Appendices for 'Do the lights stay on? Deployment and withdrawal of peacekeepers and their effect on local economic development'

List of Tables

List of Figures

Appendix 1.   Summary tables

Table A1. List of missions included in the analysis

BINUB	United Nations Integrated Office in Burundi
MINUCI	United Nations Mission in Côte d'Ivoire
MINURCA	United Nations Mission in the Central African Republic
MINURCAT	United Nations Mission in the Central African Republic and Chad
MONUA	United Nations Observer Mission in Angola
MONUC	United Nations Organization Mission in the Democratic Republic of the Congo
MONUSCO	United Nations Organization Stabilization Mission in the Democratic Republic of Congo
ONUB	United Nations Operation in Burundi
UNAMID	African Union/United Nations Hybrid Operation in Darfur
UNAMIR	United Nations Assistance Mission for Rwanda
UNAMSIL	United Nations Mission in Sierra Leone
UNAVEM III	United Nations Angola Verification Mission III
UNISFA	United Nations Interim Security Force for Abyei
UNMIL	United Nations Mission in Liberia
UNMIS	United Nations Mission in the Sudan
UNMISS	United Nations Mission in the Republic of South Sudan
UNOCI	United Nations Operation in Côte d'Ivoire
UNOMIL	United Nations Observer Mission in Liberia
UNOMSIL	United Nations Observer Mission in Sierra Leone

Table A2. Summary statistics for variables in unmatched sample

Statistic	N	Mean	St. Dev.	Min	Max
Nightlights Mean	50,648	0.065	0.468	0.000	14.333
Calibrated Nightlights Mean	50,648	0.039	0.016	0.014	0.291
Nightlights Max	50,648	2.773	8.882	0	63
Number of troops in country	50,648	5,257.992	7,919.706	0	26,210
Number of troops in grid	50,648	11.568	121.310	0	4,020
Years after peacekeepers left grid	50,648	0.134	1.078	0	17
Duration of peacekeepers in grid	50,648	0.084	0.652	0	12
Casualties in grid	50,648	1.916	40.673	0	3,747
Spatial Lag number of troops in grid	50,648	0.025	0.026	0.0004	0.201
Redeployment period	50,648	0.002	0.046	0	1
Peace time in grid	50,648	11.269	5.541	1	21
Peace time in country	50,648	1.401	1.308	1	12

Table A3. Summary statistics for variables in matched sample

Statistic	N	Mean	St. Dev.	Min	Max
Nightlights Mean	11,168	0.092	0.287	0.000	5.187
Calibrated Nightlights Mean	11,168	0.039	0.014	0.014	0.113
Nightlights Max	11,168	5.404	10.987	0	63
Number of troops in country	11,168	5,585.681	7,892.154	0	26,210
Number of troops in grid	11,168	31.470	172.690	0	3,685
Years after peacekeepers left grid	11,168	0.478	2.016	0	17
Duration of peacekeepers in grid	11,168	0.284	1.155	0	12
Casualties in grid	11,168	3.743	56.000	0	3,747
Spatial Lag number of troops in grid	11,168	0.030	0.032	0.001	0.201
Redeployment period	11,168	0.004	0.065	0	1
Peace time in grid	11,168	9.931	5.602	1	21
Peace time in country	11,168	1.473	1.397	1	12

Table A4. Summary statistics for grids that experienced UN peacekeeping for variables in matched sample

Statistic	N	Mean	St. Dev.	Min	Max
Nightlights Mean	1,512	0.106	0.265	0.000	2.018
Calibrated Nightlights Mean	1,512	0.039	0.014	0.014	0.085
Nightlights Max	1,512	6.308	11.616	0	63
Number of troops in country	1,512	6,519.623	8,280.831	0	26,210
Number of troops in grid	1,512	52.718	253.855	0	3,600
Years after peacekeepers left grid	1,512	0.420	1.786	0	15
Duration of peacekeepers in grid	1,512	0.409	1.439	0	12
Casualties in grid	1,512	2.743	28.973	0	662
Spatial Lag number of troops in grid	1,512	0.031	0.033	0.001	0.201
Redeployment period	1,512	0.005	0.068	0	1
Peace time in grid	1,512	9.797	5.621	1	21
Peace time in country	1,512	1.341	1.149	1	12

Table A5. Summary statistics for grids without UN peacekeeping for variables in matched sample

Statistic	N	Mean	St. Dev.	Min	Max
Nightlights Mean	9,656	0.090	0.290	0.000	5.187
Calibrated Nightlights Mean	9,656	0.039	0.014	0.014	0.113
Nightlights Max	9,656	5.262	10.879	0	63
Number of troops in country	9,656	5,439.438	7,819.898	0	26,210
Number of troops in grid	9,656	28.143	155.965	0	3,685
Years after peacekeepers left grid	9,656	0.487	2.050	0	17
Duration of peacekeepers in grid	9,656	0.264	1.103	0	12
Casualties in grid	9,656	3.900	59.123	0	3,747
Spatial Lag number of troops in grid	9,656	0.029	0.032	0.001	0.197
Redeployment period	9,656	0.004	0.064	0	1
Peace time in grid	9,656	9.951	5.599	1	21
Peace time in country	9,656	1.494	1.431	1	12

Table A6. Summary statistics for variables used for matching

Statistic	N	Mean	St. Dev.	Min	Max
Capital Distance	50,648	737.471	411.238	5.176	1,910.548
Population in 1990 (Gridded Population of the World)	50,648	38,021.490	88,472.220	204.835	1,490,070.000
Number of casualties before UN	50,648	9.780	26.915	0	137
Travel time to the next urban center	50,648	677.977	584.688	58.877	5,794.422
Nighlight emissions in 1994 (calibrated)	50,648	0.022	0.006	0.021	0.196

Appendix 2.   Figures of summary statistics
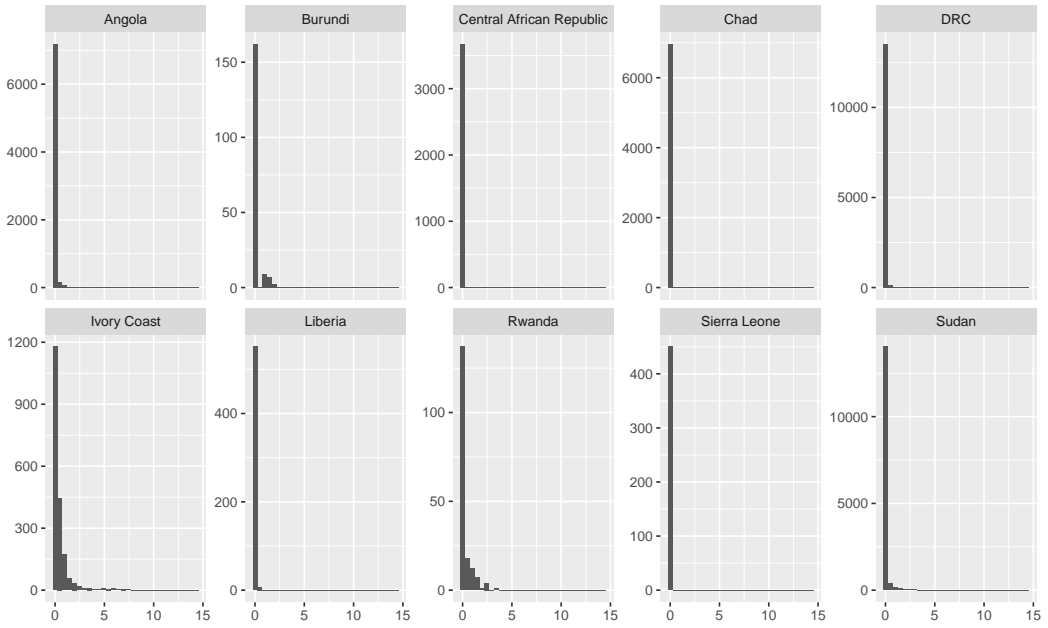
Figure A1. Histogram Full Sample: Mean nightlight emission in PRIO-GRID
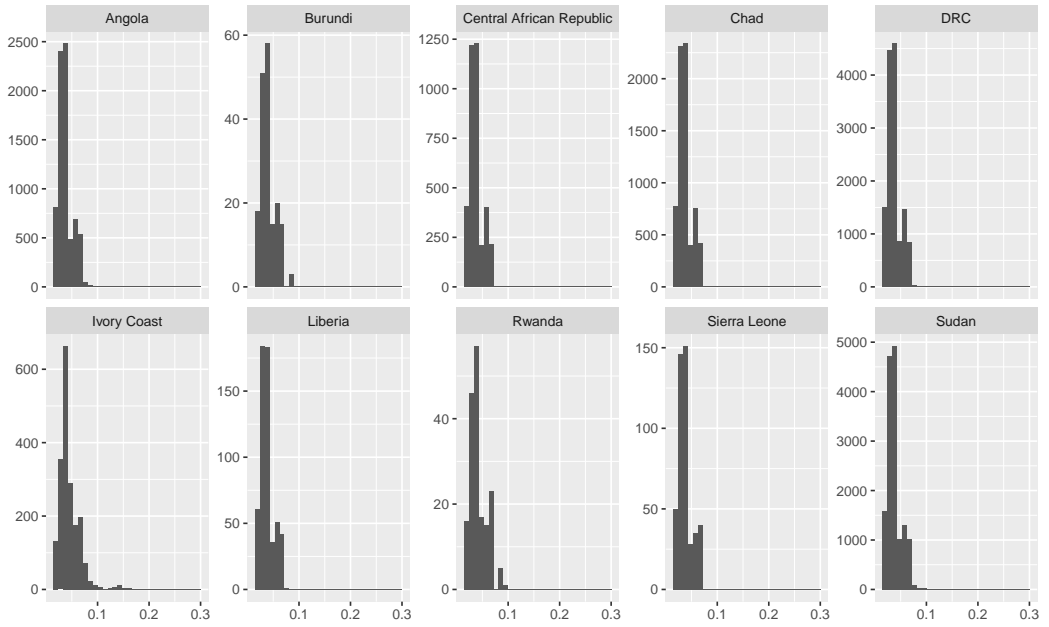
Figure A2. Histogram Full Sample: Calibrated mean nightlight emission in PRIO-GRID
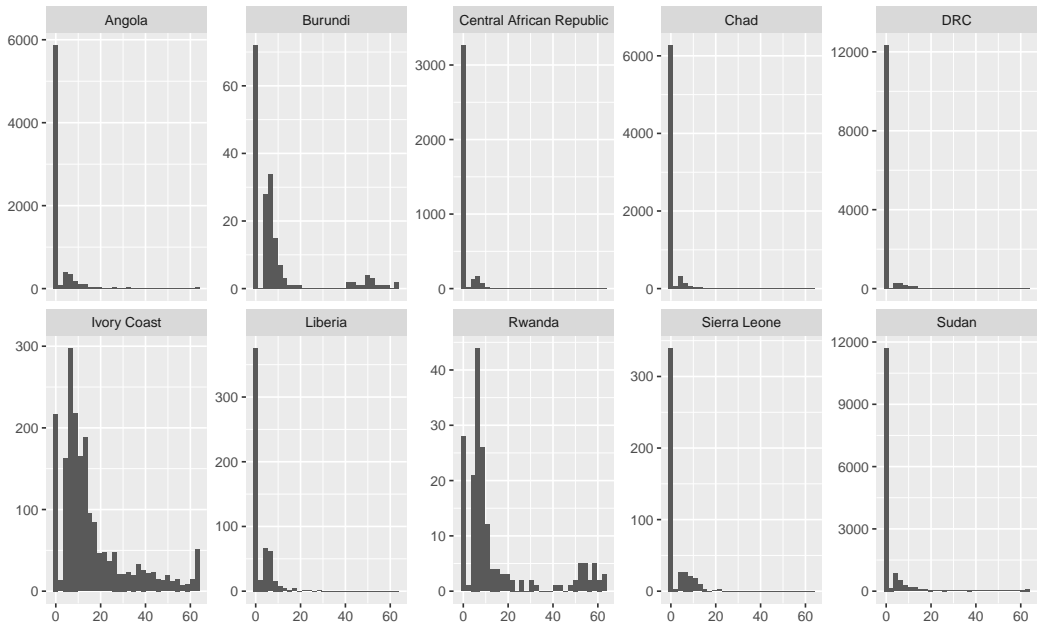
Figure A3. Histogram Full Sample: Maximum nightlight emission in PRIO-GRID
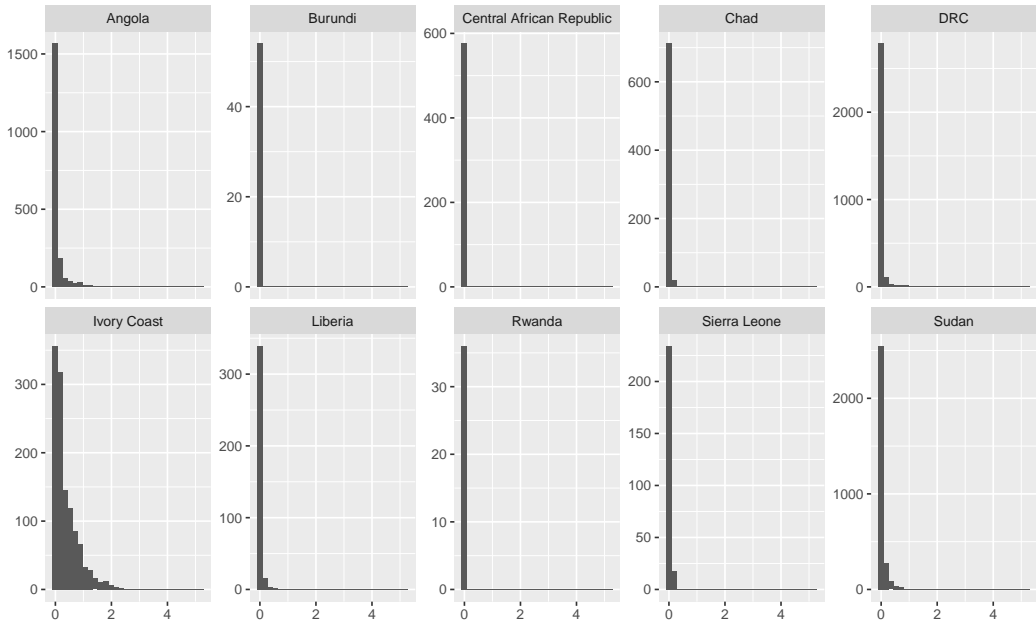
Figure A4. Histogram Matched Sample: Mean nightlight emission in PRIO-GRID
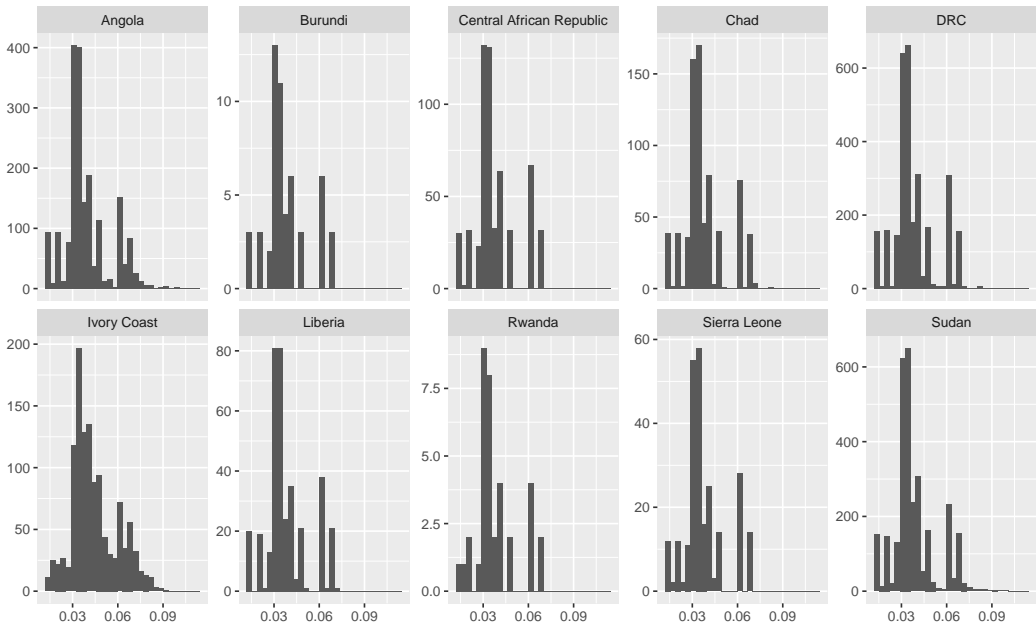
Figure A5. Histogram Matched Sample: Calibrated mean nightlight emission in PRIO-GRID
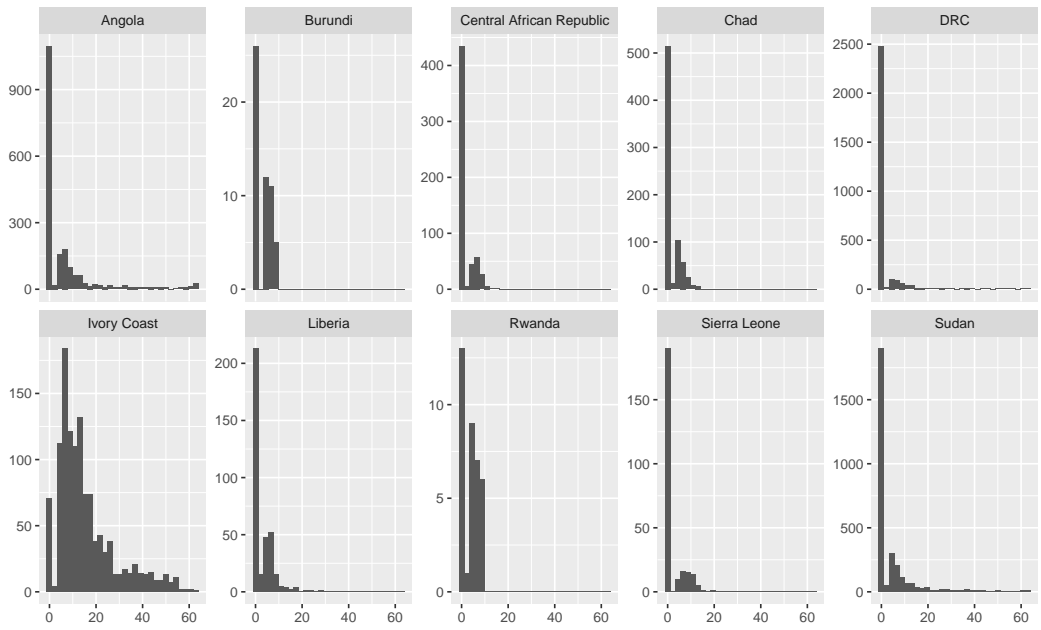
Figure A6. Histogram Matched Sample: Maximum nightlight emission in PRIO-GRID
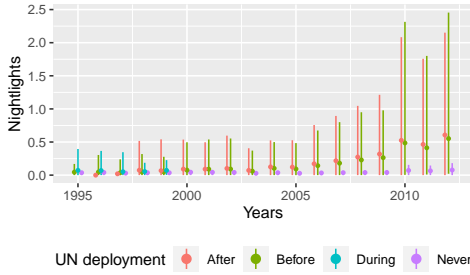
(a) Angola:Mean Nightlight

(b) Angola:Maximum Nightlight
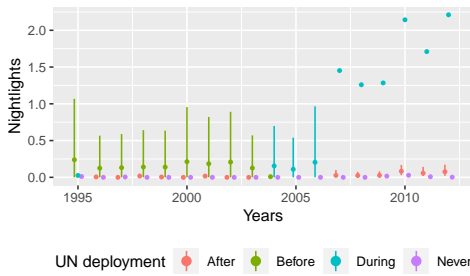
(c) Burundi:Mean Nightlight
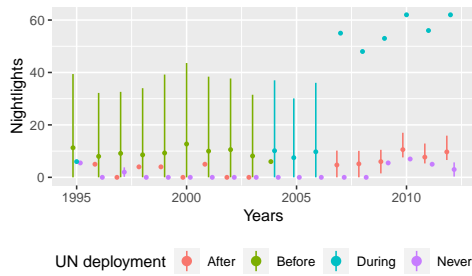
(d) Burundi:Maximum Nightlight

(e) CAR:Mean Nightlight

(f) CAR:Maximum Nightlight
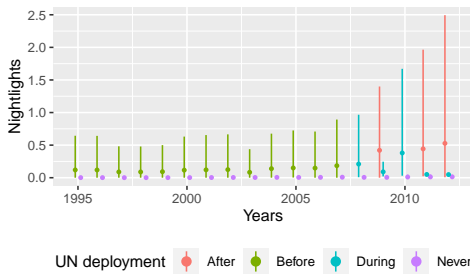
(g) Chad:Mean Nightlight
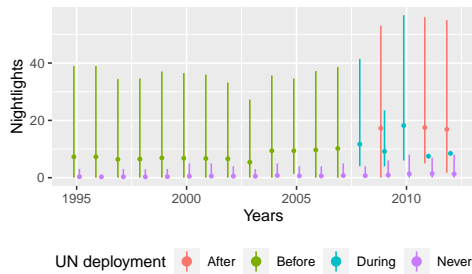
(h) Chad:Maximum Nightlight

Figure A7. Uncalibrated mean (left) and maximum (right) nightlight emission from PRIO-GRID.

(a) Ivory Coast:Mean Nightlight

(b) Ivory Coast:Maximum Nightlight
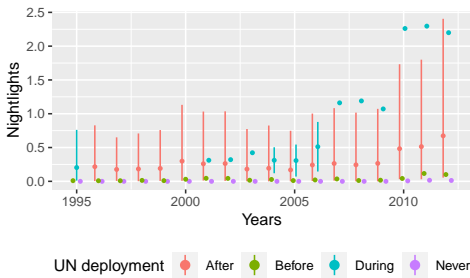
(c) Rwanda:Mean Nightlight
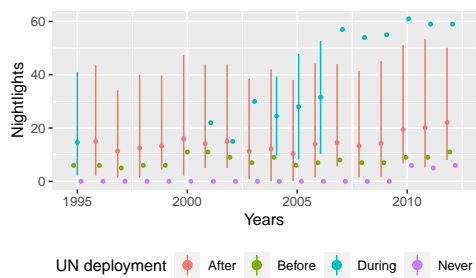
(d) Rwanda:Maximum Nightlight
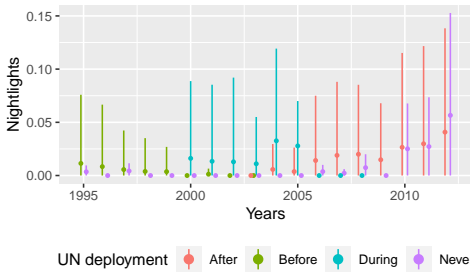
(e) Sierra Leone:Mean Nightlight
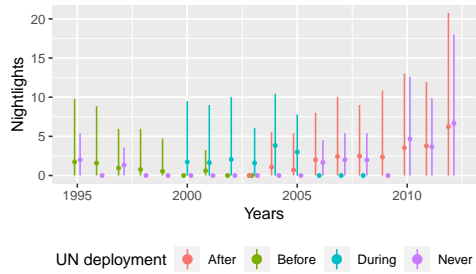
(f) Sierra Leone:Maximum Nightlight
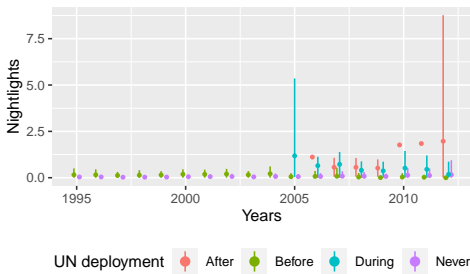
(g) Sudan:Mean Nightlight

(h) Sudan:Maximum Nightlight

Figure A8. Uncalibrated mean (left) and maximum (right) nightlight emission from PRIO-GRID.

Appendix 3.   Main results with the full sample

Table A7. Fixed effects models with unmatched samples. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable

	Uncalibrated Mean	Calibrated Mean	Uncalibrated Max	Uncalibrated Mean	Calibrated Mean	Uncalibrated Max	Uncalibrated Mean	Calibrated Mean	Uncalibrated Max
DV_{lag}	0.7772***	0.7531***	0.7088***	0.7713***	0.7521***	0.6937***	0.7697***	0.7520***	0.6926***
	(0.0034)	(0.0030)	(0.0032)	(0.0034)	(0.0030)	(0.0033)	(0.0034)	(0.0030)	(0.0033)
Troops present	0.0237***	-0.0002***	1.0654***						
	(0.0039)	(0.0000)	(0.0935)						
Troops withdrawn	0.0290***	-0.0001*	1.2759***						
	(0.0049)	(0.0001)	(0.1170)						
Years after peacekeepers left grid				0.0084***	0.0000***	0.4037***	0.0087***	0.0000***	0.4110***
				(0.0006)	(0.0000)	(0.0154)	(0.0006)	(0.0000)	(0.0154)
Duration of peacekeepers in grid				0.0054***	-0.0001***	0.4250***	-0.0023	-0.0001***	0.1837***
				(0.0021)	(0.0000)	(0.0492)	(0.0022)	(0.0000)	(0.0529)
Sq. duration of peacekeepers in grid				0.0006**	0.0000**	-0.0114*	0.0011***	0.0000***	0.0051
				(0.0003)	(0.0000)	(0.0066)	(0.0003)	(0.0000)	(0.0067)
Number of troops in grid$_{10,000}$							0.4791***	0.0026***	15.1343***
							(0.0519)	(0.0007)	(1.2223)
Number of troops in country$_{100,000}$	0.0186*	-0.0002	-0.6169***	0.0321***	-0.0001	0.0140	0.0324***	-0.0001	0.0212
	(0.0096)	(0.0001)	(0.2271)	(0.0096)	(0.0001)	(0.2268)	(0.0096)	(0.0001)	(0.2265)
Casualties in grid$_{1000}$	-0.0385***	-0.0005***	-1.1253***	-0.0297***	-0.0005***	-0.7753***	-0.0266**	-0.0005***	-0.6795***
	(0.0108)	(0.0001)	(0.2550)	(0.0108)	(0.0001)	(0.2536)	(0.0107)	(0.0001)	(0.2534)
Spatial Lag number of troops in grid	-0.1833***	0.0001	-4.9790***	-0.1627***	0.0001	-4.4793***	-0.1950***	-0.0001	-5.5113***
	(0.0381)	(0.0005)	(0.9037)	(0.0376)	(0.0005)	(0.8874)	(0.0377)	(0.0005)	(0.8899)
Redeployment period	0.0826***	0.0005***	0.8397***	0.0864***	0.0005***	1.0524***	0.0793***	0.0004***	0.8207***
	(0.0117)	(0.0001)	(0.2765)	(0.0116)	(0.0001)	(0.2740)	(0.0116)	(0.0001)	(0.2742)
Peace time in grid	-0.0008***	0.0000***	-0.0327***	-0.0006***	0.0000***	-0.0251***	-0.0005***	0.0000***	-0.0231***
	(0.0002)	(0.0000)	(0.0047)	(0.0002)	(0.0000)	(0.0047)	(0.0002)	(0.0000)	(0.0046)
Peace time in country	0.0001	0.0000***	0.0612***	-0.0004	0.0000***	0.0390***	-0.0003	0.0000***	0.0403***
	(0.0004)	(0.0000)	(0.0093)	(0.0004)	(0.0000)	(0.0093)	(0.0004)	(0.0000)	(0.0093)
Grid FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.5350	0.5766	0.5116	0.5371	0.5768	0.5184	0.5380	0.5770	0.5199
Adj. R^2	0.5073	0.5513	0.4825	0.5095	0.5516	0.4897	0.5104	0.5517	0.4913
Num. obs.	50648	50648	50648	50648	50648	50648	50648	50648	50648

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$
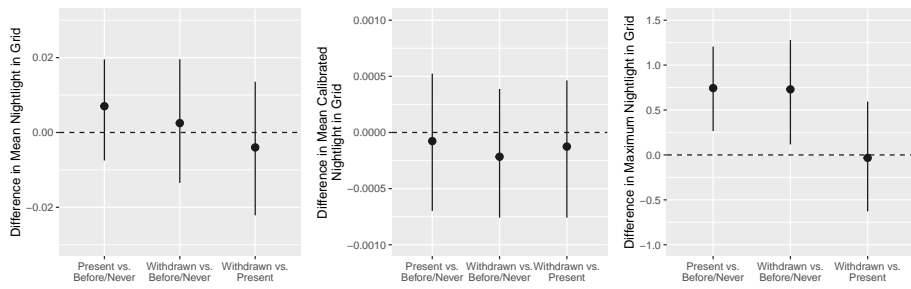
Figure A9. First difference in predicted nightlight emissions in matched PRIO-grids. Quantities are calculated by holding all other grid-level characteristics at their mean values. Left panel: Mean nightlight model. Center panel: Calibrated mean nightlight model. Right panel: Maximum nightlight model.

Appendix 4.   Matched TWFE models with indicators for years since deployment and years since withdrawal

(a) Treatment: UN presence

(b) Treatment: UN withdrawal

(c) Treatment: UN presence

(d) Treatment: UN withdrawal

(e) Treatment: UN presence

(f) Treatment: UN withdrawal
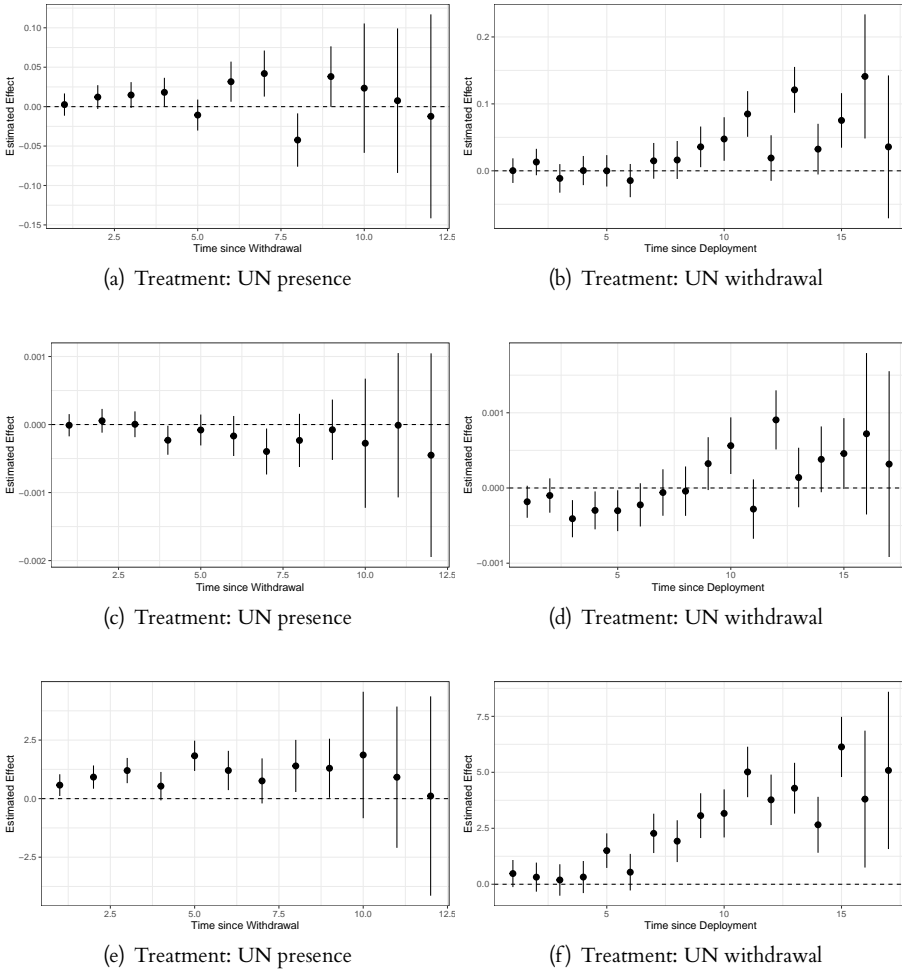
Figure A10. Matched TWFE models with time since deployment and time since withdrawal as dummy variables. First row: Mean nightlight models. Second row: Calibrated mean nightlight models. Third row: Maximum nightlight models.

Appendix 5.   Split sample analysis

In our main analysis using two-way fixed effect (TWFE) specification, we are combining the period before, during, and after peacekeeping deployment. As result, variables measuring the duration of deployment and years since withdrawal do not have a uniquely meaningful zero values. In other words, duration can be coded zero either before or after deployment. As we discuss in the manuscript, our DiD estimation addresses this concern, yet to ensure the robustness of the TWFE finding, we separate our analysis into the deployment and withdrawal periods of grids. We adjust our matching accordingly to ensure that we compare grids that are similar to those that are in the deployment and withdrawal period but did not experience UN peacekeeping. The estimates from these models are provided in Table A8 and Table A9. Figure A11 provides insights into the substantive effects, where the first two columns pertain to the deployment models (Table A8) and the last column to effects from the withdrawal model (Table A9). These models are in line with the findings of our main models. With this split sample analysis, we are also able to assess whether the size during deployment matter post-deployment empirically. We include the maximum previous number of peacekeepers in the grid. Table A9 suggests that previous deployment size matters less in the post-peacekeeping period.

Table A8. Deployment models. Fixed effects models with matched samples. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable

	Mean	Calibrated Mean	Maximum
DV_{lag}	0.8042***	0.7877***	0.6731***
	(0.0067)	(0.0055)	(0.0070)
Number of troops in country$_{100,000}$	-0.0079	0.0003**	-0.2729
	(0.0142)	(0.0002)	(0.5496)
Number of troops in grid$_{10,000}$	0.4194**	0.0064***	24.3877***
	(0.1813)	(0.0022)	(7.0131)
Duration of peacekeepers in grid	-0.0034	-0.0001	-0.3513
	(0.0130)	(0.0002)	(0.5014)
Casualties in grid$_{1,000}$	0.0197	-0.0022***	-6.3721***
	(0.0540)	(0.0006)	(2.0730)
Spatial Lag number of troops in grid	-0.0286	-0.0004*	-0.4884
	(0.0184)	(0.0002)	(0.7134)
Redeployment period	-0.0002	-0.0000***	-0.0233**
	(0.0003)	(0.0000)	(0.0103)
Peace time in grid	0.0009*	0.0000***	0.0792***
	(0.0005)	(0.0000)	(0.0201)
Peace time in country	0.0022	-0.0001***	0.3175***
	(0.0018)	(0.0000)	(0.0708)
Number of troops in grid$_{10,000}$ × Duration of peacekeepers in grid	-0.0528	-0.0004	-1.5561
	(0.0412)	(0.0005)	(1.5968)
Grid FE	yes	yes	yes
Year FE	yes	yes	yes
R^2	0.5907	0.6701	0.4854
Adj. R^2	0.5648	0.6492	0.4528
Num. obs.	11109	11109	11109

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table A9. Withdrawal models. Fixed effects models with matched samples. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable.

	Mean	Calibrated Mean	Maximum
DV_{lag}	0.8622***	0.8245***	0.7688***
	(0.0063)	(0.0052)	(0.0065)
Number of troops in country$_{100,000}$	-0.0043	0.0003	0.3768
	(0.0162)	(0.0002)	(0.5880)
Years after peacekeepers left grid	0.0037**	0.0000	0.2901***
	(0.0016)	(0.0000)	(0.0578)
Casualties in grid$_{1,000}$	0.0035	0.0000	-0.0348
	(0.0141)	(0.0002)	(0.5114)
Spatial Lag number of troops in grid	0.0277	-0.0020***	-7.9501***
	(0.0619)	(0.0007)	(2.2260)
Years after peacekeepers left grid $\times$ Max Number of troops in grid	-0.0000	-0.0000	-0.0001
	(0.0000)	(0.0000)	(0.0001)
Peace time in grid	0.0001	-0.0000	-0.0318***
	(0.0003)	(0.0000)	(0.0113)
Peace time in country	0.0008	0.0000***	0.0783***
	(0.0006)	(0.0000)	(0.0217)
Grid FE	yes	yes	yes
Year FE	yes	yes	yes
R^2	0.6535	0.7195	0.5873
Adj. R^2	0.6315	0.7017	0.5611
Num. obs.	10768	10768	10768

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$
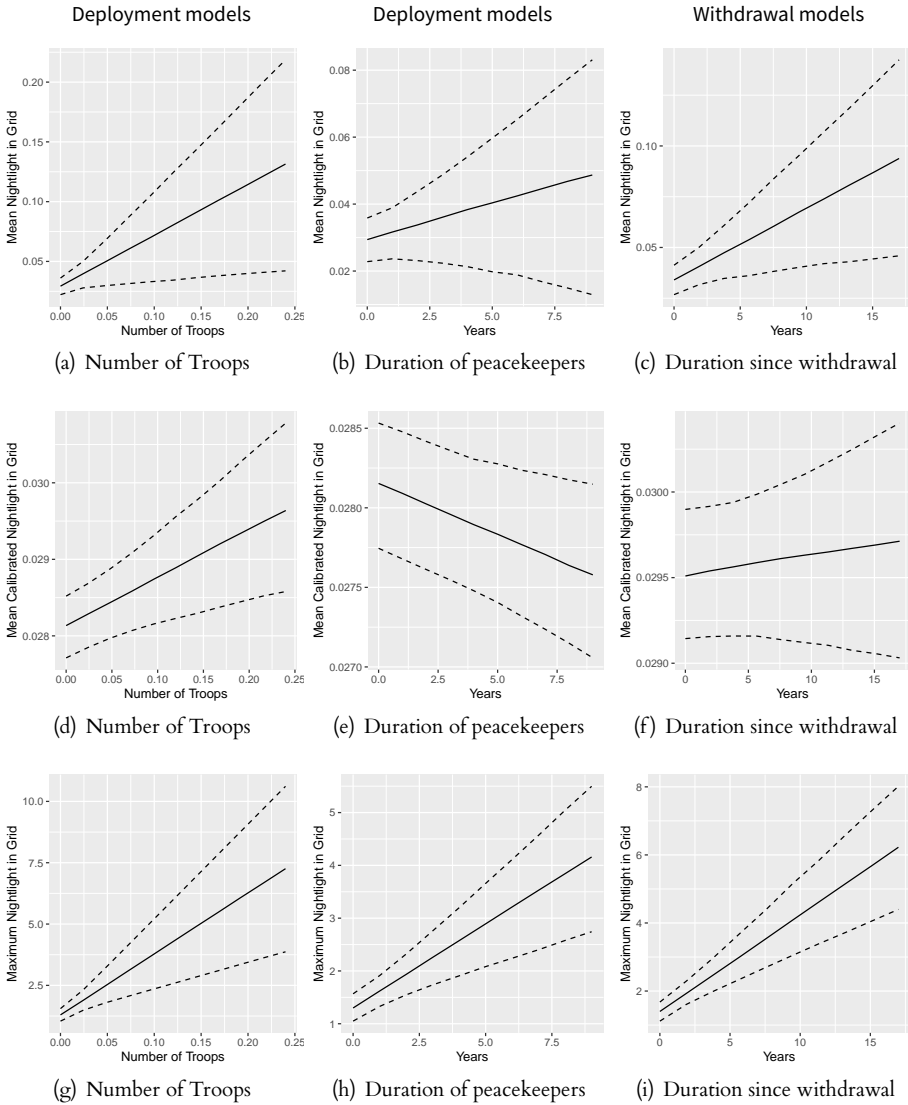
Figure A11. Predicted nightlight emissions in matched PRIO-grids. The left panels provide predicted nightlight for the number of UN troops from the deployment models (Table A8). Center panels pertain to the time UN peacekeepers have been in a PRIO-grid from the deployment models (Table A8). The right panels refer to the predicted nightlights after peacekeepers have left a PRIO-grid from the withdrawal models (Table A9) . Quantities are calculated by holding all other grid-level characteristics at their mean values. First row: Mean nightlight models. Second row: Calibrated mean nightlight models. Third row: Maximum nightlight models.

Appendix 6.   Spatial effects

In this section, we calculate the impact of spatial effects. We assess the effect by simulating spatial effects on 10x10 PRIO–grids. We set number of troops in all grids to zero and vary the number in troops in only one grid from the minimum (0) to the maximum value (4020) of observed troops in a grid. We calculate the spatial lag for all other grids accordingly and then simulate predicted value of nightlights. The visualization of these results can be found in Figure A12. We also increase the number of grids from 1 to 10 that have peacekeepers and vary the troop level from minimum to maximum. We then calculate the simulated mean nightlight emission across all 100 PRIO–grids. The results are summarized in Figure A13. We can demonstrate that increases in the number of grids with peacekeepers and increases in the overall number of peacekeepers in a grid, are associated with greater displacement effects of nightlight emissions.

These findings speak directly to the debate on peacekeeping economies. Several studies have pointed out challenges and even harmful consequences of a large international presence (e.g. Jennings and Bøås 2015; Beber et al. 2017). Our main findings show that peacekeepers may, despite those negative consequences, also generate conditions for a more positive long-term economic development after they leave, but only in areas where they were deployed. Thus, our findings point to an additional challenge associated with peacekeepers' effect on equitable growth. We do not find stronger economic development in areas neighboring peacekeeping deployments. When peacekeeping missions plan for deployment and withdrawal they should carefully consider these potentially unequal local consequences and engage aid donors in a conversation about strategic selection of local projects.
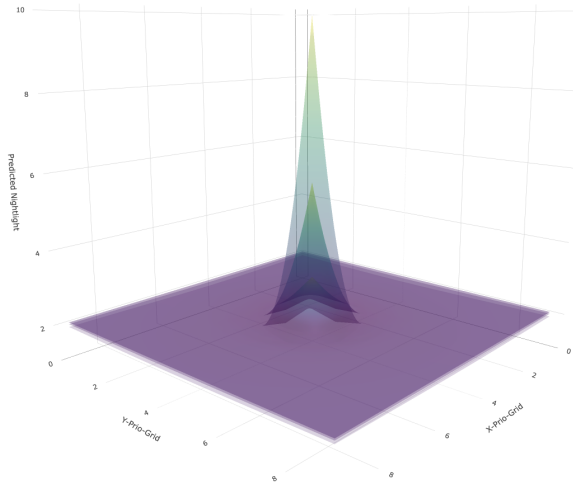
(a) Perspective above
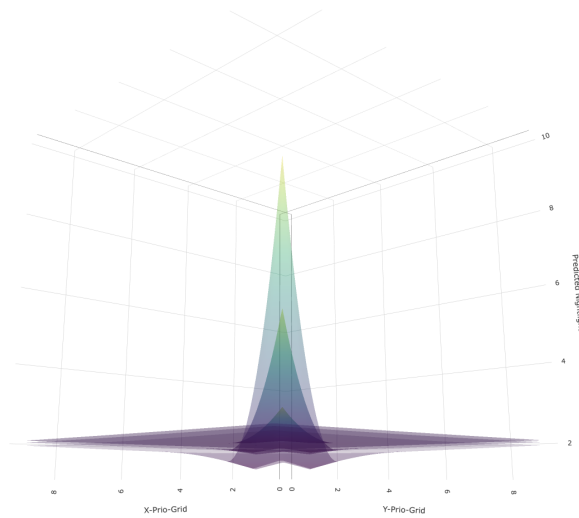
(b) Perspective below

Figure A12. Spatial effects of Troop levels on neighbouring nightlight across 10×10 grid. Spatial effect calculated by increasing troop levels in one centrally located grid (using maximum nightlight model with matching). Lowest plane = 400 peacekeepers in grid, Middle plane = 2000 peacekeepers in grid, Upper plane = 4000 peacekeepers in grid.
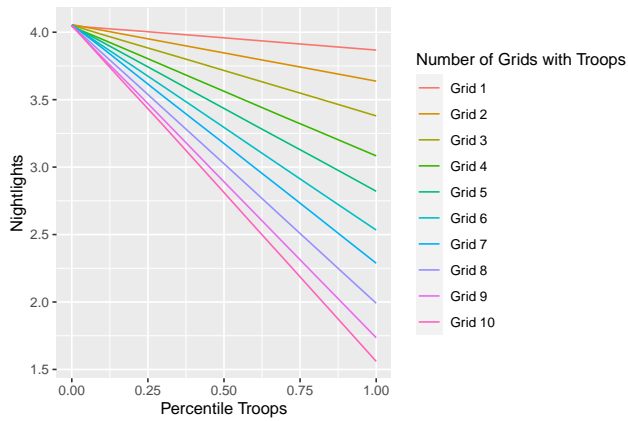
Figure A13. Spatial effects of Troop levels on mean nightlight emission across 10×10 simulated grids (using maximum nightlight model with matching). Each line for simulations with increasing numbers of grids with deployed peacekeepers. Simulations are then made with increasing the number peacekeepers in the respective grids from minimum to maximum levels.

Appendix 7.   Long-run effects

In this section, we calculate the long–run effects of our main models. These are obtained using instrumental variable (IV) estimation (Bewley 1979) which provides long–run effects with standard errors.

Table A10. Long-run effects. Fixed effects models with full and matched samples. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects.

	Mean		Calibrated Mean		Maximum	
	Full Sample	Matched Sample	Full Sample	Matched Sample	Full Sample	Matched Sample
Difference ($t_0 - t_{-1}$)	-3.3414***	-8.0386***	-3.0328***	-4.3406***	-2.2534***	-3.2947***
	(0.0635)	(0.5026)	(0.0482)	(0.1578)	(0.0344)	(0.1213)
Number of troops in country$_{100,000}$	0.1408***	-0.2730	-0.0003	-0.0006	0.0688	-3.8748
	(0.0417)	(0.1990)	(0.0005)	(0.0014)	(0.7368)	(3.0976)
Number of troops in grid$_{10,000}$	2.0799***	2.4237***	0.0106***	0.0181***	49.2374***	92.7140***
	(0.2257)	(0.7045)	(0.0027)	(0.0048)	(3.9967)	(10.9877)
Years after peacekeepers left grid	0.0376***	0.0408***	0.0002***	0.0001***	1.3371***	1.3187***
	(0.0028)	(0.0072)	(0.0000)	(0.0000)	(0.0496)	(0.1103)
Duration of peacekeepers in grid	-0.0099	0.0171	-0.0005***	-0.0002	0.5975***	0.5710
	(0.0097)	(0.0250)	(0.0001)	(0.0002)	(0.1720)	(0.3894)
Casualties in grid$_{1000}$	-0.1156**	-0.0536	-0.0020***	-0.0012	-2.2105***	-2.3555
	(0.0467)	(0.1461)	(0.0006)	(0.0010)	(0.8249)	(2.2738)
Spatial Lag number of troops in grid	-0.8465***	-1.8184***	-0.0005	-0.0172***	-17.9302***	-42.2534***
	(0.1645)	(0.5925)	(0.0019)	(0.0040)	(2.9001)	(8.9984)
Sq. duration of peacekeepers in grid	0.0050***	-0.0017	0.0000***	-0.0000	0.0166	-0.0428
	(0.0012)	(0.0032)	(0.0000)	(0.0000)	(0.0218)	(0.0497)
Redeployment period	0.3443***	0.0223	0.0018***	-0.0017*	2.6701***	-2.5094
	(0.0506)	(0.1400)	(0.0006)	(0.0010)	(0.8924)	(2.1800)
Peace time in grid	-0.0023***	0.0010	0.0001***	-0.0000**	-0.0753***	-0.0552
	(0.0009)	(0.0029)	(0.0000)	(0.0000)	(0.0151)	(0.0456)
Peace time in country	-0.0014	0.0045	0.0001***	0.0003***	0.1312***	0.3454***
	(0.0017)	(0.0072)	(0.0000)	(0.0000)	(0.0301)	(0.1118)
Grid FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
R^2	0.1776	0.1725	0.1115	0.0749	0.1067	0.1023
Adj. R^2	0.1286	0.1168	0.0585	0.0126	0.0534	0.0419
Num. obs.	50648	11168	50648	11168	50648	11168

***$p < 0.01$;**$p < 0.05$;*$p < 0.1$

Appendix 8.   Results from additional models
Appendix 8.1   Non-linearity of post-deployment effects

(a) Main Model: Linear effect

(b) Main Model: Non-linear effect

(c) After deployment model: Linear effect

(d) After deployment model: Non-linear effect

Figure A14. Panels demonstrate the effect of time since peacekeepers left a grid on maximum nightlight emission. Upper panels compare the main model specification with linear and non-linear specification. Bottom panels compare the after deployment model specification with linear and non-linear specification.

Table A11. Fixed effects models with full and matched samples with non-linear terms. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable

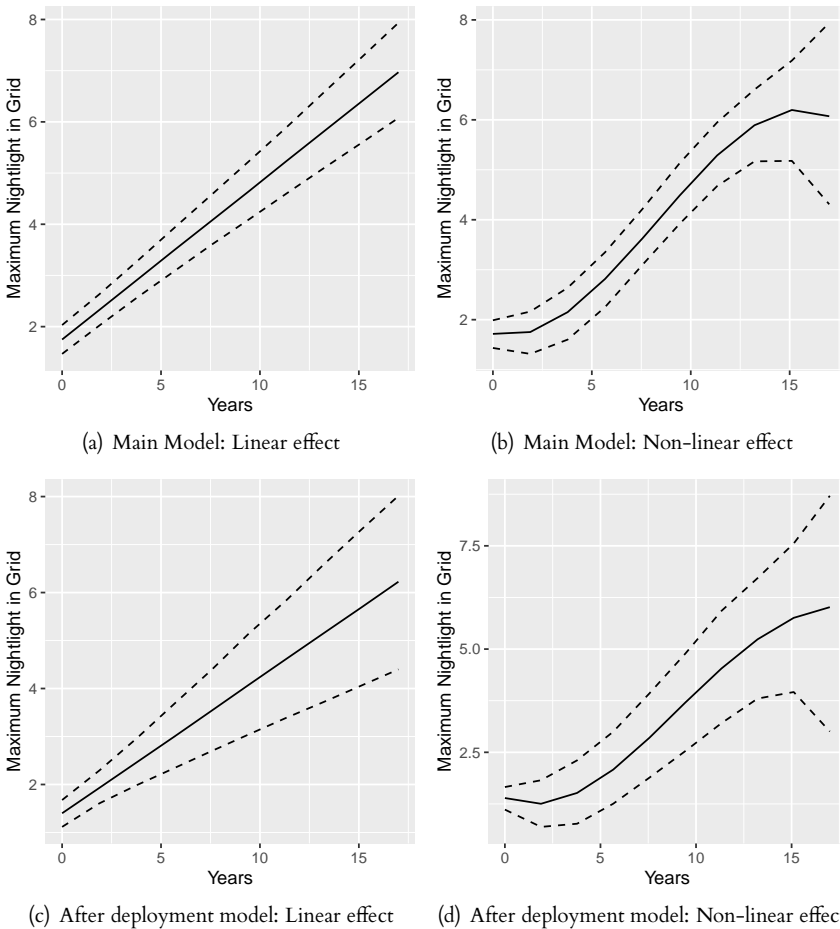|	Mean		Calibrated Mean		Maximum	
	Full Sample	Matched Sample	Full Sample	Matched Sample	Full Sample	Matched Sample
DV_{lag}	0.7691***	0.8882***	0.7517***	0.8106***	0.6913***	0.7643***
	(0.0034)	(0.0062)	(0.0030)	(0.0055)	(0.0033)	(0.0066)
Number of troops in country$_{100,000}$	0.0330***	-0.0306	-0.0001	-0.0001	0.0176	-0.9098
	(0.0096)	(0.0220)	(0.0001)	(0.0003)	(0.2264)	(0.7208)
Number of troops in grid$_{10,000}$	0.4695***	0.2676***	0.0024***	0.0034***	14.6435***	21.6352***
	(0.0520)	(0.0771)	(0.0007)	(0.0009)	(1.2243)	(2.5330)
Years after peacekeepers left grid	0.0063**	-0.0075**	-0.0001***	-0.0002***	0.0307	-0.1122
	(0.0031)	(0.0036)	(0.0000)	(0.0000)	(0.0724)	(0.1191)
Duration of peacekeepers in grid	-0.0034	-0.0003	-0.0002***	-0.0001**	0.1360**	0.0692
	(0.0023)	(0.0028)	(0.0000)	(0.0000)	(0.0534)	(0.0922)
Casualties in grid$_{1000}$	-0.0289***	-0.0080	-0.0005***	-0.0002	-0.7393***	-0.6085
	(0.0108)	(0.0161)	(0.0001)	(0.0002)	(0.2535)	(0.5293)
Spatial Lag number of troops in grid	-0.2043***	-0.1890***	-0.0001	-0.0030***	-5.4659***	-9.3912***
	(0.0378)	(0.0638)	(0.0005)	(0.0007)	(0.8912)	(2.0863)
Sq. duration of peacekeepers in grid	0.0013***	0.0000	0.0000***	0.0000	0.0101	-0.0035
	(0.0003)	(0.0004)	(0.0000)	(0.0000)	(0.0068)	(0.0117)
Redeployment period	0.0775***	0.0052	0.0004***	-0.0003	0.7822***	-0.5036
	(0.0116)	(0.0155)	(0.0001)	(0.0002)	(0.2742)	(0.5076)
Peace time in grid	-0.0006***	-0.0000	0.0000***	-0.0000**	-0.0262***	-0.0162
	(0.0002)	(0.0003)	(0.0000)	(0.0000)	(0.0047)	(0.0107)
Peace time in country	-0.0001	0.0008	0.0000***	0.0001***	0.0451***	0.0893***
	(0.0004)	(0.0008)	(0.0000)	(0.0000)	(0.0093)	(0.0261)
Sq. years after peacekeepers left grid	-0.0006	0.0017**	0.0000***	0.0000***	0.0569***	0.0696***
	(0.0006)	(0.0007)	(0.0000)	(0.0000)	(0.0137)	(0.0224)
Cube. years after peacekeepers left grid	0.0001**	-0.0001*	-0.0000*	-0.0000***	-0.0020***	-0.0028***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0007)	(0.0011)
Grid FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
R^2	0.5383	0.6761	0.5773	0.6812	0.5204	0.6024
Adj. R^2	0.5107	0.6543	0.5521	0.6597	0.4917	0.5756
Num. obs.	50648	11168	50648	11168	50648	11168

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table A12. Withdrawal models with non-linear terms. Fixed effects models with matched samples. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable

	Mean	Calibrated Mean	Maximum
DV_{lag}	0.8619***	0.8236***	0.7671***
	(0.0063)	(0.0052)	(0.0065)
Number of troops in country$_{100,000}$	-0.0056	0.0002	0.3271
	(0.0162)	(0.0002)	(0.5884)
Years after peacekeepers left grid	-0.0074	-0.0002***	-0.1929
	(0.0051)	(0.0001)	(0.1854)
Casualties in grid$_{1,000}$	0.0026	-0.0000	-0.0766
	(0.0141)	(0.0002)	(0.5113)
Spatial Lag number of troops in grid	0.0366	-0.0018**	-7.5896***
	(0.0622)	(0.0007)	(2.2373)
Max Number of troops in grid	-0.0000	0.0000	-0.0001
	(0.0000)	(0.0000)	(0.0001)
Peace time in grid	0.0000	-0.0000	-0.0345***
	(0.0003)	(0.0000)	(0.0113)
Peace time in country	0.0009	0.0000***	0.0823***
	(0.0006)	(0.0000)	(0.0218)
Sq. years after peacekeepers left grid	0.0017*	0.0000***	0.0712**
	(0.0009)	(0.0000)	(0.0345)
Cube. years after peacekeepers left grid	-0.0001	-0.0000**	-0.0026
	(0.0000)	(0.0000)	(0.0017)
Grid FE	yes	yes	yes
Year FE	yes	yes	yes
R^2	0.6537	0.7200	0.5878
Adj. R^2	0.6317	0.7022	0.5615
Num. obs.	10768	10768	10768

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Appendix 8.2   Redeployment Period

Table A13. Fixed effects models with matched samples. Outcome variable: Maximum nightlight emissions in PRIO-GRID. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable. First model pertains to the baseline model, while the second model includes interactions with the deployment period of UN peacekeepers in a grid. This is to assess possible heterogenous treatment effects.

	Baseline Model	Redeployment Interaction
DV_{lag}	0.7672***	0.7672***
	(0.0066)	(0.0066)
Number of troops in country$_{100,000}$	-0.9022	-0.9199
	(0.7212)	(0.7217)
Number of troops in grid$_{10,000}$	21.5882***	21.6849***
	(2.5344)	(2.5398)
Years after peacekeepers left grid	0.3071***	0.3064***
	(0.0259)	(0.0259)
Duration of peacekeepers in grid	0.1330	0.1196
	(0.0907)	(0.0915)
Casualties in grid$_{1000}$	-0.5485	-0.5526
	(0.5294)	(0.5295)
Spatial Lag number of troops in grid	-9.8386***	-9.7195***
	(2.0821)	(2.0860)
Sq. duration of peacekeepers in grid	-0.0100	-0.0085
	(0.0116)	(0.0116)
Redeployment period (RP)	-0.5843	-1.4975
	(0.5075)	(1.3821)
Peace time in grid	-0.0128	-0.0135
	(0.0106)	(0.0106)
Peace time in country	0.0804***	0.0818***
	(0.0260)	(0.0260)
RP $\times$ Number of troops in grid$_{10,000}$		-12.6544
		(63.8145)
RP $\times$ Years after peacekeepers left grid		0.1416
		(0.9084)
RP $\times$ Duration of peacekeepers in grid		1.1786
		(1.1544)
RP $\times$ Sq. duration of peacekeepers in grid		-0.1757
		(0.1724)
Grid FE	yes	yes
Year FE	yes	yes
R^2	0.6019	0.6019
Adj. R^2	0.5751	0.5750
Num. obs.	11168	11168

$^{***}p < 0.01; ^{**}p < 0.05; ^{*}p < 0.1$

Appendix 8.3 Duration and size interaction

Our results show that the positive effect of peacekeepers on nightlight emissions comes from their size and not merely their presence in a particular PRIO-GRID. Once we control for size, we find inconsistent evidence for the length of peacekeeping presence. To further explore this, we interact the duration and the number of peacekeepers in a grid (Appendix Table A14), and still do not find any consistent evidence for an effect of the duration of peacekeeping deployment. This might reflect a selection effect, whereby factors that influence the duration of the deployment, such as ongoing fighting or lingering insecurity, also make economic development more challenging and counteract positive impacts from peacekeepers. Staying longer is thus not sufficient for spurring economic development; instead, a sizable local presence is needed. The analysis with split samples introduced above confirms that it is the number of peacekeepers that matters during deployment.

Table A14. Fixed effects models with matched samples. Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable. Models investigate the interaction between duration of peacekeepers in a grid and their size.

	Uncalibrated Mean	Calibrated Mean	Uncalibrated Max
DV_{lag}	0.8895***	0.8130***	0.7669***
	(0.0062)	(0.0055)	(0.0066)
Number of troops in country$_{100,000}$	-0.0303	-0.0001	-0.9278
	(0.0220)	(0.0003)	(0.7215)
Number of troops in grid$_{10,000}$	0.1925	0.0042**	13.5882**
	(0.1777)	(0.0021)	(5.8229)
Years after peacekeepers left grid	0.0045***	0.0000***	0.3037***
	(0.0008)	(0.0000)	(0.0260)
Casualties in grid$_{1000}$	-0.0061	-0.0002	-0.5006
	(0.0162)	(0.0002)	(0.5314)
Spatial Lag number of troops in grid	-0.1980***	-0.0033***	-9.4713***
	(0.0642)	(0.0007)	(2.0962)
Redeployment period	0.0030	-0.0003*	-0.5478
	(0.0155)	(0.0002)	(0.5079)
Peace time in grid	0.0001	-0.0000**	-0.0129
	(0.0003)	(0.0000)	(0.0106)
Peace time in country	0.0005	0.0000***	0.0799***
	(0.0008)	(0.0000)	(0.0260)
Duration of peacekeepers in grid	-0.0001	-0.0001	0.0631
	(0.0032)	(0.0000)	(0.1038)
Sq. duration of peacekeepers in grid	0.0002	0.0000	0.0007
	(0.0005)	(0.0000)	(0.0149)
Number of troops in grid$_{10,000}$ × Duration of peacekeepers in grid	0.0821	0.0001	5.0310*
	(0.0914)	(0.0011)	(2.9936)
Number of troops in grid$_{10,000}$ × Sq. duration of peacekeepers in grid	-0.0119	-0.0001	-0.5551
	(0.0104)	(0.0001)	(0.3400)
Grid FE	yes	yes	yes
Year FE	yes	yes	yes
R^2	0.6757	0.6801	0.6020
Adj. R^2	0.6538	0.6585	0.5751
Num. obs.	11168	11168	11168

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Appendix 8.4   *Deployment size and duration treatments*

Our main matching strategy involves matching locations with and without peacekeeping presence. However, this partly ignores the selection process of large deployments versus small – something that could muddle our estimates of the size of deployments. We therefore report results using an alternative strategy by matching locations based on the deployment size and duration. To do so, we modify our treatment to capture the size and the duration of deployment. We code the troop size treatment (1) when there are no peacekeeping troops deployed in a grid, (2) when the number of peacekeeping troops is larger than 0 but smaller than 500, (3) when the number of troops is between 500 and 999, and (4) when total the number of troops deployed in grid is 1000 or higher. We code the duration treatment (1) when no peacekeepers are deployed in a grid, (2) when peacekeepers are deployed for 1 to 3 years, (3) when peacekeepers are deployed for 4 to 6 years, and (4) when peacekeepers are deployed in a grid for more than 6 years. We use Coarsened Exact Matching (CEM) to balance our sample across the four categories of the new treatment variables, using the same matching variables as we use for the binary treatment. We then rerun our deployment models with the weights obtained from CEM. These deployment models include all control variables discussed in the manuscript. Our findings on the effect of the deployment size are robust to using the deployment size categorical treatment, instead of the UN presence treatment (See Table A15). We also do not find a consistent and significant effect of the duration of peacekeeping deployment, after using the deployment duration categorical treatment (See Table A16).

Table A15. Fixed effects models with matched samples (Deployment size treatment). Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable .

	Uncalibrated Mean	Calibrated Mean Z-standardized	Uncalibrated Max
DV_{lag}	0.8702***	0.7494***	0.7536***
	(0.0059)	(0.0063)	(0.0065)
Number of troops in country$_{100,000}$	-0.0085	-0.1775***	0.4416
	(0.0183)	(0.0536)	(0.6241)
Number of troops in grid$_{10,000}$	0.5378***	1.9099***	27.5065***
	(0.0658)	(0.1929)	(2.2494)
Duration of peacekeepers in grid	-0.0027**	-0.0134***	0.1279***
	(0.0012)	(0.0036)	(0.0422)
Casualties in grid$_{1,000}$	-0.0184	0.0022	-0.7294
	(0.0294)	(0.0862)	(1.0039)
Spatial Lag number of troops in grid	-0.1017*	0.0724	-8.1118***
	(0.0572)	(0.1672)	(1.9471)
Redeployment period	-0.0437**	-0.0983*	-1.0710
	(0.0194)	(0.0570)	(0.6633)
Peace time in grid	0.0002	-0.0005	-0.0161
	(0.0003)	(0.0009)	(0.0107)
Peace time in country	0.0008	-0.0071***	0.0457
	(0.0008)	(0.0025)	(0.0288)
Grid FE	yes	yes	yes
Year FE	yes	yes	yes
R^2	0.6558	0.5483	0.5611
Adj. R^2	0.6334	0.5190	0.5327
Num. obs.	12358	12358	12358

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table A16. Fixed effects models with matched samples (Deployment duration treatment). Outcome variable: Nightlight emissions. Unit of analysis is a grid-year. All models include year and grid fixed effects as well as lagged dependent variable.

	Uncalibrated Mean	Calibrated Mean Z-standardized	Uncalibrated Max
DV_{lag}	0.8099***	0.6983***	0.7548***
	(0.0057)	(0.0062)	(0.0061)
Number of troops in country$_{100,000}$	-0.0015	-0.0800	1.2191**
	(0.0178)	(0.0507)	(0.5308)
Number of troops in grid$_{10,000}$	0.5093***	0.9162***	16.0426***
	(0.0688)	(0.1953)	(2.0456)
Duration of peacekeepers in grid	-0.0010	-0.0044	0.0890***
	(0.0011)	(0.0031)	(0.0327)
Casualties in grid$_{1,000}$	-0.0490***	-0.0000	-1.2100**
	(0.0170)	(0.0483)	(0.5056)
Spatial Lag number of troops in grid	-0.1004*	0.0051	-9.1516***
	(0.0587)	(0.1668)	(1.7469)
Redeployment period	-0.0094	-0.0186	-0.7974
	(0.0191)	(0.0544)	(0.5696)
Peace time in grid	0.0006*	0.0000	-0.0214**
	(0.0003)	(0.0010)	(0.0100)
Peace time in country	0.0008	-0.0007	0.0691***
	(0.0007)	(0.0020)	(0.0212)
Grid FE	yes	yes	yes
Year FE	yes	yes	yes
R^2	0.6042	0.4836	0.5312
Adj. R^2	0.5774	0.4487	0.4994
Num. obs.	14352	14352	14352

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$