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Research article

Club convergence in energy diversification among low- and lower-middle-income countries: The role of domestic credit and income

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Supplementary

Appendix

Table A1. Unit Root Tests of the Regression Variables.

Variables	Unit root test methods				
	LLC	Breitung	IPS	Fisher-DF	Fisher-PP
Level					
Energy HHI	−6.05***	−0.30	−0.14	101.17	112.56*
Domestic Credit by FIs	−2.68***	4.25	3.61	91.04	34.20
Domestic Credit by Banks	−2.24***	3.45	2.88	91.38	49.38
lnGDP per capita	−1.58*	2.15	1.20	121.53**	82.39
Capital Formation	−4.53***	−0.82	−1.63**	157.22***	124.76***
Education Attainment	0.04	2.00	0.99	132.05***	110.16*
CO_2 Emissions	−1.44*	1.45	2.84	83.44	72.35
Rule of Law	−5.74***	−1.53*	−1.89**	134.78***	138.58***
LnOil Price				−2.458	−1.999
First difference					
Energy HHI	−19.70***	−7.24***	−12.75***	458.73***	777.75***
Domestic Credit by FIs	−16.77***	−4.37***	−5.79***	216.65***	521.30***
Domestic Credit by Banks	−18.20***	−5.03***	−6.55***	236.42***	620.61***
lnGDP per capita	−14.69***	−2.94***	−6.43***	264.81***	477.42***
Capital Formation	−20.36***	−6.54***	−11.76***	443.57***	658.26***
Education Attainment	−13.29***	−2.08**	−4.23***	187.39***	461.58***
CO2 Emissions	−19.09***	−5.92***	−8.82***	311.28***	563.26***
Rule of Law	−21.83***	−7.74***	−12.63***	444.82***	720.52***
LnOil Price				−3.290*	−3.883**

Note: LLC, Breitung, IPS, Fisher-ADF, and Fisher-PP are panel unit root tests applied to the country-specific variables. Since lnWTIOilPrice is a common global time-series variable with no cross−sectional variation, its stationarity is assessed using the Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP) unit root tests. For presentation consistency, the ADF and PP test statistics are reported under the Fisher-ADF and Fisher-PP columns, respectively. The null hypothesis for all tests is that the series contains a unit root. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A2. Pedroni Panel Cointegration Test.

Tests	**t-statistic**
Modified Phillips-Perron	8.585 ***
Phillips-Perron	−14.890 ***
Augmented Dickey-Fuller	−13.326 ***

Note: The null hypothesis is no cointegration. ***, **, and * indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

Table A3. Robustness analysis of the Energy HHI model controlling for net FDI inflows.

Domestic credit	*Domestic Credit by Fis*						*Domestic Credit by Banks*					
Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Trend	−0.003***	−0.003***	−0.004***	−0.004***	−0.004***	−0.003***	−0.003***	−0.003***	−0.003***	−0.004***	−0.004***	−0.003***
Domestic credit	−0.149***	−0.141***	−0.151***	−0.152***	−0.149***	−0.146***	−0.169***	−0.150***	−0.168***	−0.164***	−0.165***	−0.167***
lnGDP per capita	−0.742***	−0.754***	−0.653***	−0.663***	−0.644***	−0.717***	−0.783***	−0.775***	−0.685***	−0.690***	−0.674***	−0.756***
lnGDP per capita²	0.048***	0.048***	0.043***	0.044***	0.043***	0.046***	0.051***	0.050***	0.045***	0.046***	0.045***	0.049***
LnOil Price	0.014***	0.015***	0.012***	0.014***	0.011***	0.012***	0.016***	0.016***	0.014***	0.015***	0.013***	0.013***
Capital Formation	−0.050	−0.082	−0.053	−0.057	−0.048	−0.043	−0.035	−0.066	−0.038	−0.040	−0.035	−0.027
Education Attain	0.057*	0.056**	0.049**	0.067**	0.051**	0.046*	0.067**	0.065**	0.059**	0.076**	0.059**	0.055**
CO2 Emissions	0.012	0.008	0.013	0.014	0.012	0.016	0.014	0.008	0.014	0.015	0.013	0.018
Net FDI inflows	−0.128***	−0.116***	−0.132***	−0.119***	−0.126***	−0.148***	−0.176***	−0.163***	−0.181***	−0.169***	−0.171***	−0.195***
Rule of Law	0.037*						0.041**					
Corrupt Control		0.063***						0.062***				
Gov. Effectiveness			0.017						0.019			
Voice & Account				0.057**						0.056**		
Political Stability					−0.000						0.003	
Regulatory Quality						0.049***						0.054***
Constant	3.385***	3.463***	3.025***	3.060***	2.946***	3.320***	3.506***	3.509***	3.110***	3.123***	3.034***	3.434***
Observations	966	966	966	966	966	966	966	966	966	966	966	966

*All explanatory and control variables, except the trend variable, are lagged by one year. Net FDI inflows refer to net foreign direct investment inflows as a percentage of GDP. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.*

Table A4. Convergence club classification for cardinal energy diversification.

Initial classification				Tests of club merging				Final club classification				Final Clubs' Memberships
Convergenve Clubs	Members	Log t	T-stat	Convergenve Clubs	Members	Log t	T-stat	Convergenve Clubs	Members	Log t	T-stat	
Club 1	38	−0.071	−1.367					Club 1	38	−0.071	−1.367	Algeria, Angola, Bangladesh, Benin, Bolivia, Burkina Faso, Cambodia, Cameroon, Congo, Dem. Rep., Congo, Rep., Cote d'Ivoire, Egypt, Arab Rep., Ethiopia, Ghana, Guinea, Honduras, India, Iran, Islamic Rep., Kenya, Lao PDR, Lesotho, Madagascar, Nepal, Nicaragua, Niger, Pakistan, Philippines, Rwanda, Senegal, Sri Lanka, Syrian Arab Republic, Tajikistan, Tanzania, Togo, Tunisia, Uganda, Uzbekistan, Viet Nam
Club 2	2	−1.446	−1.588	Clubs 1+2	40	−0.179	−4.507					
Club 3	3	3.760	3.475	Clubs 2+3	5	0.086	0.341	Club 2	5	0.086	0.341	Burundi, Mali, Mauritania, Samoa, Sierra Leone
Divergence	3	−1.674	−7.577	Club 3+Divergence	6	−0.923	−8.491	Divergence	3	−1.674	−7.577	Chad, Comoros, Lebanon

The null hypothesis of convergence is rejected at the 5% significance level if the t−statistic is below −1.65.

Table A5. Average cardinal energy diversification by convergence club, 2000–2021.

	Number of countries	Cardinal Energy Diversification (average)		
		2000	2021	Annual change
Club1	38	0.3104	0.4201	0.0052
Club2	5	0.0953	0.1077	0.0006
Divergent	3	0.0333	0.0180	−0.0007
Full sample	46	0.2690	0.3599	0.0043

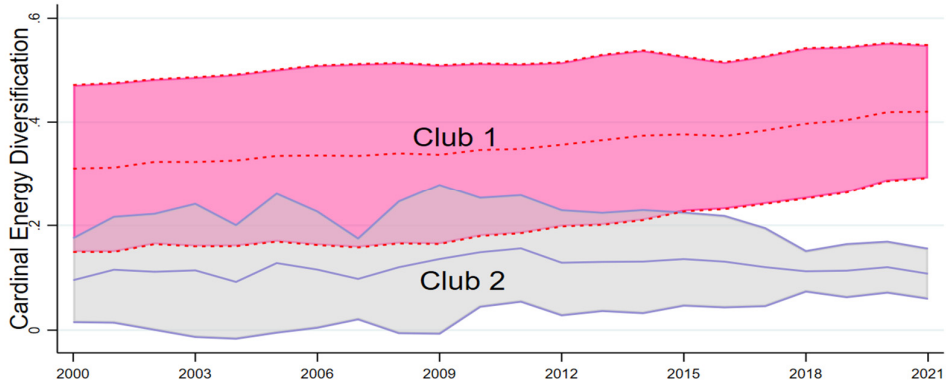


Figure A1. Cardinal energy diversification paths and 90% confidence intervals by convergence club.

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