*UNDERSTANDING PERSISTENCE OF EXOGENEOUS SHOCKS TO ELECTRICITY CONSUMPTION: THE CASE OF TURKEY**

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Overview

The examination of the fractal dynamics of electricity consumption is important on several fronts. First, if electricity consumption do not have unit roots in levels, shocks to electricity consumption will have only transitory effects. However, if electricity consumption has a unit root, exogenous shocks to electricity consumption will have permanent effects. Second, the distinction between the transitory or permanent nature of shocks has implications for the transmission of shocks from electricity consumption to other sectors of the economy. Indeed, if shocks to electricity consumption are persistent such shocks may be transmitted to other sectors of the economy. Third; if electricity consumption has long term correlation structure, positive policy shocks are likely to be more effective in moving energy consumption away from its predetermined target. Given the importance of the electric power sector in the generation of primary energy use by other sectors of the economy, it is crucial to understand the impact of shocks related to the electricity consumption.

In this paper, we examine the fractal features electricity consumption in a developing country; Turkey. In particular, we use the most promising fractal analysis approaches that allow us to study the standard cases of stationarity ($d = 0$) and unit roots ($d = 1$) as particular cases of interest. Depending on the value of fractional differentiation parameter, d, we can determine if the series is I(0) stationary ($d = 0$); stationary with long memory ($0 < d < 0.5$); nonstationary but mean reverting ($0.5 < d < 1$); or nonstationary and non-mean reverting ($d > 1$).

After the deregulation of energy markets, electricity consumption analysis and forecasting become very important for investment analysis and long/short term planning, financial procurement, cash flow analysis, capital budgeting and tariff regulations. Historical consumption investigation is very important for supply security, risk management and offer an advantage for market players in a competitive environment. Detecting fractality is very important for price predictability and finding limitations in the data regardless of the type of forecasting models.

In this paper, we investigate the long term correlation structure in electricity consumption. We focus on essential statistical properties of pink noise and identify appropriate measurement instruments to measure fractality in electricity consumption. We demonstrate the crucial steps of fractal analysis customized to catch the electricity consumption dynamics. To the best of our knowledge, this is the first fractal analysis study of electricity consumption in Turkey.

Methods

Literature on the presence of long term correlation in energy consumption is mostly based on the GPH (Geweke-Porter-Hudak, 1983) or Whittle function. However, none of the studies use either the Detrended Fluctuation Analysis (DFA) best known for its performance under nonstationary processes nor the modified R/S Analysis which is robust to short range dependence.In this paper, we examine the long term correlation structure of electricity consumption through the most promising fractal integration estimators which are Geweke-Porter-Hudak(DPH) , Local Whittle , DFA and MR/S estimators.

Our raw data set is monthly electricity consumption in Turkey from 1987-2014 which is obtained from TEIAS (Electricity Transmission Corporation of TURKEY). This gives us 534 raw observations. Logarithmic transformed and seasonally adjusted forms of raw data is also analyzed to catch the effects of seasonal short-run dynamics and to comply with the studies in the previous literature.

Conclusions

In this paper, we examine the long term correlation structure of electricity consumption in Turkey. We address the question of how easy will the implementation of electricity consumption policies in the light of the magnitude of persistence in electricity consumption. Long term memory is related to the level of persistence of shocks affecting the electricity consumption due to the significant dependence between observations. If electricity consumption exhibits long term correlation structure, then the effects caused by shocks tend to decay slowly. This feature leads to measuring the impact of energy demand management and environmental policies (shocks), as demand side management and climate change are the crucial items of government regulations.

We find that electricity consumption in Turkey, consistently across most promising methods, is non-stationary and non-mean reverting indicating that the effects of a given random shock (policy change) will be permanent, that is, it will not revert to its (old) trend level. These findings have important policy implications for measuring the effectiveness of the energy policies. It is more costly and more difficult to permanently affect energy demand when persistence is low. This suggests that response of electricity consumption to exogenous shocks is quick and the effects of such shocks are temporary. Moreover presence of long term correlation structure in electricity consumption reflects a high level of consumption habit formation which means that policy shocks (energy efficiency programs, awareness raising campaigns, etc.) are likely to be more effective in the way that electricity consumption may move away from its trend (old) level to the targeted level by nature opposed to more developed countries studied by Lean and Smyth (2009) , Gil-Alana et al.(2010), Apergis and Tsoumas (2012), Barros et al. (2012).

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