The paper «Measuring growth from outer space» was replicated. The main motivation of the paper is to offer the alternative mechanism to evaluate GDP. Namely, they offer the proxy for economic activity: the amount of light that can be observed from outer space.

At the graphs below you may find the comparison of actual GDP for Rwanda and Indonesia. Actually, it can be noticed that both of these figures underpredict the extent of measured income declines. For Indonesia, where national income data are relatively good, this could be underprediction of the true income decline. While for Rwanda, national income data are less reliable and economic activity may have been poorly recorded in the period of genocide. These examples raise the possibility that lights respond asymmetrically to income changes, dimmimg less in downturns that they rise in periods of growth.

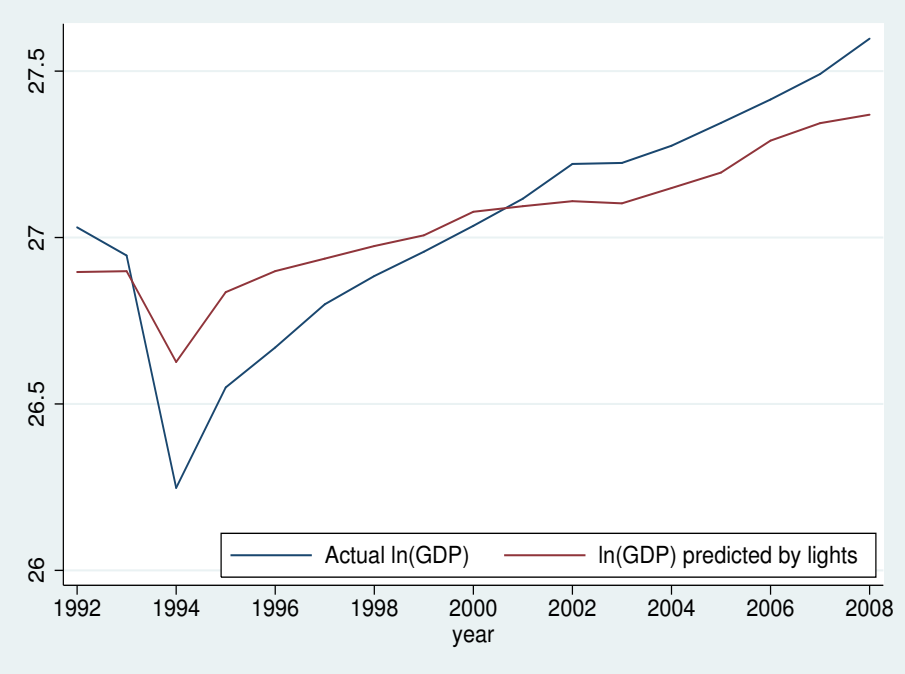

Figure 1: Comparison of actual GDP and GDP predicted by lights: Rwanda

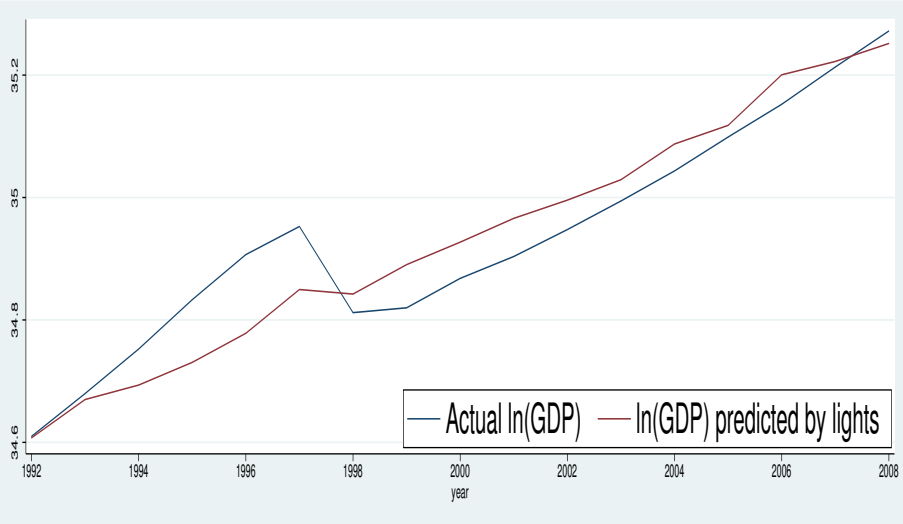

Figure 2: Comparison of actual GDP and GDP predicted by lights: Indonesia

Below is presented the main table of the paper:

	(1) ln(GDP)	(2) ln(GDP)	(3) ln(GDP)	(4) ln(GDP)	(5) ln(GDP)	(6) ln(GDP)	(7) ln(GDP)	(8) ln(GDP)
ln(lights/area)	0.277***	0.262***	0.266***	0.286***	0.282***		0.166***	0.284***
	(0.0311)	(0.0344)	(0.0314)	(0.0340)	(0.0465)		(0.0508)	(0.0301)
ln(lights/area)sq.		-0.00582						
		(0.00599)						
ln(number of cells topcoded)			0.0115*					
			(0.00588)					
ln(number of cells unlit)			-0.0124					
			(0.0122)					
Spatial Gini				0.165				
				(0.194)				
ln(KWH)						0.283***	0.201***	
						(0.0467)	(0.0407)	
Observations	3,015	3,015	3,015	3,015	1,853	1,853	1,853	3,015
R-squared	0.769	0.769	0.770	0.769	0.757	0.767	0.782	0.770
Countries	188	188	188	188	128	128	128	188

Notes: All specifications include country and year fixed effects. Column 8 excludes regions with gas flares. Robust standard errors, clustered by country, are in brackets.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table 1: Baseline Results for the World: 1992-2008; Growth in Real GDP

The replication results of this table and further tables are the same as in the paper (which is a great news!). In the first column we see that there are highly significant results, which connects the dependence of real GDP on the amount of light. Consequently, the main hypotheses is approved.

Second column shows that there is no quadratic dependence of lights on GDP. Column 3 controls for the number of pixels that are top-coded and the number that are unlit, where only being «unlit» matters. Column 4 controls for Gini coefficient, however it doesn't matter a lot, while in magnitude the result is approximately the same. In columns 5-7 researchers explore the dependency of GDP, lights and electricity. The problem with this measure is that data on electricity are available in a much narrow range of countries. The column 5 replicates column 1 (for the range of countries, for which data is available for electricity) and we see the different results in comparison with the first one. In columns 6 and 7 the predictive power of electricity is analysed. Column 6 thus reflects that electricity has the same predictive power as lights. While capturing both of these indicators in (7), where both remain significant, tells us that they may be connected with different aspects of economic activity. In sum, while electricity consumption could predict GDP growth, the key issue is that it is available for fewer countries than lights, so that we should take into consideration the very last measure.

These results can also be represented graphically. Thus, Column 2 of Table 1 suggests a quadratic specification does not fit the data. Figure 3 shows this nonparametrically, graphing the dependence of the growth of real GDP as measured in national income accounts on the growth of observed light net of year and country effects. The pictured relationship indicates a linear specification in the growth rates is appropriate.

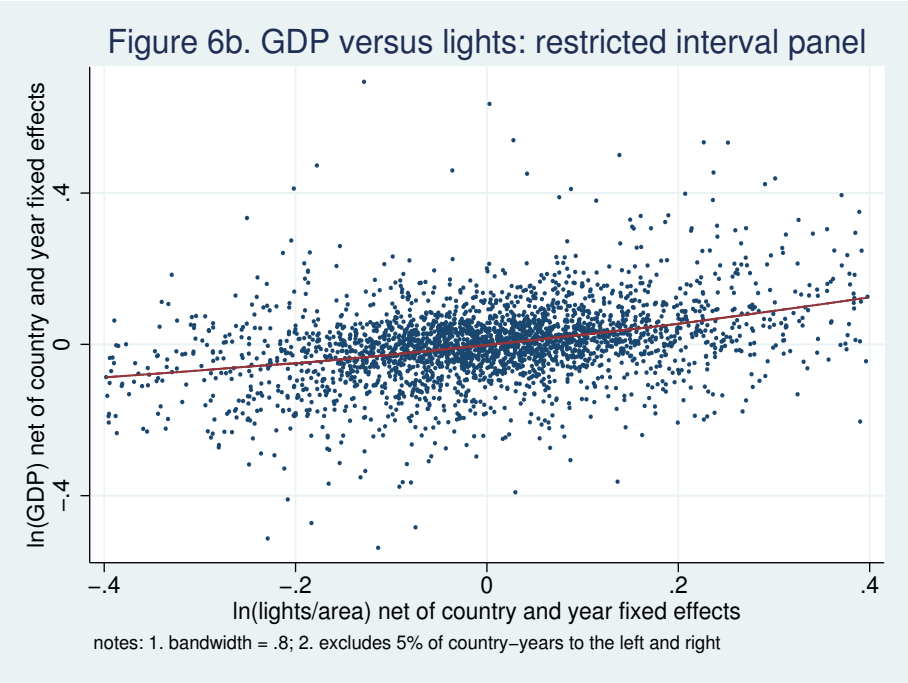

Figure 3: GDP versus lights: overall panel

This table explores two types of income change: annual fluctuations in income and long term growth. Column 2 adds country time trends, so now lights explain deviations of GDP about a

county's growth path. While it actually falls from 0.277 to 0.180 it is still significant, so that lights do a good job in predicting annual fluctuations. In column 3 authors explore ratchet effect: the possibility that because some lights growth reflects the installation of new capacity, lights are nondecreasing, so that economic downturns will not be reflected in lights. Regressing GDP on positive and negative light residuals has practically the same result, which means that there is no ratchet effect. As for long-term growth, column 4-5 explore long differences approach between 1992/93 and 2005/06 (this dependence is represented in Figure 4). The coefficient is significant, meaning that 1% in lights will lead to the growth of GDP on 0.32 %.

	(1) Fixed effects	(2) Country time trend	(3) Demeaned plus/minus	(4) Long difference	(5) Long difference
ln(lights/area)	0.277***	0.180***		0.320***	0.302***
	(0.0311)	(0.0359)		(0.0372)	(0.0373)
$\|+\Delta(ln(lights/area))\|$			0.274***		
			(0.0386)		
$\|-\Delta(ln(lights/area))\|$			-0.279***		
			(0.0557)		
ln(number of cells topcoded)					0.0205
					(0.0152)
ln(number of cells unlit)					-0.00774
					(0.0242)
Time effects	Yes	Yes	In demean	No	No
Country effects	Yes	Yes	In demean	No	No
Observations	3,015	3,015	3,015	170	170
Countries	188	188	188	170	170
(Within country) R-squared	0.769	0.904	0.209	0.279	0.288

Notes: Robust standard errors (clustered by country except in column 2) in brackets. In columns 4 and 5,long differences are formed by averaging the first and last two years of levels data.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table 2: Lights Up/Down, Time Trend, Long Difference

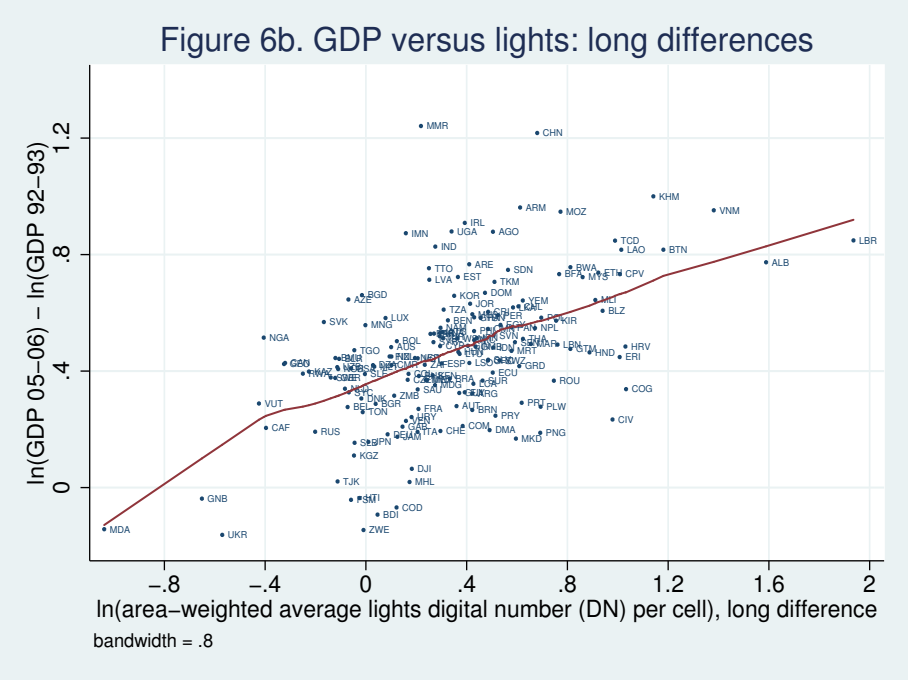

Figure 4: GDP versus lights: long differences

Finally, the analysis is replicated for low- and middle-income countries below. These particular countries, for which often we have unreliable sources. The main take-away message from the table below is the fact that while in magnitude the influence of light on GDP has increased from (0.278 to 0.307), it still remains significant giving us a good proxy for any policy analysis.

	(1) Fixed effects	(2) Country time trend	(3) Long difference
ln(lights/area)	0.307***	0.270***	0.327***
	(0.0373)	(0.0434)	(0.0463)
Constant	n/a	n/a	0.365***
			(0.0282)
Observations	1,953	1,953	113
Countries	118	118	113
(Within-country)R-squared	0.780	0.903	0.300
Country fixed effects	Yes	Yes	No
Year fixed effects	Yes	Yes	No
Country time trend	No	Yes	No
Difference in ψ for good data countries	0.0415	-0.0136	0.0964
	(0.0639)	(0.0639)	(0.0912)

Notes: Robust standard errors (clustered by country except in column 2) in brackets. In columns 4 and 5,long differences are formed by averaging the first and last two years of levels data.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table 3: Results for Rated Low-Middle Income Countries; Growth in Real GDP