COOKING FUELS AND ECONOMIC DEVELOPMENT IN DEVELOPING COUNTRIES:
CASE OF SUB-SAHARAN AFRICA

BY

IFEOLUWA GARBA

AIMS AND OBJECTIVES

- Establish existing gaps in literature on energy poverty in developing countries

- Provide empirical evidences of the impact of energy poverty on economic development in developing countries

- Recommend energy policies aimed at effectively addressing the issue.

MOTIVATION

- Access to energy is vital in tackling global development issues

- Absence of energy in developing countries has several key aspects: lack to clean fuels for cooking and/or heating is an overlooked aspect

- More people in the world lack access to clean cooking fuel (2.7 billion) than to electricity (1.2 billion)

1ST STAGE – UNIT ROOT ANALYSIS

- Examine presence (non-stationary) or absence (stationary) of unit root in variables

- Stationarity means some variable statistics are constant over time: means behaviour prediction can be more accurate

- Variables must be stationary when integrated at 1st order for cointegration tests to be considered.

1ST STAGE – UNIT ROOT ANALYSIS

Table 1: Results for panel unit root tests for GDP and Solid.

		Null: Unit root					Null: No unit root	
	Tests Variable	Levin, Lin and Chu (LLC)	Im, Pesaran and Shin (IPS)	Breitung	ADF - Fisher Chi square	PP - Fisher Chi square	Hadri	z-stat
Level	GDP	-1.1212 (0.1311)	0.8918 (0.8137)	–	2.5593 (0.8618)	0.9222 (0.9884)	3.7246 (0.0001)	3.7883 (0.0001)
	GDP (trend)	1.2035 (0.8856)	0.8443 (0.8007)	1.8563 (0.9683)	4.1453 (0.6570)	5.4072 (0.4927)	2.3169 (0.0103)	2.3335 (0.0098)
	SOLID	3.0007 (0.9987)	4.4253 (1.0000)	–	0.2544 (0.9997)	3.5888 (0.7321)	4.1189 (0.0000)	4.1257 (0.0000)
	SOLID (trend)	1.0347 (0.8496)	0.7132 (0.7621)	2.2630 (0.9882)	10.3157 (0.1120)	22.7917 (0.0009)	2.3967 (0.0083)	8.1739 (0.0000)
First difference	GDP	-1.7974 (0.0361)	-1.8103 (0.0351)	–	13.4810 (0.0360)	20.0668 (0.0027)	0.4403 (0.3299)	0.7129 (0.2379)
	GDP (trend)	-2.5189 (0.0059)	-0.4539 (0.3249)	0.6455 (0.7535)	7.3869 (0.2865)	9.9007 (0.1289)	3.6883 (0.0001)	5.0667 (0.0000)
	SOLID	-3.0472 (0.0012)	-2.6253 (0.0043)	–	22.7102 (0.0043)	21.9717 (0.0012)	0.7658 (0.2219)	2.8634 (0.0021)
	SOLID (trend)	-3.8279 (0.0001)	-2.4380 (0.0074)	- 1.1177 (0.1319)	20.4387 (0.0023)	25.0760 (0.0003)	4.4272 (0.0000)	8.0983 (0.0000)

2ND STAGE – COINTEGRATION ANALYSES

- Pedroni tests for cointegration between variables using heterogeneous panel and group mean test statistics

Table 2: Results for Pedroni residual cointegration tests.

Tests	Within panel statistics			Between panel statistics		
	Type	Statistic	p-value	Type	Statistic	p-value
GDP, SOLID	panel v-statistic	1.4016	0.0805	group rho-statistic	0.3668	0.6431
	panel rho-statistic	-0.4226	0.3363	group PP-statistic	-1.6914	0.0454
	panel PP-statistic	-2.2655	0.0117	group ADF-statistic	-1.9650	0.0247
	panel ADF-statistic	-2.9228	0.0017			
GDP, SOLID (weighted statistic)	panel v-statistic	0.6680	0.2521			
	panel rho-statistic	-0.2901	0.3859			
	panel PP-statistic	-1.8934	0.0292			
	panel ADF-statistic	-1.9883	0.0234			

2ND STAGE – COINTEGRATION ANALYSES

- Kao and Fisher tests to consider cross-sectional dependency and spillage across groups

Table 3: Results for Kao's residual cointegration test.

Model	ADF	p-value
GDP, SOLID	-0.6996	0.2421

Table 4: Results for Fisher-type cointegration tests.

Null hypothesis	Fisher stat* (trace test)	p-value	Fisher stat* (max-eigen test)	p-value
ce = 0	27.61	0.0001	24.68	0.0004
ce ≤ 1	10.29	0.1130	10.29	0.1130

3RD STAGE – LONG-RUN RELATIONSHIP ESTIMATION

- The long-run relationship between the two variables is assessed.

- The panel DOLS and FMOLS tests are applied at this stage

Table 5: Results from DOLS and FMOLS tests.

	Models	
	DOLS	FMOLS
Co-efficient	-61.0918	49.8929
Std.Error	3.0834	8.2559
t-statistic	-2.0307	6.0433
p-value	0.0515	0.0000

FINAL STAGE – CAUSALITY ANALYSES

- Long-run causality

Table 6: Results for Granger causality test (L = lags).

Independent variable	f-statistic	p-value	Sense of causality
		GDP	
SOLID (L = 1)	1.2340	0.2729	
SOLID (L = 2)	1.7639	0.1855	SOLID → GDP
SOLID (L = 5)	1.3122	0.2952	
		SOLID	
GDP (L = 1)	39.2465	2e-07	
GDP (L = 2)	6.7489	0.0032	GDP → SOLID
GDP (L = 5)	2.8013	0.0418	

- Short-run causality

Table 7: Short-run causality results.

Dependent variable	Chi-square	p-value	Sense of causality
SOLID	14.4803	0.0007	GDP → SOLID
GDP	0.7798	0.6771	SOLID → GDP

SUMMARY OF EMPIRICAL FINDINGS

- Panel unit root analyses confirm the absence of unit root across all tests after first differencing. Variables are differenced stationary – fulfilling conditions for cointegration analyses

- 3 out of 4 cointegration tests confirm variables Solid and GDP are cointegrated

- Cointegration elasticities with GDP as dependent variable confirms negative and significant long-run relationship

- Long-run causality test with Solid as dependent variable confirms causality for optimal lag (1) and further lags
- Long-run causality with GDP as dependent variable shows no causality

- Short-run with Solid as dependent variable shows causality
- Short-run with GDP as dependent variable shows no causality

IMPLICATIONS OF FINDING

- Energy consumption and economic development hypotheses: neutrality, conservation, growth and feedback hypotheses.

- Uni-directional causality relationship running from GDP per Capita to Solid observed.

- Findings strongly support the energy-economy conservation hypothesis for sub-Saharan Africa.

- In long-run, economic developments influence household usage of solid fuels

- In short-run, economic developments influence household usage of solid fuels

POLICY IMPLICATION AND CONCLUSIONS

- Energy conservative policies such as traditional-fuel use reduction strategies, demand management measures, amongst others, might positively impact on the economic development.

- **To conclude:**
  - To address general poverty, developing countries need to address energy poverty as an aspect of the issue.

  - All in all, as a part of improving general economic development and addressing general poverty, it would be beneficial for countries to continue to progress from traditional cooking fuels to modern cooking alternatives.

Thank you.

QUESTIONS?