



IMPACT OF ECONOMIC POLICY UNCERTAINTY ON RENEWABLE ENERGY GROWTH

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INTRODUCTION:



- The study examines the effect of economic policy uncertainty (EPU) on renewable energy (RE) growth for 20 countries from 2000 to 2018.
- Renewable energy promotes environmental sustainability, dynamic economic development, and energy independence. However, the growth of RE is low compared to other energy sources.
- EPU captures the likelihood that future economic and political policies may shift from the current period, which can impact RE investment and deployment.

MOTIVATION:

- Past research has shown that EPU can impact RE utilization and growth, but its exact effect is unclear.
- Understanding the impact of EPU on RE growth is important, as it can inform policymakers on how to design policies to support the renewable energy transition.





RESEARCH QUESTION

- What is the effect of economic policy uncertainty (EPU) on renewable energy (RE) growth?

RESEARCH METHODOLOGY:

- The study uses data on RE growth, EPU, economic growth, trade openness, carbon emissions, population growth, technological innovation, financial development, and energy consumption for 20 countries from 2000 to 2018.
- An empirical model is estimated using the IV-GMM approach to address endogeneity issues.

FINDINGS:

- The results indicate that EPU has an insignificant effect (UNCLEAR) on RE growth.
- The findings from the causality analysis also show no evidence of causality between EPU and RE growth.
- The coefficients of the IV-GMM estimates are marginally larger compared to the OLS estimates, suggesting that the IV-GMM approach addresses omitted variable bias.



COMBINED STATISTICS

Variables	Obs	Mean	SD	Min	Max
Inre	314	2.508	1.616	-5.965	4.494
Inhydro	288	2.220	1.695	-2.995	4.469
Inothers	311	0.622	1.722	-5.965	3.277
Ingdp	380	9.949	1.027	6.717	11.250
Inepu	365	7.150	0.440	5.781	8.617
Inco2pc	300	1.895	0.747	-0.036	3.005
Into	380	4.217	0.747	2.986	6.093
Indcps	365	4.479	0.649	2.555	5.452
Inrnd	339	0.250	0.727	-2.040	1.516
Inpopg	334	-0.352	0.902	-4.668	1.672
Inene	312	7.967	0.742	6.031	9.043



COMBINED STATISTICS

	Count	Mean	Standard Deviation	Min	Max
InRE	317	2.510101	1.608764	-5.964915	4.494157
Inhydro	291	2.225501	1.687071	-2.995408	4.468709
Inothers	314	0.591572	1.741457	-5.964915	3.276582
Ingdp	380	9.888893	1.040564	6.627356	11.19105
Inepu	366	4.664335	0.438461	3.295871	6.132247
Inco2pc	361	1.873593	0.766357	-0.123584	3.01895
Into	380	4.211568	0.747650	2.973466	6.092712
Indcps	354	4.676261	0.915060	2.504789	7.660974
Inrnd	367	0.241953	0.723843	-2.0321	1.5077
Inpopg	335	-0.341511	0.892959	-4.667887	1.671758
Inene	315	7.973778	0.740174	6.027033	9.042578



RESULTS:

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	OLS			IV-GMM		
Variables	Hydro	Others	Total	Hydro	Others	Total
<i>lndp</i>	-0.758*** (0.168)	1.548*** (0.171)	-0.092 (0.184)	-0.775*** (0.176)	1.608*** (0.180)	-0.085 (0.197)
<i>Inepu</i>	-0.265 (0.222)	-0.136 (0.203)	-0.258 (0.176)	-0.460 (0.371)	-0.312 (0.308)	-0.441 (0.303)
<i>Inco2pc</i>	-3.208*** (0.286)	-0.375 (0.286)	-2.278*** (0.305)	-3.108*** (0.287)	-0.129 (0.302)	-2.202*** (0.310)
<i>Into</i>	-1.237*** (0.187)	-0.838*** (0.174)	-1.330*** (0.174)	-1.284*** (0.198)	-0.939*** (0.177)	-1.400*** (0.179)
<i>Indcps</i>	0.353** (0.149)	-0.403** (0.204)	-0.168 (0.187)	0.418*** (0.154)	-0.519** (0.215)	-0.165 (0.207)
<i>Inrnd</i>	-1.245*** (0.190)	0.838*** (0.210)	-0.553*** (0.208)	-1.177*** (0.194)	1.105*** (0.230)	-0.443* (0.228)
<i>Inpopg</i>	0.067 (0.088)	0.491*** (0.095)	0.028 (0.085)	0.118 (0.084)	0.498*** (0.098)	0.097 (0.092)
<i>Inene</i>	4.045*** (0.519)	-1.441*** (0.472)	2.526*** (0.572)	3.868*** (0.523)	-1.877*** (0.497)	2.386*** (0.580)
Constant	-10.913*** (3.045)	3.635 (2.891)	-4.223 (2.743)	-8.201** (3.715)	8.254** (3.581)	-1.703 (3.396)
Observations	210	229	230	181	200	200
R ²	0.555	0.375	0.523	0.576	0.404	0.538
RMSE	1.176	1.323	1.225	1.111	1.283	1.221
F-statistic	43.879	21.611	35.404	40.358	22.338	33.005
J				0.167	0.203	0.248
JP				0.682	0.653	0.619
Mean VIF	6.89	6.29	6.29			



OLS REGRESSION RESULTS:

Dep. Variable:	lnRE	R-squared:	0.523			
Model:	OLS	Adj. R-squared:	0.504			
Method:	Least Squares	F-statistic:	28.74			
Date:	Fri, 12 Apr 2024	Prob (F-statistic):	5.66e-30			
Time:	23:13:46	Log-Likelihood:	-252.25			
No. Observations:	219	AIC:	522.5			
Df Residuals:	210	BIC:	553.0			
Df Model:	8					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	-8.6968	1.690	-5.146	0.000	-12.029	-5.365
lndgp	0.2384	0.117	2.038	0.043	0.008	0.469
lnepu	0.0657	0.145	0.452	0.651	-0.221	0.352
lnco2pc	-2.1765	0.190	-11.440	0.000	-2.552	-1.801
lnto	-0.3638	0.104	-3.486	0.001	-0.570	-0.158
lndcps	0.2297	0.093	2.471	0.014	0.046	0.413
lnrnd	-0.6456	0.109	-5.901	0.000	-0.861	-0.430
lnpopg	0.1489	0.071	2.090	0.038	0.008	0.289
lnene	1.6906	0.287	5.887	0.000	1.124	2.257
	Omnibus:	5.244	Durbin-Watson:	0.188		
Prob(Omnibus):		0.073	Jarque-Bera (JB):	6.214		
Skew:		-0.181	Prob(JB):	0.0447		
Kurtosis:		3.742	Cond. No.	485.		

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

RMSE 0.7655956162043476

Mean Vif 1 5.234759325757757



OLS REGRESSION RESULTS:

Dep. Variable:	lnhydro	R-squared:	0.559			
Model:	OLS	Adj. R-squared:	0.542			
Method:	Least Squares	F-statistic:	33.29			
Date:	Fri, 12 Apr 2024	Prob (F-statistic):	1.66e-33			
Time:	23:15:43	Log-Likelihood:	-343.74			
No. Observations:	219	AIC:	705.5			
Df Residuals:	210	BIC:	736.0			
Df Model:	8					
Covariance Type:	nonrobust					
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	coef	std err	t	P> t	[0.025	0.975]
const	-6.4534	2.567	-2.514	0.013	-11.513	-1.394
lngdp	-0.5082	0.178	-2.861	0.005	-0.858	-0.158
lnepu	-0.1181	0.221	-0.536	0.593	-0.553	0.317
lnco2pc	-2.4679	0.289	-8.542	0.000	-3.037	-1.898
lnto	-1.3570	0.159	-8.561	0.000	-1.669	-1.045
lndcps	0.1550	0.141	1.098	0.274	-0.123	0.433
lnrnd	-0.8158	0.166	-4.911	0.000	-1.143	-0.488
lnpopg	0.3607	0.108	3.333	0.001	0.147	0.574
lnene	2.9788	0.436	6.831	0.000	2.119	3.838
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Omnibus:	8.398	Durbin-Watson:	0.218			
Prob(Omnibus):	0.015	Jarque-Bera (JB):	8.243			
Skew:	-0.441	Prob(JB):	0.0162			
Kurtosis:	3.352	Cond. No.	485.			
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Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

RMSE 1.1626137739520992

Mean Vif 1 5.234759325757757



OLS REGRESSION RESULTS:

Dep. Variable:	lnothers	R-squared:	0.573			
Model:	OLS	Adj. R-squared:	0.556			
Method:	Least Squares	F-statistic:	35.15			
Date:	Fri, 12 Apr 2024	Prob (F-statistic):	6.92e-35			
Time:	23:15:17	Log-Likelihood:	-294.16			
No. Observations:	219	AIC:	606.3			
Df Residuals:	210	BIC:	636.8			
Df Model:	8					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	-1.1993	2.047	-0.586	0.559	-5.234	2.835
lngdp	1.7745	0.142	12.529	0.000	1.495	2.054
lnepu	0.0712	0.176	0.405	0.686	-0.275	0.418
lnco2pc	-0.5767	0.230	-2.503	0.013	-1.031	-0.123
lnto	0.1195	0.126	0.946	0.345	-0.130	0.369
lndcps	-0.1546	0.113	-1.373	0.171	-0.376	0.067
lnrnd	0.4827	0.132	3.644	0.000	0.222	0.744
lnpopg	0.2214	0.086	2.565	0.011	0.051	0.391
lnene	-1.8144	0.348	-5.218	0.000	-2.500	-1.129
	Omnibus:	42.121	Durbin-Watson:	0.327		
Prob(Omnibus):		0.000	Jarque-Bera (JB):	73.950		
Skew:		-1.003	Prob(JB):	8.75e-17		
Kurtosis:		5.020	Cond. No.	485.		

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

RMSE 0.9270510974535083

Mean Vif 1 5.234759325757757



IV-GMM RESULTS:

IV-GMM Estimation Summary

Dep. Variable:	lnRE	R-squared:	0.5081
Estimator:	IV-GMM	Adj. R-squared:	0.4830
No. Observations:	207	F-statistic:	444.43
Date:	Fri, Apr 12 2024	P-value (F-stat)	0.0000
Time:	23:19:07	Distribution:	chi2(10)
Cov. Estimator:	robust		

Parameter Estimates

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Intercept	-9.8042	1.4755	-6.6446	0.0000	-12.696	-6.9123
lngdp	0.2099	0.1447	1.4504	0.1469	-0.0738	0.4937
lnco2pc	-2.2226	0.1364	-16.297	0.0000	-2.4899	-1.9553
lnepu	0.0281	0.2089	0.1344	0.8931	-0.3814	0.4376
lnto	-0.2940	0.0805	-3.6495	0.0003	-0.4518	-0.1361
lndcps	0.2406	0.0846	2.8436	0.0045	0.0748	0.4065
lnrnd	-0.6850	0.0933	-7.3430	0.0000	-0.8679	-0.5022
lnpopg	0.1164	0.0452	2.5763	0.0100	0.0279	0.2050
lnene	1.7701	0.3168	5.5877	0.0000	1.1492	2.3909
lnepu_lag1	-0.0556	0.2545	-0.2183	0.8272	-0.5544	0.4433
lnepu_lag2	0.1961	0.2206	0.8891	0.3740	-0.2362	0.6284

RMSE 0.7743058350740569



IV-GMM RESULTS:

IV-GMM Estimation Summary

Dep. Variable:	lnhydro	R-squared:	0.5361
Estimator:	IV-GMM	Adj. R-squared:	0.5122
No. Observations:	205	F-statistic:	381.65
Date:	Fri, Apr 12 2024	P-value (F-stat)	0.0000
Time:	23:19:27	Distribution:	chi2(10)
Cov. Estimator:	robust		

Parameter Estimates

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Intercept	-6.5677	2.5428	-2.5828	0.0098	-11.552	-1.5838
lngdp	-0.5425	0.1847	-2.9369	0.0033	-0.9045	-0.1804
lnco2pc	-2.5144	0.2573	-9.7707	0.0000	-3.0188	-2.0100
lnepu	-0.0276	0.2912	-0.0949	0.9244	-0.5984	0.5431
lnto	-1.2909	0.1940	-6.6542	0.0000	-1.6711	-0.9107
lndcps	0.1722	0.1081	1.5933	0.1111	-0.0396	0.3841
lnrnd	-0.8599	0.1201	-7.1572	0.0000	-1.0954	-0.6244
lnpopg	0.3237	0.1092	2.9631	0.0030	0.1096	0.5378
lnene	3.0605	0.4843	6.3187	0.0000	2.1112	4.0098
lnepu_lag1	-0.1523	0.3492	-0.4361	0.6628	-0.8366	0.5321
lnepu_lag2	-0.0446	0.3198	-0.1394	0.8891	-0.6714	0.5822

RMSE 1.1942333452240552



IV-GMM RESULTS:

IV-GMM Estimation Summary						
Dep. Variable:	lnothers	R-squared:	0.5865			
Estimator:	IV-GMM	Adj. R-squared:	0.5649			
No. Observations:	203	F-statistic:	1587.7			
Date:	Fri, Apr 12 2024	P-value (F-stat)	0.0000			
Time:	23:20:43	Distribution:	chi2(10)			
Cov. Estimator:	robust					
Parameter Estimates						
	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Intercept	-2.1507	1.7365	-1.2386	0.2155	-5.5541	1.2527
lndgdp	1.8036	0.1364	13.226	0.0000	1.5363	2.0709
lnc02pc	-0.6673	0.1595	-4.1836	0.0000	-0.9799	-0.3547
lnepu	-0.0210	0.2433	-0.0865	0.9311	-0.4979	0.4558
lnto	0.0494	0.0999	0.4943	0.6211	-0.1464	0.2451
lndcps	-0.1873	0.0896	-2.0893	0.0367	-0.3630	-0.0116
lnrnd	0.5380	0.1192	4.5139	0.0000	0.3044	0.7715
lnpopg	0.2353	0.0740	3.1814	0.0015	0.0903	0.3803
lnene	-1.8036	0.2132	-8.4596	0.0000	-2.2214	-1.3857
lnepu_lag1	-0.0023	0.2935	-0.0078	0.9938	-0.5776	0.5730
lnepu_lag2	0.3540	0.3065	1.1550	0.2481	-0.2468	0.9548
RMSE 0.9420351385052357						



CAUSALITY ANALYSIS:



Null hypothesis	F-statistic	p-value
Inepu does not Granger-cause Inre	1.223	0.296
Inre does not Granger-cause Inepu	0.679	0.508
Inepu does not Granger-cause Inhydro	1.063	0.347
Inhydro does not Granger-cause Inepu	0.104	0.901
Inepu does not Granger-cause Inothers	1.295	0.276
Inothers does not Granger-cause Inepu	0.899	0.408



CAUSALITY ANALYSIS:

	Null hypothesis	F-statistic	p-value
0	Inepu does not Granger-cause InRE	1.701845	0.185030
1	InRE does not Granger-cause Inepu	0.263011	0.769004
2	Inepu does not Granger-cause Inhydro	0.679490	0.508065
3	Inhydro does not Granger-cause Inepu	0.287751	0.750265
4	Inepu does not Granger-cause Inothers	3.877081	0.022318
5	Inothers does not Granger-cause Inepu	1.029988	0.358935



CONCLUSION:

- With global warming and climate change being major environmental issues, policymakers should focus on supporting renewable energy development through their policies.
- However, this study finds that EPU does not significantly interrupt RE growth, suggesting that policymakers should not overly focus on reducing EPU to promote RE growth.
- Instead, policymakers should adopt other policies and measures to directly support the renewable energy transition, such as investment incentives, R&D support, and improving the regulatory environment.



Thanks!

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