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Politics in Action:

Economic Performance of Parliamentary Constituencies

UPA (2) versus NDA (Modi Years)



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Dr. Shamika Ravi & Dr. Mudit Kapoor

Politics in Action: Economic Performance of Parliamentary Constituencies UPA (2) versus NDA (Modi Years)

**Dr. Shamika Ravi¹
Dr. Mudit Kapoor**

1. Introduction

In a vibrant democracy, assessing the economic performance under different political regimes is crucial. Typically, the debate is limited to comparing growth rates or poverty reduction at the macro level. However, for a more meaningful analysis of politics in action, we need a direct measure of the impact of politics on people's economic well-being by assessing the economic performance at the parliamentary constituency level, district and sub-district level. Unfortunately, the lack of reliable economic data at the parliamentary constituency level hampers our ability to compare the economic performance at the disaggregated level across different political regimes over time and across political parties during a political regimen. In this essay, we wish to overcome this challenge by exploiting open and publicly available daytime high-resolution satellite imagery data on built-up surfaces. Research has shown that such data are a good proxy for detecting economic markets. Furthermore, they are good at detecting economic activities in smaller cities and towns, which would be missed if we relied exclusively on nightlight data², which has become popular for economic analysis in recent years.

The primary objective of this essay is to use the high-resolution daytime satellite imagery data on built-up surfaces at the level of the parliamentary constituency across three different epochs: 2010, 2015, and 2020. We use the built-up surface data in these epochs to compute the annualized growth rate from 2010 to 2015 and between 2015 and 2020. The distribution of growth rate across parliamentary constituencies from 2010 to 2015 captures the performance of economic activity during the UPA (2), while the growth rate from 2015 to 2020 captures the economic performance during the NDA under Prime Minister Modi.

The first set of results compares the annualized mean growth rates in the built-up surface during UPA (2) [2010 to 2015] with NDA (under Modi) [2015 to 2020]. We find significantly higher growth of built-up surface under the Modi years of 2015-2020 than growth under the UPA years of 2010-15.

The next set of results compares the distribution of the annualized growth rates across the parliamentary constituencies depending on the proportion of the total built-up area to the total area of the parliamentary constituency. We hypothesize that less

¹ Dr. Shamika Ravi is a Member, EAC-PM and Dr. Mudit Kapoor is from ISI, Delhi.

² Detecting urban markets with satellite imagery: An application to India (Baragwanath et al. *Journal of Urban Economics*, 2021)

developed parliamentary constituencies, in terms of the ratio of total built-up surface to total area, are likely to grow faster than more developed parliamentary constituencies. To a certain extent, this phenomenon reflects the impact of growth on regional inequality. Furthermore, we study this across UPA (2) [2010 to 2015] and NDA (under Modi) [2015 to 2020]. Our analysis reveals that the Modi years saw significantly higher growth in the less developed constituencies, implying a more significant reduction in inequality across parliamentary constituencies compared to the previous years under the UPA government.

In addition, this paper also compares the performance of economic activity across different political parties, the Bhartiya Janata Party (BJP), the Indian National Congress (INC), and Others during the UPA (2) [2010 to 2015] and the NDA (under Modi) [2015 to 2020].

In the final part of our analysis, we compare the annualized growth rates of built-up surface at the district and the sub-district level. For this part of the analysis, we present results for three periods: UPA (1) [2005 to 2010], UPA (2) [2010 to 2015], and NDA (under Modi) [2015 to 2020]. We demonstrate that the annualized growth rate was significantly higher during the NDA (under Modi) [2015 to 2020] than during UPA (1) [2005 to 2010] or UPA (2) [2010 to 2015]. Furthermore, we show that annualized growth rates of the built-up surface during the NDA (under Modi) [2015 to 2020] in the less developed districts or sub-districts in terms of the ratio of total built-up surface to the total area, was significantly higher than during UPA (2) [2010 to 2015] or UPA (1) [2005 to 2010]. These results at the district and sub-district level seem to confirm our earlier findings that regional inequalities in terms of built-up surface reduced faster during the NDA (under Modi) than UPA (1) or UPA (2).

Before we proceed with the results, it is imperative to describe the data briefly in the next section. A discussion section, limitations, and a conclusion follow the results section.

2. Data

The data set for our analysis comes from the open and publicly available Global Human Settlement Layer (GHSL) project, whose mission is to "produce global spatial information about the human presence on the planet over time."³ This project is supported by the Joint Research Centre (JRC) of the European Commission in partnership with the GEO Human Planet Initiative.⁴

We used the spatial raster data on the built-up surface based on the multiple-sensor, multiple-platform satellite imagery data from the Landsat data and the

³ Global Human Settlement Layer (GHSL) project Supported by the Joint Research Centre (JRC) and the DG for Regional and Urban Policy (DG REGIO) of the European Commission, together with the international partnership [GEO Human Planet Initiative](#)

⁴ <https://earthobservations.org/activity.php?id=119>

Sentinel-2 for three epochs: 2010, 2015, and 2020. In particular, we exploit high resolution data on the predicted surface of the built-up total (in square meters), which measures the gross surface bounded by the building wall perimeter, informally referred to as the "building footprint" for each epoch.⁵

The dataset on the 543 parliamentary constituencies was from the Election Commission of India. We limited our attention to the 2009 and 2014 Lok Sabha as these parliamentary constituencies were based on the Presidential Notification issued on 19th February 2008, the Delimitation Orders of the Delimitation Commission set up under the Delimitation Act, 2002.

The details on the delimitation exercise are available on the Election Commission of India website.⁶

The shape files of the boundary of the Parliamentary Constituency are from the Community Created Maps of India website.⁷ The shape file for the Ladakh parliamentary constituency was created by combining the Leh and Kargil districts.

The district and sub-district shape files are based on Census 2011 classifications. The shape files were available from the Development Data Labs⁸, and detailed information about the data and shape files are available at Asher et al.⁹

Ideally, we would have liked to compute the growth rates between 2009 and 2014 and 2014 and 2019; however, the daytime satellite imagery data is available between 2010, 2015, and 2020.

3. Results

Our first set of results for the 543 parliamentary constituencies compares the annualized growth rate of the predicted surface area during UPA (2) from 2010 to 2015 with NDA (under Modi) from 2015 to 2020.

⁵ Pesaresi, Martino; Politis, Panagiotis (2023): GHS-BUILT-S R2023A - GHS built-up surface grid, derived from Sentinel2 composite and Landsat, multitemporal (1975-2030). European Commission, Joint Research Centre (JRC) [Dataset] doi: 10.2905/9F06F36F-4B11-47EC-ABB0-4F8B7B1D72EA PID: <http://data.europa.eu/89h/9f06f36f-4b11-47ec-abb0-4f8b7b1d72ea>

Concept & Methodology:

European Commission, GHSL Data Package 2023, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-68-02341-9, doi:10.2760/098587, JRC133256

⁶ <https://www.eci.gov.in/delimitation>

⁷ <http://projects.datameet.org/maps/>

⁸ <https://www.devdatalab.org/>

⁹ Asher, Sam, Tobias Lunt, Ryu Matsuura, and Paul Novosad. "Development research at high geographic resolution: an analysis of night-lights, firms, and poverty in India using the shrug open data platform." The World Bank Economic Review 35, no. 4 (2021): 845-871.

Table 1:

Annualized growth rate	UPA (2) [2010 to 2015]	NDA [2015 to 2020]
Mean	2.8% [SD = 1.4%]	3.3% [SD = 2.9%]
Maximum	9.1%	19.2%
Minimum	0.05%	0.1%

Our analysis of the comparison of the mean growth rates during the UPA (2) and the NDA (under Modi) reveals that the difference in growth rates between the political regimes of 0.5% was significant at the conventional 95% significance (see **Figure 1a**).

Figure 1a

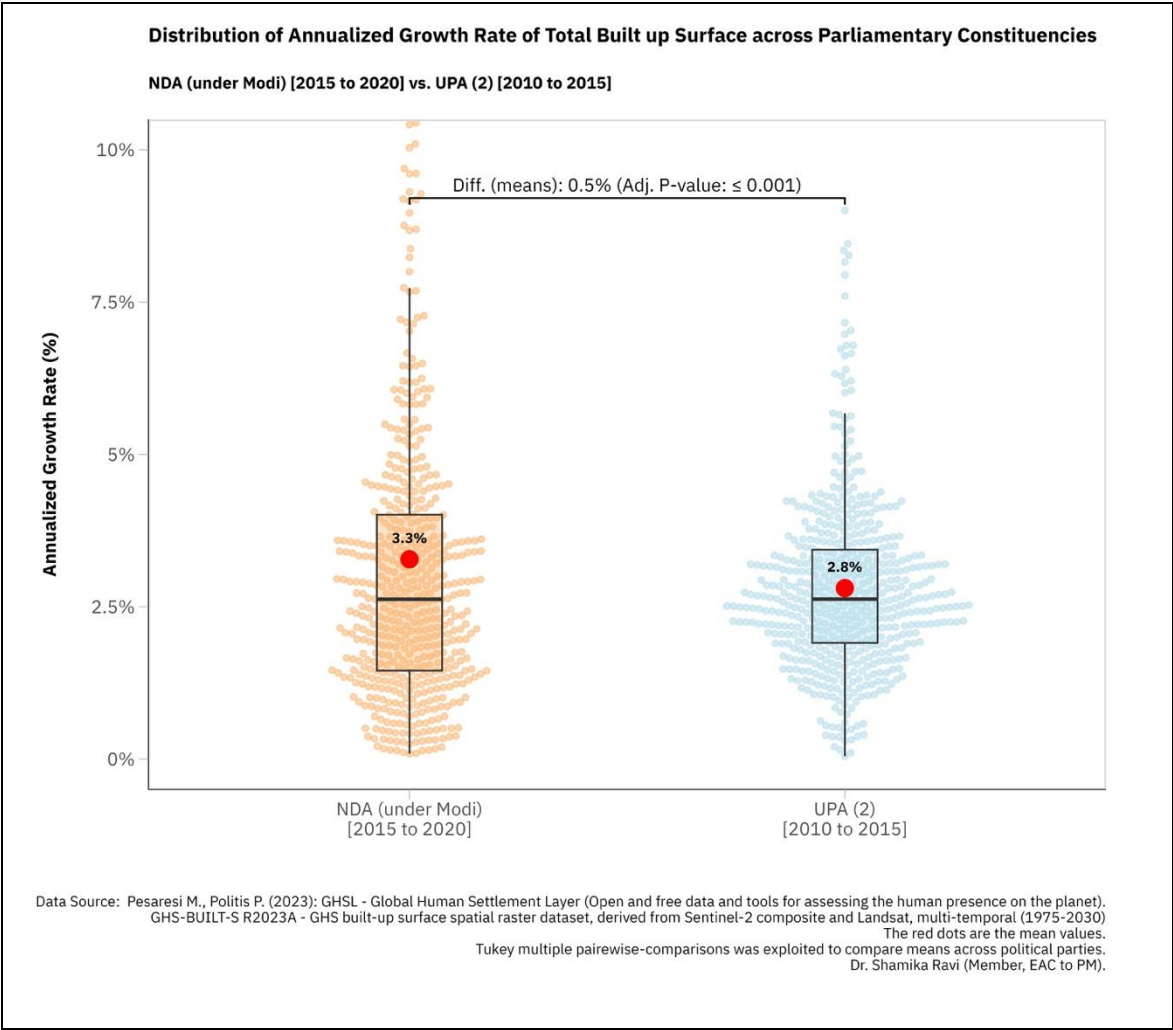


Figure 1b: Distribution of Annualized growth rates of built-up surfaces across Parliamentary Constituencies, UPA (2) [2010-2015] and NDA (under Modi) [2015-2020]

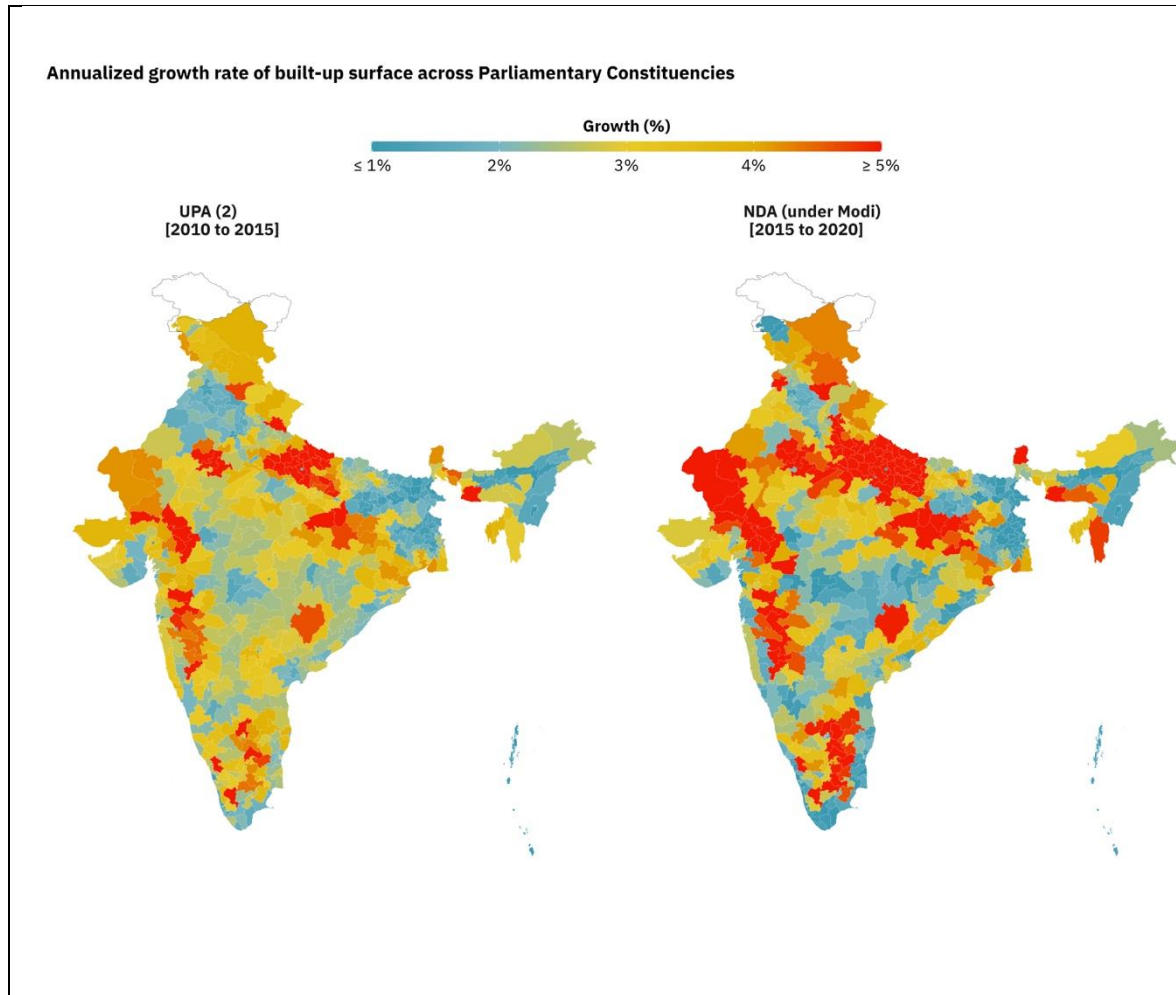
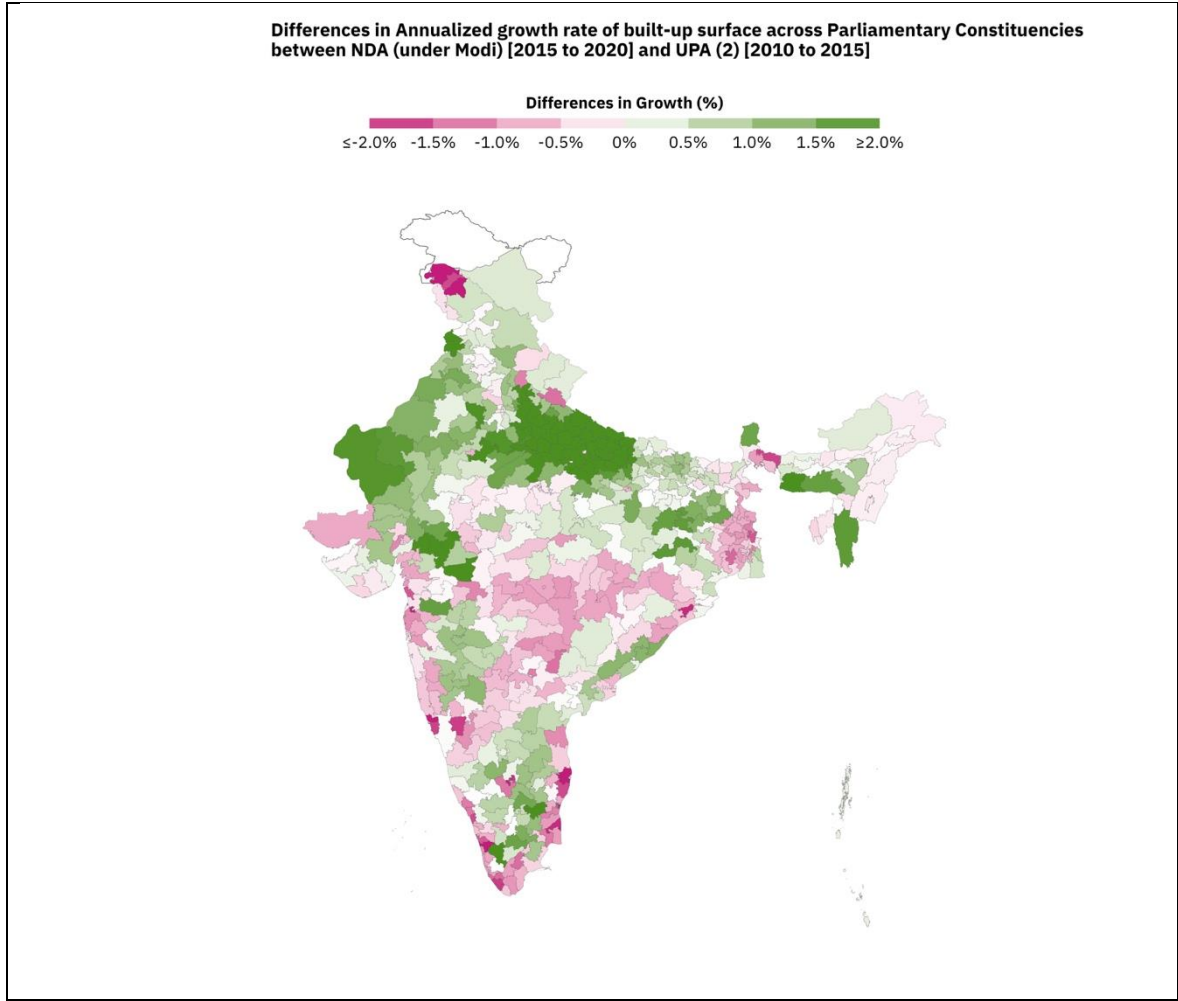


Figure 1c: Differences in the Annualized growth rate of built-up surface across Parliamentary Constituencies between NDA (under Modi) [2015 to 2020] and UPA (2) [2010 to 2015]



For our following analysis, we exploit the Ordinary Least Square (OLS) regression analysis, where the rate of growth in the parliamentary constituency was regressed on the lag value of the logarithm of the ratio of total built-up surface in the parliamentary constituency to the total area, state fixed effects. We also control the political party (the BJP, the INC, and Others) governing the parliamentary constituency. In particular, we run the following regression,

$$\begin{aligned} \text{Rate of growth}_{i,t} &= \text{constant} + \beta_1 \text{Logarithm} \left(\frac{\text{Total built-up surface area}}{\text{Total area}} \right)_{i,t} \\ &+ \beta_2 \text{State}_i + \beta_3 \text{Political party}_{i,t} + \text{error}_{i,t}, \end{aligned}$$

where i is the parliamentary constituency, t is the time frame for [2010 to 2015] and [2015 to 2020]. State_i represents the state in which the parliamentary constituency was located. $\text{Political party}_{i,t}$ represents the political party in power in the parliamentary constituency.

The regression results are presented in Table 2.

Table 2:

	UPA (2) [2010 to 2015]	NDA (under Modi) [2015 to 2020]
Logarithm of Ratio of Total built-up surface to Total area	-0.64 (95% CI: -0.75 to -0.54)	-1.12 (95% CI: -1.34 to -0.91)
State fixed effects	Yes	Yes
Political party	Yes	Yes
<i>Observations</i>	543	543
<i>Adjusted R²</i>	0.40	0.44
Mean Growth rate	2.8% [SD = 1.4%]	3.3% [SD = 2.9%]

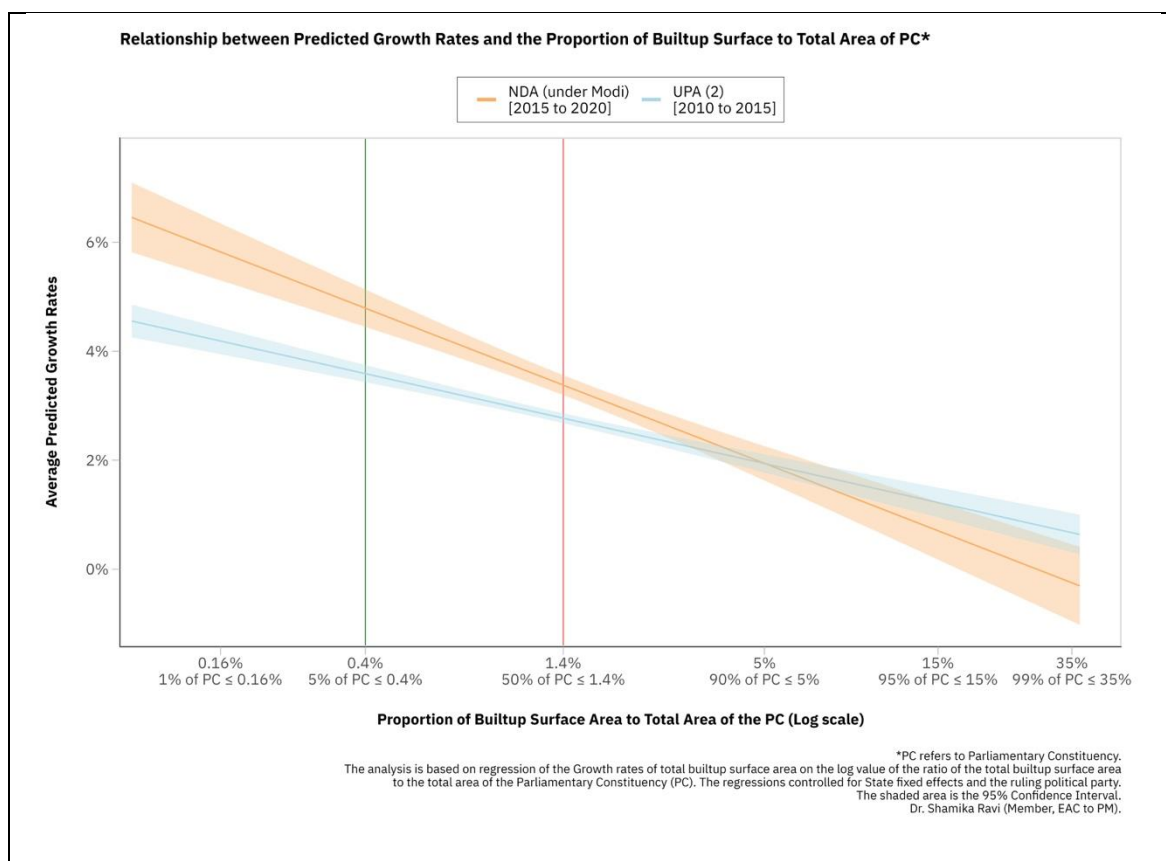
The regression results reveal that during UPA (2) and NDA (under Modi), the annualized growth rate in total built-up surface was higher in less developed parliamentary constituencies with a lower ratio of total built-up surface to total area. For example, in 2010, the percentage of total built-up surface to total area was less than 1.2% in 50 percent of the parliamentary constituencies. For 2015, this ratio was less than 1.4% in 50 percent of the constituencies.

Based on the regression results, we observed that during the UPA (2) [2010 to 2015], the median parliamentary constituency, which had a ratio of total built-up surface to the total area of 1.2%, grew on an average at 2.9% (95% Confident Interval [CI]: 2.8% to 3.0%), however, during the NDA (under Modi) [2015 to 2020], the median parliamentary constituency grew at 3.5% (95% CI: 3.3% to 3.7%), and this difference in growth rates was statistically significant at the conventional 95% confidence interval. Furthermore, when we compare the parliamentary constituency at the 25% percentile of the ratio of the total built-up surface to the total area, we found that during the NDA (under Modi) [2015 to 2020], 4.0% (95% CI: 3.78% to 4.24%). In comparison, during the UPA (2) [2010 to 2015], it was 3.2% (95% CI: 3.1% to 3.3%).

We present the results on predicted values based on the regression results for different values of the ratio of total built-up surface to the total area for UPA (2) [2010 to 2015] and NDA (under Modi) [2015 to 2020].¹⁰

¹⁰ The predicted values were computed by using the *margins* command in STATA 18.

Figure 2: Predicted Values



The above figure reveals that growth rates were significantly higher in less developed parliamentary constituencies (in terms of the ratio of Built-up surface to Total Area) during the NDA (under Modi) as compared to UPA (2) [2010 to 2015]. A key implication of this result is that inequalities in terms of built-up surface across parliamentary constituencies declined faster during the NDA (under Modi) [2015 to 2020] than during UPA (2) [2010 to 2015].

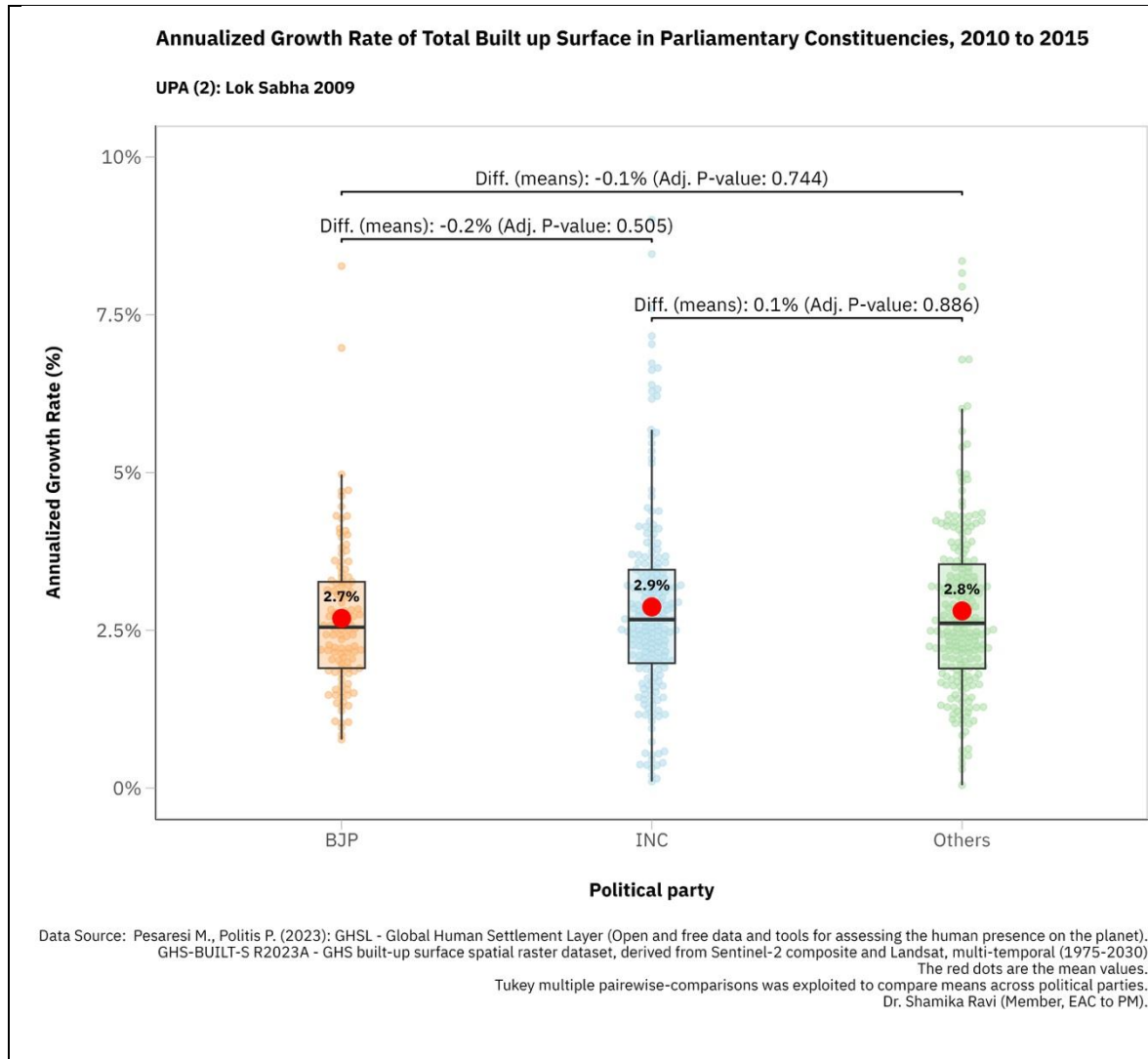
Next, we compare the performance of political parties, the BJP, the INC, and others, across different political regimes. These results are presented in the following table.

Table 3: UPA (2) [2010 to 2015]

Annualized growth rate	BJP	INC	Others
Mean	2.7% [SD = 1.2%]	2.9% [SD = 1.6%]	2.8% [SD = 1.4%]
Maximum	8.3%	9.0%	8.3%
Minimum	0.8%	0.1%	0.5%

We found no significant difference in the mean growth rates across the political parties during the UPA (2). For the BJP, the mean growth rate across parliamentary constituencies was 2.7%, and it varied across the parliamentary constituencies with a maximum of 8.3% and a minimum of 0.8%. The average growth rate for the INC was 2.9%, with the maximum at 9.0% and the minimum at 0.1%. For Others, the average growth rate was 2.8%, the max was 8.4%, and the minimum was 0.5%.

Figure 3: Comparison of the annualized growth rate of total built-up surface in Parliamentary Constituencies across Political Parties, 2010 to 2015



Next, we compared the performance of political parties across the parliamentary constituencies during the NDA under Prime Minister Modi, presented in Table 4.

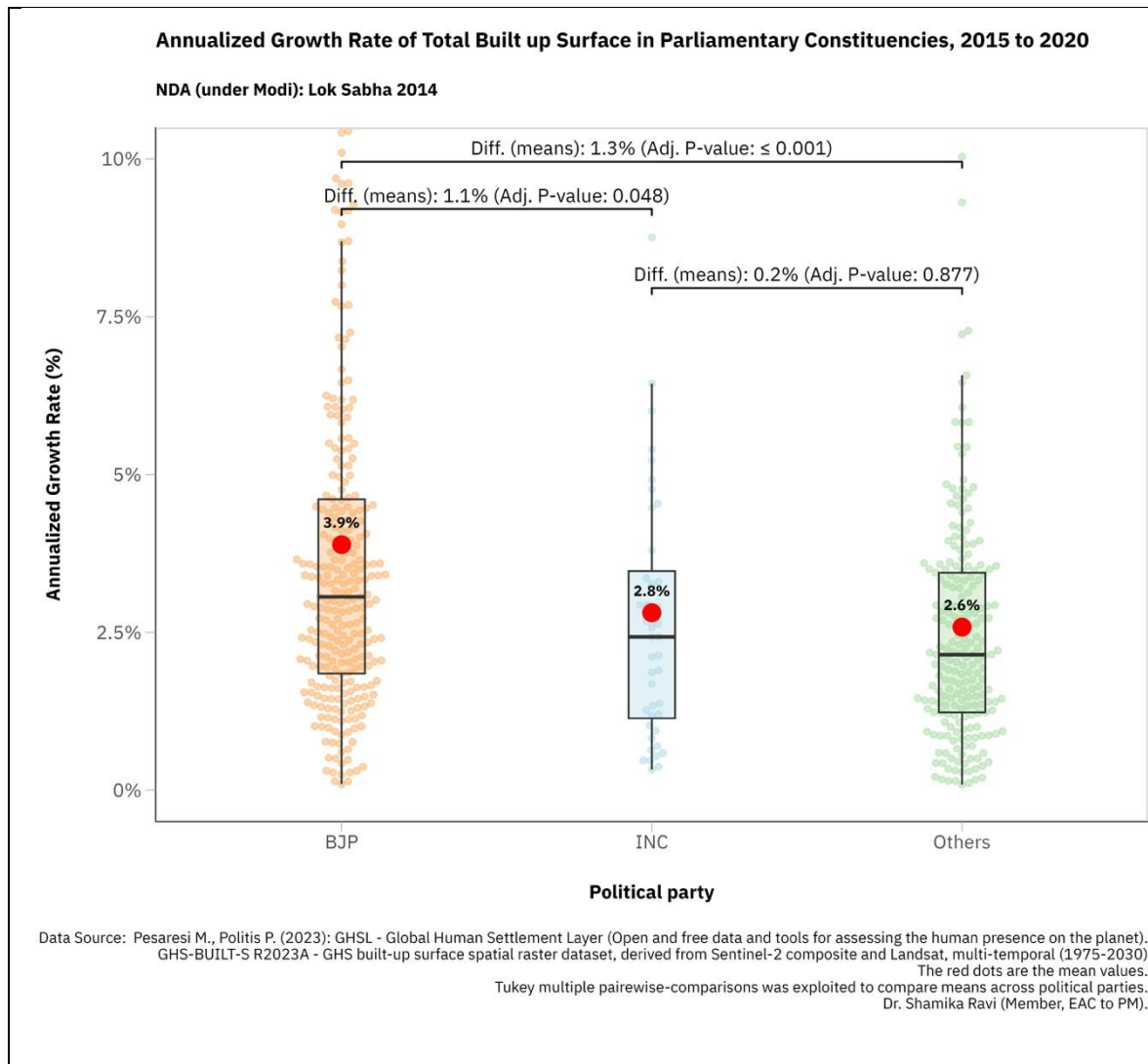
Table 4: NDA (under Modi) [2015 to 2020]

Annualized growth rate	BJP	INC	Others
Mean	3.9% [SD = 3.2%]	2.8% [SD = 2.4%]	2.6% [SD = 2.2%]
Maximum	19.2%	12.1%	18.4%
Minimum	0.1%	0.3%	0.1%

We found that the mean annualized growth rate in parliamentary constituencies under the BJP was 3.9%, and it varied across the parliamentary constituencies, where the maximum was 19.2% and the minimum was 0.1%. The mean annualized growth rate for the INC was 2.8%, with the maximum at 12.1% and the minimum at 0.3%. For Others, the mean annualized growth rate across parliamentary constituencies was 2.6%, with the maximum at 18.4% and the minimum at 0.1%.

When we statistically compared the means across political parties, we found that the growth rates were significantly higher in BJP-ruled parliamentary constituencies than in the INC, where the difference in growth rates was 1.1%. When we compared the BJP to Others, we found that the difference in growth rates at 1.3% was higher in BJP-ruled parliamentary constituencies. This difference was significant at the conventional 95% significance. However, we do not find any statistical difference in the mean growth rates when comparing the INC with Others. We present these results in Figure 4.

Figure 4: Comparison of the annualized growth rate of total built-up surface in Parliamentary Constituencies across Political Parties, 2015 to 2020



Our final results of annualized growth rates in built-up surface areas are at the district and sub-district levels for three distinct political regimes: UPA (1) [2005 to 2010], UPA (2) [2010 to 2015], and the NDA (under Modi) [2015 to 2020].

At this district and the sub-district level, the mean annualized growth rate was significantly higher during the NDA (under Modi) [2015 to 2020] than during UPA(2) [2010 to 2015] or during the UPA (1) [2005 to 2010]. These results are presented in Figures 5a and 5b.

Figure 5a: Comparison of the annualized growth rate of total built-up surface across Districts

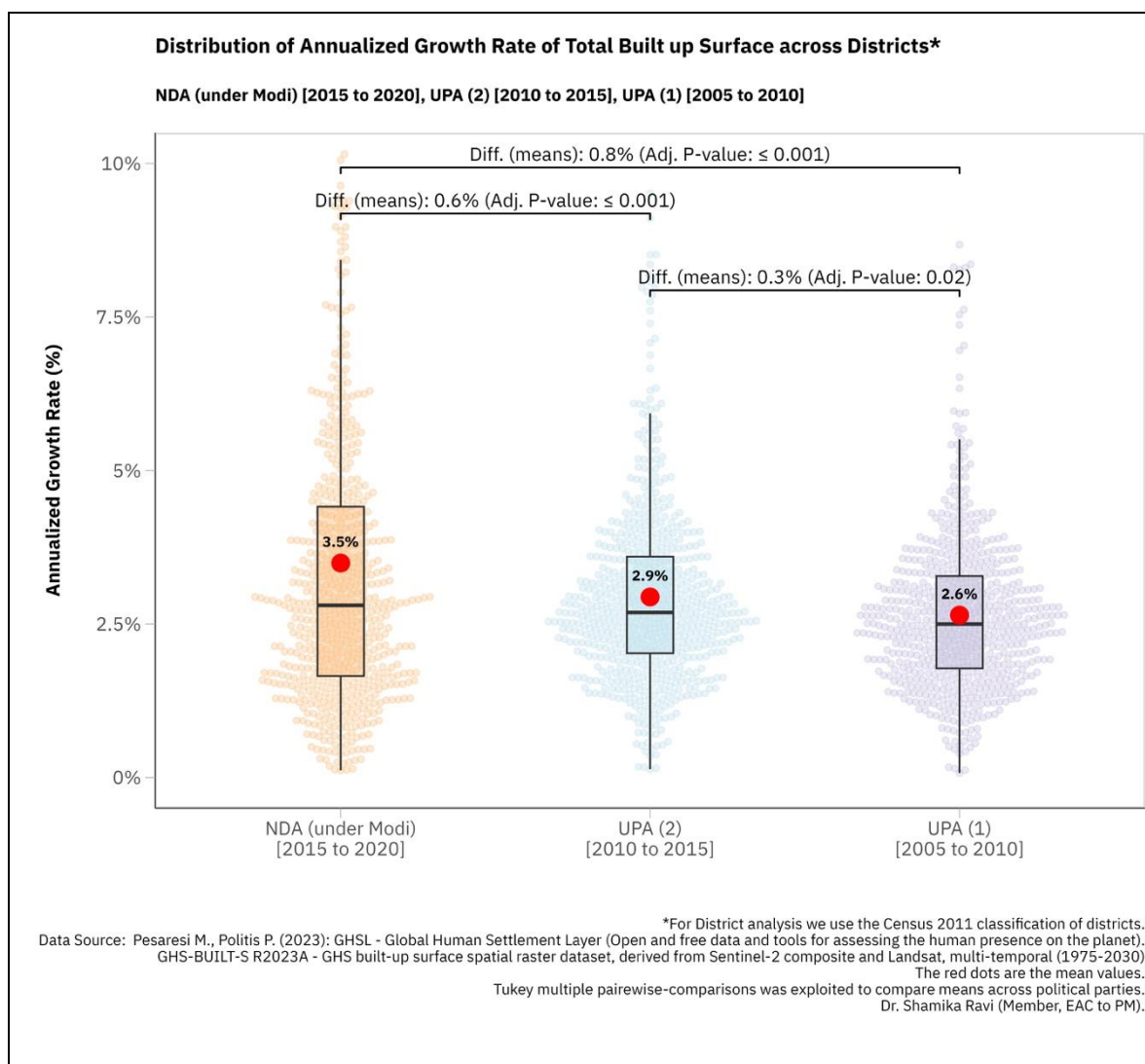
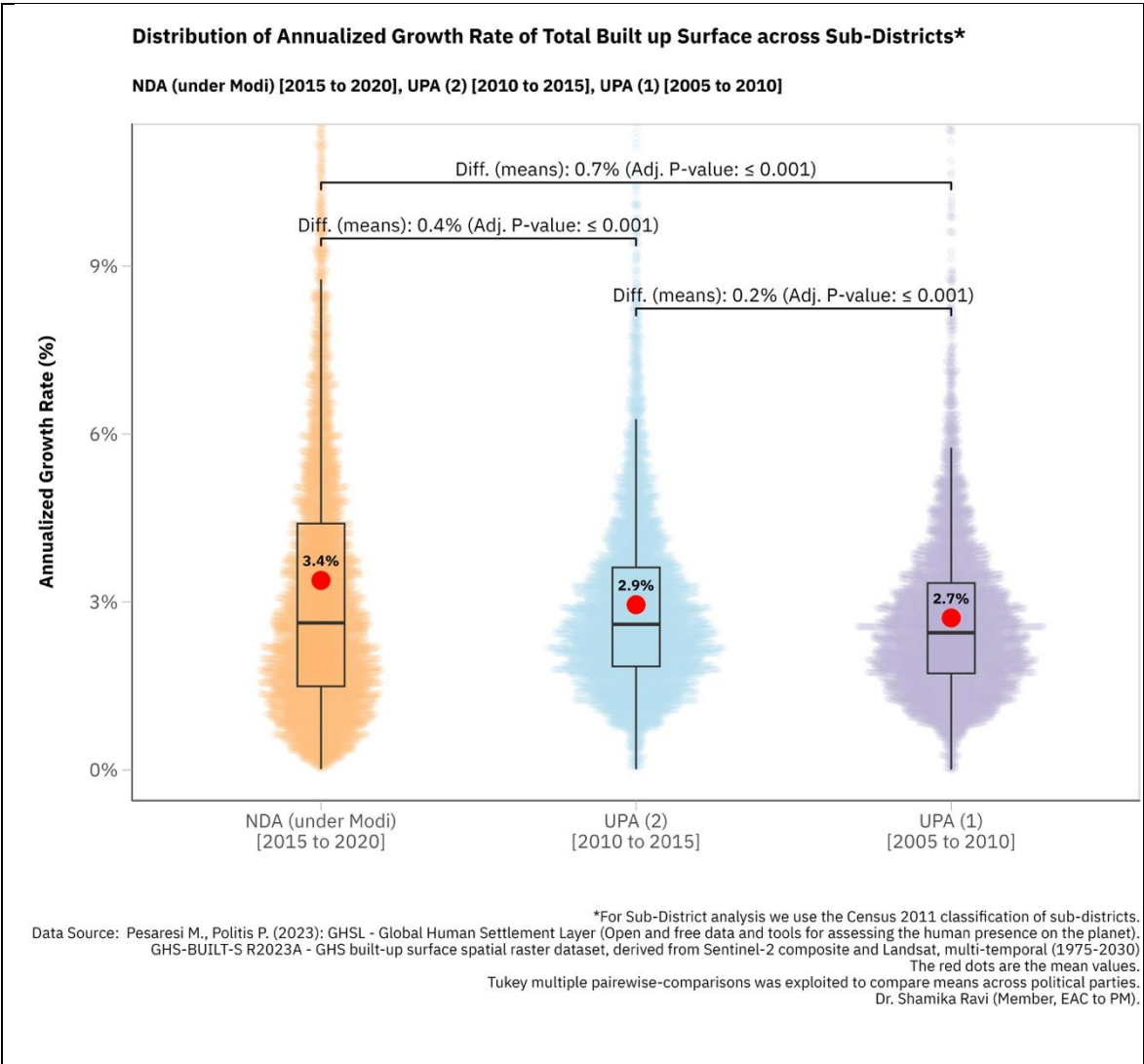


Figure 5b: Comparison of the annualized growth rate of total built-up surface across Sub-Districts



We ran an OLS regression to assess if the annualized growth rates of built-up surfaces were higher for the less developed districts and the sub-districts. The regression results are presented in Tables 5a and 5b.

Table 5a: District Level Analysis

	UPA (1) [2005 to 2010]	UPA (2) [2010 to 2015]	NDA (under Modi) [2015 to 2020]
Logarithm of Ratio of Total built-up surface to Total area	-0.36 (95% CI: -0.46 to -0.26)	-0.55 (95% CI: -0.67 to -0.43)	-0.98 (95% CI: -1.20 to -0.76)
State fixed effects	Yes	Yes	Yes
Observations	640	640	640
Adjusted R ²	0.37	0.36	0.39
Mean Growth rate	2.6% [SD = 1.3%]	2.9% [SD = 1.5%]	3.5% [SD = 2.8%]

Table 5b: Sub – District Level Analysis

	UPA (1) [2005 to 2010]	UPA (2) [2010 to 2015]	NDA (under Modi) [2015 to 2020]
Logarithm of Ratio of Total built-up surface to Total area	-0.19 (95% CI: -0.23 to -0.16)	-0.35 (95% CI: -0.39 to -0.31)	-0.87 (95% CI: -0.93 to -0.80)
State fixed effects	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
Observations	5968	5968	5968
Adjusted R ²	0.56	0.61	0.66
Mean Growth rate	2.7% [SD = 1.5%]	2.9% [SD = 1.7%]	3.4% [SD = 2.8%]

The regression results reveal that during UPA (2), UPA (1) and NDA (under Modi), the annualized growth rate in total built-up surface was significantly higher in less developed districts and sub-districts with a lower ratio of total built-up surface to total area. However, for the district and the sub-district level, the level of growth in less developed regions was significantly higher during NDA (under Modi) [2015 to 2020] than during the UPA (2) [2010 to 2015] or UPA (1) [2005 to 2010]. *A key implication of these results is that regional inequalities in terms of built-up surfaces reduced faster during the NDA (under Modi) than during UPA (2) or UPA (1).* We use the regressions results to compute the predicted annualized growth values for NDA (under Modi), UPA (2), and UPA (1) for different values of the ratio of the built-up surface to the total area at the district and the sub-district level. These results are presented in Figures 6a and 6b.

Figure 6a: Average Predicted Values for District Level

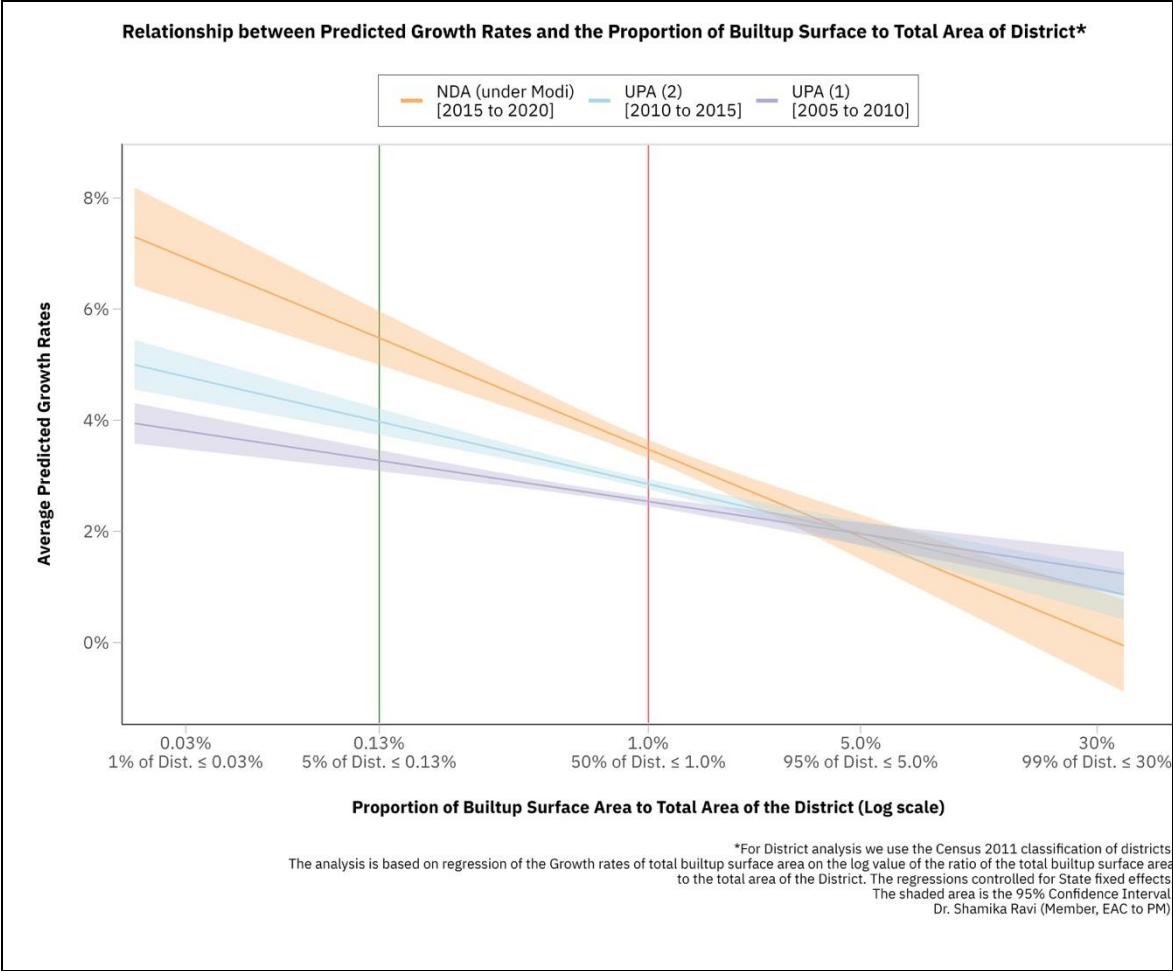
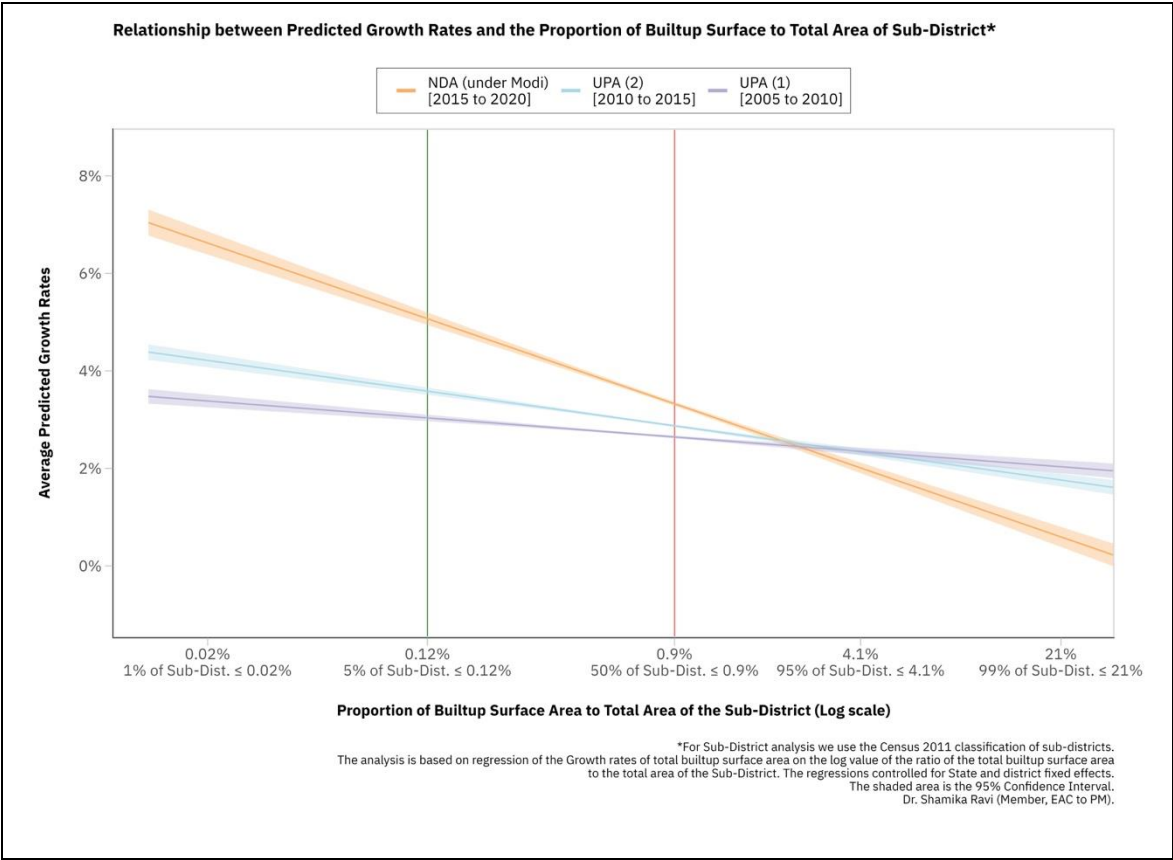


Figure 6b: Average Predicted Values for Sub-District Level



4. Discussion

Assessing the economic performance of political parties at the parliamentary constituency level is a challenging task primarily due to a lack of reliable data. In this essay, we have exploited the open and publicly available daytime high-resolution spatial raster data on the built-up surface across different epochs: 2010, 2015, and 2020 and at the level of the parliamentary constituency to compare annualized growth rates in built-up surface across UPA (2) [2010 to 2015] and NDA (under PM Modi) [2015 to 2020] and across political parties, the BJP, the INC, and Others, within the political regimen. This dataset is open and publicly available. Moreover, research has shown that daytime satellite data on built-up surfaces is a good proxy for economic markets, a measure of economic activity.

We found that the mean growth rates of built-up surface across parliamentary constituencies were approximately 18% higher during the NDA (under Modi) when compared to UPA (2) [3.3% during the NDA (under Modi) versus 2.8% during the UPA (2)].

Based on our OLS regression results, we found that during the UPA (2) [2010 to 2015] and NDA (under Modi) [2015 to 2020], the annualized growth rate of the built-up surface was significantly higher in less developed parliamentary constituencies, suggesting that there is convergence or decline in inequality between parliamentary constituencies. However, the convergence or growth rates in less developed parliamentary constituencies were much higher during the NDA (under Modi) [2015 to 2020] than in UPA (2) [2010 to 2015]. This result seems to suggest that inequality in terms of total built-up surface across the parliamentary constituency declined much faster during the NDA (under Modi) [2015 to 2020] than during UPA (2) [2010 to 2015]. Once again, it is essential to emphasize that the difference in predicted growth rates across the parliamentary constituencies between the NDA (under Modi) [2015 to 2020] and the UPA (2) [2010 to 2015] was higher in less developed parliamentary constituencies (lower ratio of total built-up surface to total area). For example, the predicted growth rates in the annualized built-up surface were higher by 20% during the NDA (under Modi) [2015 to 2020] when compared to UPA (2) [2010 to 2015] in the parliamentary constituency with a median ratio of total built-up surface to total area. Meanwhile, for the same ratio in the 25th percentile parliamentary constituency, the difference in predicted growth rates in the annualized built-up surface was higher by 25% during NDA (under Modi) [2015 to 2020] than in UPA (2) [2010 to 2015].

Furthermore, when we compare the performance of political parties, we do not find any statistical difference in the mean growth rates across the BJP, the INC, and Others during the UPA (2) [2010 to 2015]. However, during the NDA (under Modi) [2015 to 2020], we found the mean annualized growth rate of built-up surfaces was higher in the BJP-ruled parliamentary constituencies than in the INC and Others. In particular, we saw that the annualized growth rate in the BJP-ruled parliamentary constituencies was approximately 39% higher than in the INC-ruled parliamentary constituencies (3.9% for the BJP versus 2.8% for the INC). Similarly, when we compared BJP to Others, it was approximately 50% higher for the BJP (3.9% for BJP

versus 2.6% for Others). However, there was no statistical difference between the INC and Others.

Furthermore, we perform the same analysis at the district and the sub-district level, which allows us to compare the economic performance in terms of annualized growth of built-up surface for NDA (under Modi) [2015 to 2020], UPA (2) [2010 to 2015], and UPA (1) [20015 to 2010]. Our results revealed that growth during the NDA (under Modi) was significantly higher than during UPA (2) or UPA (1). Moreover, we observed that regional inequalities at the district and the sub-district level reduced significantly faster during NDA (under Modi) than during UPA (2) or UPA (1).

5. Limitations

It is imperative to mention that daytime satellite imagery data is suitable for capturing the spatial expanse of economic markets or the extensive margins of economic activity. In contrast, the nightlight data better captures the intensive margins. Therefore, by focusing on daytime satellite imagery data in this essay, our emphasis is on the extensive margins of economic activity. Furthermore, more research is needed at the micro level to ensure that data produced from the daytime satellite imagery reflect the economic realities on the ground.

Another critical limitation of the data is that the predictions of built-up surface areas from the daytime satellite imagery data are subject to expected errors. However, efforts have been made to minimize these errors. Two strategies were adopted for error assessments: (1) to compare model predictions with human assessment of the same satellite image, and (2) to compare the model predictions with other datasets that are typically considered more accurate. Error analysis revealed that the data's overall accuracy was approximately 94%.¹¹

6. Conclusion

Using a novel dataset on open and publicly available high-resolution daytime satellite imagery of built-up surface, we compared the annualized growth of built-up surface (a good proxy for economic activity) across parliamentary constituencies in India across different political regimes UPA (2) [2010 to 2015] versus NDA (under Modi) [2015 to 2020]. Research has shown that such data are a good proxy for detecting economic markets, and they are good at detecting economic activities everywhere, including smaller cities and towns, which would be missed if we relied exclusively on nightlight data, which has gained much popularity in recent years.

We find significantly higher growth of build-up surface under the Modi years, and we also find that the growth rates were significantly higher in less developed parliamentary constituencies (in terms of the ratio of Built-up surface to Total Area) during the Modi years as compared to UPA (2). We also compared the performance of political parties across different political regimes.

¹¹ For a more detailed analysis on the concepts and methodologies of the data produced by the Global Human Settlement Layer (GHSL) see <https://ghsl.jrc.ec.europa.eu/data.php>