An Assessment of Impact of Institutional Capacity, Educational Outcomes and Political Leadership in the Economic Growth of Municipalities of Nepal

Primary Researcher: Aashish Panta '26, Swarthmore College
Research Mentor: Raj Kharel, Economic Geographer
Supported by: Ella Foster-Molina '07, PhD, Social Science Quantitative Laboratory Associate, Swarthmore College

Table of Contents

Abstract

Rural and urban municipalities of Nepal have witnessed an upward trajectory in economic growth in the past few years manifested as infrastructural progress such as road expansions, power connectivity, educational and health facilities, and more. A robust understanding of the factors conducive to economic growth in municipalities can provide a policy roadmap for further strengthening such factors.

In my research, I am interested in empirically analyzing the impact of three key potential determinants of economic growth---institutional capacity, educational outcomes, and political leadership---from 2017 to 2021.

In an institutional capacity, I refer to the ability of municipalities to execute their responsibilities reflected through their day-to-day performance and overall accomplishments. I am curious whether stronger institutional capacity is related to better economic growth or not.

In terms of educational outcomes, I am focusing on the percentage of the population with a high school degree or above. Recent studies have empirically shown that higher educational attainment among the population yields higher economic growth[1]. I am eager to see if the conclusion holds true in the context of the municipalities of Nepal.

In the case of political leadership, I am specifically looking at quantifiable aspects of chairpersons of municipality---like their sex, age at election, and political affiliation. These three variables provide a foundation for analyzing the difference in the performance of male and female leaders, the impact of age on economic growth, and the performance of chairpersons belonging to the ruling party in the federal government.

---

[1] In a recent empirical study of 38 countries, Li et al. (2024) found that population segments with higher education had a significantly positive impact on GDP growth.

Introduction of Federalism in Nepal

- Nepal became a federal republic in 2015 after promulgation of a new constitution in 2015
- The tiers of governments under federalism are:
  - 1 federal government
  - 7 provincial governments
  - 753 local governments
    - 6 metropolitan cities
    - 11 sub-metropolitical cities
    - 276 municipalities
    - 460 rural municipalities
- Government tenures:
  - 1st election: September 2017
  - 2nd election: May 2022

Quantifying Economic Growth

- Lack of data on GDP of local governments
- Nightlight data of Nepal used as a proxy for economic activities
- Nightlight data is an idea proxy for economic activities as well as human wellbeing for a developing country like Nepal as a large share of economy is in informal sector, which is not effectively captured by GDP[2]
- In context of Nepal, researchers have used VIIRS nightlight data to estimate the impact of the 2015 earthquakes[3]
- Unit of nightlight: $nW/cm^2/sr$ ((nanowatts per square centimeter per steradian)
  - It quantifies how much light is being emitted or received per unit area and in a specific direction in the night sky.

- For my research, I trace change in nightlight as follows:
  - **rel_chgnl**: ln (sum of nightlight of 2021) – ln (sum of nightlight of 2017)
  - It examines the relative change in nightlight from 2017 to 2021

---

[2] Liu et al. (2021) found nightlight data as a strong indicator of GDP of China. Ghosh et al. (2013) demonstrate that nightlights data is a strong proxy for determining human well-being.

[3] Tveit et al. (2022) used VIIRS nightlights data to estimate the impact of 2015 earthquakes in Nepal.

Evolution of Real GDP and Nighlight

Figure 1: Evolution of ln (Real GDP) and ln (sum of nightlight) in Nepal from 2012-2023

Plausible Explanations:

1. **Drop from 2015 to 2016:** A 7.8 magnitude earthquake hit Nepal in 2015 causing massive destruction of physical infrastructure. An economic blockade from India (60% import partner) that followed further impacted the economy.
2. **Jump from 2016 to 2017:** In Nepal, "Residential load shedding ended since early 2017, and there has been no industrial load shedding since early 2018." (World Bank, 2019) Alongside, there is also a net positive effect from aid and relief efforts.
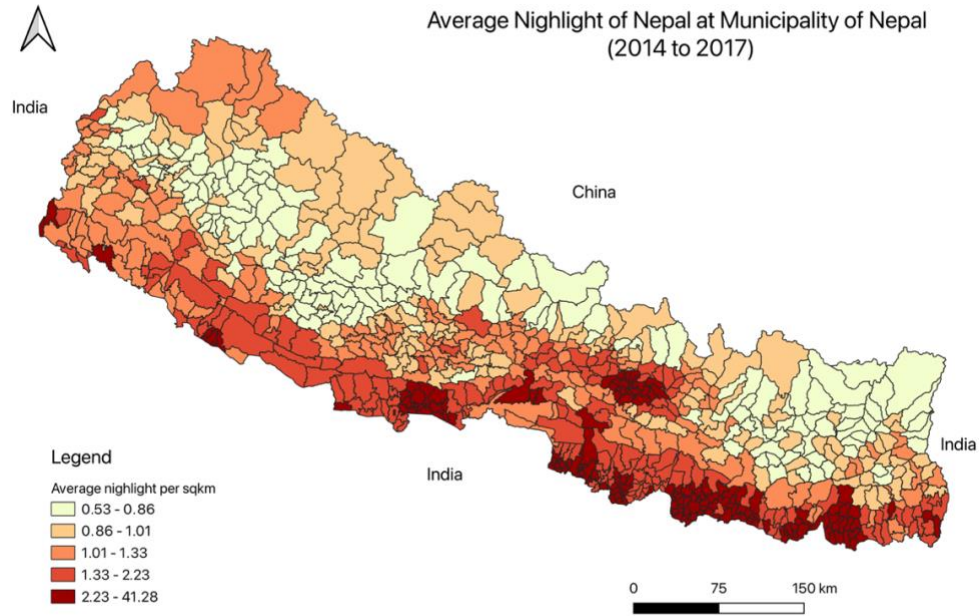
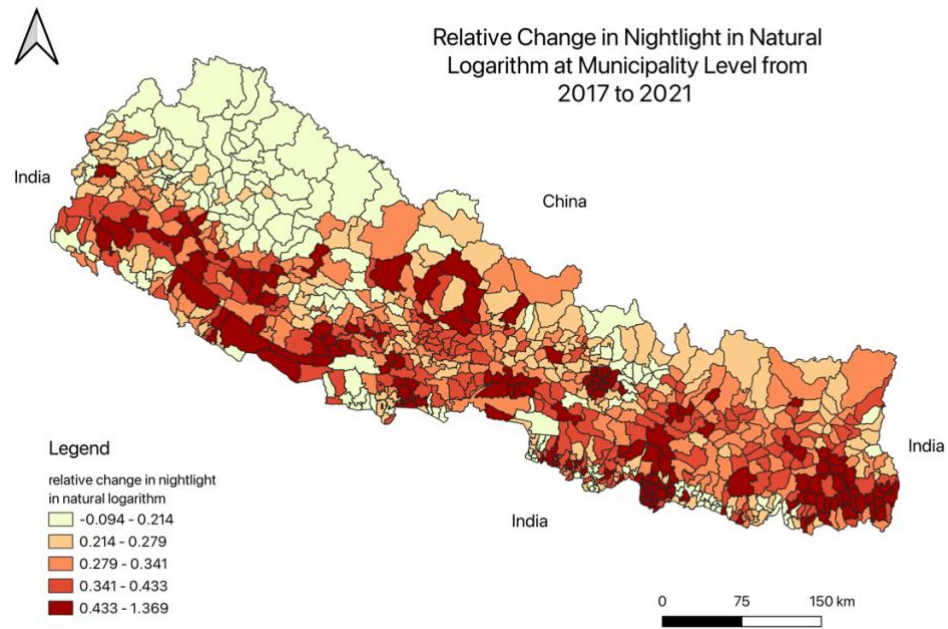*Figure 2: Average nightlight per sq.km for Nepal at municipality level from 2014 to 2017*

Figure 3: Relative Change in Nightlight in Natural Logarithm at Municipality Level from 2017 to 2021
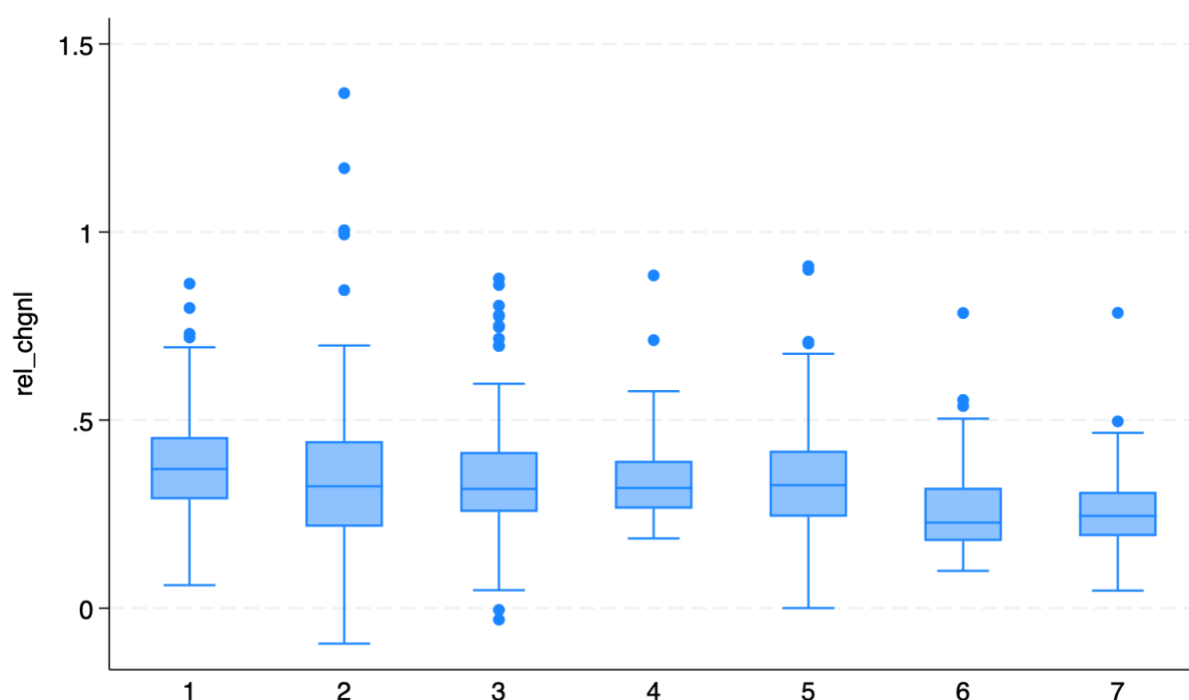
Figure 4: Box plot of the relative change in nightlight in natural logarithm from 2017 to 2021across 7 provinces

Institutional Capacity

- Local Government Institutional Capacity Self-Assessment (LISA)
  - An assessment metric introduced by Ministry of Federal Affairs and General Administration in 2020/21
  - Focused on day-to-day performance and overall quantitative accomplishments
- An aspect which can be substantially improved without significant investment of capital and labor
- LISA Breakdown:

SN	Category Title	Points
1	Governance Management	9
2	Organization & Administration	8
3	Budget Plan Management	11
4	Fiscal Economic Management	11
5	Service Delivery	16
6	Judicial Execution	9
7	Physical Infrastructure	13
8	Social Inclusion	10
9	Environmental Protection and Disaster Management	10
10	Cooperation and Coordination	6
	Total	**100**

- Each of the LISA Category is weighted with sub-categories as follows:

Indicators	Process Scenario	Quantitative Scenario	Total
21%	34%	45%	100%

- For instance, Cooperation and Coordination is calculated as follows:

10. Cooperation and Coordination Overall Scenario (6 points)					
10.1Indicators		10.2 Process Scenario	10.3 Quantitative Scenario		
10.1.1 cooperation and coordination among federal, province & local governments	10.1.2 Inter local governments cooperation and coordination	10.2.1 Formation and operation of inter-local governments committee (more than two local governments) to address common interests.	10.3.1 Inter-government coordination and facilitation	10.3.2 Inter local governments partnership	10.3.3 Coordination with District Development Committee

- For my research, I trace LISA and its component scores as follows:
  - **lisa_avg**: average LISA score of 2020/21 and 2021/22
  - **cop_cor_avg:** average cooperation and coordination score of 2020/21 and 2021/22
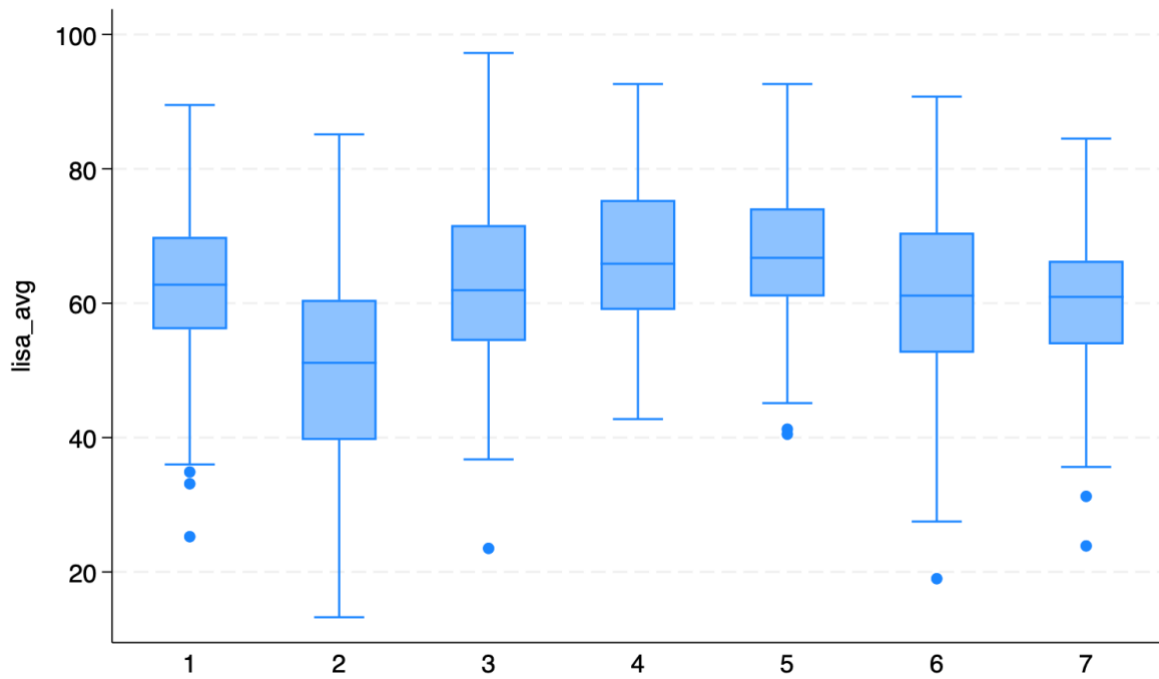
Figure 5: Box plot of average LISA score of 2020/21 and 2021/22 across 7 provinces

Figure 6: Scatter plot with fitted line of relative change in nightlight in natural logarithm from 2017 to 2021 over average LISA score of 2020/21 and 2021/22

Figure 7: Scatter plot with fitted line of relative change in nightlight in natural logarithm from 2017 to 2021 over average cooperation and coordination score of 2020/21 and 2021/22

Educational Outcome

- Currently have the data on population that has high school qualification
    - Will be replacing with population that has high school qualification and above
    - I am tracing educational outcome as:
        - **high_school_percentage:** percentage of population who have completed high school (to be changed to percentage of population who have completed high school or above)
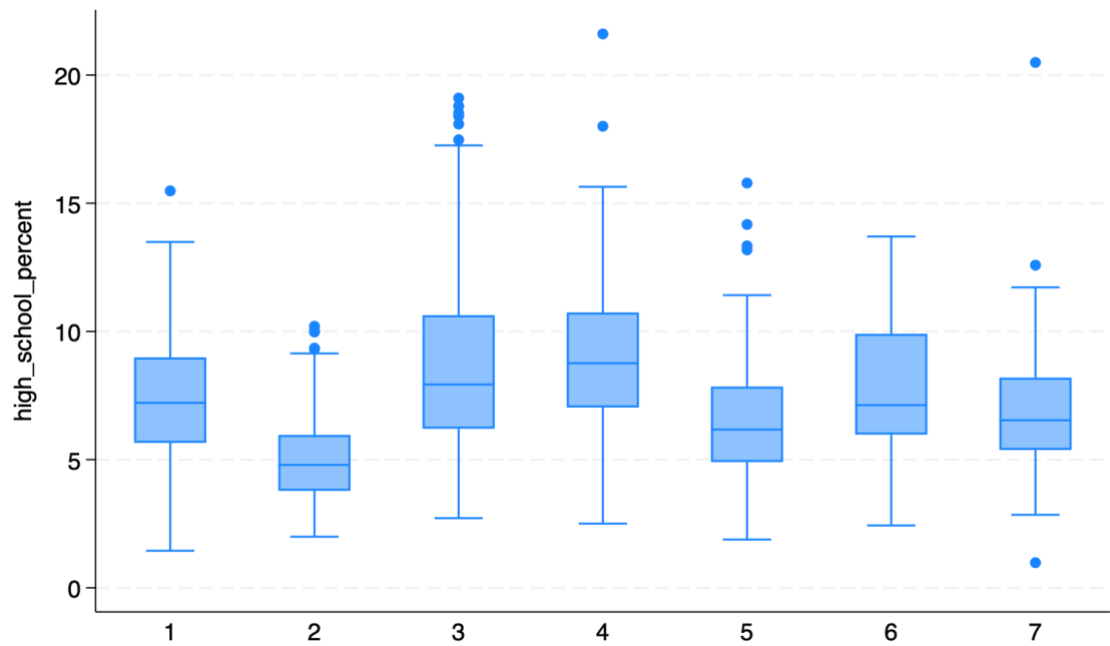
Figure 8: Box plot of high school attainment across 7 provinces
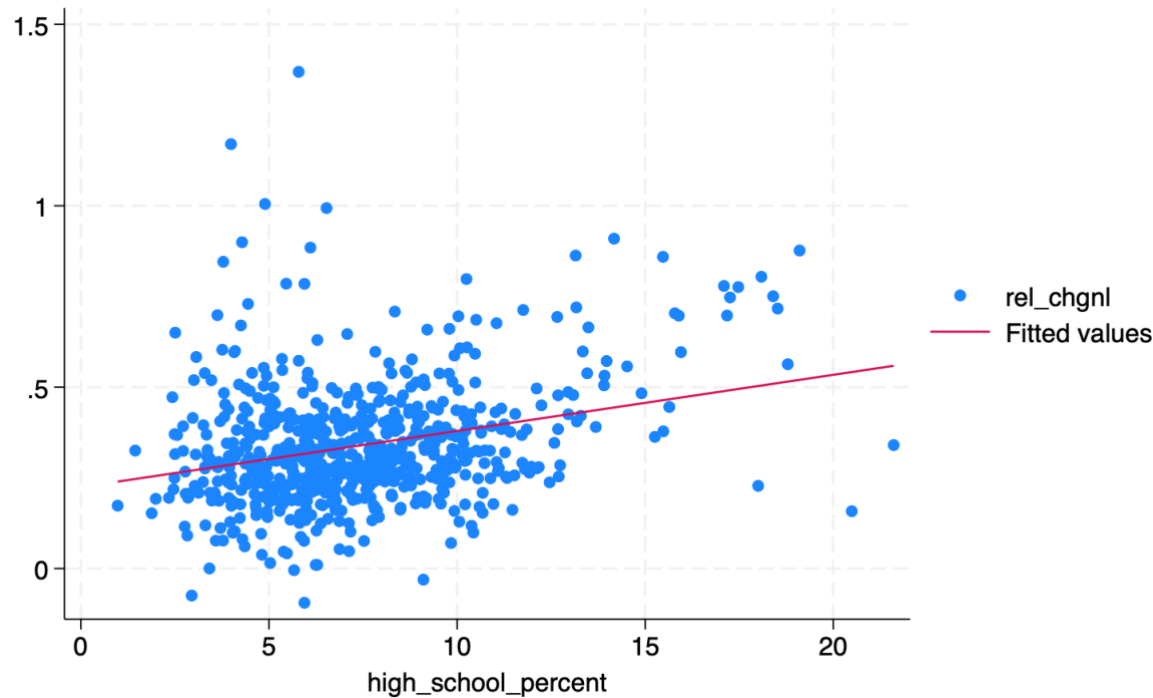
rcent per

2021cencus across 7 provinces

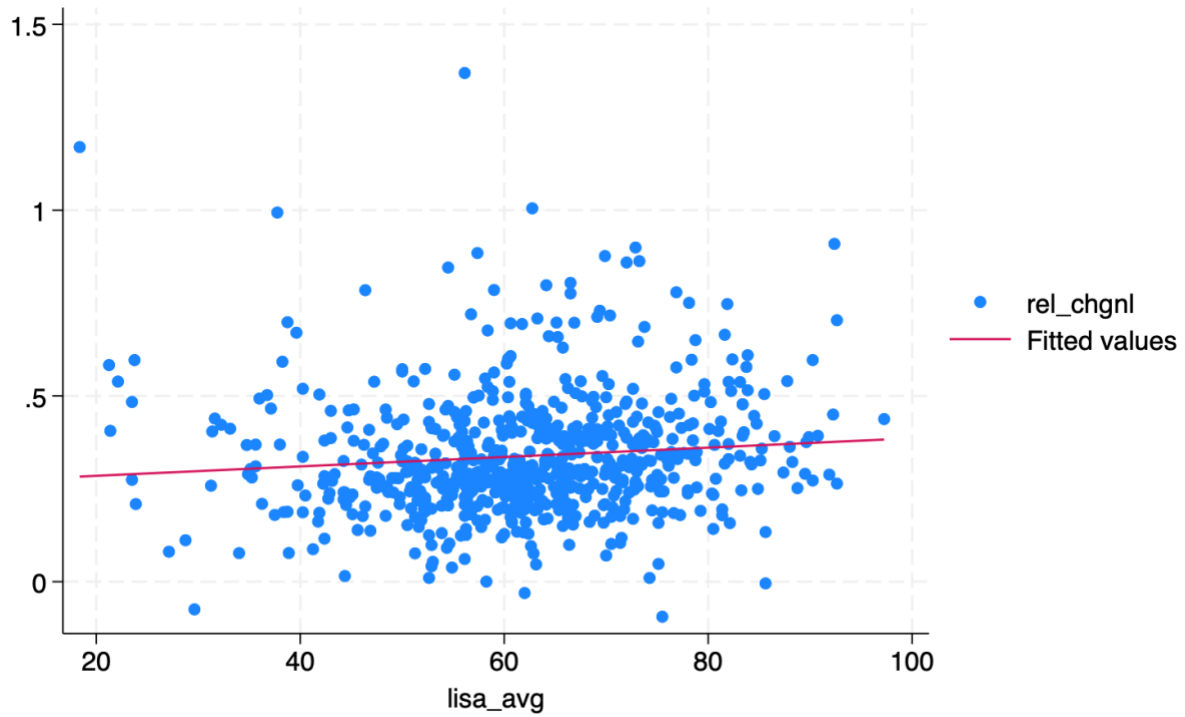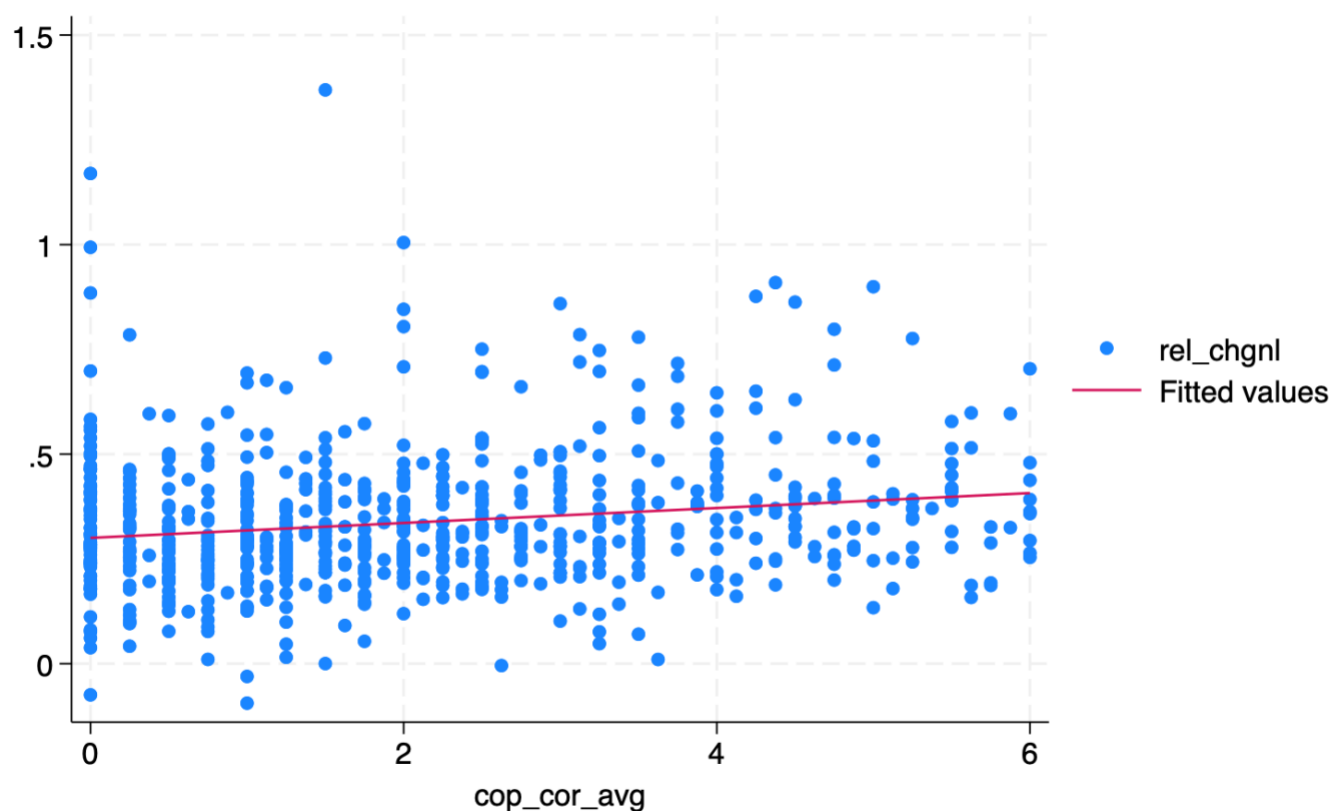*Figure 9: Scatter plot with fitted line of relative change in nightlight in natural logarithm from 2017 to 2021 over high school attainment percent per 2021census*

Political Leadership

- Focused on chairperson only
- Only 14 female observations across 735 observations
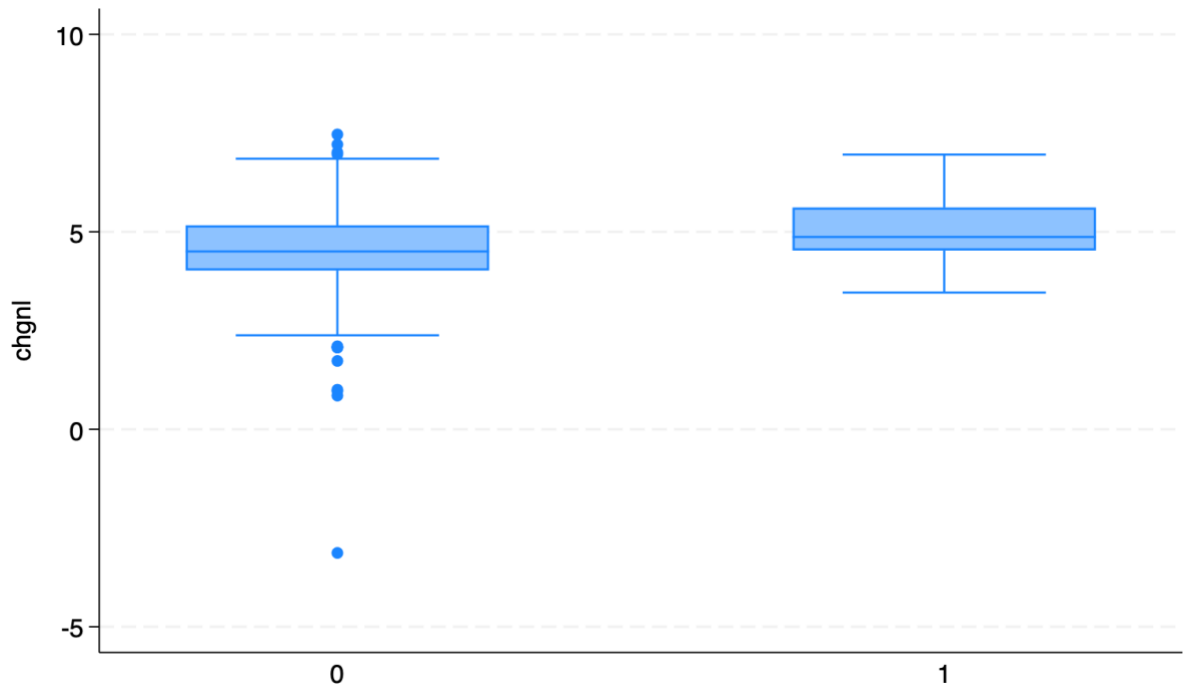
Figure 10: Box plot of relative change in nightlight in natural logarithm from 2017 to 2021 across male and female. 0 indicates males whereas 1 indicates female.
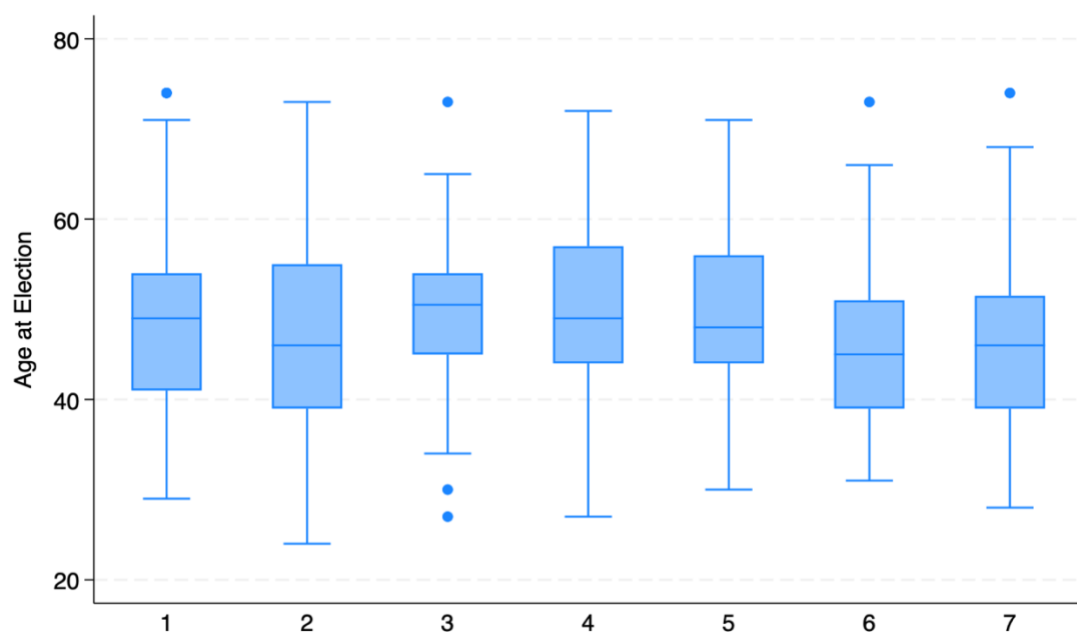
Figure 11: Box plot of age at election in 2017 across 7 provinces
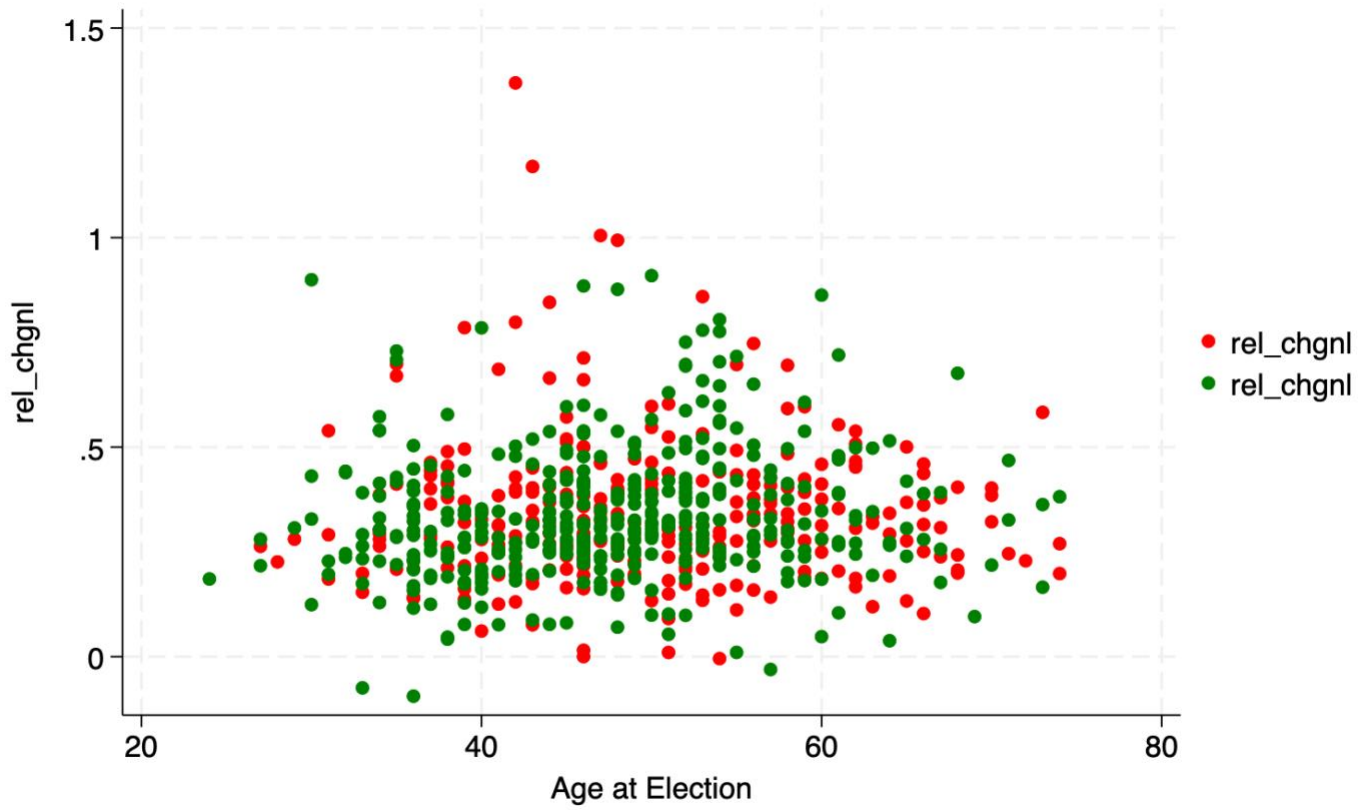
Figure 12: scatter plot of relative change in nightlight in natural logarithm from 2017 to 2021 over age at election of municipality chairperson in 2017. Red dots indicate the affiliation to opposition whereas green dots indicate the affiliation to government coalition.

Variables and Date Sources

1. **chgnl**: log (sum of nightlight of 2021 – sum of nightlight of 2017)
   Extracted from VIIRS Nighttime Lights dataset using QGIS software

2. **log_baseline_nl:** log (average of sum of nightlight of 2014, 2015, 2016, 2017)
   Extracted from VIIRS Nighttime Lights dataset using QGIS software

3. **lisa_avg**: average LISA score of 2020/21 and 2021/22 (In case, LISA score of 2020/21 was not available, LISA score of 20 21/22 is considered to be the average)
   Downloaded from LISA website of the government of Nepal

4. **high_school_percentage:** percentage of population who have completed high school (to be changed to percentage of population who have completed high school or above)
   *Manually constructed dataset from datasets of each province from National Population and Housing Census 2021*

5. **ageatelection**: age of chairperson at election in 2017
   Manually constructed dataset from the election result pdfs published in Nepali

6. **gov_coalition**: dummy variable Government Coalition = 1 if the chairperson of the municipality is affiliated with the parties in the federal government coalition
   Manually constructed dataset from the election result pdfs published in Nepali and then coded in Stata

7. **female**: dummy variable female = 1if the chairperson is a female
   Manually constructed dataset from the election result pdfs published in Nepali and then coded in Stata

8. **ln_popn**: log of population as per census of 2021
   Extracted from the Preliminary Data of National Population and Housing Census 2021

9. **LISA sub-categories averages of 2020/21 and 2021/22**

SN	Category Title	Points	Coded variable
1	Governance Management	9	gov_magm_avg
2	Organization & Administration	8	org_admin_avg
3	Budget Plan Management	11	budg_magm_avg
4	Fiscal Economic Management	11	fiscal_magm_avg
5	Service Delivery	16	service_dev_avg
6	Judicial Execution	9	jud_exe_avg
7	Physical Infrastructure	13	phy_infra_avg
8	Social Inclusion	10	soc_inc_avg
9	Environmental Protection and Disaster Management	10	env_protec_avg
10	Cooperation and Coordination	6	cop_cor_avg
	Total	**100**	

Regression Results

Initial Regression

VARIABLES	(1) rel_chgnl	(2) rel_chgnl	(3) rel_chgnl	(4) rel_chgnl	(5) rel_chgnl	(6) rel_chgnl	(7) rel_chgnl	(8) rel_chgnl
log_baseline_nl	0.014	0.011	0.007	0.007	0.007	0.006	0.005	-0.013
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
lisa_avg		0.001*	-0.000	-0.000	-0.000	0.000	0.000	-0.000
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
high_school_percent			0.015***	0.015***	0.015***	0.016***	0.015***	0.013***
			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
ageatelection					0.000	0.000	0.000	-0.000
					(0.001)	(0.001)	(0.001)	(0.001)
gov_coalitiion						-0.021*	-0.021*	-0.021*
						(0.013)	(0.013)	(0.012)
female							0.052	0.058
							(0.047)	(0.050)
ln_popn								0.066***
								(0.008)
Constant	0.265***	0.211***	0.192***	0.192***	0.174**	0.191***	0.190***	-0.328***
	(0.049)	(0.062)	(0.060)	(0.060)	(0.068)	(0.071)	(0.071)	(0.074)
Observations	692	692	692	692	692	692	692	692
R-squared	0.003	0.012	0.084	0.084	0.084	0.088	0.090	0.176

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

LISA Regression

VARIABLES	(1) rel_chgnl	(2) rel_chgnl	(3) rel_chgnl	(4) rel_chgnl	(5) rel_chgnl	(6) rel_chgnl	(7) rel_chgnl	(8) rel_chgnl	(9) rel_chgnl	(10) rel_chgnl	(11) rel_chgnl	(12) rel_chgnl
log_baseline_nl	0.014	0.014	0.014	0.012	0.012	0.012	0.012	0.008	0.008	0.006	0.006	0.005
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
gov_magm_avg		0.004	0.006	0.002	0.004	-0.002	-0.001	-0.003	-0.004	-0.004	-0.006	-0.010
		(0.007)	(0.008)	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
org_admin_avg			-0.003	-0.006	-0.004	-0.009	-0.009	-0.011	-0.011	-0.012*	-0.012*	-0.006
			(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
budg_magm_avg				0.008	0.010*	0.007	0.007	0.004	0.003	0.003	0.003	0.003
				(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
fiscal_magm_avg					-0.005	-0.008	-0.008	-0.010	-0.010	-0.010*	-0.011*	-0.010*
					(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
service_dev_avg						0.010***	0.010**	0.007*	0.007	0.007	0.006	0.006
						(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
jud_exe_avg							-0.000	-0.003	-0.003	-0.004	-0.005	-0.012*
							(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
phy_infra_avg								0.012***	0.012***	0.011***	0.008**	0.007**
								(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
soc_inc_avg									0.002	0.000	-0.001	-0.003
									(0.004)	(0.004)	(0.004)	(0.004)
env_protec_avg										0.006	0.002	-0.003
										(0.005)	(0.005)	(0.005)
cop_cor_avg											0.018***	0.016***
											(0.005)	(0.005)
high_school_percent												0.015***
												(0.003)
Constant	0.265***	0.237***	0.235***	0.235***	0.240***	0.240***	0.240***	0.299***	0.303***	0.314***	0.356***	0.323***
	(0.049)	(0.079)	(0.078)	(0.078)	(0.080)	(0.079)	(0.079)	(0.080)	(0.080)	(0.081)	(0.082)	(0.081)
Observations	692	692	692	692	692	692	692	692	692	692	692	692
R-squared	0.003	0.004	0.004	0.008	0.009	0.017	0.017	0.034	0.034	0.035	0.054	0.120

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Revised Regression

VARIABLES	(1) rel_chgnl	(2) rel_chgnl	(3) rel_chgnl	(4) rel_chgnl	(5) rel_chgnl	(6) rel_chgnl	(7) rel_chgnl	(8) rel_chgnl	(9) rel_chgnl
log_baseline_nl	0.014	0.008	0.007	0.004	0.004	0.003	0.003	0.002	-0.015*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
phy_infra_avg		0.009***	0.004	0.001	0.001	0.001	0.001	0.001	-0.002
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
cop_cor_avg			0.014***	0.010**	0.010**	0.010**	0.010**	0.010**	0.010**
			(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
high_school_percent				0.014***	0.014***	0.014***	0.014***	0.014***	0.012***
				(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
ageatelection					0.000	0.000	0.000	0.000	-0.000
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
female						0.052	0.052	0.052	0.057
						(0.046)	(0.046)	(0.048)	(0.051)
gov_coalitiion								-0.022*	-0.021*
								(0.013)	(0.012)
ln_popn									0.065***
									(0.008)
Constant	0.265***	0.240***	0.246***	0.192***	0.182***	0.181***	0.181***	0.201***	-0.318***
	(0.049)	(0.050)	(0.051)	(0.051)	(0.062)	(0.062)	(0.062)	(0.066)	(0.075)
Observations	692	692	692	692	692	692	692	692	692
R-squared	0.003	0.021	0.034	0.093	0.094	0.096	0.096	0.100	0.183

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Reflections

- Working on an independent project is sometimes daunting and lonely
    - Sometimes I get stuck with "I don't know what to do next!"

- Realization of both ambition and caution
    - How do I understand causality with simply the training of ECON31

- Regardless of the uncertainty, I have enjoyed the process of independent study

- What inspires me to wake up every day and work on the project
    - I am employing my knowledge in my own context
    - Envisioning that one day my work could be a policy recommendation for strengthening federalism in Nepal and beyond
    - Knowing that I am learning and discovering everyday
    - Looking back at my only other empirical project---final project of ECON3

Key Questions

- What further can I accomplish with this dataset?

- How can I turn this summer research into:
    - A publishable paper
    - An aid to research position (and later grad school) applications

Sources

Li, J., Xue, E., Wei, Y. *et al.* How popularising higher education affects economic growth and poverty alleviation: empirical evidence from 38 countries. *Humanit Soc Sci Commun* **11**, 520 (2024). https://doi.org/10.1057/s41599-024-03013-5

Li, J., Xue, E., Wei, Y. *et al.* How popularising higher education affects economic growth and poverty alleviation: empirical evidence from 38 countries. *Humanit Soc Sci Commun* **11**, 520 (2024). https://doi.org/10.1057/s41599-024-03013-5

Liu H, He X, Bai Y, Liu X, Wu Y, Zhao Y, Yang H. Nightlight as a Proxy of Economic Indicators: Fine-Grained GDP Inference around Chinese Mainland via Attention-Augmented CNN from Daytime Satellite Imagery. *Remote Sensing*. 2021; 13(11):2067. https://doi.org/10.3390/rs13112067

Tveit, T., Skoufias, E. & Strobl, E. Using VIIRS nightlights to estimate the impact of the 2015 Nepal earthquakes. *Geoenviron Disasters* **9**, 2 (2022). https://doi.org/10.1186/s40677-021-00204-z

World Bank, Power-Less to Powerful , 2019, Accessed on July 6, 2024 https://www.worldbank.org/en/news/feature/2019/11/25/power-less-to-powerful