Analysis of Monthly Power Demand in Korea Using Panel Model

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Overview

The price elasticity of demand is defined as the measure of percentage change of demand when price changes in one percent. It is important to get the proper estimates of this price elasticity to better understand the behavior of consumers in power market. Although there are previous researches on the empirical estimation of the price elasticity of power demand such as those of KEEI [3] and Patrick and Wolak [4], recent empirical work on domestic power demand has not been reported since.

In this paper we design an econometric model to analyze the monthly electricity power demand in Korea. The data set used in our analysis is monthly electricity consumption for the period of 2004-2010 provided by KEPCO (Korean Electricity Power Company).

Method

Since our sample has a panel data structure with 36 different contract types for the period of Jan. 2004 to Dec. 2010, we use a panel model to fully utilize the data information. For the convenience of estimation process, all of the contract types are classified into two big groups, service and manufacture group, respectively. Service group consists of 14 contract types including those of service and education sectors. Meanwhile manufacture group is composed of 22 contract types including industrial and agricultural sector in addition to the contract type for street light. A least square dummy-variable panel model is applied for each group [2]. The estimation model specified for this study is:

$$\hat{y}_{(i,t)} = \sum_{(k=1)}^{n} \beta_{1k}\, y_{(i,(t-k))} + \sum_{(k=1)}^{n} \beta_{2k}\, PE_{(i,(t-k))} + \sum_{(k=1)}^{n} \beta_{3k}\, PI_{(i,(t-k))} + \beta_4 PE_{(i,t)} + \beta_5 PG_{(i,t)} + \beta_6 PO_{(i,t)} + \beta_7 House_{(i,t)} + \beta_8 PI_{(i,t)} + \beta_9 HDD_{(i,t)} + \beta_{10} CDD_{(i,t)} + \sum_{(j=1)}^{mab} \beta_{11j}\, SD_j + \sum_{(j$$

where

$y_{i,t}$	: Electricity consumption for regional i at time t
$y_{i,(t-k)}$	: Electricity consumption at time t-k (k-th lag)
$PE_{i,(t-k)}$	: Price of electricity (real term) at time t-k (k-th lag)
$PI_{i,(t-k)}$	: Production index at time t-k (k-th lag)
$PE_{i,t}$	: Price of electricity (real term)
$PG_{i,t}$	: Price of gas (real term)
$PO_{i,t}$	: Price of oil (real term)
$House_{i,t}$	: Number of household
$PI_{i,t}$	: Production index
$HDD_{i,t}$	: Heating Degree Days
$CDD_{i,t}$	: Cooling Degree Days
SD_j	: Structure break Dummy (SD_j = 1 for specific structure periods)
MD_j	: Monthly Dummy (MD_j = 1 for month j)

CD_j : Contract type Dummy ($CD_j = 1$ for contract type j)

α_i : Fixed effect

The specified model for electricity consumption includes explanatory variables such as the price of electricity for each contract, the price of gas and oil products, producer price index, industry specific production index, the number of customers, and temperature (to calculate Heating Degree Days and Cooling Degree Days), which are gathered from various sources, such as Bank of Korea [1] and Korea Meteorological Administration (KMA) [4]. Then by adding different combination of structure break, the lags of electricity consumption, the price of electricity, and production index, model estimation is conducted.

Expected Results

Preliminary estimation results show that some of the estimates for price elasticity of power demand are larger in absolute value than those reported by KEEI [3]. The sign of cross price elasticity of power demand varies across the power demand with different contract types. Meanwhile, the production index and the number of household have positive sign with high statistical significance.

Considering the high growth rate of power demand, and the fact that there has not been a comprehensive analysis of power demand, recently, this study would provide important information on the better understanding of power market in Korea.

References

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