Short- and Long-Run Analysis of Factors Affecting Electricity Consumption in Sub-Saharan Africa

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Introduction
- Electricity is a vital contributor to the economy
- It stimulates improvements in many aspects of society including employment, health, food preservation, farming, medical technology and education (Tucker et al. 2014)
- The World Bank reported that in 2012, 621 million people lacked access to electricity in Sub-Saharan Africa

Motivation
- Contributes to studies that look at causality between electricity consumption & macroeconomic variables in Sub-Saharan Africa
- Analyzes causality in individual countries
- The inclusion of Industry, trade openness & financial development

Literature

<table>
<thead>
<tr>
<th>Energy Cons.</th>
<th>to</th>
<th>Econ. Growth</th>
<th>Reducing energy cons. affects growth (conservation policies have effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Econ. Growth</td>
<td>Neutrality hypothesis</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Econ. Growth</th>
<th>to</th>
<th>Energy Cons.</th>
<th>Conservation policies have little effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>either</td>
<td>Econ. Growth</td>
<td>Complement each other</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Energy Cons.</th>
<th>To(-)</th>
<th>Econ. Growth</th>
<th>Energy use constrained by infrastructural, political obstacles – put pressure on poverty</th>
</tr>
</thead>
</table>

<table>
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<tr>
<th>Econ. Growth</th>
<th>To(-)</th>
<th>Energy Cons.</th>
<th>Increased economic growth; people use less energy; walk, mass transit</th>
</tr>
</thead>
</table>

Objective
This study seeks to analyze causality between electric power consumption, GDP, trade openness, financial development and industry in Sub-Saharan Africa

Methodological Approach (VECM)

Figure 1: Sub-Saharan Africa

Figure 2: Granger Causality Results

Results
Short Run Causality Running from

- GDP to Elec. Consumption
- Financial Development to Elec. Consumption
- Industrial growth & trade openness to Elec. Consumption

Long Run Causality Running from

- GDP, trade openness, financial development and industry to electricity consumption in Congo, Cote d'Ivoire, South Africa and Zambia

Average Growth Rates(%) between 1971 to 2011

Summary of Key Findings
- GDP & financial development play an important role in predicting future values of electricity consumption in Cote D’Ivoire, Zambia, and South Africa
- Energy demand projections in these economies that exclude GDP and financial development might provide inaccurate forecasts
- In Gabon, industrial growth & trade openness play a role in predicting future values of electricity consumption
- In Kenya, there are forces outside our model which Granger cause electricity consumption

Weakness of the Study
- Interpretations ought to be treated with caution due to the small sample size
- Non-grid electric power consumption from small and medium sized were not considered
- The use of generators (non-inclusion in official statistics)

Further Information

GDP & Growth Rates

<table>
<thead>
<tr>
<th>Cote d’Ivoire</th>
<th>Congo Republic</th>
<th>Kenya</th>
<th>Gabon</th>
<th>South Africa</th>
<th>Zambia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pop. (millions)</td>
<td>20.40</td>
<td>4.45</td>
<td>44.35</td>
<td>1.67</td>
<td>52.98</td>
</tr>
<tr>
<td>GDP (current US$ in billions)</td>
<td>31.10</td>
<td>14.09</td>
<td>55.24</td>
<td>19.34</td>
<td>350.63</td>
</tr>
<tr>
<td>GDP growth (annual %)</td>
<td>9%</td>
<td>3%</td>
<td>6%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>Electricity production in 2011 (kWh)</td>
<td>6.10</td>
<td>1.23</td>
<td>7.85</td>
<td>1.77</td>
<td>259.60</td>
</tr>
</tbody>
</table>

ELEC_GROWTH does not Granger Cause FD_GROWTH
URBAN_GROWTH does not Granger Cause ELEC_GROWTH
IMPORTS_GROWTH does not Granger Cause ELEC_GROWTH
EXPORTS_GROWTH does not Granger Cause ELEC_GROWTH

Please contact Gabon, Cote d’Ivoire, South Africa & Zambia.

Figure 2: Granger Causality Results

Null Hypothesis: F-Stat  Prob.

- EXPORTS_GROWTH does not Granger Cause ELEC_GROWTH 0.4735 0.7914
- ELEC_GROWTH does not Granger Cause EXPORTS_GROWTH 1.5076 0.2232
- IMPORTS_GROWTH does not Granger Cause ELEC_GROWTH 1.5801 0.2021
- ELEC_GROWTH does not Granger Cause IMPORTS_GROWTH 0.8965 0.4986
- GDP_GROWTH does not Granger Cause ELEC_GROWTH 0.4590 0.8028
- ELEC_GROWTH does not Granger Cause GDP_GROWTH 1.5474 0.2113
- INDUSTRY_GROWTH does not Granger Cause ELEC_GROWTH 1.9211 0.1988
- ELEC_GROWTH does not Granger Cause INDUSTRY_GROWTH 0.4644 0.7990
- URBAN_GROWTH does not Granger Cause ELEC_GROWTH 0.2090 0.9556
- ELEC_GROWTH does not Granger Cause URBAN_GROWTH 0.2780 0.9208
- FD_GROWTH does not Granger Cause ELEC_GROWTH 0.7538 0.5913
- ELEC_GROWTH does not Granger Cause FD_GROWTH 0.9112 0.4897