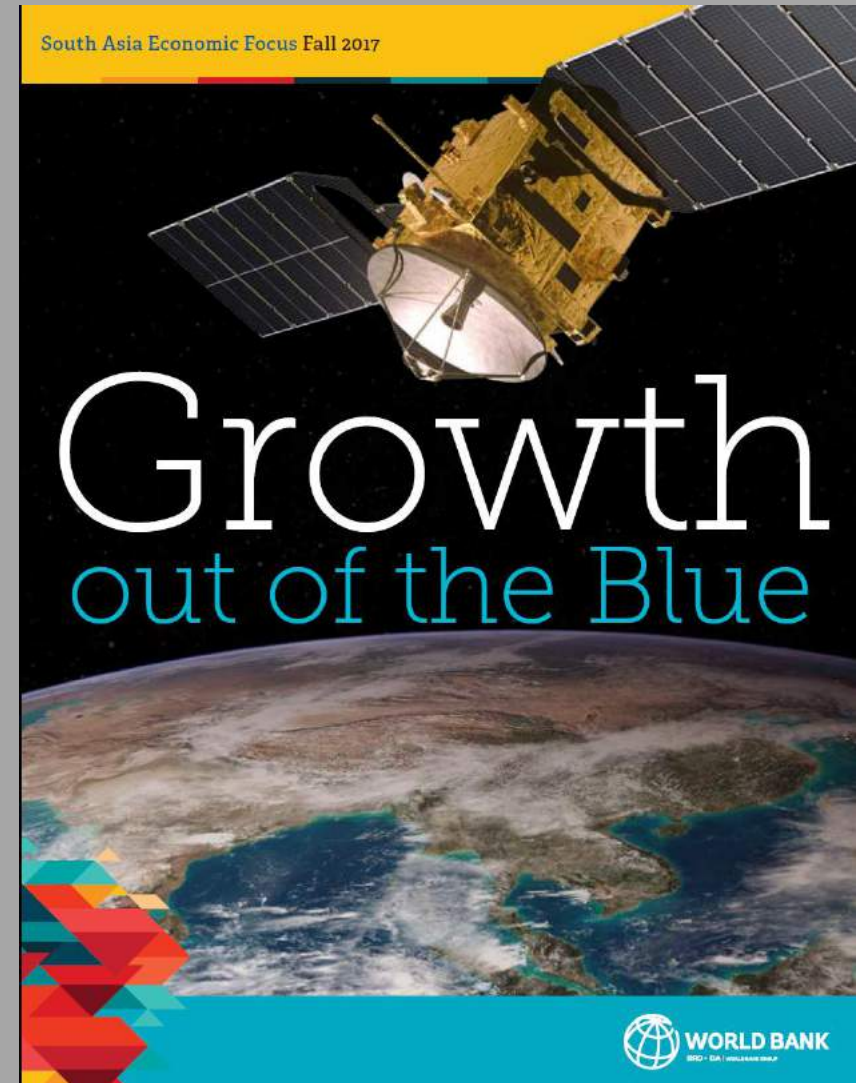# South Asia Economic Focus Fall 2017

Recent economic developments

South Asia's economic outlook

In focus: growth out of the blue

South Asia country briefs
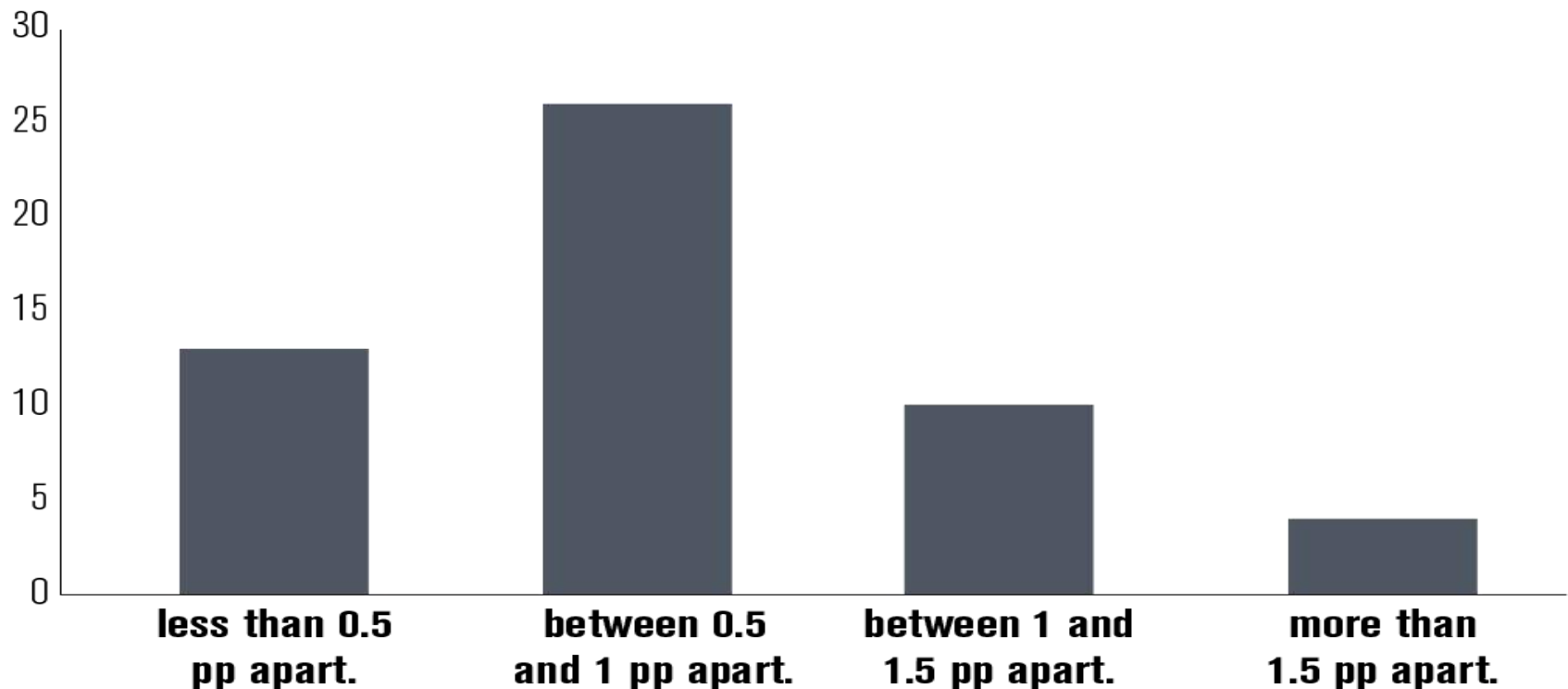
The measurement of economic activity is imprecise by nature

Researchers and practitioners see a gap between estimated and actual growth.

Compared to the initial GDP growth estimate, the actual GDP growth in your country has in general been
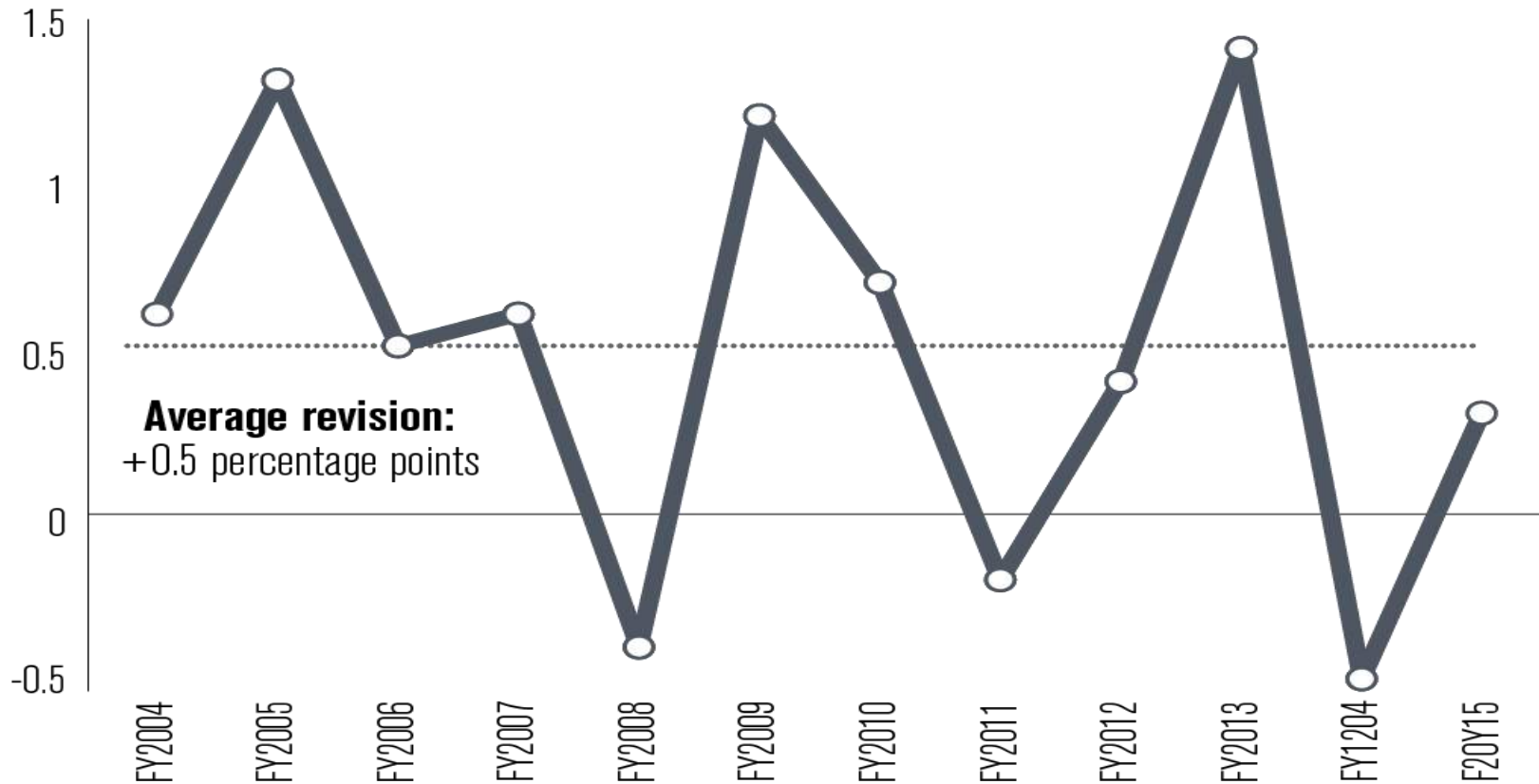
Number of answers

Source: World Bank South Asia Economic Policy Network.

Preliminary GDP growth rates can be revised substantially.

Revisions of GDP estimates in India
Second revision minus advanced estimate, percentage points
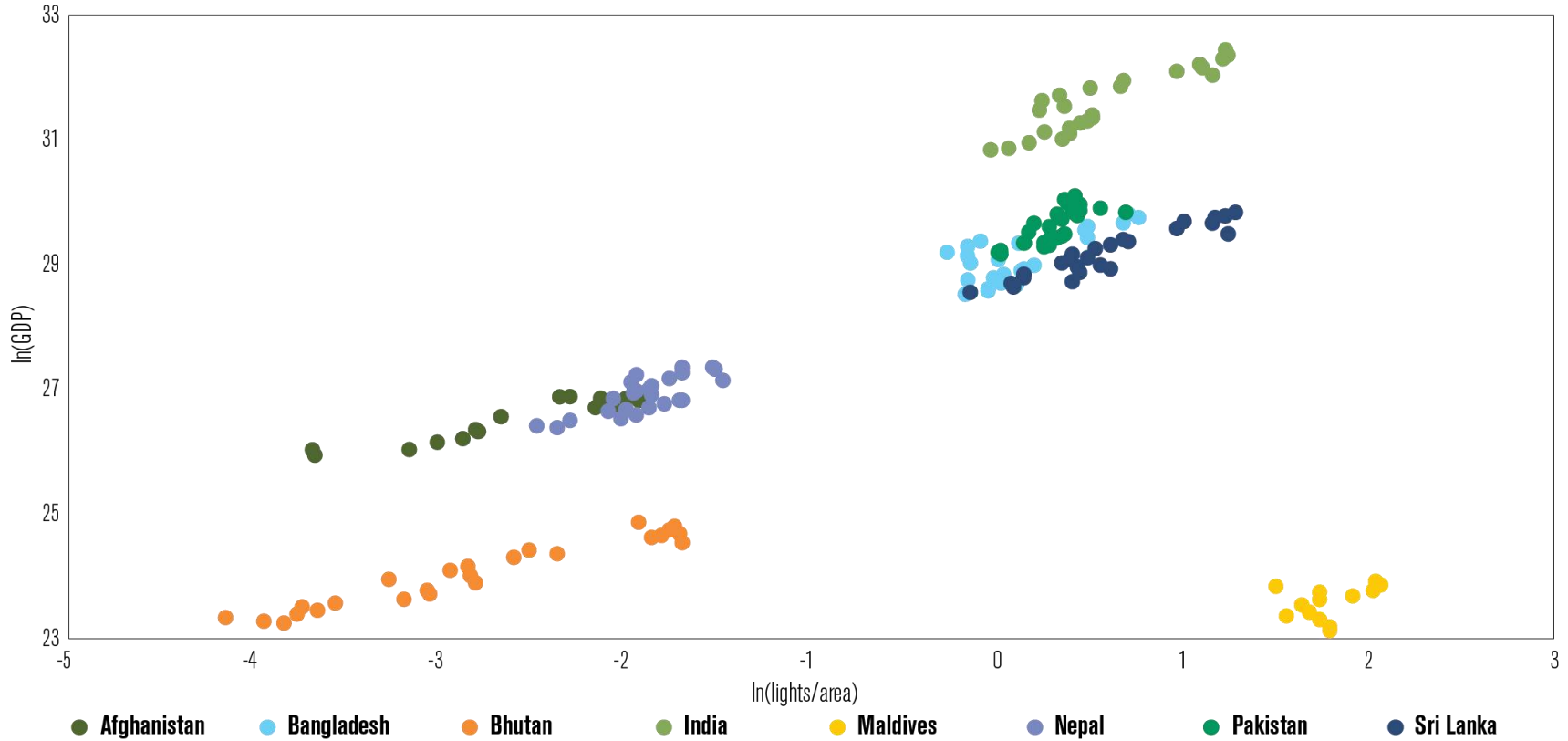
Average revision:
+0.5 percentage points

(X-axis: FY2004, FY2005, FY2006, FY2007, FY2008, FY2009, FY2010, FY2011, FY2012, FY2013, FY1204, F20Y15)

Source: World Bank South Asia Economic Policy Network.

Nightlight and economic activity

GDP levels and nightlight intensity are correlated.

Nightlight intensity and economic activity, 1992-2016

Source: World Bank South Asia Economic Policy Network.

# The relationship is similar in South Asia and elsewhere.

	World ln(GDP)	World without South Asia ln(GDP)	South Asia ln(GDP)
ln(lights/area)	0.267*** (0.0303)	0.266*** (0.0314)	0.248*** (0.0491)
Observations	3,966	3809	157
Countries	187	179	8
(within country) R^2	0.788	0.782	0.971

Note: The following regression is estimated: , where is the natural logarithm of GDP of country i in year t measured in constant local currency, is the natural logarithm of lights per km^2 , is a country-fixed effect and   is a year fixed-effect Robust standard errors, clustered by country, are in parentheses. *** p<0.01

The relationship is stronger in poorer countries.

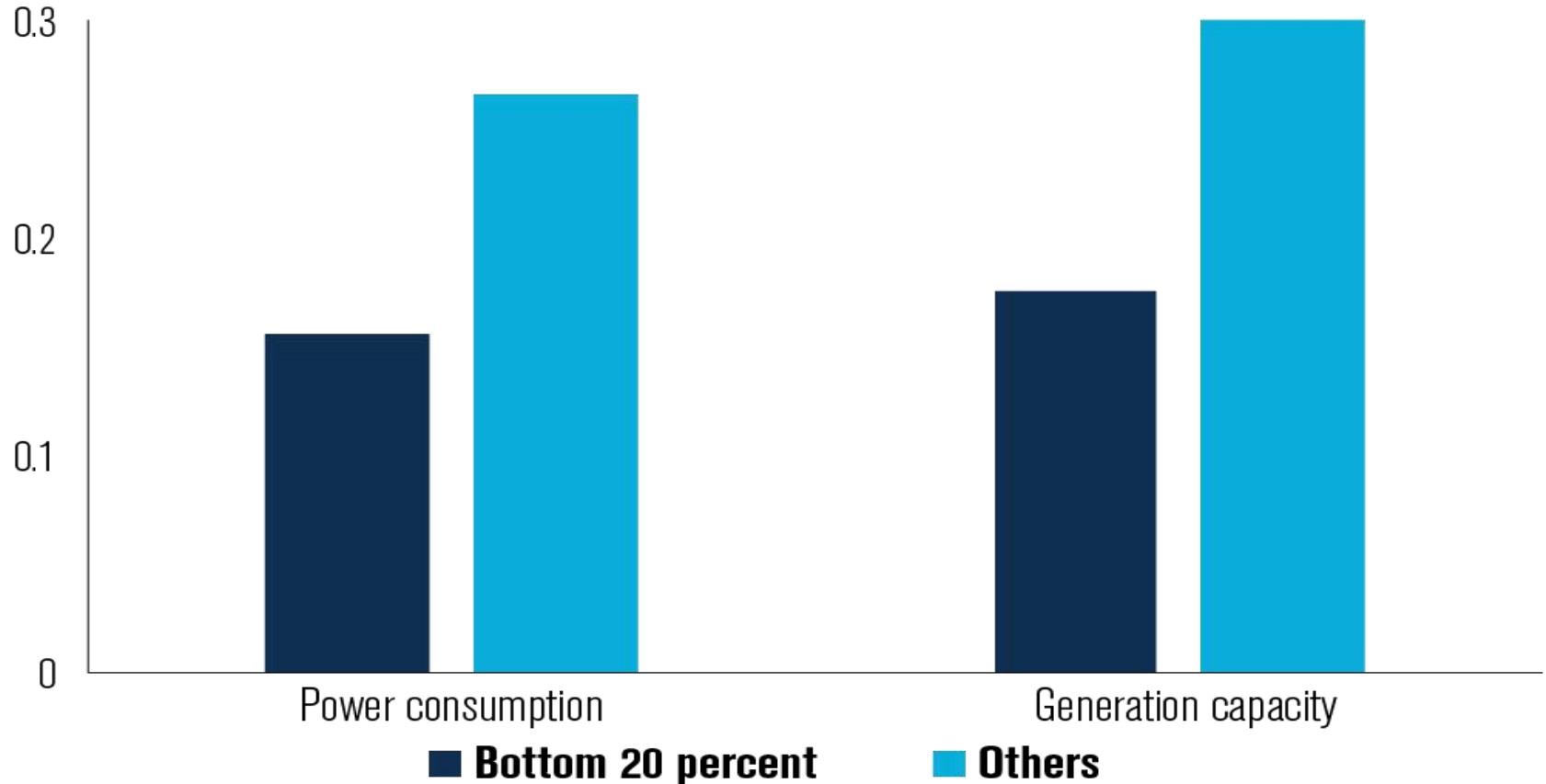**Response of GDP to a change in nightlight intensity**

Percentage change for a one percent change
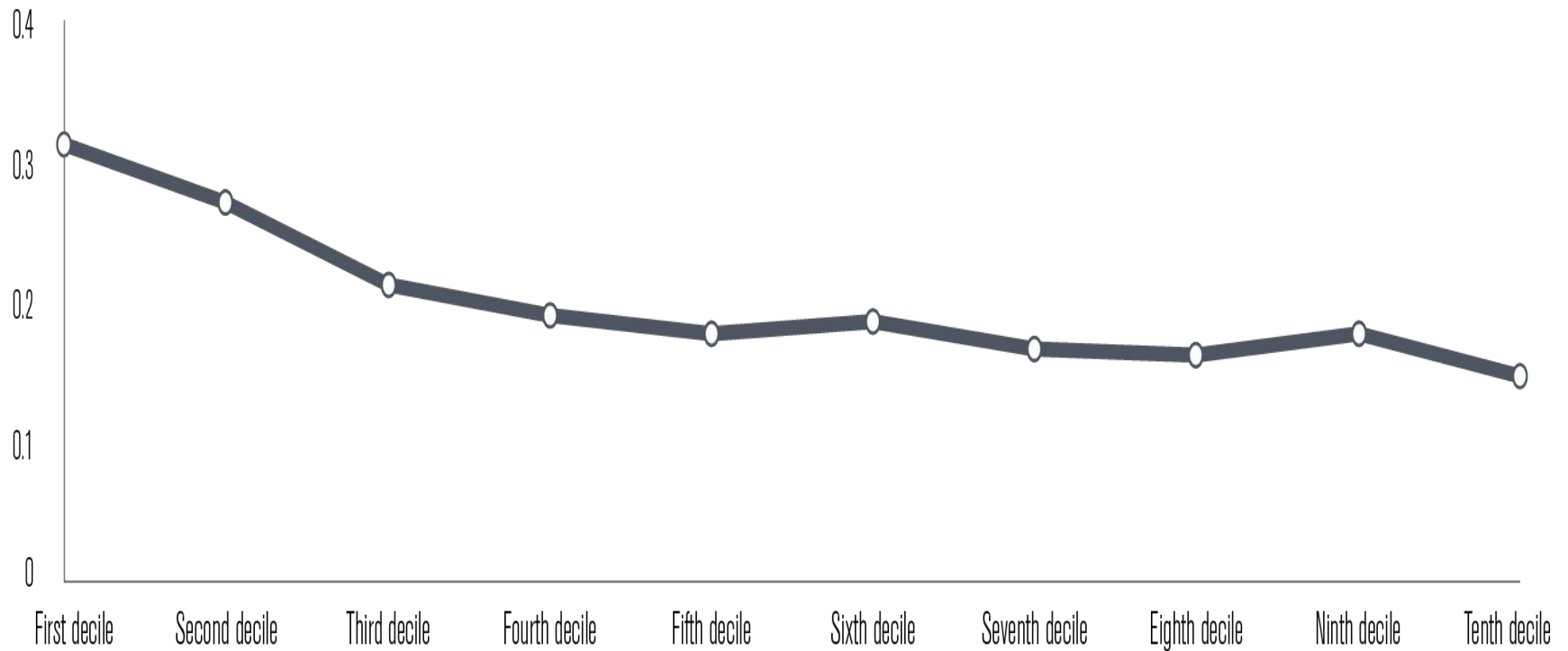
The relationship is weaker when power infrastructure is limited.

Response of GDP to a change in nightlight intensity
Percentage change for a one percent change
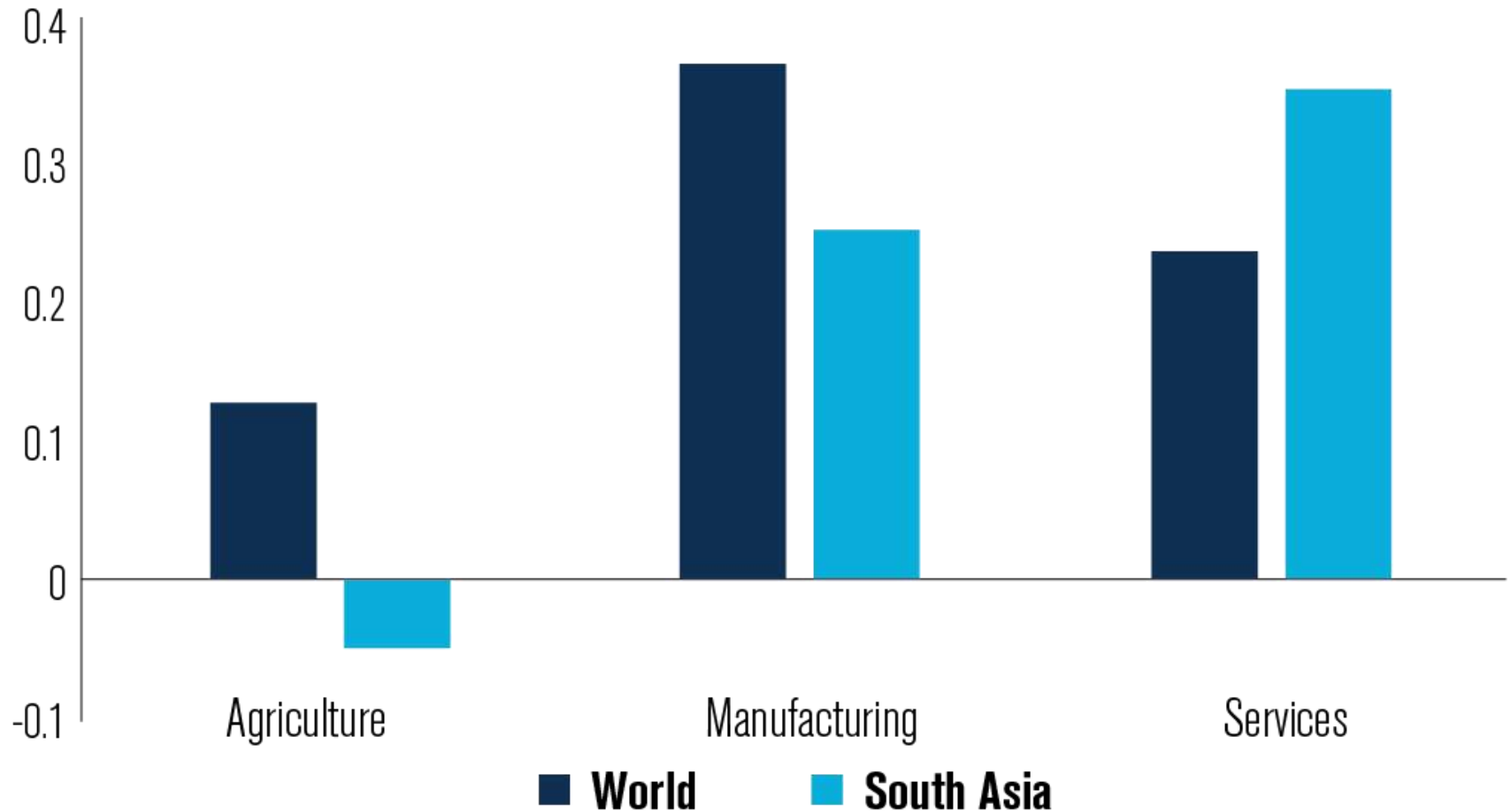

Legend: ■ Bottom 20 percent ■ Others

X-axis: Power consumption, Generation capacity

The relationship is especially weak in agricultural sector.

Response of GDP to a change in nightlight intensity

Percentage change for a one percent change

■ **World**   ■ **South Asia**

Nightlight intensity and GDP growth

Short-term relationship: stronger in South Asia than elsewhere.

	World $\Delta\ln(GDP)$	World without South Asia $\Delta\ln(GDP)$	South Asia $\Delta\ln(GDP)$
$\Delta\ln$(lights/area)	0.0547*** (0.0161)	0.0557*** (0.0166)	0.0741*** (0.0154)
Observations	3,778	3,629	158
Countries	187	179	7
(within country) R^2	0.094	0.096	0.338

Note: The following regression is estimated: $\Delta\ln(GDP_{i,t})=a+b_i+c_t+\delta\,\Delta\ln(light_{i,t})+\varepsilon_{i,t}$ where $\ln(GDP_{i,t})$ is the natural logarithm of GDP of country i in year t measured in constant local currency, $\ln(light_{i,t})$ is the natural logarithm of lights per km² , b_i is a country-fixed effect and c_t is a year fixed-effect. The regressions in the first and second column are estimated using data until 2013. The regression in the thrid column is estimated using data until 2016 and excludes Maldives. Robust standard errors, clustered by country, are in parentheses. *** p<0.01.
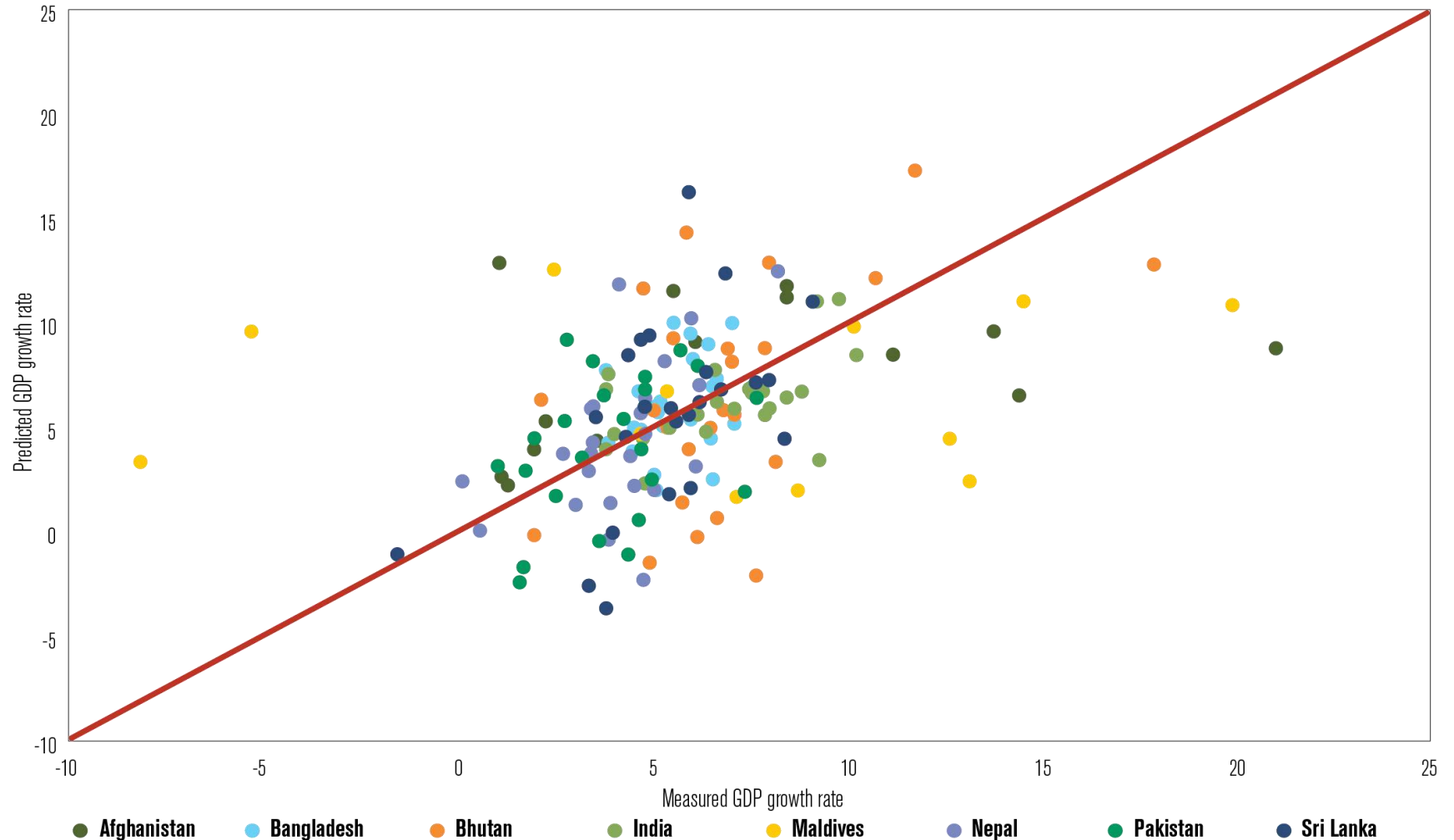
Short-term changes in nightlight intensity carry information and not only noise (I).

Annual Change in nightlight intensity and in GDP, 1992-2016

- ● Afghanistan
- ● Bangladesh
- ● Bhutan
- ● India
- ● Maldives
- ● Nepal
- ● Pakistan
- ● Sri Lanka
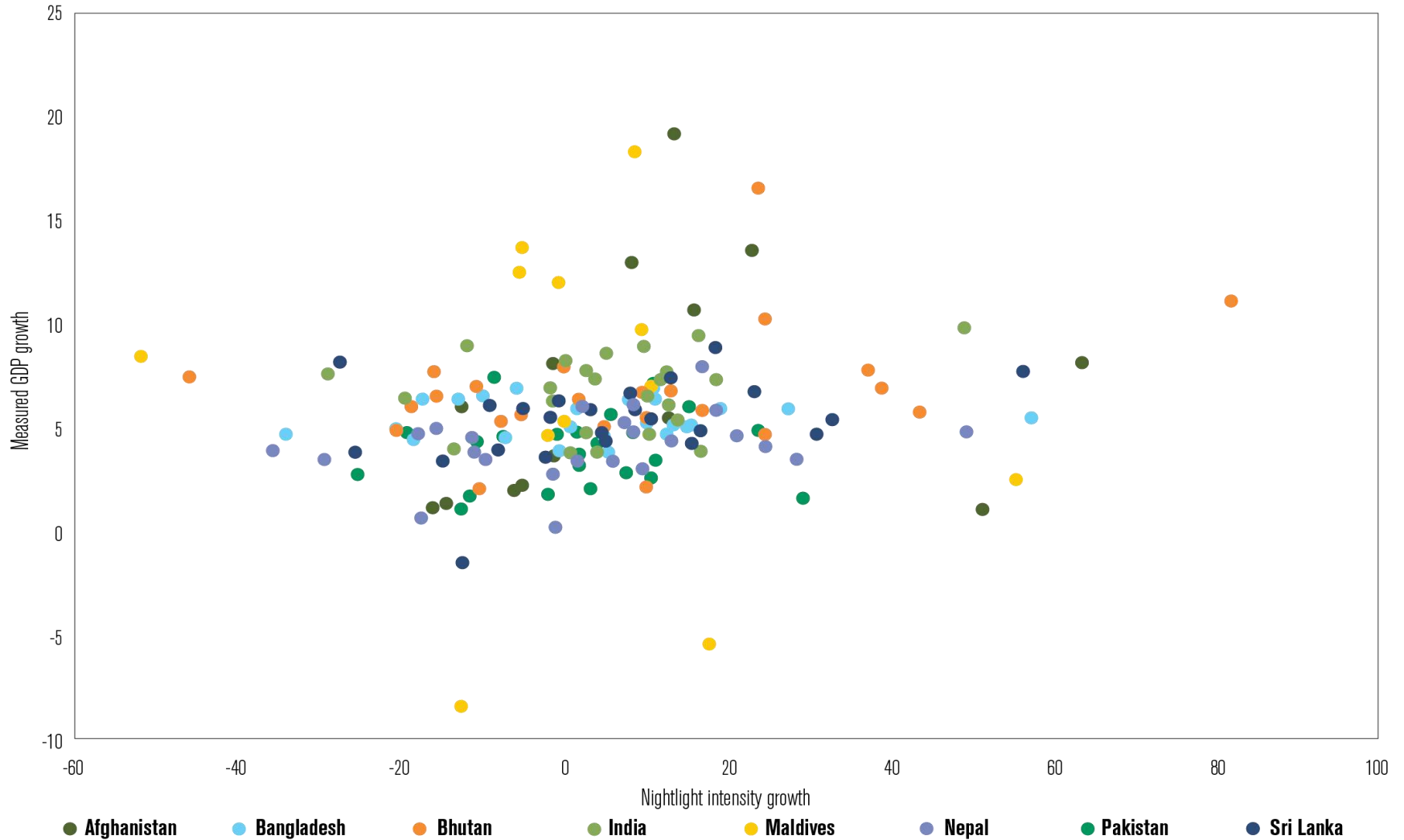
Short-term changes in nightlight intensity carry information and not only noise (II).
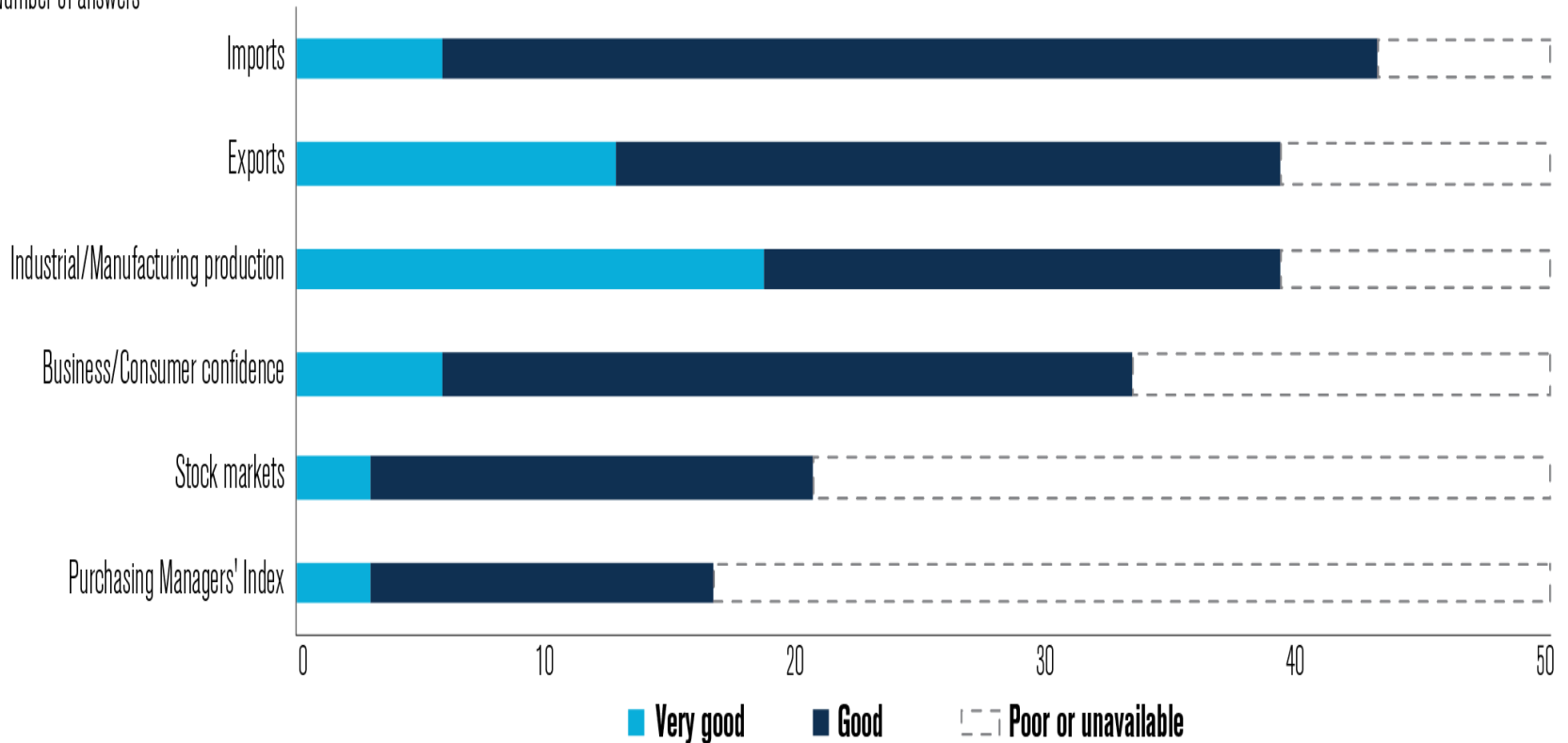
Annual change in measured and predicted GDP growth, 1992-2016

Several lead indicators are used to forecast GDP growth.

How well do the following early indicators, if available, predict GDP in your country?
Number of answers

Legend: ■ Very good ■ Good ⌐⌐ Poor or unavailable

Categories (top to bottom): Imports, Exports, Industrial/Manufacturing production, Business/Consumer confidence, Stock markets, Purchasing Managers' Index

X-axis: 0, 10, 20, 30, 40, 50

Source: World Bank South Asia Economic Policy Network.

Nightlight is a good lead indicator for annual GDP growth.

Indicator	Country coverage	Observations	Correlation with GDP
Business/Consumer Confidence	India, Sri Lanka, Pakistan	16	0.64**
Manufacturing production	India, Sri Lanka, Pakistan, Bangladesh	40	0.44***
Nightlight intensity (shorter sample)	India, Sri Lanka, Pakistan, Bangladesh, Nepal, Bhutan	60	0.35***
Industrial production	India, Sri Lanka, Pakistan	56	0.34*
Nightlight intensity (longer sample)	India, Sri Lanka, Pakistan, Bangladesh, Nepal, Bhutan	144	0.30***
Exports	India, Sri Lanka, Pakistan, Bangladesh, Nepal, Bhutan	131	0.28***
Stock market indices	India, Sri Lanka, Pakistan, Bangladesh	67	0.21*
Services/Manufacturing PMI	India, Sri Lanka	14	0.24
Imports	India, Sri Lanka, Pakistan, Bangladesh, Nepal, Bhutan	150	0.17**
Banking credit	India, Sri Lanka, Bangladesh	44	0.08

Note: All indicators are in growth rates; for Business/Consumer Confidence and Service/Manufacturing Purchasing Managers' Index we also tested levels and demeaned levels but did not find a significant relationship *** p<0.01, ** p<0.05, * p<0.10.
Source: GDP data from World Bank and all other data retrieved from Trading Economics.

Source: GDP data from World Bank, light data from South Asia Spatial Database (Li et al 2015), DMSP-OLS, VIIRS, and World Bank staff calculations, and all other data were retrieved from Trading Economics.

Using nightlight for prediction

Allowing for differences across countries increases precision (I).

**Sum of root mean squared errors for South Asia**
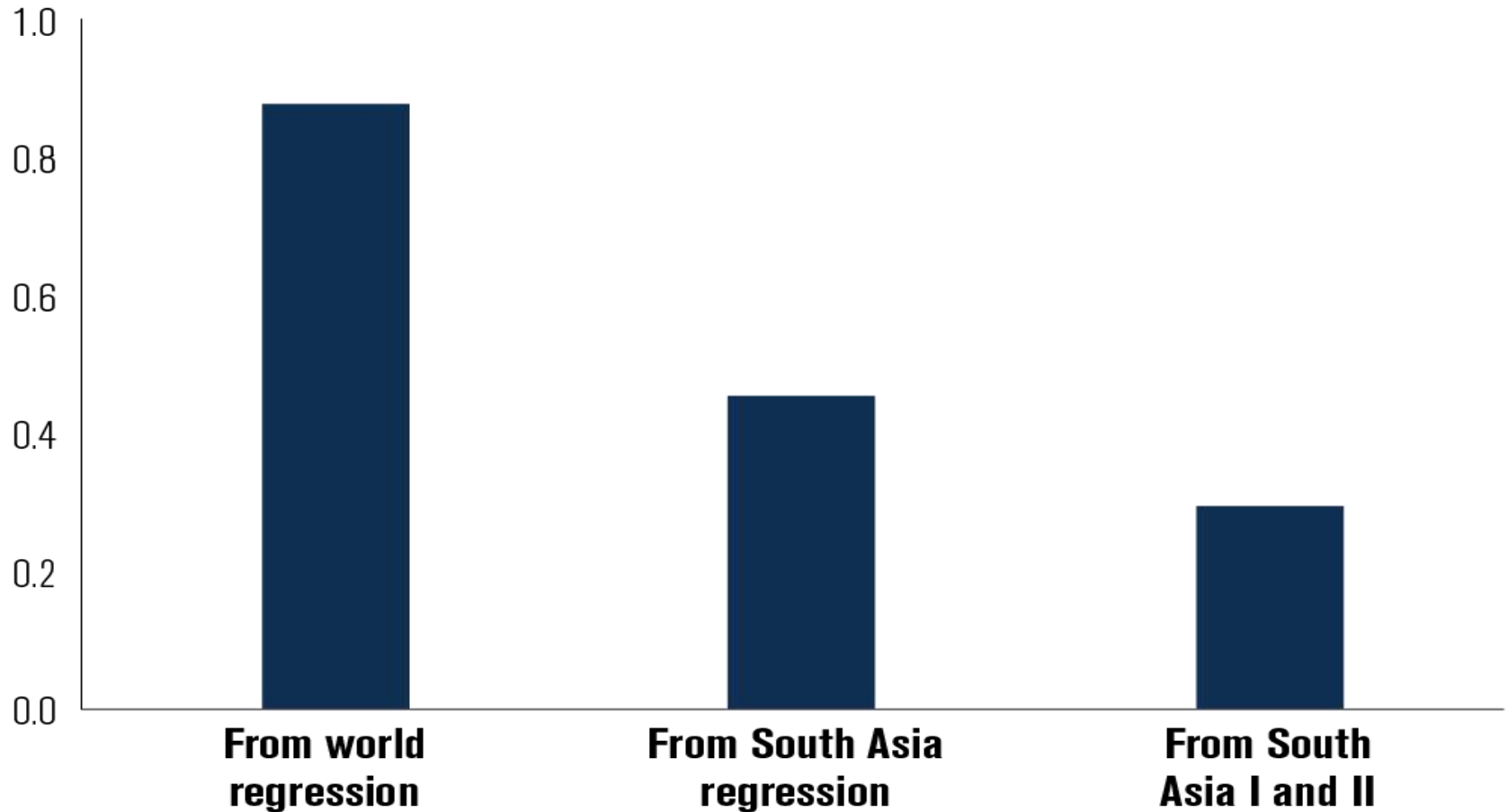
# Allowing for differences across countries increases precision (II).

	World ln(GDP)	South Asia ln(GDP)	South Asia I ln(GDP)	South Asia II ln(GDP)
ln(lights/area)	0.267*** (0.0303)	0.273*** (0.0481)	0.169* (0.0611)	0.350*** (0.0110)
Observations	3,966	178	78	100
Countries	187	8	4	4
(within country) R^2	0.788	0.976	0.987	0.994

Note: South Asia I includes Afghanistan, Bangladesh, India and Maldives. South Asia II includes of Bhutan, Nepal, Pakistan, and Sri Lanka. All regressions expect the first are estimated from 1992 to 2016. The regression specification is the same as before. * $p<0.1$ and *** $p<0.01$.
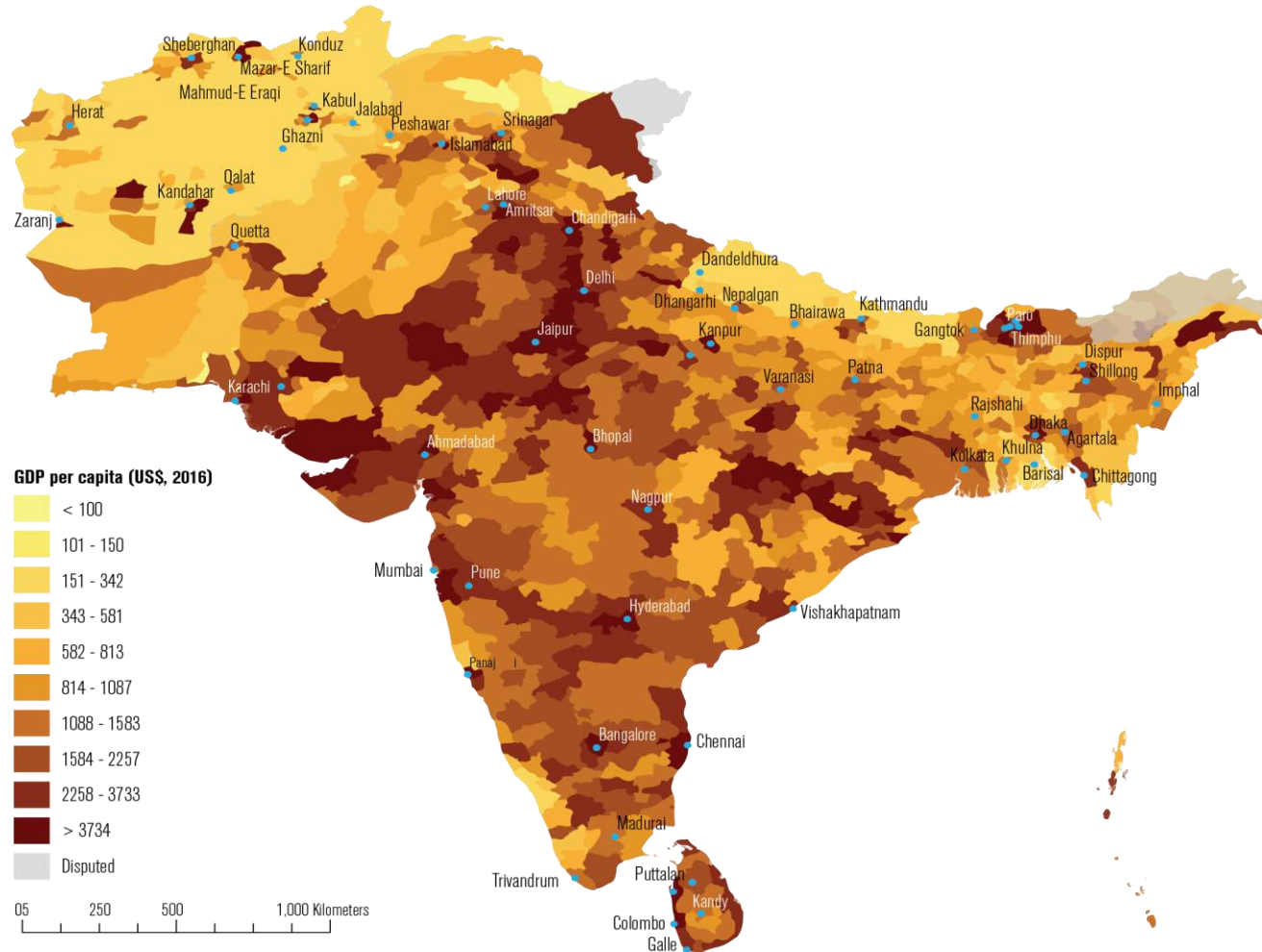
GDP predicted based on the elasticity approach closely tracks measured GDP.
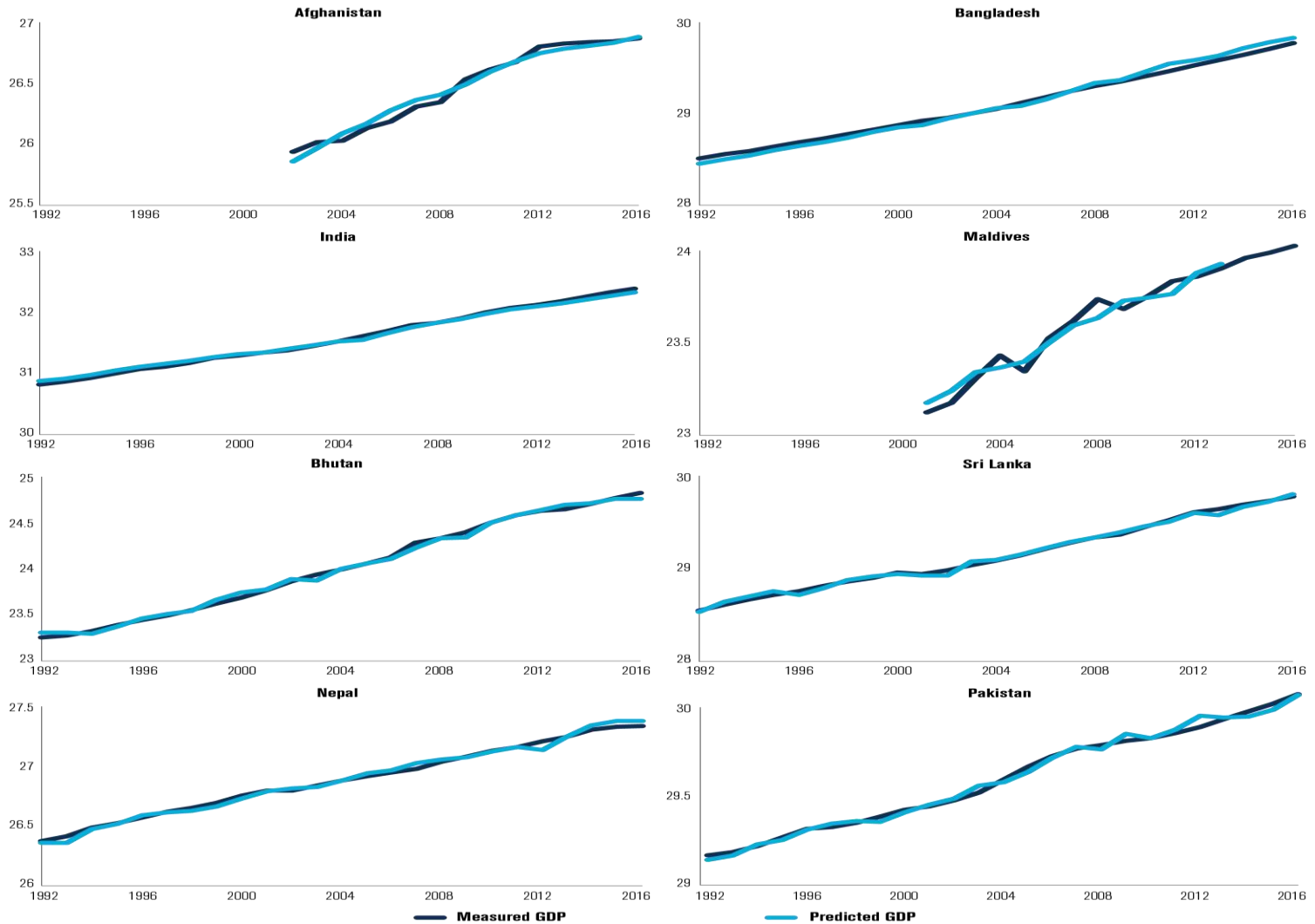
In India, nightlight intensity predicts subnational GDP relatively well.

a. At state level

b. At district level
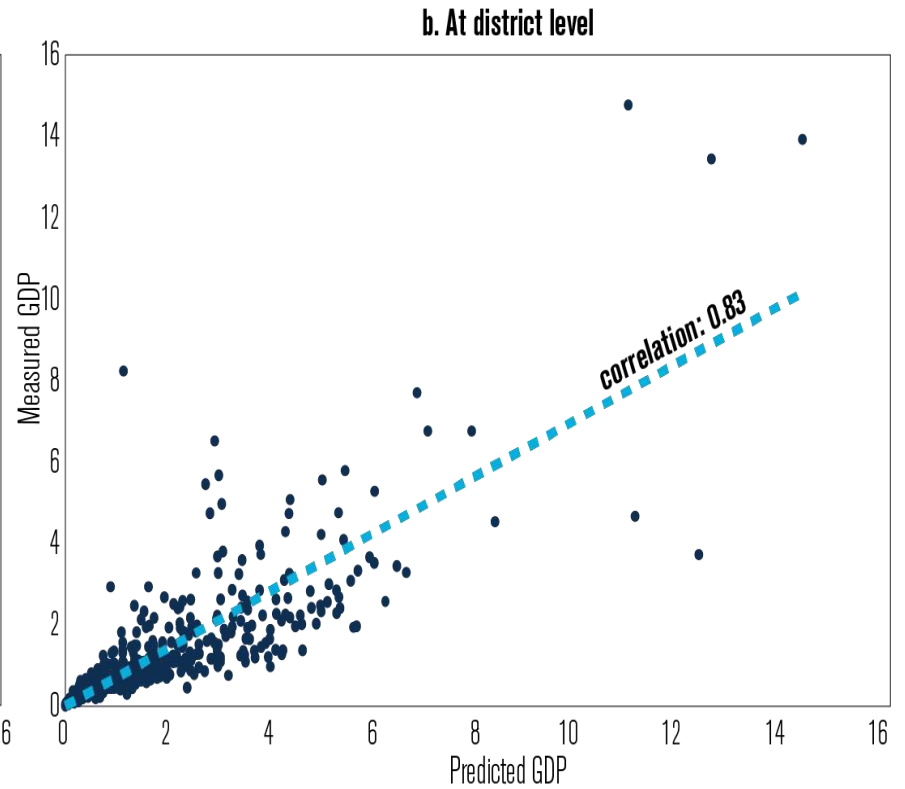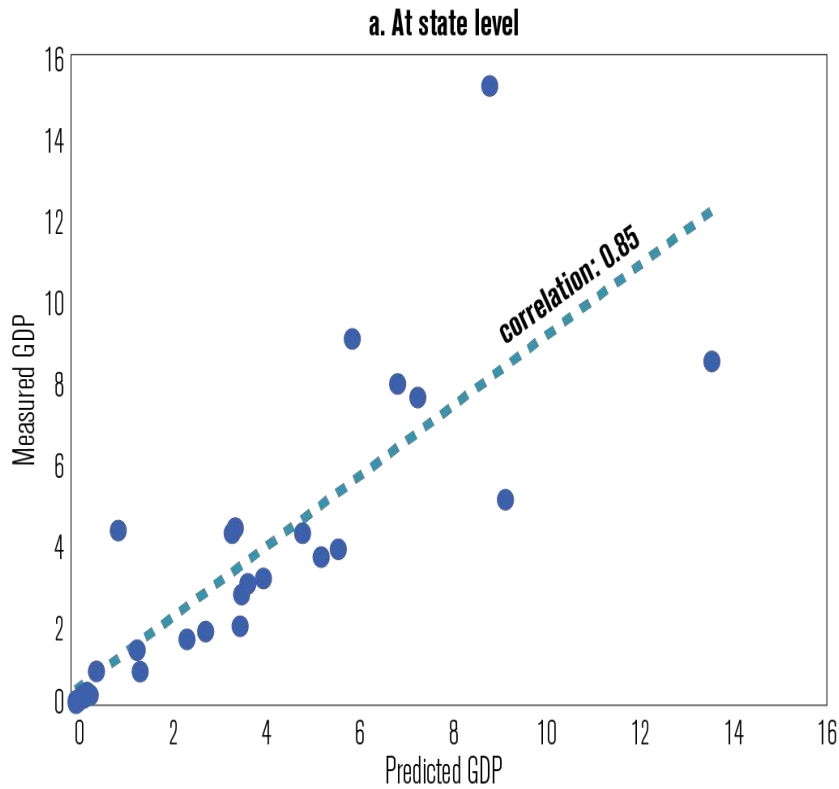
The spatial approach yields a granular picture of GDP per capita in South Asia.

GDP per capita (US$, 2016)

- < 100
- 101 - 150
- 151 - 342
- 343 - 581
- 582 - 813
- 814 - 1087
- 1088 - 1583
- 1584 - 2257
- 2258 - 3733
- > 3734
- Disputed

Source: World Bank WDI, South Asia Spatial Database (Li et al, 2015), DMSP-OLS, VIIRS, and staff calculations.

Nightlight intensity is a poor lead indicator for quarterly GDP growth.

Indicator	Correlation with GDP		
	Observations	**Contemporaneous**	**Lead**
Manufacturing production	51	0.71***	0.56***
Industrial production	135	0.49***	0.43***
Exports	129	0.35***	0.30***
Business Confidence	39	0.32***	0.30**
Banking credit	97	0.32***	0.12
Stock market index	111	0.39*	0.43*
Services PMI	33	0.04	-0.05
Manufacturing PMI	32	0.07	-0.05
Nightlight intensity	36	-0.23	-0.03

Note: All indicators are in growth rates; for Business Confidence and Service and Manufacturing Purchasing Managers' Index we also tested levels and demeaned levels. For the first two the relationship is not significant, for the latter the relationship remains significant but weaker then for growth.
Source: All other data retrieved from Trading Economics.

Source: World Bank South Asia Spatial Database (Li et al 2015), DMSP-OLS, VIIRS, and World Bank staff calculations, Trading Economics

The lead indicator approach helps improve GDP growth forecasts.

Forecast Evaluation		India		Sri Lanka	
		RMSE	MAE	RMSE	MAE
Simple benchmarks					
naïve	$\Delta GDP_{(t-1)}$	1.0	0.9	1.8	1.6
AR(1)	$\alpha GDP_{(t-1)}$	2.0	1.7	3.0	2.8
Single-variable models					
(1)	X_t = Industrial production	1.9	1.7	1.5	1.4
(2)	X_t = Manufacturing production	2.7	2.5		
(3)	X_t = Night lights growth	1.5	1.1	2.4	2.1
(4)	X_t = Export growth	2.2	1.9	2.9	2.6
(5)	X_t = Loan growth	0.7	0.5	6.8	6.0
(6)	X_t = PMI	1.1	0.9		
(7)	X_t = Business confidence	1.4	1.0		
Two-variable models					
(8)	X_t = Loan growth, industrial production	0.7	0.5		
(9)	X_t = Loan growth, manufacturing production	0.7	0.5		
(10)	X_t = Loan growth, nightlight growth	0.6	0.4		
(11)	X_t = Loan growth, export growth	1.7	1.6		
(12)	X_t = Loan growth, PMI	1.5	1.2		
(13)	X_t = Loan growth, business confidence	1.5	1.1		
(14)	X_t = Industrial production, nightlight growth			1.5	1.3
(15)	X_t = Industrial production, export growth			2.3	1.9
(16)	X_t = Industrial production, loan growth			6.9	6.4

Source: World Bank WDI, South Asia Spatial Database (Li et al, 2015), DMSP-OLS, VIIRS, and staff calculations.

Shedding light on recent economic episodes

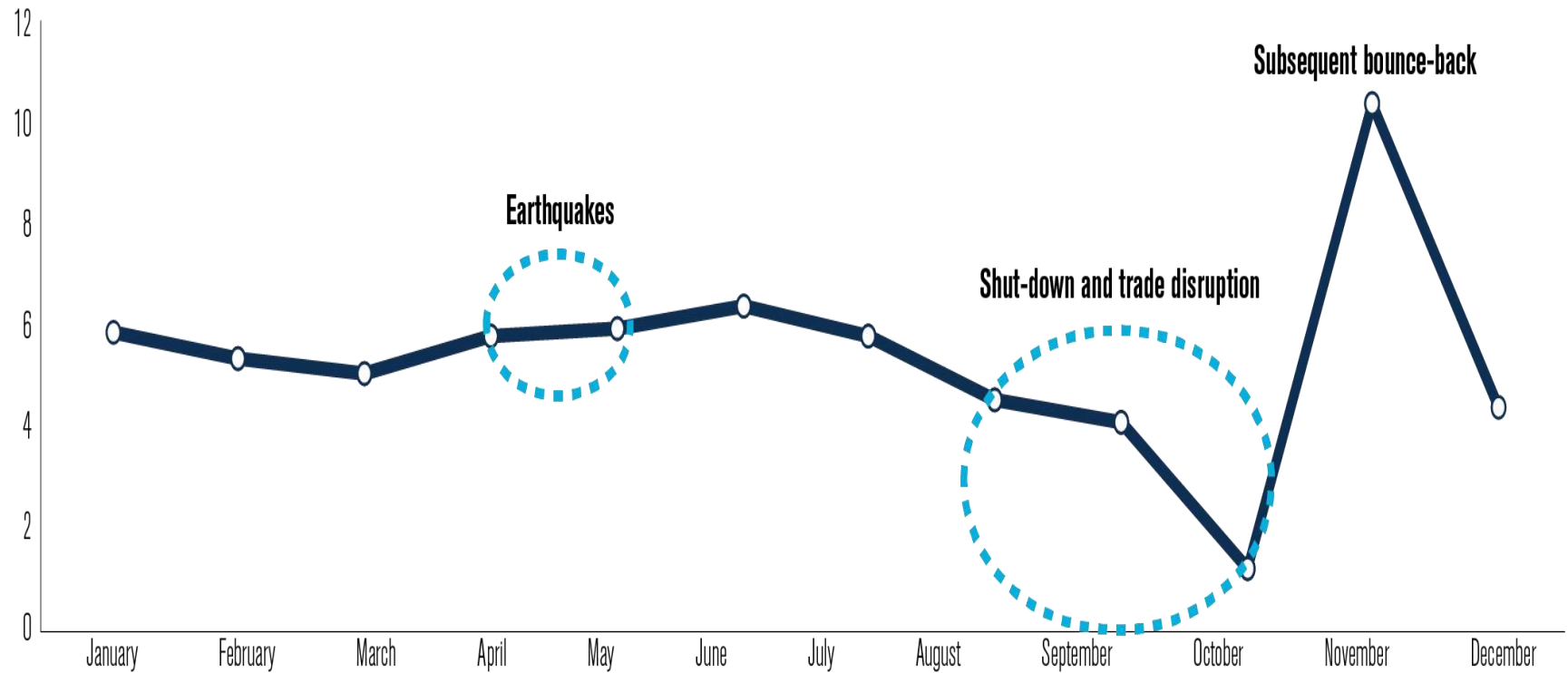# In India both the old and the new GDP series are highly correlated with nightlight intensity.

Correlation of GDP series with nightlight intensity

Legend: GDP at factor cost (FY2004 prices) — GDP at market prices (FY2011 prices)
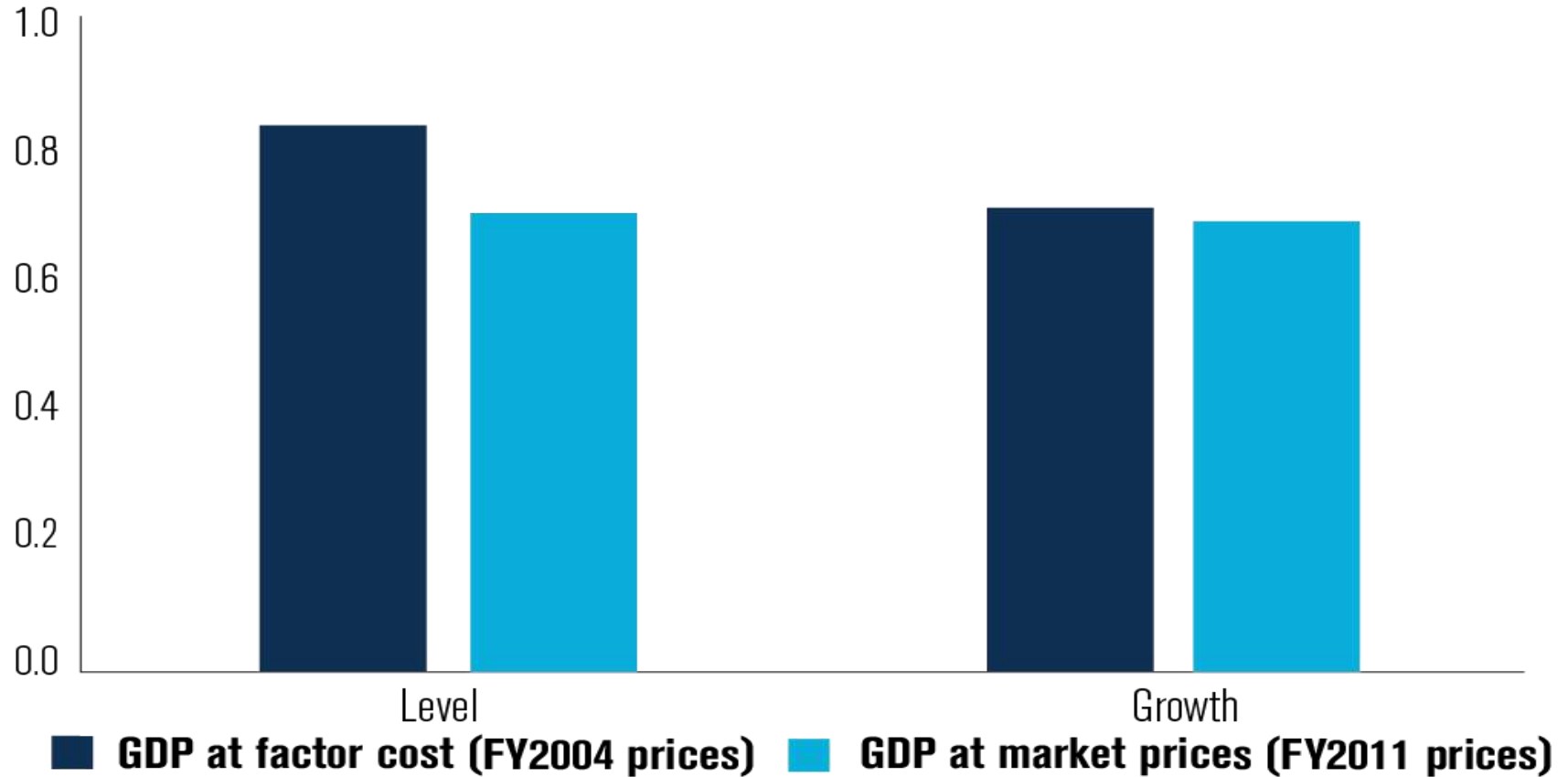
Trade disruption had a much larger impact on economic activity than the earthquakes.
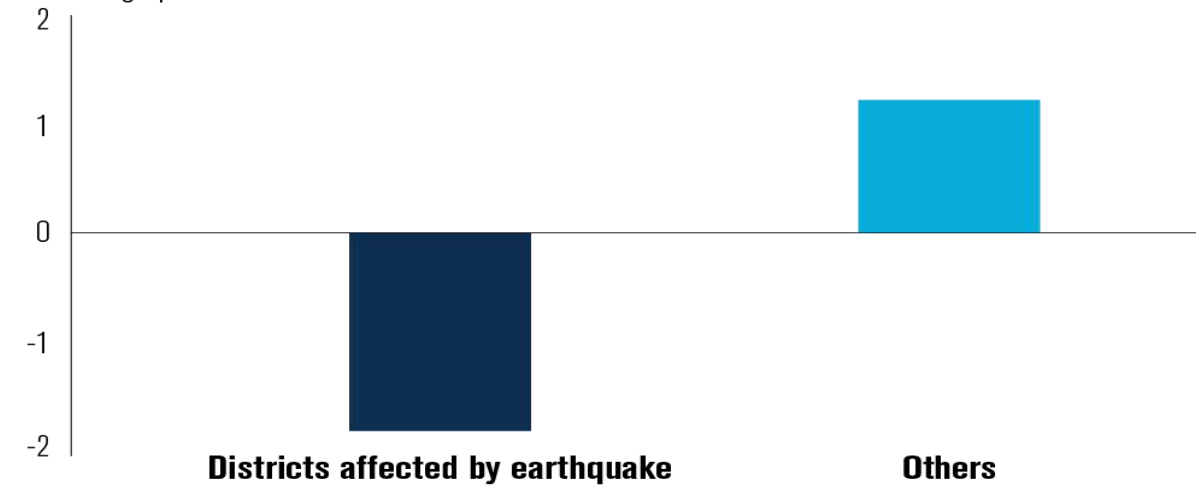

Real GDP growth predicted by nightlight
Percent, y-o-y

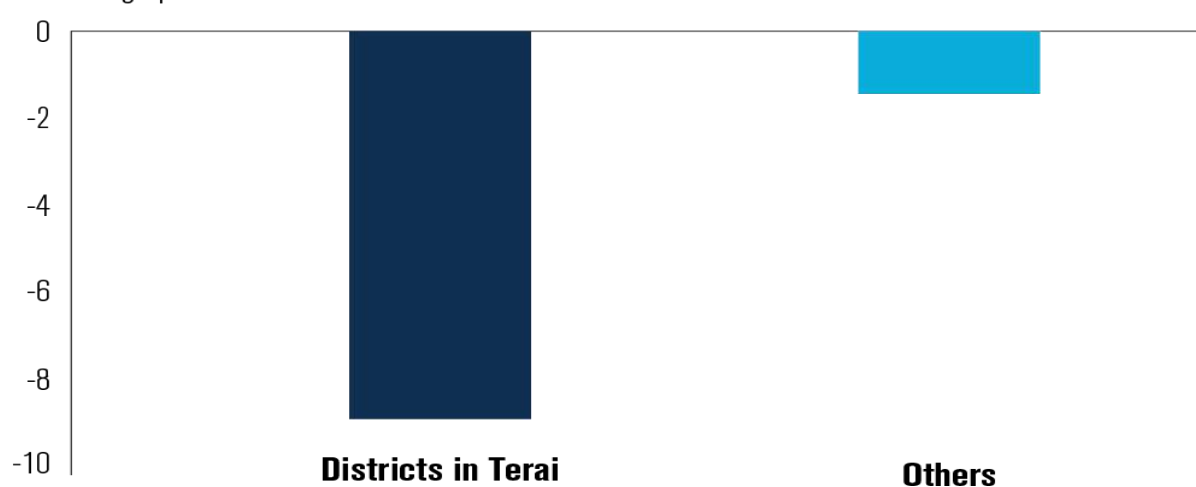# The GDP impacts of the shocks were substantial at the local level.

Change in GDP growth in April/May 2015 versus a year ago
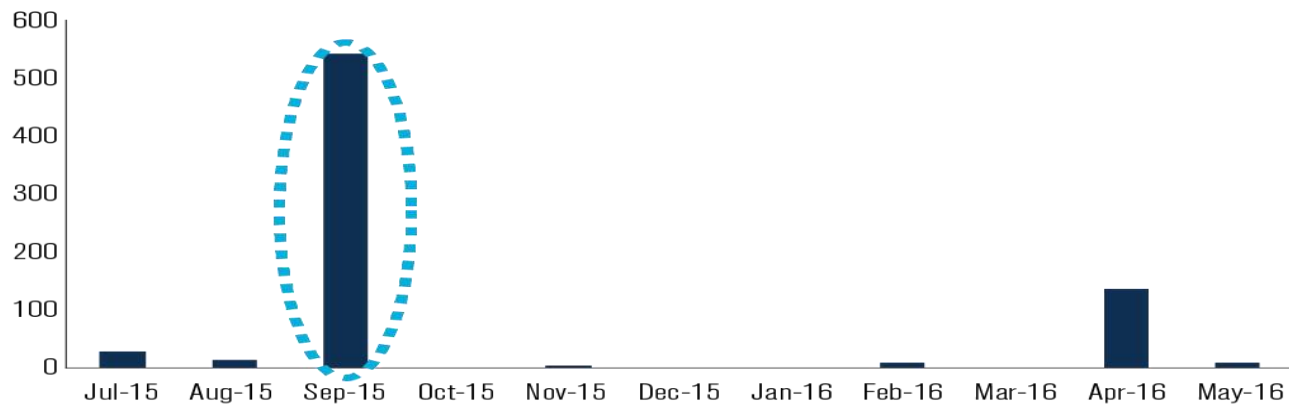Percentage points

Districts affected by earthquake — Others

Change in GDP growth in September/October 2015 versus a year ago
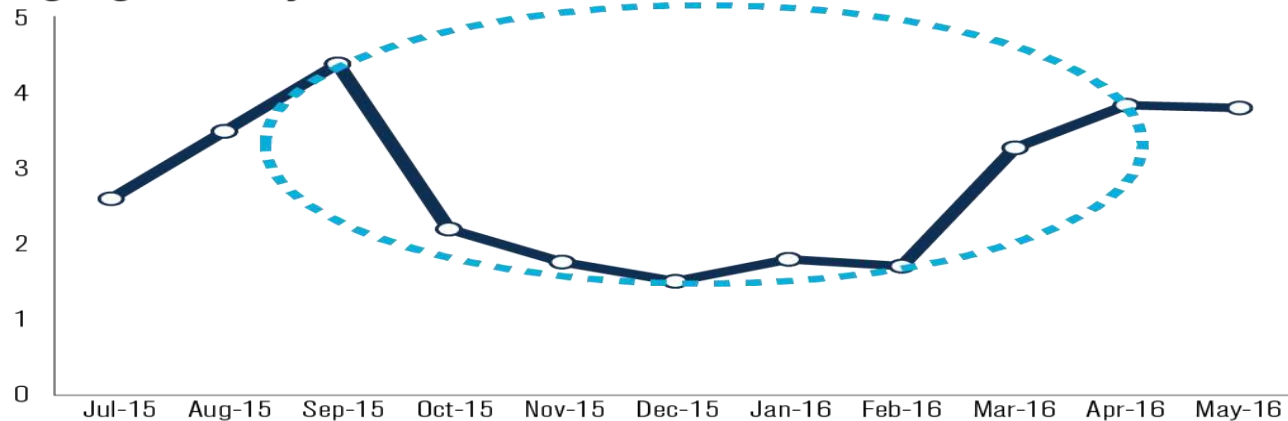Percentage points

Districts in Terai — Others

The deadly attack on Kunduz had a lasting impact on nightlight intensity.

Killed or injured in conflict
Total number

Source: CSCW and Uppsala Conflict Data Program.

Nightlight intensity

Across districts, conflict reduces GDP growth for up to a quarter.

	2005-2016				2014-2016			
	Annual GDP growth	Annual GDP growth	Annual GDP growth	Annual GDP growth	Quarterly GDP growth	Quarterly GDP growth	Monthly GDP growth	Monthly GDP growth
Killed and injured (per 1000)	-1.194 (2.343)	-2.009 (3.025)	-1.306 (1.280)	0.986 (2.141)	-6.940** (2.370)	-5.541** (2.572)	-9.291** (3.309)	-8.675** (3.309)
District and year FE	no	yes	no	yes	no	yes	no	yes

Note: The regression is estimated for Afghan districts. GDP is predicted using night lights as described above. The number of injured and killed is from the CSCW and Uppsala Conflict Data Program.

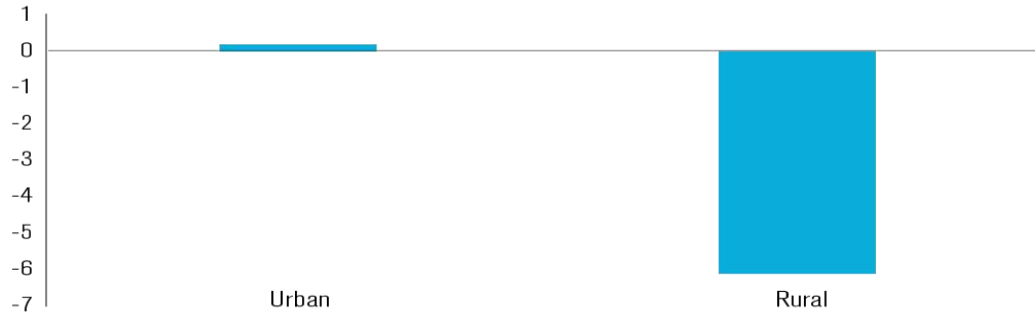# The negative impact of demonetization was short-lived at the aggregate level.

Nightlight intensity in India
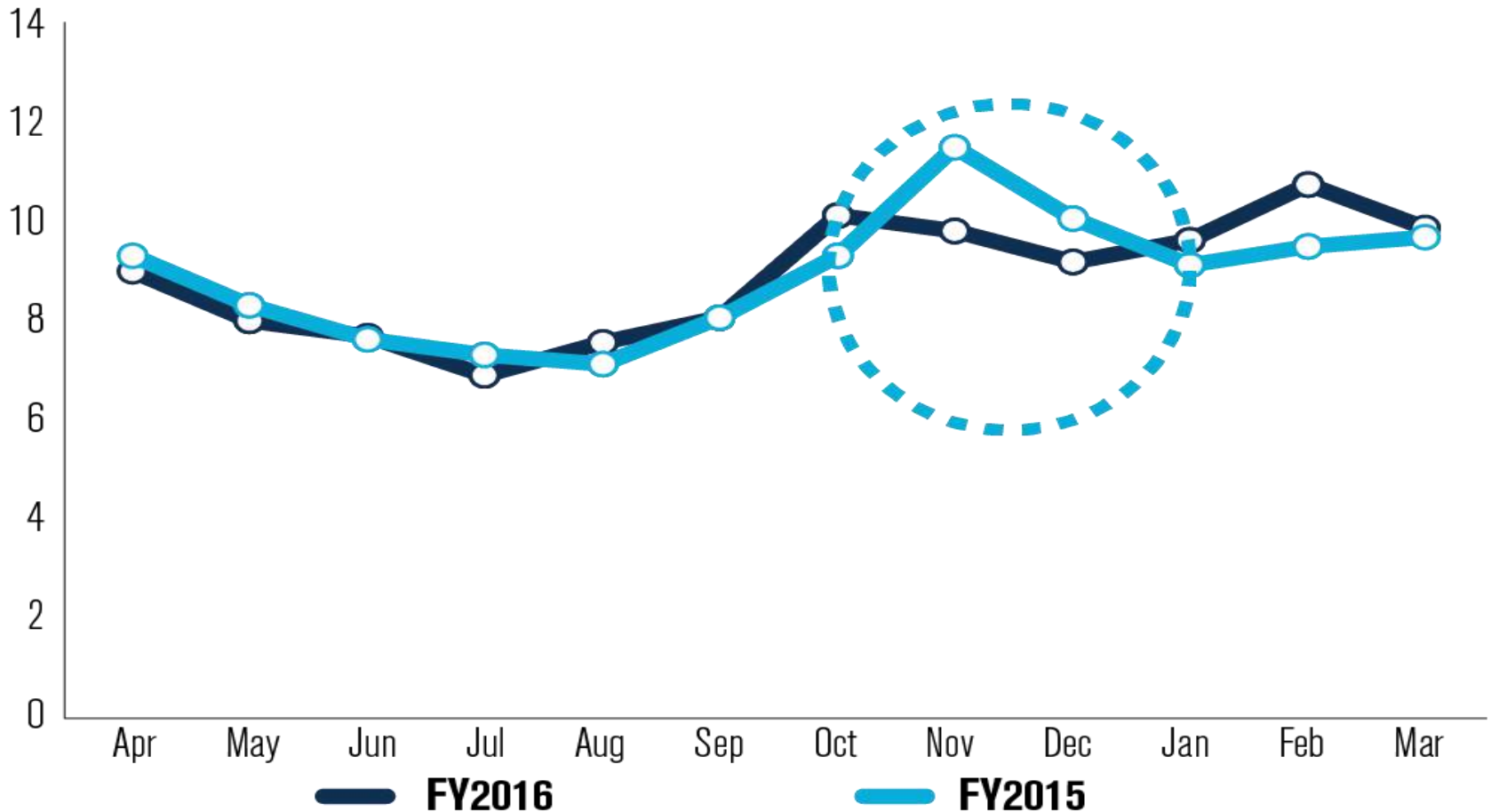
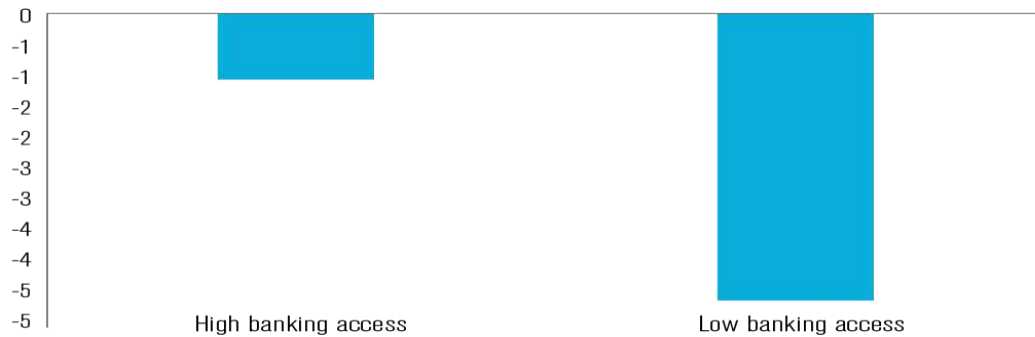# The performance of more informal districts was temporarily worse after demonetization.

Change in GDP growth in FY2016 Q3 vs FY2015 Q3
Percentage points

Change in GDP growth in FY2016 Q3 vs FY2015 Q3
Percentage points

Change in GDP growth FY2016 Q3 vs FY2015 Q3
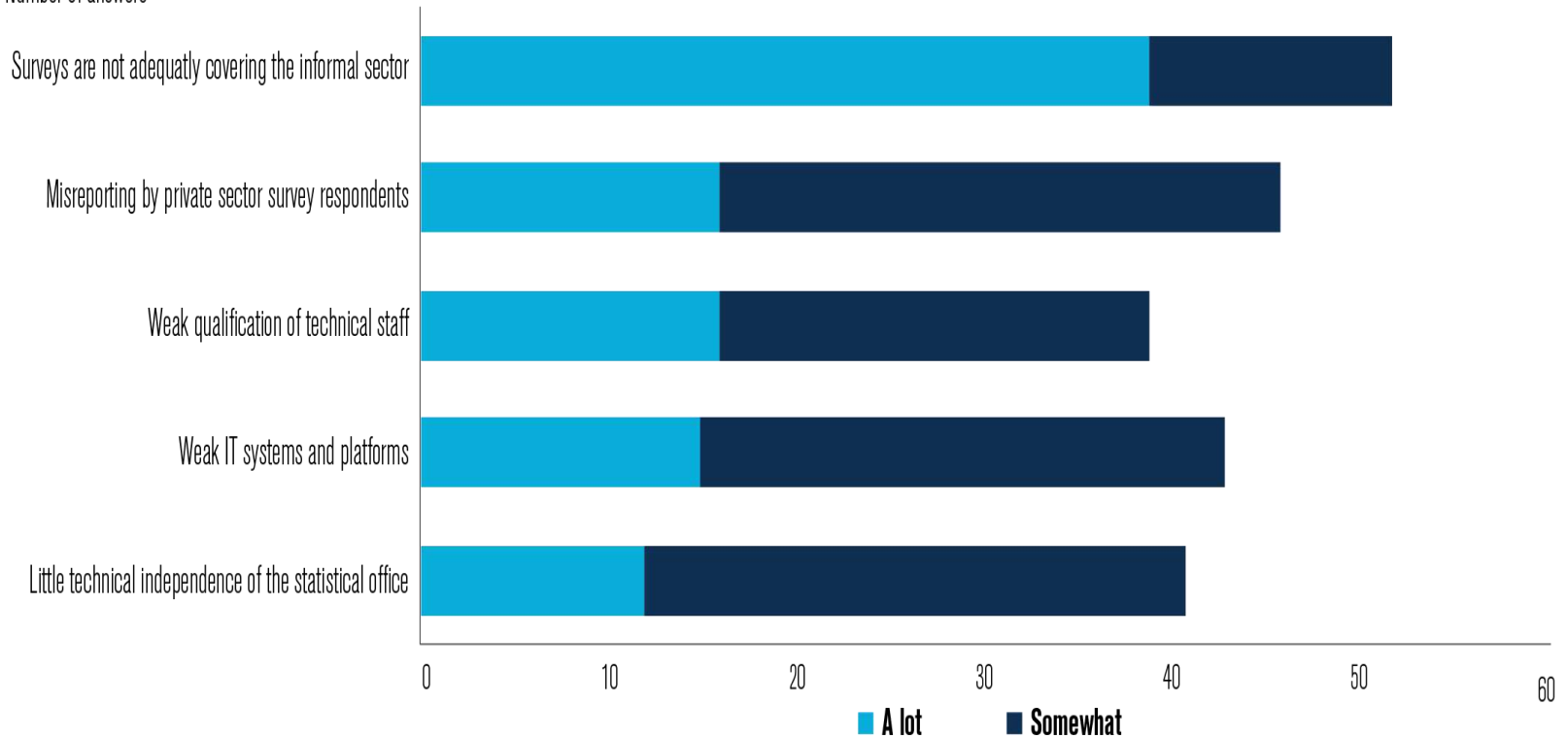Percentage points

Toward stronger statistical systems

GDP measurement faces challenges that can be overcome.

Do the following things hinder GDP measurement in your country?
Number of answers

Legend: A lot (light blue), Somewhat (dark blue)

Source: World Bank South Asia Economic Policy Network.