20–23. *JSTOR*, http://www.jstor.org/stable/23527385. Accessed 7 May 2024.

KUMAR, SANJAY, et al. “The Weakening of Electoral Anti-Incumbency.” *Economic and Political Weekly*, vol. 48, no. 13, 2013, pp. 128–31. *JSTOR*, http://www.jstor.org/stable/23391474. Accessed 7 May 2024.

Lewis-Beck, Michael S. “Economics and the American Voter: Past, Present, Future.” Political Behavior, vol. 10, no. 1, Jan. 1988, pp. 5–21. https://doi.org/10.1007/bf00989377.

Lewis-Beck, Michael S., and Mary Stegmaier. “Economic Determinants of Electoral Outcomes.” Annual Review of Political Science, vol. 3, no. 1, June 2000, pp. 183–219. https://doi.org/10.1146/annurev.polisci.3.1.183.

Li, Xuecao, et al. “A Harmonized Global Nighttime Light Dataset 1992–2018.” Scientific Data, vol. 7, no. 1, June 2020, https://doi.org/10.1038/s41597-020-0510-y.

Nadeau, Richard, and Michael S. Lewis-Beck. “National Economic Voting in U.S. Presidential Elections.” The Journal of Politics, vol. 63, no. 1, Feb. 2001, pp. 159–81. https://doi.org/10.1111/0022-3816.00063.

Nadeau, Richard, et al. “Economics and Elections Revisited.” Comparative Political Studies, vol. 46, no. 5, Oct. 2012, pp. 551–73. https://doi.org/10.1177/0010414012463877.

Nooruddin, Irfan, and Pradeep Chhibber. “Unstable Politics.” Comparative Political Studies, vol. 41, no. 8, Feb. 2008, pp. 1069–91. https://doi.org/10.1177/0010414007309202.

Pedersen, Mogens N. “THE DYNAMICS OF EUROPEAN PARTY SYSTEMS: CHANGING PATTERNS OF ELECTORAL VOLATILITY.” European Journal of Political Research, vol. 7, no. 1, Mar. 1979, pp. 1–26. https://doi.org/10.1111/j.1475-6765.1979.tb01267.x.

Plescia, Carolina, and Sylvia Kritzinger. “Retrospective Voting and Party Support at Elections: Credit and Blame for Government and Opposition.” Journal of Elections, Public Opinion and Parties, vol. 27, no. 2, Oct. 2016, pp. 156–71. https://doi.org/10.1080/17457289.2016.1243543.

Powell, G. Bingham, and Guy D. Whitten. “A Cross-National Analysis of Economic Voting: Taking Account of the Political Context.” American Journal of Political Science, vol. 37, no. 2, 1993, pp. 391–414. JSTOR, https://doi.org/10.2307/2111378. Accessed 7 May 2024.

Ray, Subhasish, and Anil M. Varughese. “Economic Voting in Multi-level Contexts: Evidence From Kerala and West Bengal in India.” Electoral Studies, vol. 73, Oct. 2021, p. 102378. https://doi.org/10.1016/j.electstud.2021.102378.

Sarkar, Sandip, and Bharatee Bhusana Dash. “On The Measurement of Electoral Volatility.” Mathematical Social Sciences, vol. 126, Nov. 2023, pp. 119–28. https://doi.org/10.1016/j.mathsocsci.2023.10.005.

Sircar, Neelanjan. “The Politics of Vishwas: Political Mobilization in the 2019 National Election.” Contemporary South Asia, vol. 28, no. 2, Apr. 2020, pp. 178–94. https://doi.org/10.1080/09584935.2020.1765988.

Sukhtankar, Sandip. India Assembly Constituency Maps. uva.theopenscholar.com/sandip-sukhtankar/data.

SURI, K. C. “The Economy and Voting in the 15th Lok Sabha Elections.” Economic and Political Weekly, vol. 44, no. 39, 2009, pp. 64–70. JSTOR, http://www.jstor.org/stable/25663597. Accessed 7 May 2024.

Susewind, Raphael. “GIS shapefiles for India’s parliamentary and assembly constituencies including polling booth localities.” -, Jan. 2014, https://doi.org/10.4119/unibi/2674065.

Vaishnav, Milan, and Reedy Swanson. “Does Good Economics Make for Good Politics? Evidence From Indian States.” India Review, vol. 14, no. 3, July 2015, pp. 279–311. https://doi.org/10.1080/14736489.2015.1066218.

Wlezien, Christopher. “The Myopic Voter? The Economy and US Presidential Elections.” Electoral Studies, vol. 39, Sept. 2015, pp. 195–204. https://doi.org/10.1016/j.electstud.2015.03.010.

Appendix 1: Descriptive Statistics

Table 3: TCPD Assembly Elections by Party, 1980-onwards

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
Constituency_No	243762	116	93	1	40	175	425
Year	243762	2003	13	1980	1993	2014	2023
Assembly_No	243762	11	3.9	1	8	14	18
Votes	243733	15965	23039	-1	891	24503	584098
Valid_Votes	243762	178924	292735	-1	81122	171801	19579792
Electors	243550	180583	90289	0	125966	228035	1593907
Turnout	243549	65	14	-0.01	56	75	736
Constituency_Type	243762						
...	2	0%					
... BL	191	0%					
... GEN	185243	76%					
... SC	35425	15%					
... ST	22901	9%					
Vote_Share_Percentage	243617	16	19	0	0.81	31	100
ENOP	243617	3.1	1.1	1	2.3	3.6	14
is_winner	243762	0.16	0.36	0	0	0	1

Table 4: Electoral Outcomes by Constituency Election

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
Constituency_No	38522	111	91	1	37	169	425
Year	38522	2000	13	1980	1990	2012	2023
Assembly_No	38522	10	3.7	1	8	13	18
Electors	38522	157402	86236	0	106094	203218	1593907
Turnout	38522	66	15	-0.01	57	76	736
ENOP	38522	2.9	1	0	2.2	3.3	14
volatility	38522	30	27	0	2.3	50	100
incumb_share	38522	25	23	0	0	45	100
state_incumb_share	38522	22	22	0	0	41	100
nat_incumb_share	38522	16	20	0	0	35	100

Table 5: Nightlights by Constituency

Nightlights Data

state	ac_name	ng_2008	ng_2021	geometry
Telangana	Sirpur	1.950624	7.792569	MULTIPOLYGON (((79.55699 19...
Telangana	Chennur	4.220965	11.604282	MULTIPOLYGON (((79.90563 19...
Telangana	Bellampalli	4.106324	9.460627	MULTIPOLYGON (((79.908 19.1...
Telangana	Mancherial	10.471242	16.960398	MULTIPOLYGON (((79.10574 19...
Telangana	Asifabad	3.475947	7.919819	MULTIPOLYGON (((78.73274 19...
Telangana	Khanapur	5.721958	8.795670	MULTIPOLYGON (((78.59774 19...
Telangana	Adilabad	8.101927	11.853553	MULTIPOLYGON (((78.59774 19...
Telangana	Boath	5.354019	9.051396	MULTIPOLYGON (((78.51174 19...
Telangana	Nirmal	8.248992	12.583598	MULTIPOLYGON (((78.16924 19...
Telangana	Mudhole	5.712011	10.087209	MULTIPOLYGON (((78.16924 19...

x
4074

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
ac_no	122780	103	85	0	35	157	403
delta_year	122780	2006	8.7	1992	1999	2014	2021
nightlights	122764	13	20	0	2.3	13	221

Table 6: Lagged Panel Dataset

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
ac_no	10292	100	81	1	34	150	403
delta_year	10292	2006	7.6	1994	2000	2013	2020
nightlights	10292	13	16	0	3.2	14	63
Constituency_No	10292	103	85	1	35	155	424
election_year	10292	2007	7.6	1995	2001	2014	2021
Assembly_No	10292	11	3	2	9	13	17
Electors	10292	175874	84875	0	135550	218240	1593907
Turnout	10292	68	13	0	60	77	108
ENOP	10292	2.9	0.89	0	2.2	3.2	11
volatility	10292	34	20	0.62	17	48	100
incumb_share	10292	37	18	0	28	49	100
state_incumb_share	10292	32	20	0	17	47	100
nat_incumb_share	10292	22	21	0	0	41	100
mean_nightlights	10292	11	4.8	6.5	8.1	15	60
percent_change	10292	6	241	-100	-8.5	11	18865
percent_change_3	10292	17	57	-100	-1.2	30	4856
percent_change_t	10292	32	564	-100	-1.4	45	55518
past_three	10292	14	20	0.0023	3.1	14	116
percent_change_p3	10292	3.9	7.4	-16	-0.37	8.3	27
percent_change_p3_3	10292	20	45	-97	-0.34	31	1538
percent_change_p3_t	10292	32	54	-100	0.012	55	206
delta_ENOP	9398	-0.064	0.96	-8	-0.48	0.36	8.1
delta_Turnout	9398	0.44	12	-661	-3.7	5.3	98
cycle	10292	2005	7.9	1991	2001	2011	2021

Table 7: Panel Dataset of 15 Major States

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
ac_no	6139	116	84	1	49	171	403
delta_year	6139	2001	3.6	1994	1998	2004	2010
nightlights	6139	9.6	13	0	2.6	10	63
Constituency_No	6139	123	89	1	51	179	424
election_year	6139	2002	3.6	1995	1999	2005	2011
Assembly_No	6139	11	2.1	5	10	13	15
Electors	6139	179901	70220	64594	141219	199826	1593907
Turnout	6139	65	12	6.8	57	73	95
ENOP	6139	2.9	0.91	1	2.2	3.2	11
volatility	6139	35	21	0.62	18	50	100
incumb_share	6139	36	19	0	27	48	100
state_incumb_share	6139	30	20	0	11	46	100
nat_incumb_share	6139	19	21	0	0	39	90
mean_nightlights	6139	8.3	0.83	6.5	7.9	8.4	13
percent_change	6139	6.6	161	-100	-7.9	12	11245
percent_change_3	6139	14	31	-100	-2.3	28	896
percent_change_t	6139	32	52	-100	4.1	46	846
past_three	6139	9.4	13	0.0031	2.6	9.6	63
percent_change_p3	6139	3.8	7.6	-16	-0.75	8.4	27
percent_change_p3_3	6139	17	27	-85	2.1	26	407
percent_change_p3_t	6139	28	44	-99	7	45	206
delta_ENOP	5926	-0.039	0.98	-6.6	-0.45	0.39	8.1
delta_Turnout	5926	-0.48	13	-661	-5	5.2	73
cycle	6139	2000	4	1991	1996	2001	2011

Table 8: Panel Dataset of 2006 and 2011 electoral cycles

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
ac_no	3157	96	84	1	31	142	403
delta_year	3157	2009	3.4	2005	2006	2012	2014
nightlights	3157	12	16	0	2.9	13	63
Constituency_No	3157	96	85	1	30	140	403
election_year	3157	2010	3.4	2006	2007	2013	2015
Assembly_No	3157	11	3.3	2	10	14	16
Electors	3157	179068	92898	5814	136454	228611	1593907
Turnout	3157	70	14	0	63	80	108
ENOP	3157	3	0.98	0	2.3	3.4	11
volatility	3157	33	20	0.62	17	46	100
incumb_share	3157	37	18	0	28	48	100
state_incumb_share	3157	32	20	0	16	46	100
nat_incumb_share	3157	19	19	0	0	37	100
mean_nightlights	3157	11	3.1	8.2	8.4	15	15
percent_change	3157	13	369	-100	-10	9.7	18865
percent_change_3	3157	14	92	-100	-4.4	24	4856
percent_change_t	3157	23	225	-100	-4.8	34	12311
past_three	3157	13	17	0.0031	2.8	13	63
percent_change_p3	3157	3	7.9	-16	-1.5	7.3	26
percent_change_p3_3	3157	12	39	-97	-2.4	21	1538
percent_change_p3_t	3157	21	48	-100	-4	39	206
delta_ENOP	2741	0.087	1	-8	-0.33	0.54	8.1
delta_Turnout	2741	3.5	10	-79	-1.6	9.1	79
cycle	3157	2008	2.5	2006	2006	2011	2011