Abstract

Many researchers have studied the causal relationship between energy consumption and economic growth. Previous research has shown that increasing electricity consumption helps increase the size of the existing middle class, and therefore bolstering economic growth\(^1\)\(^2\). We employ a co-integration study to investigate how electricity consumption affects GDP per capita in four Latin American countries.

Introduction

Electricity consumption is our variable of interest. We believe that if developing countries have more power infrastructure, GDP growth will increase. Our focus is on developing countries since this is where most of the future global growth will take place\(^2\). The four countries in our study are Argentina, Brazil, Chile, and Mexico. We hope that our results will help influence policy in developing countries, which will lead to further growth. In order to carry out this project we obtained data from The World Bank from 1971 to 2010. We found a unit root problem in our base model, so we employed a differenced model in order to account for non-stationarity. To address problems with autocorrelation, we used a lagged model. This resulted in a Granger causality framework, demonstrating a strong causal relationship between energy consumption and GDP.

Literature Review

Previous economic literature shows how energy consumption has a significant impact on a change of income in developing countries using cointegrated panel analysis. The results demonstrate the co-movement and the causal relationship between energy consumption and GDP in 18 developing countries, using data from 1975 to 2001. Soyta and Sari assess the impact of a change in energy consumption on income and vice versa in G-7 countries. Their study shows how energy consumption is not significant to economic growth, which can result from environmental policies such as the Kyoto Protocol, which aims to reduce greenhouse gasses (GHG) emissions.

Models

Level Model:

\[
\ln gdp_t = \beta_0 + \beta_1 \ln elec_{t-1} + \epsilon_t
\]

Error correction model:

\[
\Delta \ln gdp_t = \alpha_0 + \sum_{j=1}^{M1} \alpha_j \Delta \ln gdp_{t-j} + \sum_{j=1}^{M2} \beta_j \Delta \ln elec_{t-j} + \delta u_{t-j} + \epsilon_t
\]

Research Question

Is there a granger–causal relationship between electricity and economic growth in developing countries? Is there a long run relationship between these two variables?

Hypothesis

If developing countries increase electricity consumption, then this will increase GDP per capita (increase growth).

Graphs

Models

<table>
<thead>
<tr>
<th>Country</th>
<th>(F^*) Value</th>
<th>(P^*) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>6.03***</td>
<td>0.0019***</td>
</tr>
<tr>
<td>Brazil</td>
<td>11.55***</td>
<td>0.0002***</td>
</tr>
<tr>
<td>Chile</td>
<td>32.77***</td>
<td>0.0000***</td>
</tr>
<tr>
<td>Mexico</td>
<td>3.98**</td>
<td>0.0282**</td>
</tr>
</tbody>
</table>

Results

<table>
<thead>
<tr>
<th>(F^*) Value</th>
<th>(P^*) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0000***</td>
<td>Yes</td>
</tr>
<tr>
<td>0.0000***</td>
<td>Yes</td>
</tr>
<tr>
<td>0.0000***</td>
<td>Yes</td>
</tr>
<tr>
<td>0.0282**</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Conclusion

After running a Granger causality test, we conclude that there exists a causal relationship between electricity consumption and GDP growth in Argentina, Brazil, Chile, and Mexico. In addition, we found that these two variables are co-integrated after doing a Chow test on the logs of electricity consumption. This indicates that both our variables are moving in conjunction and will converge back to a certain equilibrium after any shock. Our study suggests that policy makers in developing countries should take a closer look at improving power infrastructure in order to promote long term economic growth.

References