Call Your Leader: Does the Mobile Phone Affect Policymaking?

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Motivation

- The role of media and the rapid growth of information and communication technology (ICT) are becoming significant over the years.
- Aker and Mbiti (2010) documented the growth of mobile phone adoption and its impacts on Africa's economic development.
  - Mobile phones connect individuals to individuals, information, markets, and services.
- The World Bank (2016) depicts the extensive growth of ICTs across the developing countries.
- Nonetheless, studies on the impact of ICT in policy-making are (still) limited.
  - Limited evidence on the role of the mobile phone on policies.
- Most of the previous studies focused on the impact of (mass) media (e.g. television, radio and newspaper) on voter turnout or political accountability (Besley and Burgess, 2002; Strömberg, 2004; Olken, 2009; Snyder Jr and Strömberg, 2010; Gentzkow et al., 2011; Enikolopov et al., 2011; and more).

Some Anecdotal Evidence

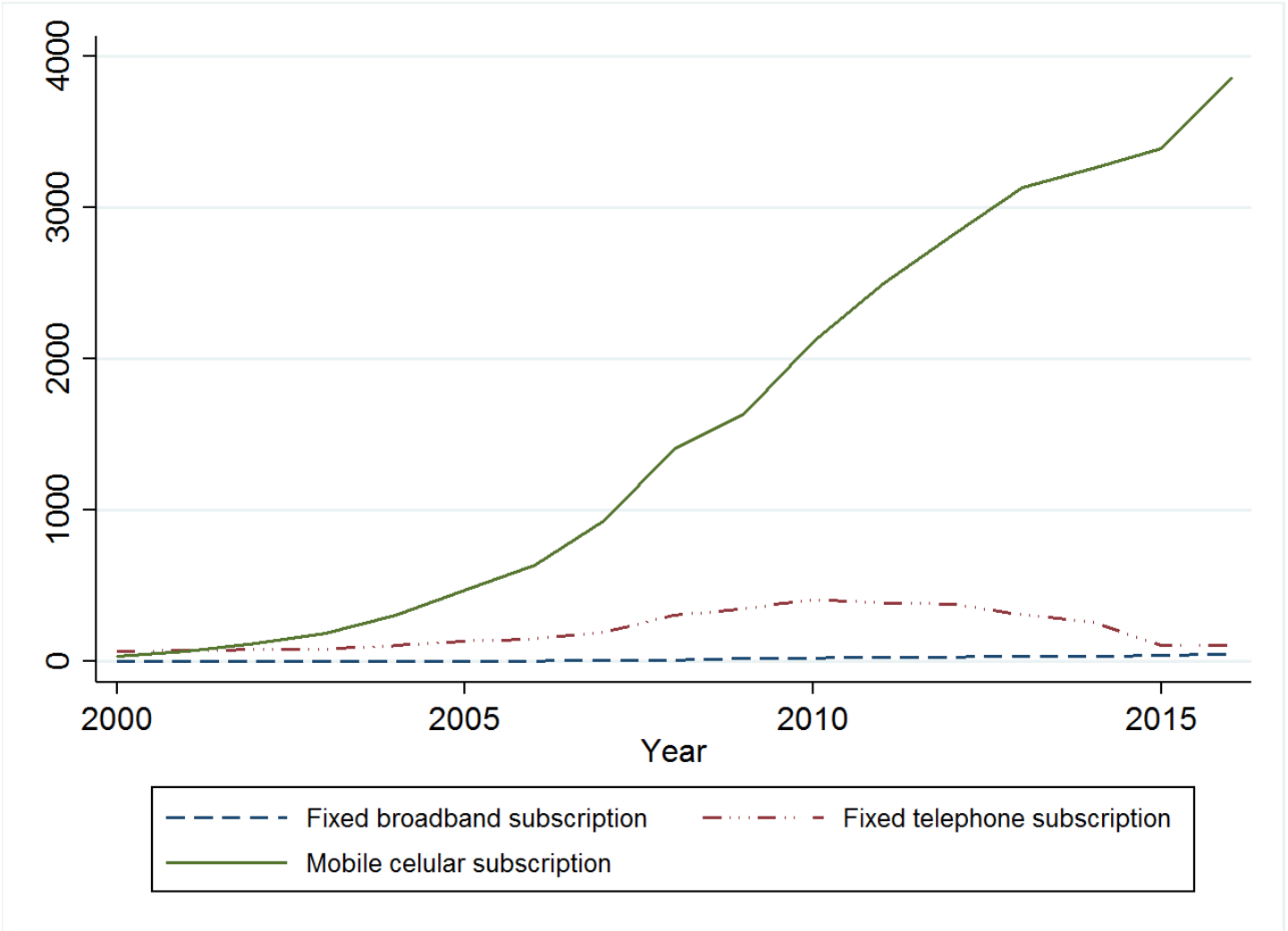
- Call your representatives in the US, especially during the replacement of *Obamacare* and Tax Bill.
  - Celebrities and influencers asked people to call their reps or senators to change their stances or votes.
- The previous governor in DKI Jakarta (Basuki Tjahaja Purnama or *Ahok*) provided his mobile phone number(s) to Jakartans.
  - They can call or text directly to him when they urgently needed some help from the government, e.g. road improvement, ambulance, disaster assistance, etc.

Why Indonesia?

- Indonesia just democratised for 20 years after led by Suharto's authoritarian regime (1966-1998).
- Indonesia becomes more decentralised and local governments have greater responsibility, including village governments.
  - Law No. 22/1999 on regional administration and recently Law No. 6/2014 on village administrations.
- The liberalisation of ICT sectors increase the affordability to use telecommunication services.
  - Law No. 36/1999 on telecommunication followed by an increasing number of telecommunication providers.

Why Indonesia?

The development of ICTs subscription in Indonesia (in 10,000 people)



- In 2002, 11.7 million people owned mobile phone. In 2016, it was 385.5 million people.
- In 2010 almost all of Indonesian people had access to ICT services, especially mobile phone.

This Paper

- This study investigates the role of ICTs (mobile phone) in policy-making in Indonesia
  - Do ICTs or mobile phones affect policy-making of the village leaders?
  - Do ICTs affect social participation activities or civic engagements?

- Address the endogeneity concerns by implementing instrumental variable strategy.

- This study contributes to what extent the mobile phone affects policies and in which place it has significant contribution.

- This study fills the gaps in the importance of mobile phone, not only to increase political participation, but also to improve policies and leader's decisions.

- However, this study does not investigate the role of social media or internet on policies.

Snapshot of the Results

- Villages with higher signal strength have an increased likelihood of having infrastructure programs.
  - Higher signal strength is associated with an increase of the probability of having infrastructure programs by 0.37 points.
- Strong signal strength increases the probability of having economic programs by 0.52 points.
- Villages covered with strong signal strength have a higher probability of having civic engagement activity (increased by 1.59 points).
- The mobile phone has a strong influence in rural villages rather than in urban villages.
  - Mobile phone improves the ability of rural people to interact with their leaders compared with urban people.
  - Different type of governments between urban and rural villages.

Political and Administrative Context

- Indonesia has five main tiers of government
  1. Central government
  2. Province government
  3. District government (*Kabupaten* and *Kota*)
  4. Sub-district government (*Kecamatan*)
  5. Village (*Desa* and *Kelurahan*)

- Law No. 22/1999 on regional administrations provides major reforms in terms of transferring decision making power to district and village governments.
  - Villages are more autonomous. It can elect their village head and run village owned enterprises.
  - There is an annual meeting between village head and villagers to evaluate the village administrations.
  - Previously village head would only report their activities to the district or sub-district governments.

Village Administrative Institutions

- *Desa* village head was elected by the villagers through village elections. Meanwhile, *Kelurahan* village head was appointed by district governments.
- Public goods provision can be funded from village own budget or from other sources of funding, e.g. upper level government transfers and donors.
- Almost 48% of the infrastructure programs at the village level funded by the village own budgets (Central Bureau of Statistics, 2014).

ICTs Development in Indonesia

- Before 1999, telecommunication sectors were monopolised by PT Telkom (State Owned Enterprise).
- Law No. 36/1999 on telecommunication embarked the liberalisation of ICTs
  - Private companies in ICT sectors can enter the market.
  - Remove the restrictions for foreign companies to the telecommunication market.
- As the results, currently there are 6 "big companies" in the telecommunication sectors. Telecommunication costs therefore have been decreasing.
- In 2005, The Indonesian Broadband Plan (*Palapa Ring Project*) was introduced. The aim is to increase the access to ICTs for all part of Indonesia. Especially remote and outer areas.

Conceptual Framework

1. **M1** The mobile phone increases the incentive for the citizens to report or request their need to the village leader
   - Grossman et al. (2016) and Grossman et al.(2014): the mobile phone reduces telecommunication costs and therefore increases the probability of voters to engage and communicate with their leaders

2. **M2** The mobile phone becomes the media to transfer information among villagers and therefore increase the pressure to the village leader to perform well
   - ICT increases the exhange of information among the population and the consequences of this is an increase in political mobilisation and pressure for the government (see, among others, Manacorda and Tesei (2017); Pierskalla and Hollenbach (2013); Shapiro and Weidmann (2015)).

3. **M3** Village leader uses the mobile phone to spread information to her/his villagers
   - Village leader provides information to her/his people which could also affect civic engagement activities
   - Related to study about persuasion (see DellaVigna and Gentzkow (2010)) and media on policies (See Strömberg (2001) and Strömberg (2004)).

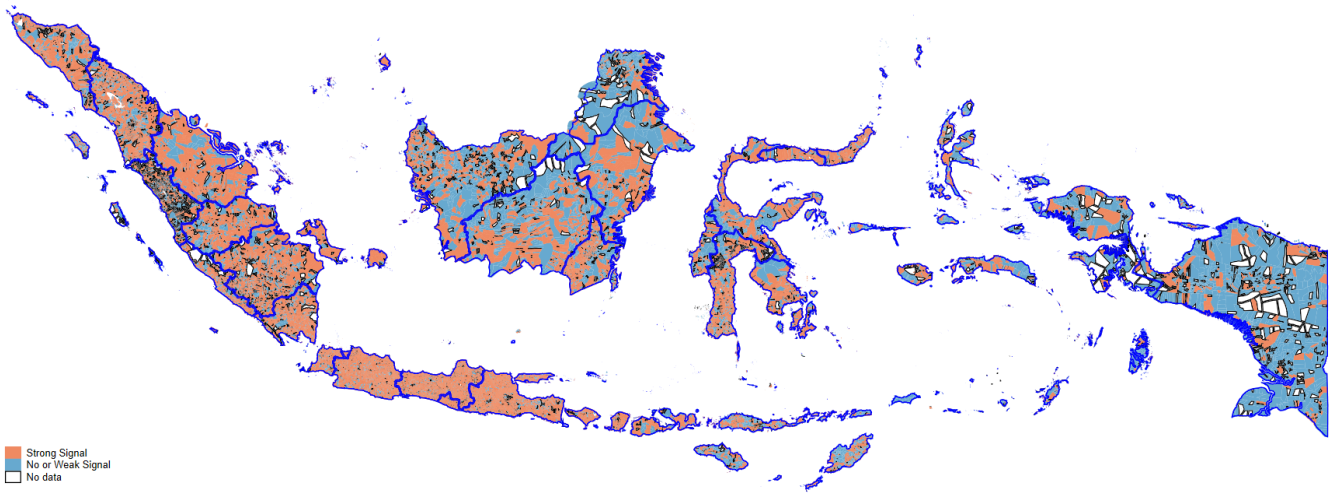
Data

- The Indonesian Village Potential Statistics (PODES)
  - Census of the village that provides comprehensive information about village characteristics across Indonesia.
  - Every two or three years, Central Bureau of Statistics Republic of Indonesia (BPS-RI) conducted the census. In every waves, the statistics has a different focus. Therefore, some variables are not reported in all waves.
- Unit of observation: Village levels
- # of Villages: 14,221
- Period of study: 2008, 2011 and 2014.
- Total # of observations: 42,663 Summary Statistics

Main Variables

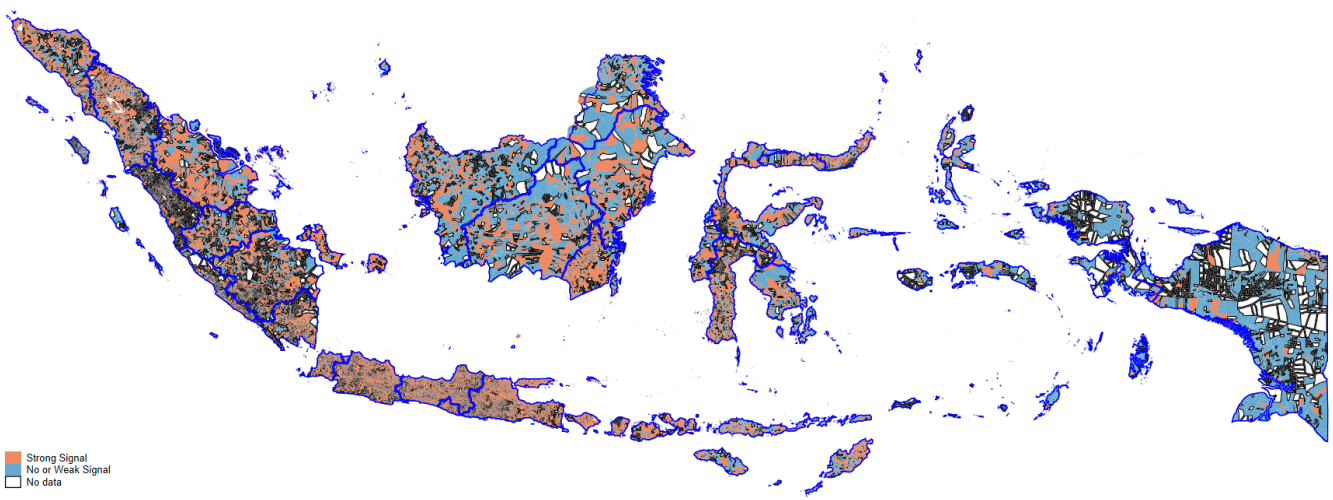
- Main dependent variables:
  1. Infrastructure programs: Dummy variable for infrastructure programs (e.g. irrigation system, housing, schools, bridge, etc.) funded by village budget.
  2. Economic empowerment programs: Dummy variable for economic empowerment/programs (e.g. grant, training) funded by village budget.
  3. Civic engagement activities: Dummy variable for civic engagement or social participation activity (*gotong royong* or mutual and reciprocal assistance (Bowen, 1986)).
- Main explanatory variable
  - Signal strength: Dummy variable for mobile phone signal strength
  - 1 = signal is very strong; 0 = otherwise

Figure: Mobile Phone Signal Strength at Village Level in 2014



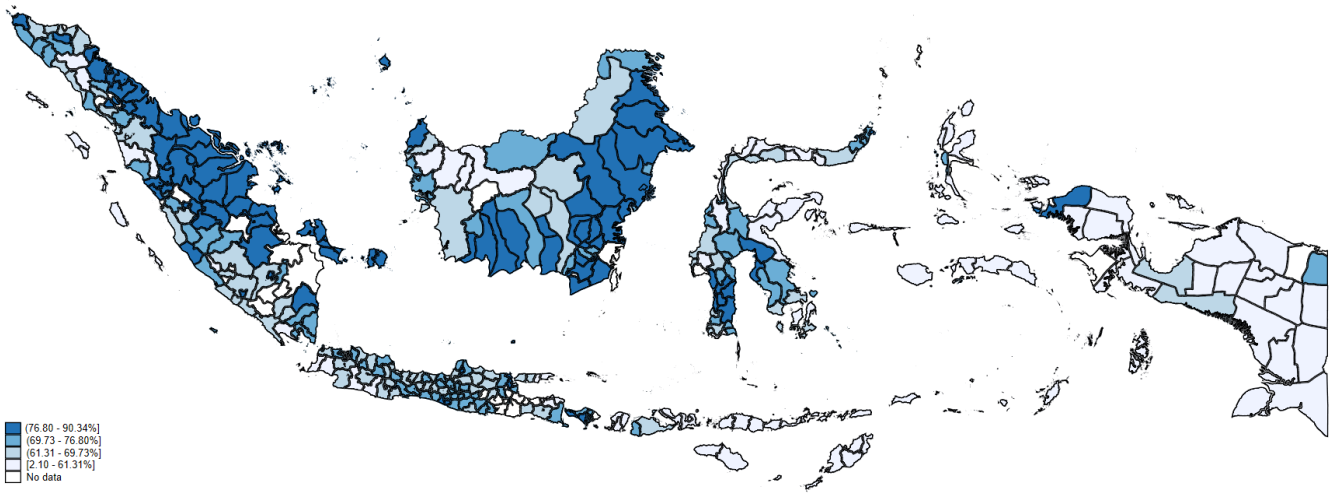
Source: Author's calculation from Podes 2014

Figure: Mobile Phone Signal Strength at Village Level in 2008



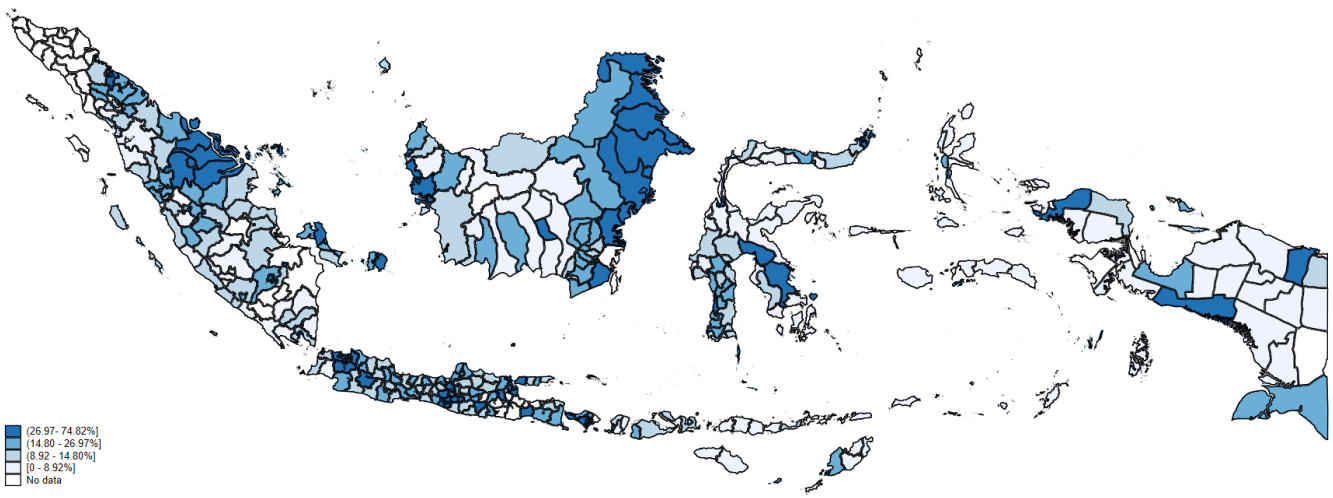
Source: Author's calculation from Podes 2008

Figure: Mobile Phone Subscriptions at District Level in 2010



Source: Author's calculation from Population Census 2010

Figure: Mobile Phone Subscriptions at District Level in 2005



Source: Author's calculation from SUPAS 2005

Empirical Strategy

- In this study, three main econometric methods are used to examine the impact of mobile phone on policies: (1) linear probability model, (2) logit model.

- The linear probability model specification is the following:

$$Y_{v,t} = \beta Signal_{v,t} + \gamma X_{v,t} + \theta_v + \vartheta_t + \epsilon_{v,t} \quad (1)$$

  - $Y_{v,t}$ is the binary dependent variable in the village v at time t.
  - $Signal_{v,t}$ is a dummy variable that has value 1 if the village v at time t has a strong mobile signal strength and 0 if otherwise;
  - $X_{v,t}$ are vector of control variables;
  - θ_v are village fixed effects; and ϑ_t are year fixed effects.

Findings

Infrastructure Programs

	(1)	(2)	(3)	(4)	(5)	(6)
Signal	0.054***	0.011*	0.013*	0.014**	0.11**	0.11***
	(0.0093)	(0.0066)	(0.0068)	(0.0068)	(0.056)	(0.035)
N	42663	42663	41594	41594	34768	41594
R^2	0.001	0.472	0.467	0.470		
pseudo R^2					0.617	
Estimation Method	LPM	LPM	LPM	LPM	Logit	Logit
Village FE	Yes	Yes	Yes	Yes	Yes	No
Year FE	No	Yes	Yes	Yes	Yes	Yes
Urban * Year FE	No	No	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes

* Notes: Robust standard errors in parentheses. The dependent variable in this estimation is dummy variable for infrastructure program at the village level. The years included in the regressions are 2008, 2011 and 2014. Column (5) is the coefficient for the fixed effects logit regression. Column (6) is the coefficient for the random effects logit regression. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Findings

Economic Programs

	(1)	(2)	(3)	(4)	(5)	(6)
Signal	0.050***	0.017**	0.016**	0.017**	0.098**	0.15***
	(0.0087)	(0.0076)	(0.0078)	(0.0078)	(0.044)	(0.031)
N	42663	42663	41594	41594	30076	41594
R^2	0.001	0.212	0.213	0.213		
pseudo R^2					0.285	
Estimation Method	LPM	LPM	LPM	LPM	Logit	Logit
Village FE	Yes	Yes	Yes	Yes	Yes	No
Year FE	No	Yes	Yes	Yes	Yes	Yes
Urban * Year FE	No	No	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes

* Notes: Robust standard errors in parentheses. The dependent variable in this estimation is dummy variable for economic program at the village level. The years included in the regressions are 2008, 2011 and 2014. Column (5) is the coefficient for the fixed effects logit regression. Column (6) is the coefficient for the random effects logit regression. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Findings

Civic Engagement

	(1)	(2)	(3)	(4)	(5)	(6)
Signal	0.051***	0.013**	0.018***	0.019***	-0.020	0.11***
	(0.0079)	(0.0062)	(0.0063)	(0.0063)	(0.080)	(0.041)
N	42663	42663	41594	41594	20500	41594
R^2	0.002	0.357	0.357	0.357		
pseudo R^2					0.693	
Estimation Method	LPM	LPM	LPM	LPM	Logit	Logit
Village FE	Yes	Yes	Yes	Yes	Yes	No
Year FE	No	Yes	Yes	Yes	Yes	Yes
Urban * Year FE	No	No	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes

* Notes: Robust standard errors in parentheses. The dependent variable in this estimation is dummy variable for civic engagement activities at the village level. The years included in the regressions are 2008, 2011 and 2014. Column (5) is the coefficient for the fixed effects logit regression. Column (6) is the coefficient for the random effects logit regression. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Instrumental Variable

- The results from the LPM and Logit estimations might be biased, because of signal strength variable might be non-random. There might be a measurement error in the signal strength variable.

- I employ the plausibly exogenous variation of flash rate intensity per km^2 at the village levels. The similar approach implemented by Manacorda and Tesei (2017).
  - This data is provided by the **US National Aeronautics and Space Administration (NASA)**. It is the mean of flash rate per km^2 between 1998 and 2013.
  - The data is not available for every year, however Andersen et al. (2012) and Manacorda and Tesei (2017) show that there is a consistent pattern for the lightning strike across the period of time
  - Higher flash rate is associate with lower signal quality (Andersen et al., 2012).

- Hence, the first stage for this estimation will be:

$$Signal_{v,t} = \alpha_{v,t} + Z_{v,t} + \gamma X_{v,t} + \theta_v + \vartheta_t + \mu_{v,t} \quad (2)$$

where $Z_{v,t} = Flash\ rate_v * time\ trend$. I also include the set of control variables $X_{v,t}$ as well as village fixed effects (θ_v) and year fixed effects (ϑ_t).

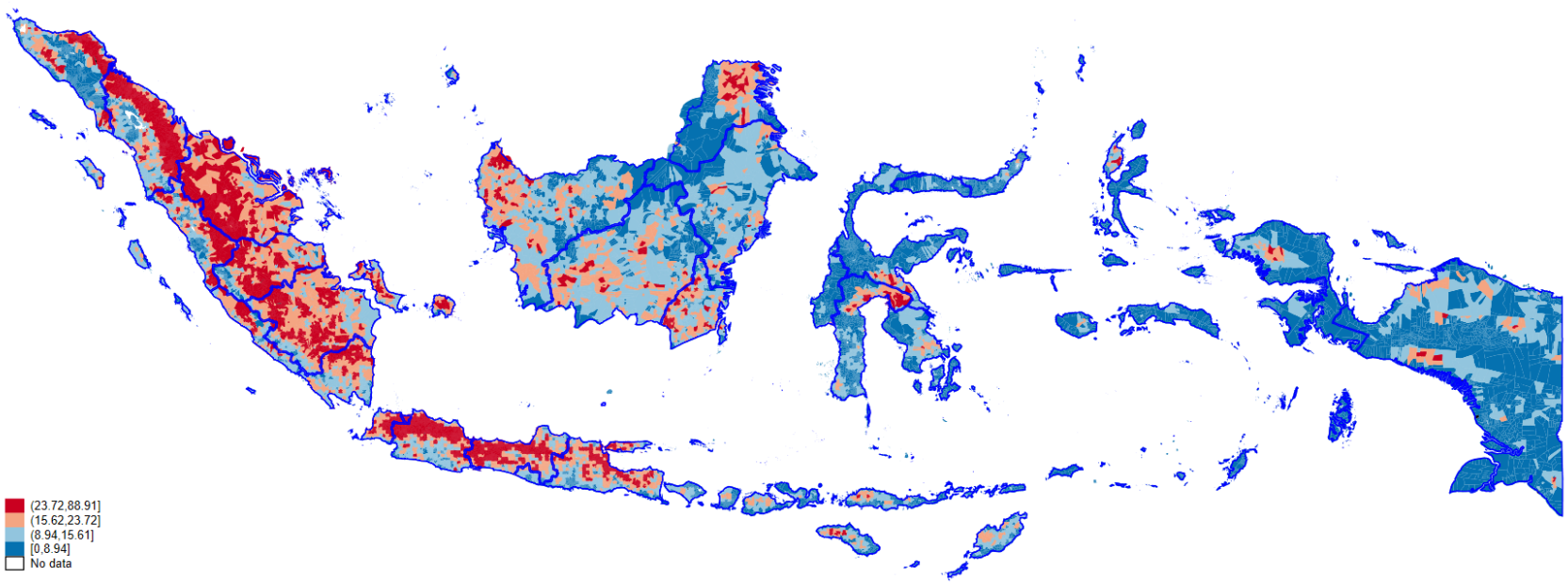
Instrumental Variable

- Cecil et al. (2014) suggest that regions in tropics and sub tropics have higher tendency of annual flash rate.
- Albrecht et al. (2011) also observe that high flash rates are linked to topographical features.
- Indonesia is one of the country which have higher flash rate incidence due to its location and also geographical characteristics
  - The mean flash rate in Indonesia between 1998 and 2013 was 20.29 flash rate per km^2
  - This global flash rate was around 2.9 flash rate/km^2 and the average flash rate in tropic and sub-tropic regions was around 10 flash rate/km^2.

Instrumental Variable

- The underlying assumption: flash rate intensity is plausibly exogenous. It might be not true because flash rate is also depend on geographical conditions.
- The probability of having higher intensity of flash rate would affect village conditions and by the end will affect the policies.
- To isolate this, I perform additional check whether flash rate intensity has any correspondence with the dependent variables conditional on a set of controls and geographical time invariant characteristics.
- This is also to show that the exclusion restriction by using this instrument holds in this study.

Mean Annual Flash Rate Density between 1998 and 2013 (Flash Rate/km^2)



Source: Author's calculation from Cecil et al. (2014)

Instrumental Variable Estimation Results

	(1) Infrastructure Program	(2) Infrastructure Program	(3) Economic Program	(4) Economic Program	(5) Civic Engagement	(6) Civic Engagement
Signal	0.39**	0.37*	0.60**	0.52*	1.43***	1.59***
	(0.19)	(0.21)	(0.27)	(0.29)	(0.34)	(0.40)
N	42663	41561	42663	41561	42663	41561
Estimation Method	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Village FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
First Stage						
Flash Rate Intensity X Time Trend	-0.001***	-0.0009***	-0.001***	-0.0009***	-0.001***	-0.0009***
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
F	26.06	22.46	26.06	22.46	26.06	22.46

* Notes: The years included in the regressions are 2008, 2011 and 2014. Signal strength is instrumented by mean annual flash rate density per km^2. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Exogeneity

Desa versus Kelurahan

	(1)	(2)	(3)	(4)
	Dependent Variable = Infrastructure Program			
Signal	0.011*	0.61*	0.020	0.094
	(0.0063)	(0.34)	(0.031)	(0.47)
R^2	0.466		0.437	
First Stage				
Flash Rate Intensity X Time Trend		-0.0017***		-0.002***
		(0.0004)		(0.0006)
F		12.62		14.22
	Dependent Variable = Economic Program			
Signal	0.019**	0.67	0.046	0.84
	(0.0076)	(0.48)	(0.032)	(0.59)
R^2	0.298		0.339	
First Stage				
Flash Rate Intensity X Time Trend		-0.0017***		-0.002***
		(0.0004)		(0.0006)
F		12.62		14.22
	Dependent Variable = Civic Engagement			
Signal	0.0041	1.82***	0.050*	0.97*
	(0.0054)	(0.63)	(0.029)	(0.57)
R^2	0.404		0.448	
First Stage				
Flash Rate Intensity X Time Trend		-0.0017***		-0.002***
		(0.0004)		(0.0006)
F		12.62		14.22
N	38026	37923	3568	3561
Estimation Method	LPM	2SLS	LPM	2SLS
Year * Topography FE	Yes	Yes	Yes	Yes
Sub-District FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sample	Desa	Desa	Kelurahan	Kelurahan

* Notes: Robust standard errors in parentheses and clustered at the sub-district. The unit of observation is at the village level. Signal strength is instrumented by flash rate intensity at the sub-district levels interacted with time trend.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Additional and Robustness Check

- Selection bias using propensity score matching. Propensity Score Matching
- Replacing dummy for signal strength with ordered signal strength (2 = strong signal, 1 = weak signal and 0 = no signal). Ordered Signal Strength
- Introducing strong and no signal as the alternative explanatory variables. Strong versus no signal
- All estimations show signal strength is positively associated with policies

Conclusions

- This study purpose is to answer whether mobile phone would affect policymaking
  1. It shows that higher signal strength is associated with higher economic and infrastructure programs
  2. Mobile phone increases the probability of having civic engagement
  3. Village heads at the rural village are more responsive
- Mobile phone plays an important role on influencing leader's decision making.
- Need to increase access to ICTs, especially in remote areas.
- Future study might be the role of social media or digital media on policies.

Appendix

Table: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Main Variables					
Infrastructure = 1 if there is program for infrastructure; 0 = otherwise	42,663	0.34	0.48	0	1
Economic = 1 if there is program on providing capital; 0 = otherwise	42,663	0.53	0.49	0	1
Civic Engagement = 1 if village has civic engagement activity; 0 = otherwise	42,663	0.47	0.49	0	1
Signal = 1 if signal is very strong; 0 = otherwise	42,663	0.81	0.39	0	1
Base Transceiver Station = 1 if village has BTS; 0 = otherwise	42,663	0.37	0.48	0	1
Distance to the nearest BTS (in km)	42,663	4.03	9.68	0	400
Other Variables					
Male Leader	41,594	0.94	0.24	0	1
Age	41,594	44.59	8.13	20	87
Years of Education	41,594	12.35	2.66	0	22
Population (in numbers of people)	42,663	4,229.78	4,598.85	16	95,031
Expenditure per Capita (in Rupiah)	42,663	520,427.8	231,317.1	179,700	2,671,080
Main Source of Income 1 = agriculture; 0 = others	42,663	0.84	0.36	0	1
Muslim Majority	42,663	0.44	0.49	0	1
Multi Ethnic	42,663	0.65	0.47	0	1
Numbers of Mosque	42,663	4.78	5.07	0	99
Numbers of Church	42,663	0.55	1.63	0	75
Topography 1 = Top of a Mountain 2 = Valley or Slopes 3 = Lowland	42,663	2.68	0.71	1	3
Coastal	42,663	0.07	0.26	0	1
Transportation Access 1 = by land, 0 = otherwise	42,663	0.96	0.20	0	1
Asphalt Road	42,663	0.75	0.43	0	1
Distance to Jakarta (km)	42,663	705.86	560.04	10.61	3,773.78
Distance to District (km)	42,663	32.35	38.99	0.1	999.8
Distance to Sub-District (km)	42,663	6.69	11.18	0.05	599.8
Village Own Sources Revenues (in million Rupiah)	42,663	80.54	228.94	0	9,857
Additional Informations					
Number of Provinces	27				
Number of Districts	156				
Number of Sub-districts	1188				

Flash Rate Intensity and Dependent Variables

	(1) Infrastructure Program	(2) Economic Program	(3) Civic Engagement
Flash Rate Intensity X Time Trend	-0.0000095	-0.00020	-0.00017
	(0.00019)	(0.00026)	(0.00024)
N	41594	41594	41594
R^2	0.480	0.220	0.306
N	41594	41594	41594
Estimation Method	LPM	LPM	LPM
Year X Island X Topography FE	Yes	Yes	Yes
Village FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

IV

Propensity Score Matching

	(1) Infrastructure Program	(2) Infrastructure Program	(3) Economic Program	(4) Economic Program	(5) Civic Engagement	(6) Civic Engagement
Signal	0.039*	0.012*	0.063***	0.03***	0.036*	0.006
	(0.020)	(0.006)	(0.018)	(0.008)	(0.022)	(0.004)
N	41594	41594	41594	41594	41594	41594
Estimation Method	NNM	Kernel	NNM	Kernel	NNM	Kernel
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Village FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Geographical Controls	Yes	Yes	Yes	Yes	Yes	Yes

* Notes: The years included in the regressions are 2008, 2011 and 2014. The propensity matching results include a full set of control variables and additional geographical variables (topography, urban, paved road, land and distance to sub-district). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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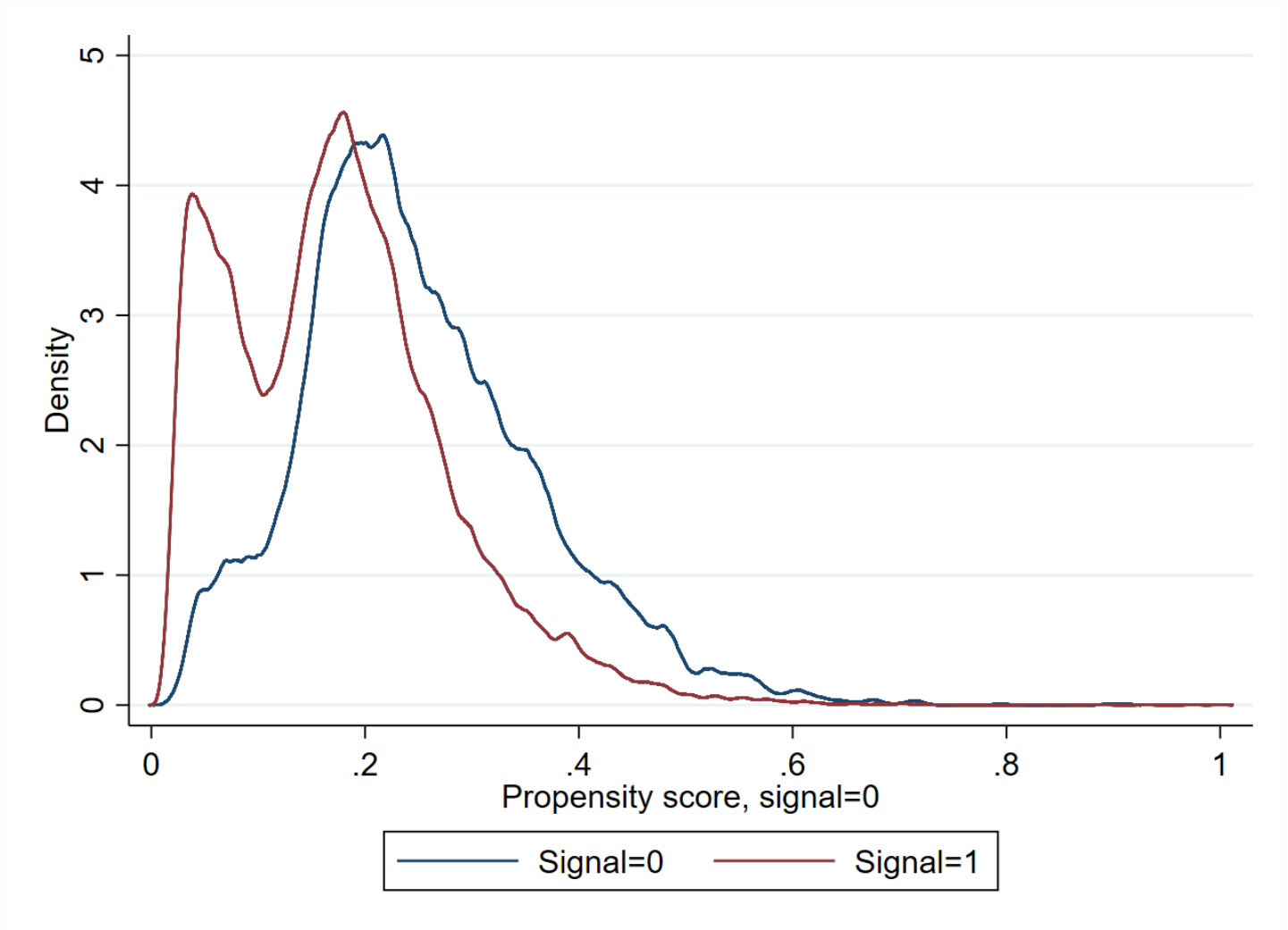
Figure: (Weak) Overlap and Common Support Condition



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Ordered Signal Strength

	(1) Infrastructure Program	(2) Infrastructure Program	(3) Economic Program	(4) Economic Program	(5) Civic Engagement	(6) Civic Engagement
Ordered Signal	0.011*	0.25*	0.011	0.35*	0.019***	1.07***
	(0.0059)	(0.14)	(0.0068)	(0.19)	(0.0057)	(0.22)
N	41594	41561	41594	41561	41594	41561
R^2	0.467		0.213		0.357	
Estimation Method	LPM	2SLS	LPM	2SLS	LPM	2SLS
Village FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
First Stage						
Flash Rate Intensity		-0.0014***		-0.0014***		-0.0014***
X Time Tredmd		(0.0002)		(0.0002)		(0.0002)
F		37.32		37.32		37.32

* Notes: The years included in the regressions are 2008, 2011 and 2014. Ordered signal equal to 2 if signal is strong, 1 if signal is weak and 0 if no signal. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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Strong versus No Signal

	(1) Infrastructure Program	(2) Infrastructure Program	(3) Economic Program	(4) Economic Program	(5) Civic Engagement	(6) Civic Engagement
Strong Signal	0.013*	0.013*	0.018**	0.019**	0.016**	0.0082
	(0.0069)	(0.0070)	(0.0080)	(0.0081)	(0.0064)	(0.0064)
Weak Signal	0.00091	0.0023	0.026	0.027	-0.036*	-0.035*
	(0.018)	(0.018)	(0.021)	(0.021)	(0.019)	(0.019)
N	41594	41594	41594	41594	41594	41594
R^2	0.467	0.467	0.213	0.213	0.357	0.361
Estimation Method	LPM	LPM	LPM	LPM	LPM	LPM
Village FE	Yes	Yes	Yes	Yes	Yes	Yes
Topography * Year FE	No	Yes	No	Yes	No	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

* Notes: The years included in the regressions are 2008, 2011 and 2014. Strong signal is equal to 1 if the village has strong signal and 0 if otherwise. No signal is equal to 1 if the village has no signal and 0 if otherwise. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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