



FONDATION POUR LES ÉTUDES  
ET RECHERCHES  
SUR LE DÉVELOPPEMENT  
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# A new approach for economic impact evaluation of decentralized electrification projects

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African Association for Rural Electrification  
Association Africaine pour l'Électrification Rurale

## Context

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- Scarcity of scientific evaluations of distributed electrification projects, due to the high cost of usual household surveys
- Satellite observation data now routinely produced are more and more used by economists as proxy indicators of economic activity (Berthélemy, Maurel and Ruben, 2020).
- NTL (Night-Time Light), in particular, is a good correlate of GDP at macro national and sub-national levels.

## Outline

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- Data: DMSP & VIIRS ( most relevant databases for NTL data)
  - Methodology
  - Results obtained on DMSP and DMSP-like data
  - Discussion (robustness checks)
    - Comparison with results obtained on larger pixels
    - Comparison with VIIRS data for recent projects
    - Comparison with CoSMMA evaluations when information in CoSMMA can be triangulated
  - policy cocusions

## Data

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- We extracted from CoSMMA 50 projects whose location was precisely known
- We used NTL data observed for 3km by 3km pixels in which these projects are located
- DMSP NTL data are available from 1992 to 2013. Since 2013, DMSP data are no longer available but we have now more precise VIIRS data
- We built homogeneous time series from 1992 to 2018, using data provided by Lee et al. (2020) who transformed VIIRS data into DMSP-like data

## Methodology

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- We extracted information from years prior to the implementation of projects to build predicted NTL values beyond implementation year
- The principle technical issue was to design an adequate treatment of zeroes, which are frequently observed for small villages in DMSP and DMSP-like data
- In some cases, we were able to run regressions defining a linear time trend
- Otherwise, we used as counterfactual the simple average of positive NTL values observed before project implementation

## Methodology

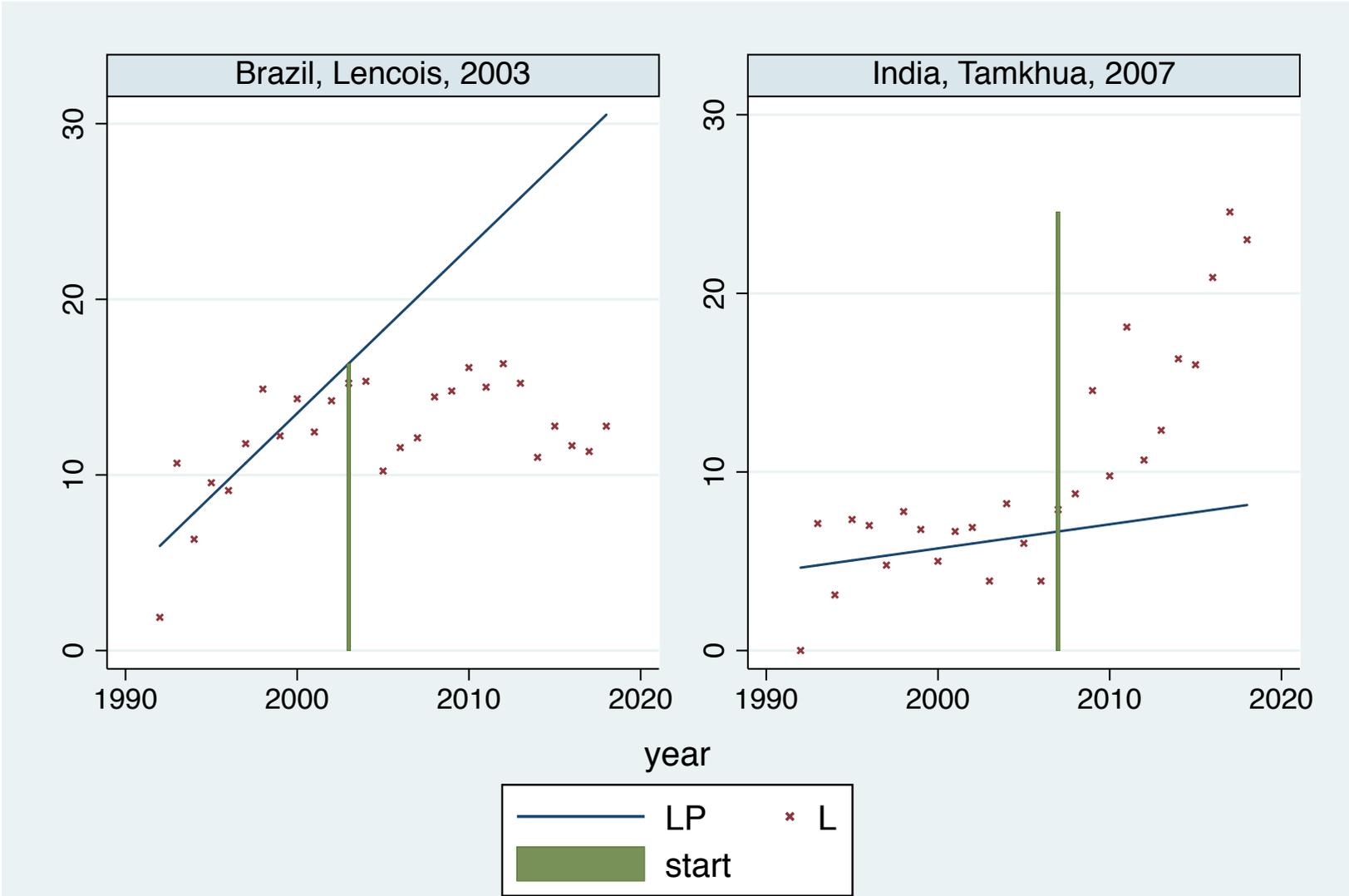
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- The construction of counterfactual trends is associated with the computation of their standard deviation, and the building of statistical tests of significance of divergence of observed NTL from the counterfactual trends
- We decided that a project succeeded in the short run (medium run) if its average NTL over years  $T_0+1$  to  $T_0+3$  ( $T_0+4$  to  $T_0+6$ ) was significantly positive.

# Illustrations

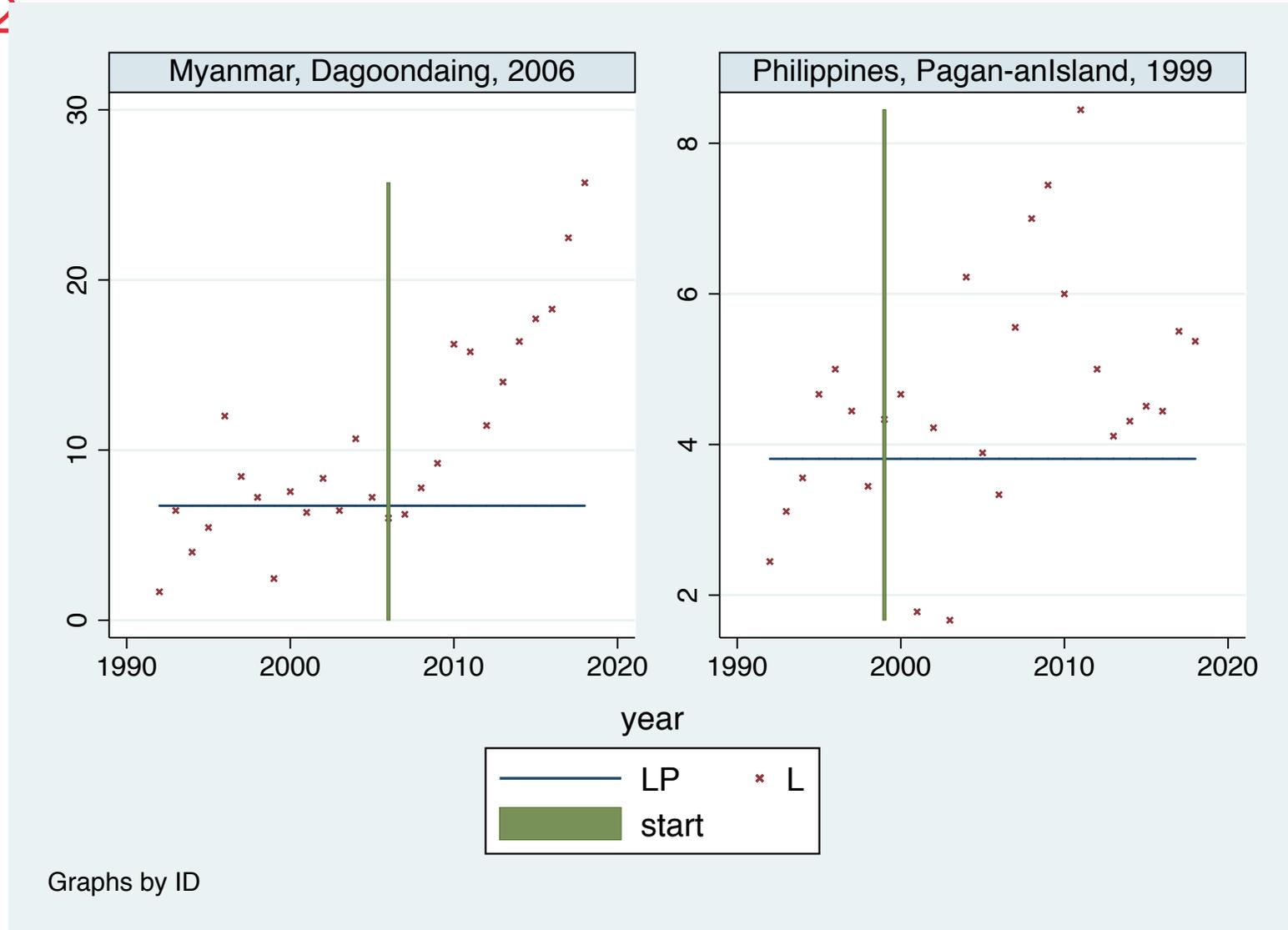


# Illustration 1



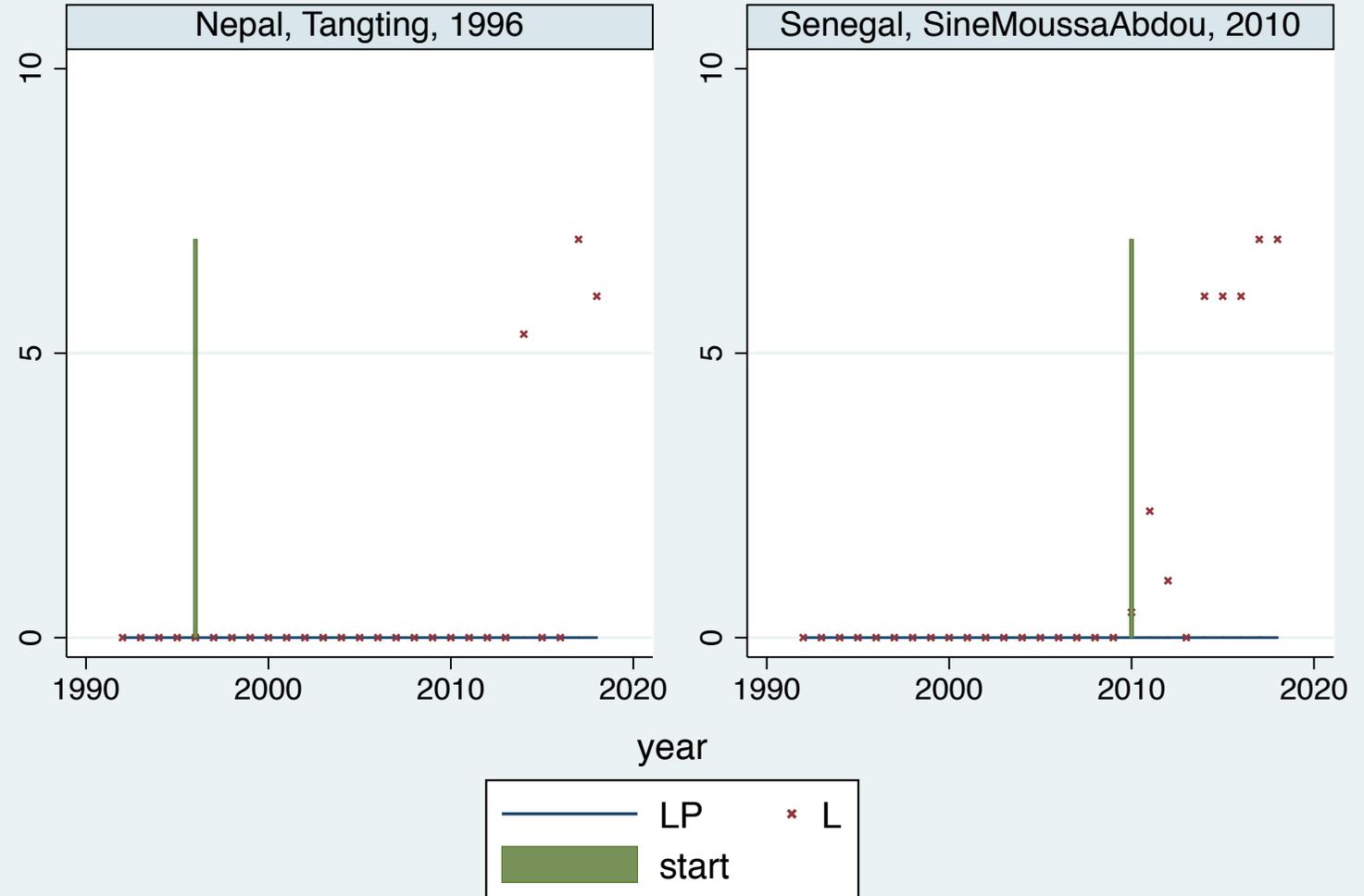
Graphs by ID

## Illustration 2



Graphs by ID

# Illustration 3



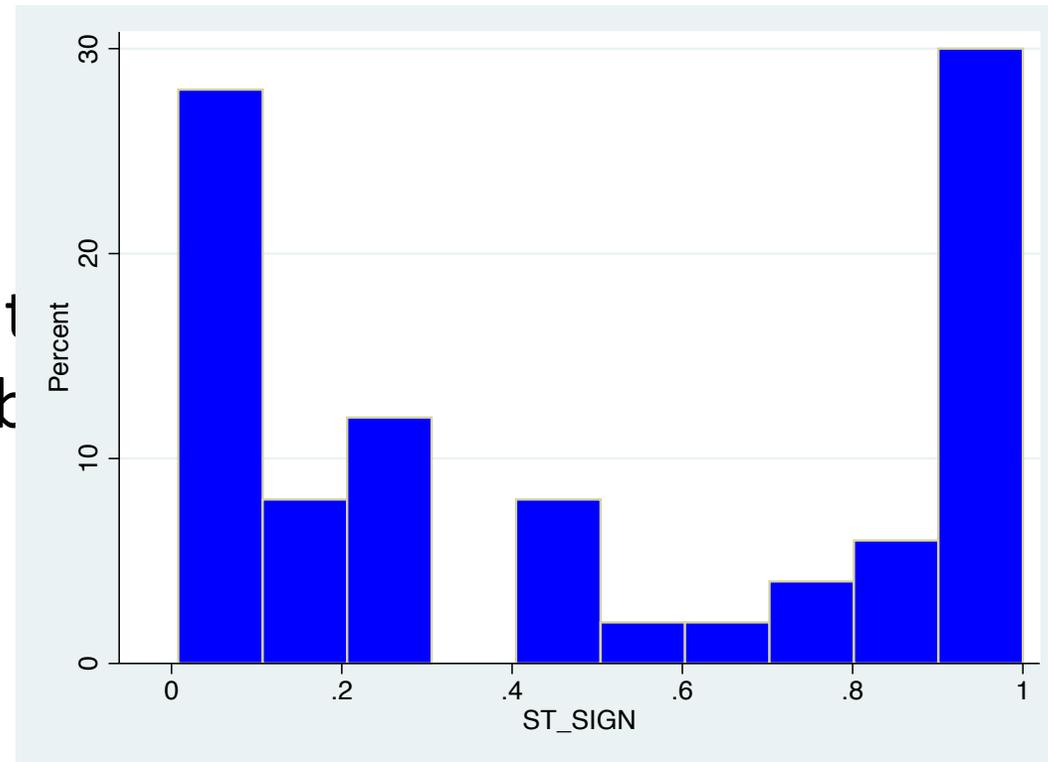
Graphs by ID

# Results



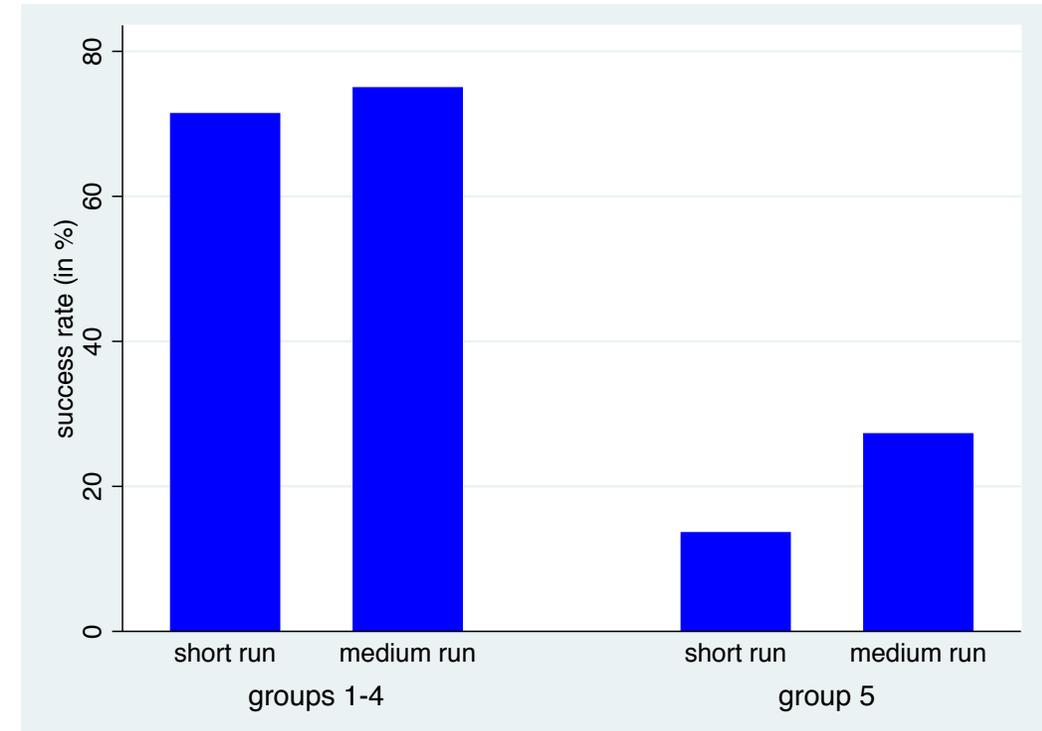
## Identification of probably successful projects

- 49% projects successful in t with a probab equal 80%.



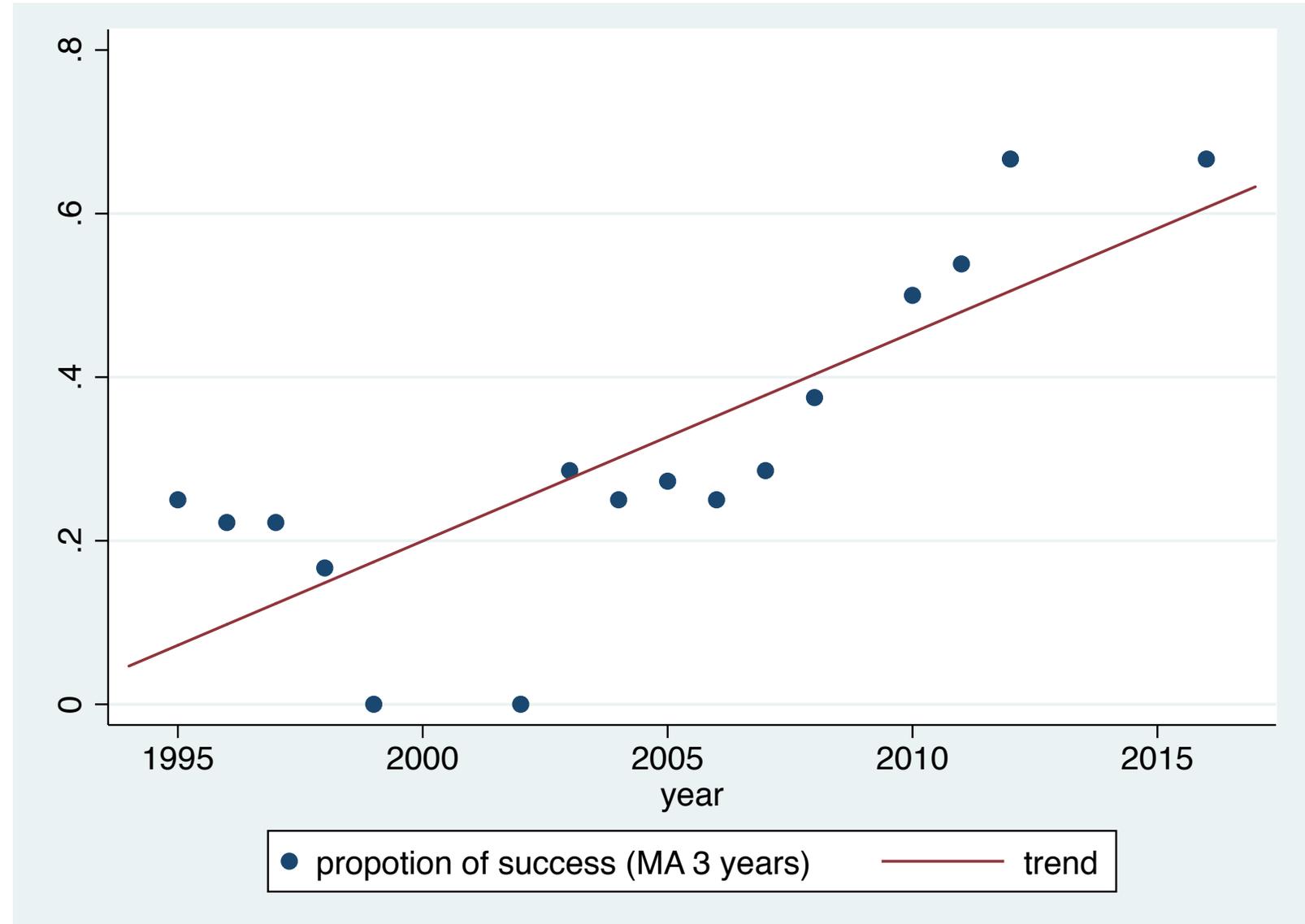
## Success depends on initial conditions

- Success rate of projects in localities Initially (out of the dark) *versus* (in the dark)

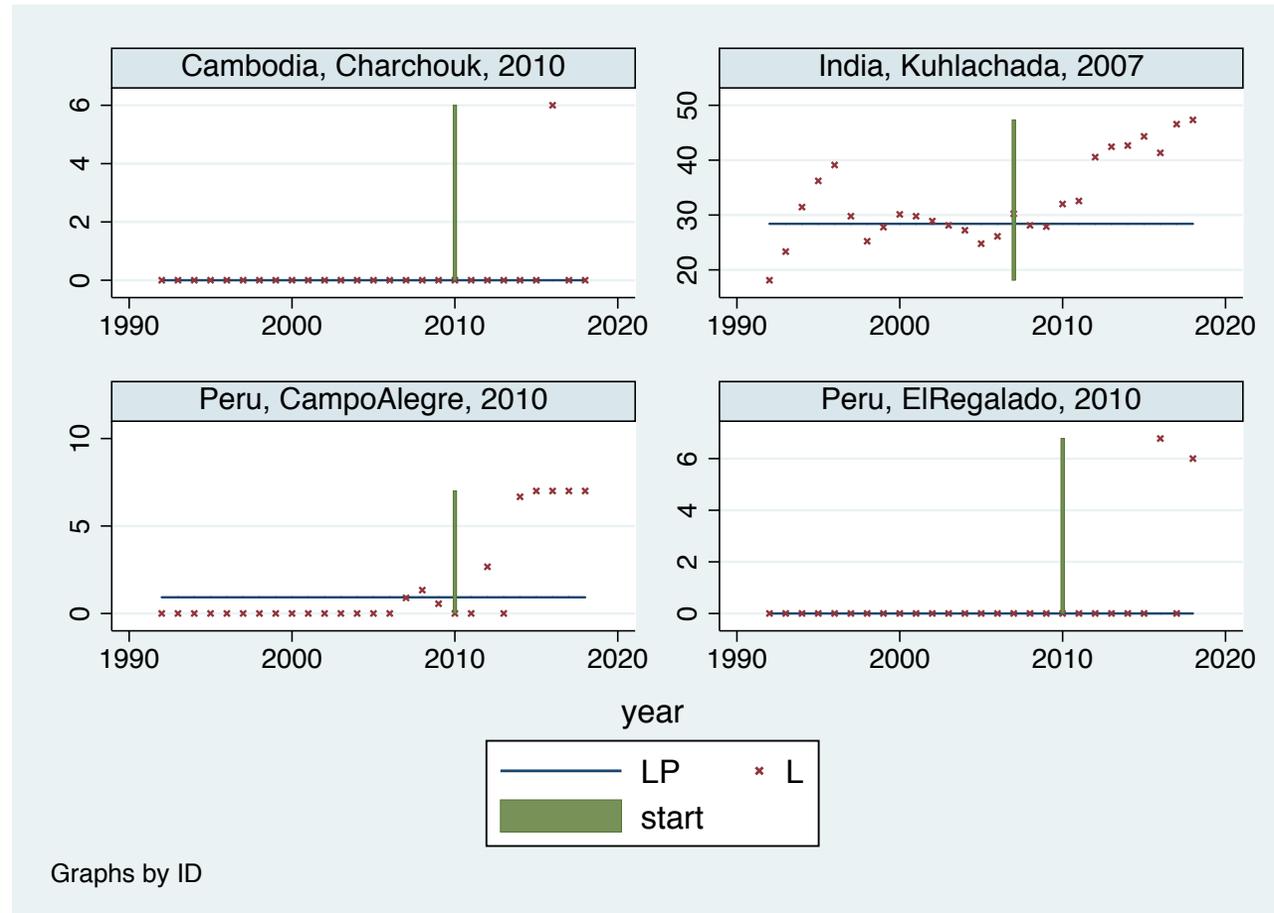


## Progress over time

- The rate of success increased significantly over time

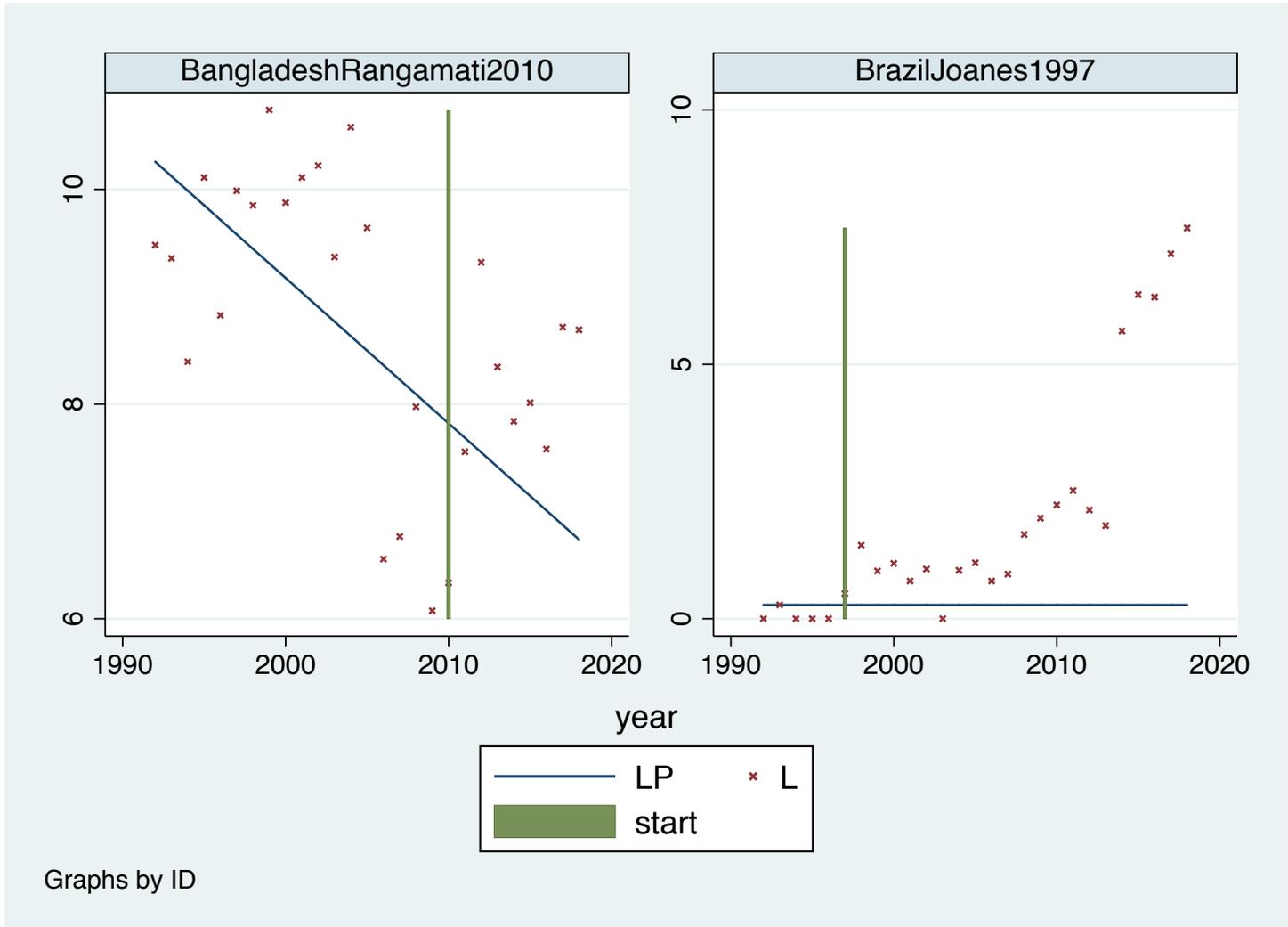


# Success can be delayed, particularly for localities initially in the dark



## Success persists in the medium run

- Only 2 out of 23 successes in the short run are not confirmed in the medium run

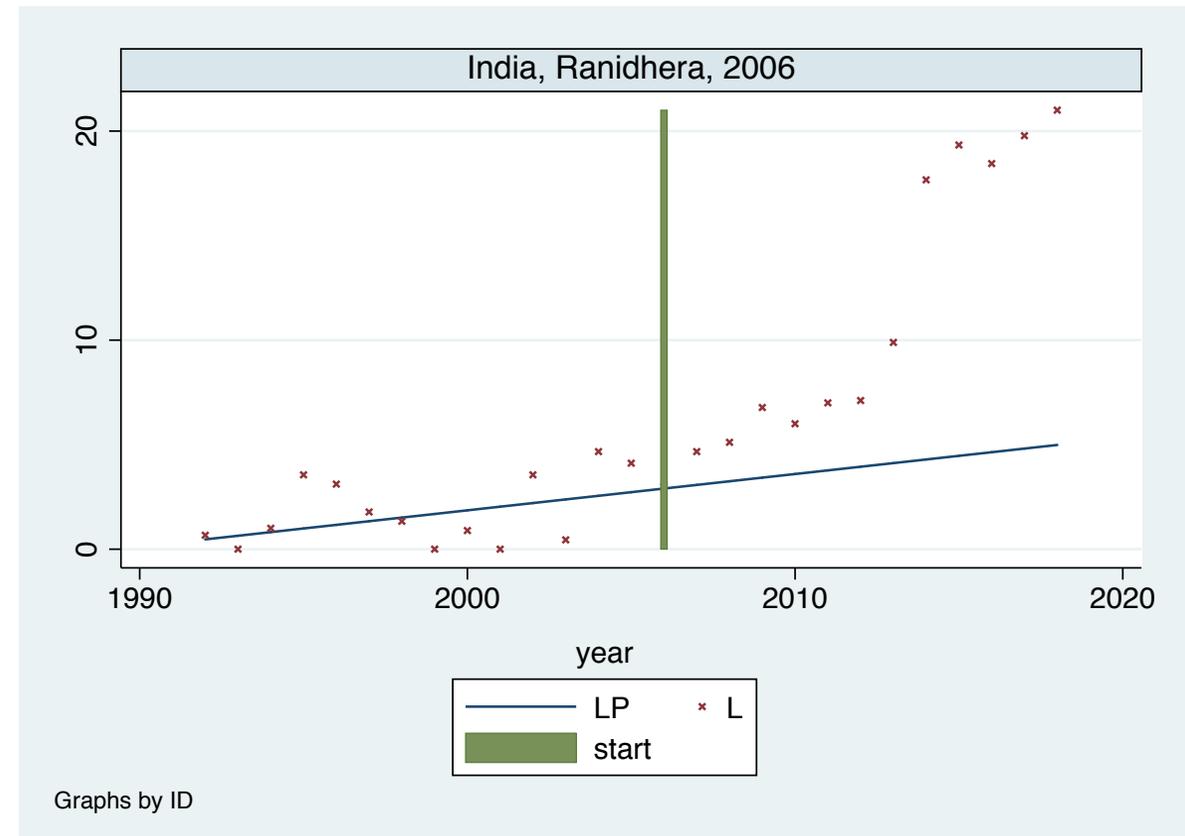


Graphs by ID

## Successful projects trigger a large acceleration of local incomes

- The effect of successful projects on economic activity has a median of 14 %

In Ranidhera, India (Mdiam project), income per capita doubled in ten years

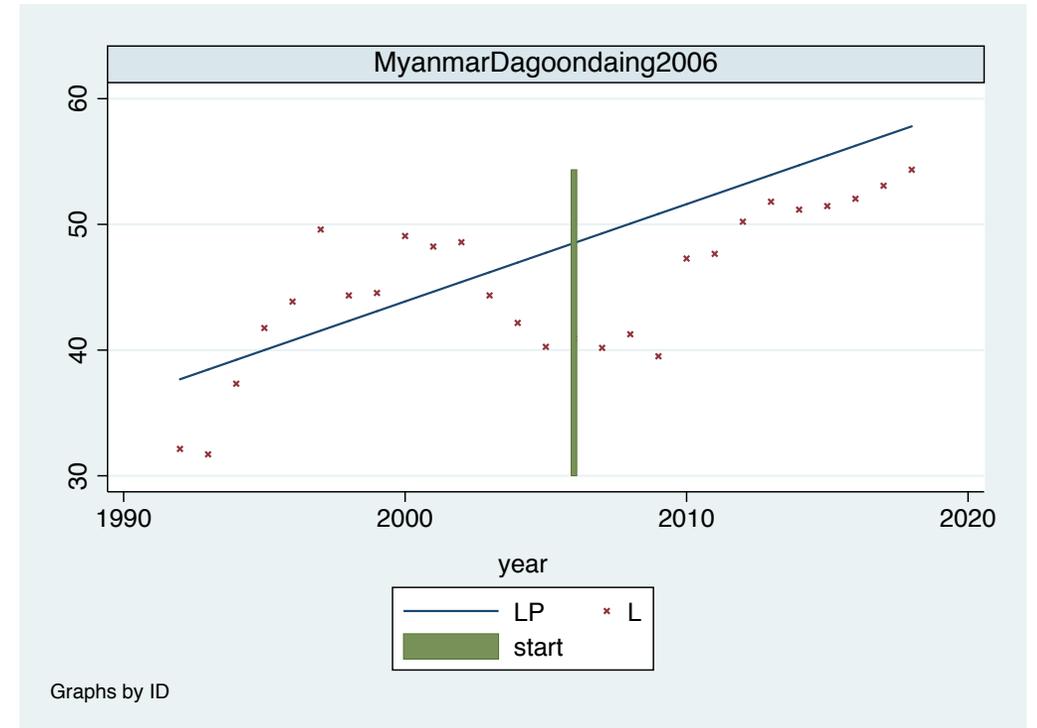
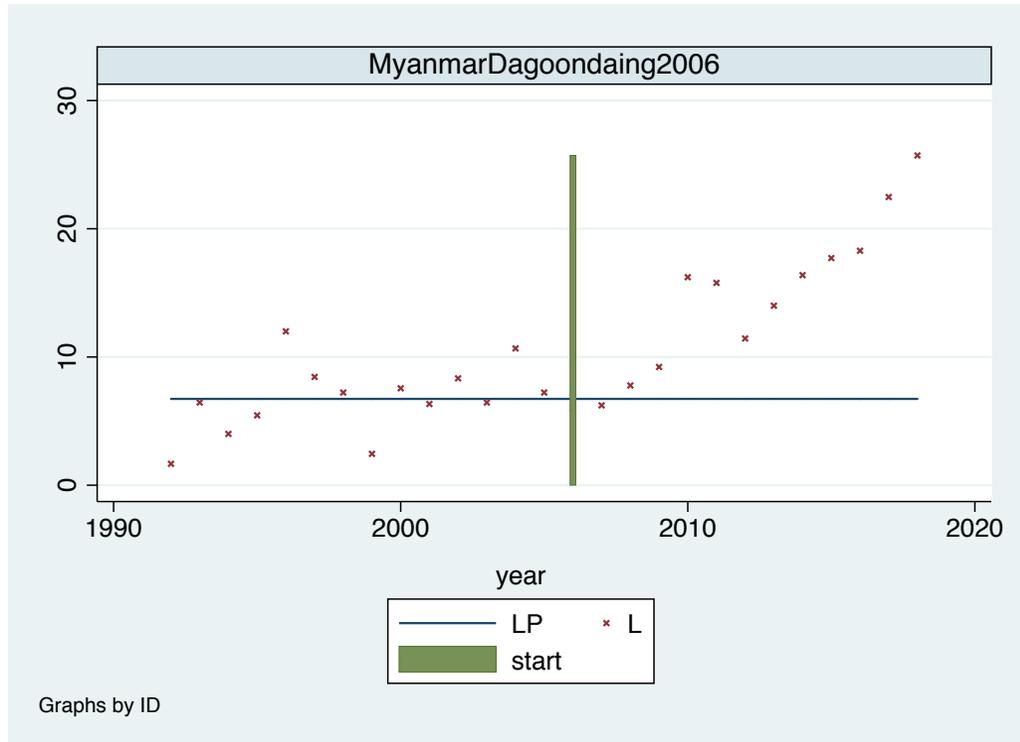


# Robustness checks



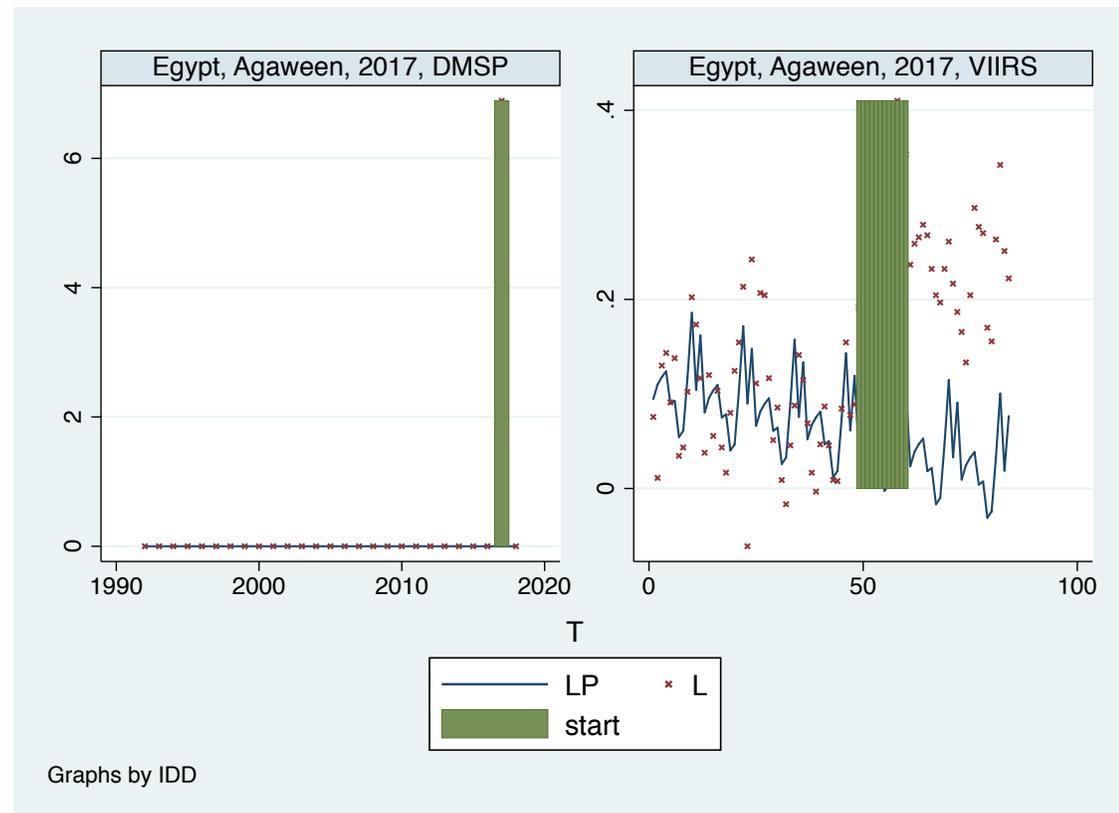
## Comparison with results on 9kmX9km pixels

- All (but one) projects, successful for 3kmx3km pixels, are found successful using 9kmx9km pixels



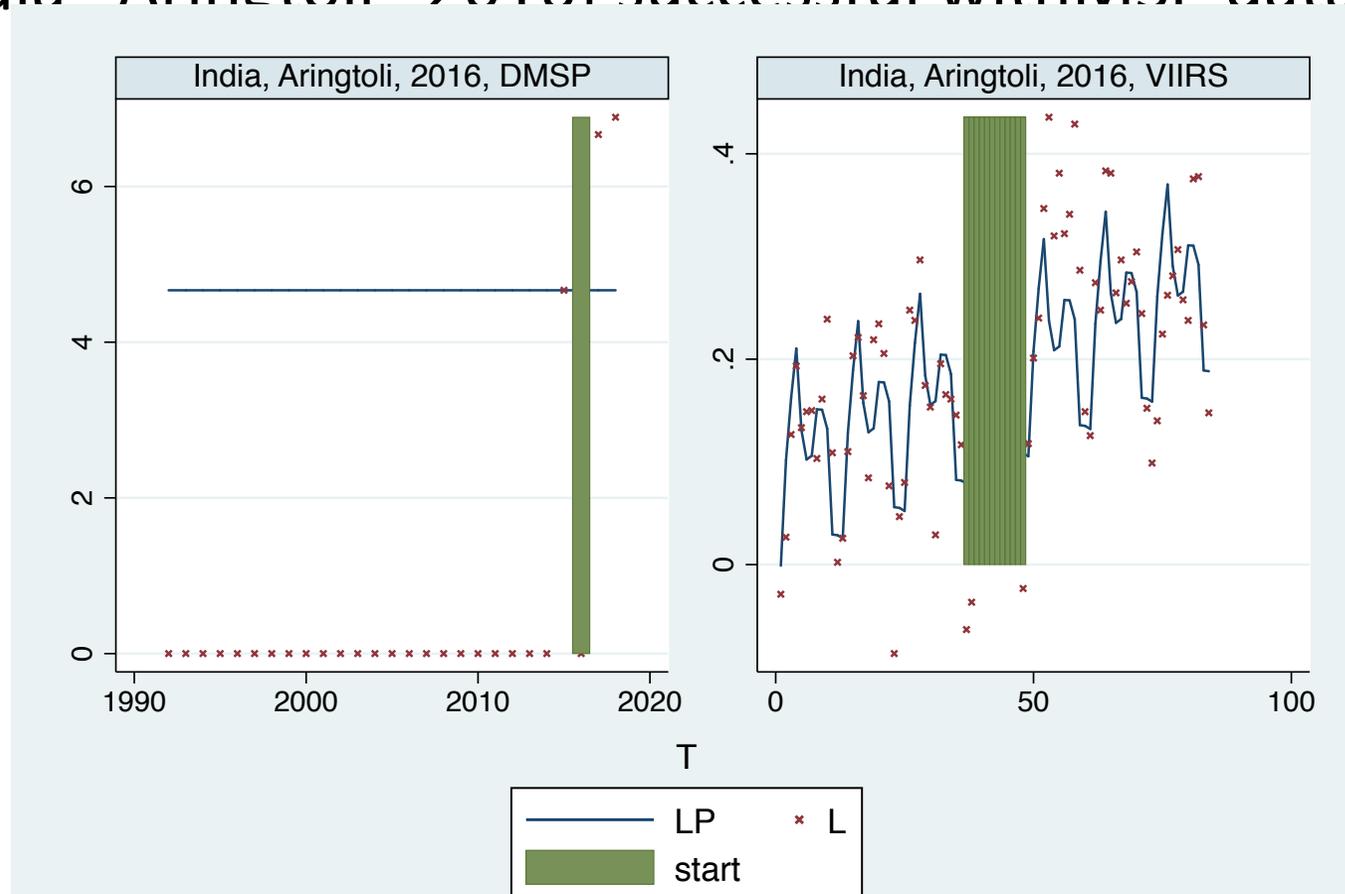
## Comparison with monthly VIIRS data for recent projects

- Project [Egypt , Agaweenn 2017] failed with DMSP data,but was successful with VIIRS data



## Comparison with monthly VIIRS data for recent projects

- Project | India Aringtoli 2016] successful withMSP data, failed with VIIRS data

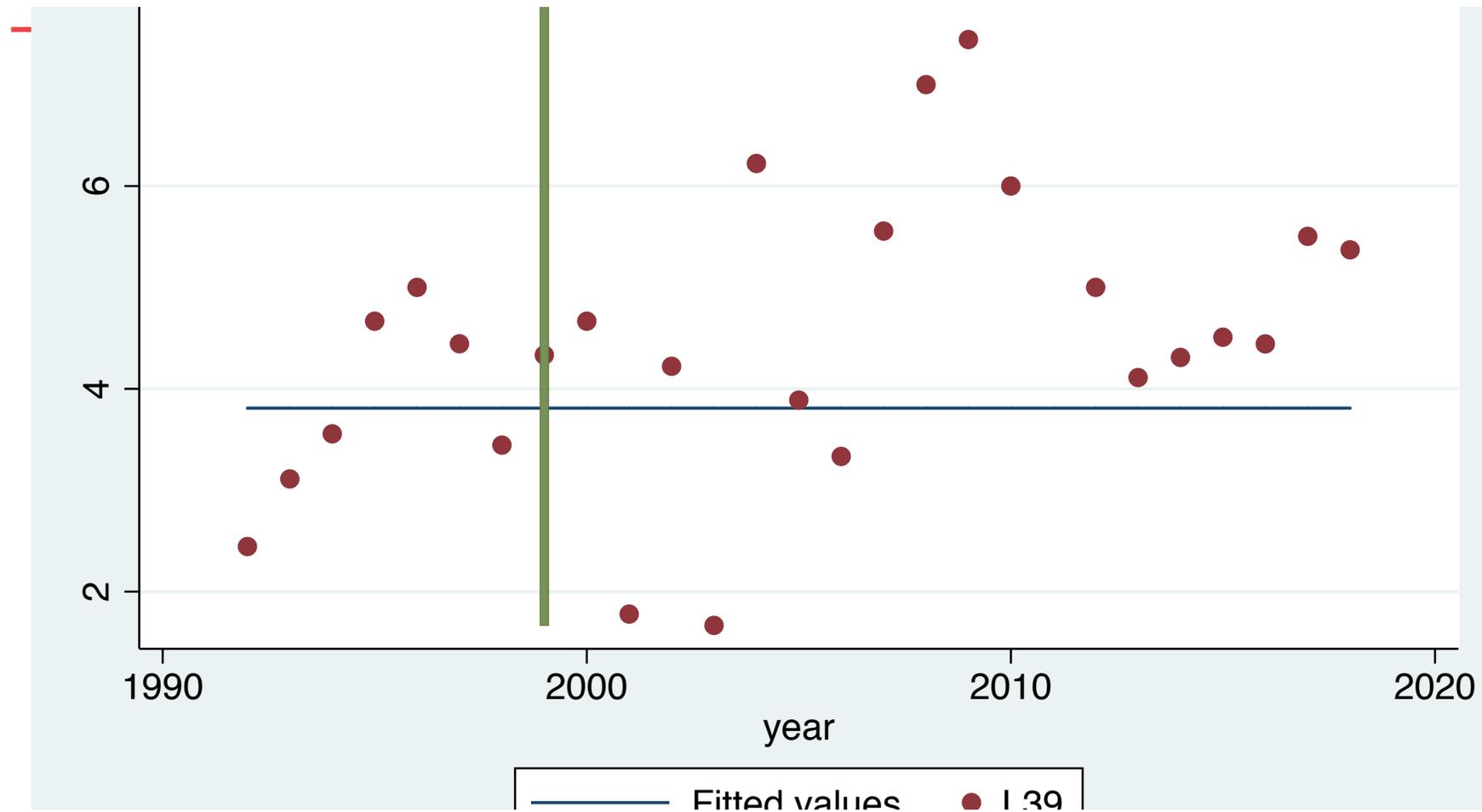


Does this approach confirm  
—results obtained with traditional  
evaluation methods?

For triangulation of CoSMMA evaluations, we selected projects with at least 3 independent indications that they had positive effects

Project	ENERGY		ECON.		COM-		INFO & COMM
	ACCESS	EDUC.	TRANSF.	ENVIRT.	MUNITY	Health	
Bangladesh, Rangamati, 2010	X			X		X	
Brazil, Igarapé, 2004	X		X	X	X		
India, Tamkhua, 2007	X	X	X	X	X	X	X
Kenya, Mpeketoni, 1994	X	X	X			X	
Namibia, Tsumkwe, 2008	X	X	X				
Namibia, Tsumkwe, 2012	X	X	X				X
Philippines, Pagan-anIsland, 1999	X	X		X			
Senegal, SineMoussaAbdou, 2010	X	X			X		
South Africa, Lucingweni, 2011	X			X			X

Only 1 out of 9 projects for which triangulation was feasible (and concluding to success) actually failed according to our data.  
 (Philippines, Pangan An Island, 1999)



# Policy conclusions

- Successful projects are associated with large effects on local economic growth. This should lead policy makers to pay more attention to distributed electrification projects, which could accelerate economic development.
- About half of projects have failed. Given the previous conclusion, it is urgent to identify factors that may facilitate, or otherwise hinder the success of such projects.
- One key element of failure seems to be the initial energy poverty of localities concerned. In localities that are initially in the darkness, policy interventions aiming at accelerating adoption of electricity in consumption and production behaviours should be considered.

Thank you

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