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# ELECTRICITY CONSUMPTION AND ECONOMIC GROWTH IN EU15

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## OVERVIEW

Energy is a vital input for social and economic development of countries. Developments of social and economic activities increase the demand for energy. Many studies [1],[2], [3], [4] on developed and developing countries are assessed relationship between energy consumption and economic growth. However we investigate on the EU15 (European Union 15) countries which are net importers of energy [5] and defined as high-income economies in World-Bank classification.

That's our main purpose to find out the effects of energy consumption on these high income countries. To investigate the relationship in this paper Consumer Price Index is used instead of energy prices, as it was mentioned in the [1] Gross Domestic Product (GDP) per capita as an indicator of economic growth.

## METHODS

In order to investigate the relationship between electricity consumption and growth, this paper develops an empirical model using a panel data approach. Panel data models are usually estimated using either fixed or random effect techniques. If the individuals are thought to be very similar, then OLS is appropriate if the individual specific component is not independent with respect to the explanatory variables or assumed that the countries are very different the fixed effects estimator is used. The random effect estimator is used if the individual specific component is assumed to be random with respect to the explanatory variables.

The data used in the analysis consist of EU-15 countries[1] over 1996-2003 annual period. The data were collected from World Development Indicators web site.

An electricity demand model in logarithmic form is adopted based on [3] and [6]:

Estimated Coefficient Model:

$$\ln \text{epc}_{it} = \alpha_{it} + \beta_1 \ln \text{gdp}_{it} + \beta_2 (\ln \text{gdp}_{it})^2 + \beta_3 \ln \text{p}_{it} + (1 - \gamma_2) \ln \text{epc}_{i,t-1} + \omega_{it} \quad (1)$$

Long run relationship:

$$\ln \text{epc}_{it} = \delta_{it} + \phi_1 \ln \text{gdp}_{it} + \phi_2 \ln \text{gdp}_{it}^2 + \phi_3 \ln \text{p}_{it} + \varepsilon_{it} \quad (2)$$

where lnepc is the natural logarithm of Electric power consumption (kWh per capita), lngdp is the natural logarithm of GDP per capita (constant 2000 US$) lnp is the natural logarithm of consumer price index (2005 = 100), $\ln \text{epc}_{i,t-1}$ is the lagged variable of lnepc, $\varepsilon$ and $\omega$ are normally distributed error term, subscript i and t represent country and year respectively.

## RESULTS

Table 1 reports the estimated models[2] results. The first two columns show Fixed Effects Model (FEM) results , third and fourth columns show Random Effect Model (REM) results.

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[1] Austria, Belgium, Denmark, ,Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden, United Kingdom
[2] We used for all estimations in this paper Stata, version 10.

All models are statistically significant in 0,01 level. Both the random and the fixed effects models, have an $R^2$ around 0.5 which is rare to achieve in a cross country analysis. Significance of coefficients can be investigated from the table.

Table1: Estimation Results  (Dependent Variable: lnepc)

| Variable | Fixed Effects Coefficients | | Random Effects Coefficients | |
|---|---|---|---|---|
| | Long Run | Estimated | Long Run | Estimated |
| Constant | -50.22876*** (-10.58) | -51.5301*** (-11.00) | -49.96263*** -(10.12) | -46.4045*** (-6.04) |
| Lngdp | 11.10564*** (11.59) | 11.3313*** (12.01   ) | 11.04858*** (11.09) | 10.2238 *** (6.60) |
| $\ln gdp^2$ | -0.5299006*** (-11.31) | -0.5428*** (11.75) | -0.5260156*** (-10.77) | -0.4821*** (-6.25) |
| Lnp | 0.2496991*** (3.07) | 0.2773*** (3.48) | 0.2310031*** (2.78) | 0.2013* (1.67) |
| lnepc(-1) | - | 0.0249** (2.21) | - | 0.0488** (2.29) |
| Rsq within | 0.8559 | 0.8626 | 0.8557 | 0.8425 |
| Rsq between | 0.4248 | 0.4423 | 0.4298 | 0.4982 |
| Rsq overall | 0.4331 | 0.4509 | 0.4380 | 0.5053 |
| $F/\chi^2$ statistics♣ | 201.99 *** | 156.95*** | 555.50*** | 245.26*** |

♣ F is used for FEM , Chi square is used for REM. t-values are in parentheses. ***,**,* denotes significance at 0,01,0.05,0.l levels respectively.

**CONCLUSIONS**

This study shows that the relationship between electricity consumption and economic growth in EU15 from 1996 to 2003 by using panel data approach. The empirical evidence indicates that there is a  long-run  relationship between economic growth, electricity consumption and consumer price index. The model implies a positive relationship between economic growth and electricity consumption and it is also significant. The level of economic growth is high, so the consumption of electricity will be also high.

The coefficients imply the income and price elasticities of electric consumption. In order to interpret the results of income and price elasticities, it should be taken into account that these measures vary with their respective income and price levels. Therefore, the produced GDP will be more energy intensive, as it is expected from industrialized countries [6].

The price elasticity has a negative coefficient whereas expected coefficient is positive. However the countries which are investigated are industrialized countries and necessities of energy and the level of consumption is higher than the other countries. That's the reason why they have negative income elasticity.

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