

Electricity Consumption and Economic Growth in the Presence of Structural Break: Evidence from Sri Lanka

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Introduction

Global electricity demand doubled between 1990 and 2016, outpacing other fuels, and is set to grow at twice the pace of energy demand as a whole in the next 25 years (IEA 2018). In addition a recent world wide shift towards digital society, electrification in the transportation sector, expansion of business, and urbanization are some common reasons in many countries that has influenced the electricity demand growth (Athukorala and Wilson, 2010). This high electricity consumption is of concern in developing countries where a high growth rate of electricity consumption is expected. An interesting case in research and policy issues is whether aggregate electricity consumption, which is considered as a proxy for energy consumption, can forecast non energy variables. Lack of this understanding could result in misguiding long run investment decisions in the electricity sector. Such causes will lead to periodic power shortages which are common to developing countries (Athukorala and Wilson, 2010).

At the global scale the electricity sector attracts more investment than oil and gas combined at present (IEA 2018). Under such circumstances it is important to improve our understanding on the link between electricity demand growth and economic growth. This link which appears to have a

generic effect indeed varies across countries. The existing literature provides ample evidence on variation in this relationship across countries (Ozturk and Bilgili, 2015). We believe it is important to re-investigate the issue following the recent advances in time series estimation technique with a focus on structural breaks in the data generating process. Besides methodological differences such variations in the above relationship could be attributed to complementary effects of the power sector with others in the economy.

Objective

In this study we empirically investigate the relationship between electricity consumption and economic growth of Sri Lanka by incorporating structural breaks into the models. Such analysis could add a different dimension to this debate because allowing for structural breaks is important given that during the period considered the economy has experienced several shocks, all of which have potentially caused a break in economic growth and or electricity consumption.

Methodology

This study used annual time series data of the Sri Lankan economy from 1971-2015. The data was obtained from World Bank Development Indicators. All variables are converted to natural logs prior to analysis. The multivariate framework includes real GDP in billions of constant 2010 US dollars, real gross fixed capital formation (K) in billions of constant 2010 U.S dollars, real domestic investment, real Foreign Direct investment, total labour force (L) in millions and electric power consumption (ELC) defined in kilowatt hours. In this paper, we measure n as growth rate of labour force, g is the rate of technology growth and δ is the rate of depreciation. We further set $(g + \delta)$ at the rate of 0.05¹⁴ because we notice it is a match with the available data in Sri Lanka. The use of Gross Capital Formation as a proxy for capital stock is standard in the energy literature¹⁵.

¹⁴We follow Maniw, Romer, and Weil (1992) in choosing 0.05 as a reasonable assessment of the value of $(g+d)$

¹⁵Using gross fixed capital formation instead of the stock of gross physical capital has its own limitations. Gross capital formation as a flow variable, does not measure the stock of capital accumulated over years.

To examine the relationship between electricity consumption (ELC) and economic growth (GDP) we use an augmented production function in which output is expressed as a function of capital, labour and electricity consumption. We further segregate capital into domestic capital (DI) and foreign direct investment (FDI). This is to capture the relationship between external financing and economic growth. In our analysis, we apply the Granger Causality approach developed by Toda and Yamamoto (1995) to ascertain the direction of causality between electricity consumption and economic growth.

Results and Discussion

We used the LM unit root test with one break. Interestingly there are two variables for which the unit root null is rejected and the break in the intercept is significant at 10 percent level or better. To determine the presence of long-run equilibrium relationship between economic growth and its determinants we applied the multivariate Johansen (1998) cointegration test. The results of Johansen cointegration tests or Trace statistics rejects the null of $r \leq 0$ but cannot reject $r \geq 1$ and also, the Lmax statistics rejects the null of $r=0$ but fails to reject $r=1$ at 5% level of significance. Even though we find that electricity consumption and economic growth in Sri Lanka are cointegrated, it does not confirm the direction of causality. For this reason, we implemented the TYDL causality test proposed by Toda and Yamamoto and Dolado-Lutkepohl (1995) approach to verify the direction of causality. We use the popular VAR modeling to infer the direction of causality among the variables in the model. The VAR model is just a special case of the AR models where we have more than one equation. The model suggests that electricity consumption Granger cause GDP growth but GDP growth does not Granger cause electricity consumption. However this does not imply that electricity consumption is not important for economic growth in Sri Lanka but rather that electricity consumption only has a minimal effect on economic growth.

The results of this study have many policy implications. Variations in the regulatory environment in the electricity sub-sector, linkages and complementarities between sectors would result in country wide heterogeneity between energy consumption and economic growth. Thus we

suggest that one needs to carefully consider the country specific effects particularly when the study uses country wide pooled data.

Conclusion

This paper contributes to the debate on electricity consumption and economic growth. For this purpose, recent developments in unit root tests considering structural breaks have been applied to investigate the relationship between electricity consumption and growth in Sri Lanka. The results indicate a unit root process in electricity consumption. The implication of the finding is that shocks on the demand side will be effective. Thus demand management policies such as block pricing, taxation, financial incentives and subsidies essentially have flattened the demand for electricity. The results further revealed that there exists a stable relationship between economic growth and electricity consumption. We found that generally electricity consumption, FDI and capital stock positively affect economic growth.

References

- Amarawickrama, H. and Hunt, L. (2008). Electricity demand for Sri Lanka: A time series analysis. *Energy*,(33): 724-739.
- Apergis, N. 2016. Environmental Kuznets curves: New evidence on both panel and country-level CO2 emissions. *Energy Economics*,(54): 263-271.
- Athukorala, W. P. P. A. & Wilson, C. (2010). Estimating short and long-term residential demand for electricity: New evidence from Sri Lanka. *Energy Economics*, 32: S34-S40.
- Dilaver, Z. & Hunt, L. C. (2011). Industrial electricity demand for Turkey: A structural time series analysis. *energy Economics*, 33: 426-436.
- Ozturk, I. & Bilgili, F. (2015). Economic growth and biomass consumption nexus: Dynamic panel analysis for Sub-Saharan African countries. *Applied Energy*, 137: 110-116.