Research Proposal, Nihar Nandan Hemantha Kumara (nh2644)

Topic: Using Night Light as economic indicator in India

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My research will be a combination of a detailed literature review and an empirical paper. The goal of my research paper is to answer the question: *Is night light a reliable indicator for economic growth in India.* Night-light data provides a numerical measure of brightness of the earth during the night, which is a direct result of human activities. It holds a lot of potential in economic analysis since there is relatively less noise compared to traditional data collection techniques. There are drawbacks when using light night for economic analysis and a section of my paper will focus on the shortcomings of using it for analysis. A substantial amount of research has been done regarding the use of night light as an economic indicator especially in developing countries and will be the focus of my literature review. I also intend to spend some time on answering the question of whether using such technology driven and numerical techniques is efficient when it pertains to developing and complex economies like India.

Previous work mostly uses simple regression models to estimate the relationship between light night and GDP. My research will focus on trying to use more advanced statistical models (non-linear estimation, quantile regression, etc.) to develop a relationship and to check whether they are statistically significant and useful. Past research doesn't account for the impact of informal economies on local growth. Most regressions only correlate between GDP and night light, but I want to extend this analysis to different sectors within a region. More than 80% of the Indian economy is unorganized and is a significant contributor to development in rural areas. The research will also check whether there is a relationship between different sectors becoming organized to an increase in urbanization. If time permits, I would like to try to model the expansion of growth based on night light with urban settlements at the center of growth. I would also like to study the relationship during COVID, but India is infamous for untimely data and there is no current data on night light or other economic factors. I will spend a section of my paper on theorizing on how using the data during COVID, we can confirm whether night light is a reliable economic indicator.

An example of a regression model from a past paper is given below* (first paper in reference)

Table 3a: Regression Results of Residuals of Q-o-Q GDP Growth and its Components on Residuals of Night lights after Controlling Seasonality

Variables	GDP	GVA	Agriculture and Allied Activities	PFCE
Residuals of night lights	0.088***	0.074***	0.196***	0.067*
	(0.016)	(0.014)	(0.038)	(0.035)
Constant	0.000	0.000	-0.000	0.000
	(0.206)	(0.217)	(0.458)	(0.428)
Observations	22	22	22	22
R-squared	0.463	0.358	0.464	0.103

***: p<0.01; **: p<0.05; *: p<0.1.
Note: The figures in parentheses are robust standard errors.

About the API - The India Lights platform shows light output at night for 20 years for 600,000 villages across India. The Defense Meteorological Satellite Program (DMSP) has taken pictures of the Earth every night from 1993 to 2013. Researchers at the University of Michigan, in collaboration with the World Bank, used the DMSP images to extract the data. Each point in the dataset represents the light output of a specific village at a specific point in time. The granularity of the night light average will be decided through the course of the research.

Columns in data from night lights API

Field	Type	Description
quintile1-4		Quintile values for the median
result	Object[]	Time series data
key	String	Identifier of geographical area
year	Number	Year of measurement
month	Number	Month of measurement
satellite	String	Satellite that took measurement
count	Number	Number of measurements in this month
Luminosity/vis_median	Number	Average median of measurements for this month

References –

- *Night-time Luminosity: Does it Brighten Understanding of Economic Activity in India? (Anupam Prakash, Avdhesh Kumar Shukla, Chaitali Bhowmick, Robert Carl Michael Beyer)**
- Night Lights and Economic Activity in India: A study using DMSP-OLS night time images (Laveesh Bhandari, Koel Roychowdhury)
- Nighttime lights as a proxy for human development at the local level (Anna Bruederle, Roland Hodler)
- Illuminating Economic Growth (Yingyao Hu and Jiaxiong Yao)
- MEASURING ECONOMIC GROWTH FROM OUTER SPACE (J. Vernon Henderson, Adam Storeygard, and David N. Weil)
- Measuring Economic Growth from Outer Space (Henderson, J. Vernon; Storeygard, Adam; and Weil, David N.)
- Understanding the Impact of Windstorms on Economic Activity from Night Lights in Central America (Oscar A. Ishizawa, Juan Jose Miranda, Hongrui Zhang)