OECD-EUROPE NATURAL GAS DEMAND: AN OUTLOOK TO 2020

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Abstract

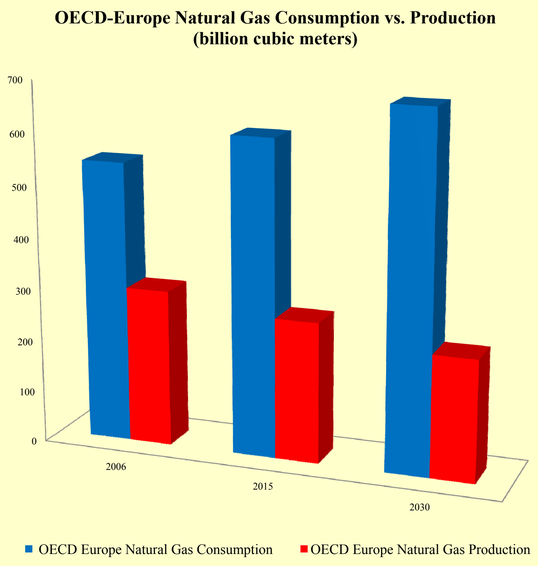
Research Motivation: OECD-Europe's natural gas import dependency is expected to increase due to declining indigenous production and increasing use of natural gas in power generation as a relatively clean alternative to other fossil fuels. Therefore, identifying the structure and composition of OECD-Europe natural gas demand and the responsiveness of demand to its main determinants is imperative for evaluating policy options. Moreover, it is important to minimize the uncertainty about future natural gas consumption as this can provide invaluable information for market forces.

Methodology: This study employs the Structural Time Series Modelling approach by Harvey (1989) coupled with Underlying Energy Demand Trend concept of Hunt et. al. (2003) and uses a consistent data set from IEA in order to estimate OECD-Europe aggregate natural gas consumption.

Results / Conclusions:. GDP, natural gas prices and the underlying energy demand trend all play important roles in driving European natural gas consumption. This study incorporates all of these issues while modelling European natural gas demand. The study finds that the income and price elasticities are 0.95 and -0.18 respectively, with an initially increasing (until 1996) and then decreasing (since 1996) underlying energy demand trend. Based on the estimated equation and different forecast assumptions, it is predicted that European natural gas consumption will be between 294,660 and 468,338 ktoe by 2020.

1. Background:

European natural gas demand is expected to rise in the next few decades mainly because of increasing environmental concerns and related policies. In this respect, it is expected that the use of natural gas in the power sector will increase given its low carbon intensity among other fossil fuels and relative fuel efficiency (EIA, 2009).



Moreover, the Gas Exporting Countries Forum (GECF), which was held in 2001, has become another concern for Europe, since in future GECF may act as a cartel to gain control over European natural gas supplies and prices (Stern, 2002). Not surprisingly, import dependency creates anxiety through Europe as future gas cartels might manipulate the natural gas prices that could have significant negative effects over European economies. In order to adopt necessary measures and policies, reliable energy forecasts are a necessity for policy makers.

Energy Security

- **Supply Disruptions**
  Russia-Ukraine Conflict
  In 2006 3 days, In 2009 3 weeks.
- **Global Competition for Natural Gas**
  China-India etc.
- **Transport of Natural Gas**
  LNG-CNG
  Natural Gas Pipelines
  (Nabucco Vs. South Stream)

Nabucco Vs. South Stream

2. Methodology:

Structural Times Series Modelling

OECD-Europe Natural Gas Demand is Characterized by:

$$E_t = f(Y_t, P_t, \mu_t) \quad (1)$$

Log-Linear form of long term OECD-Europe Natural gas demand function:

$$A(L)e_t = B(L)y_t + C(L)p_t + \mu_t + \varepsilon_t \quad (2)$$

e_t= *Ln (NG consumption);*
y_t =*Ln (GDP);*
p_t= *Ln(NG Price Index for OECD-Europe);*
μ_t= *Level of Underlying Energy Demand Trend;*
ε_t= *a random error term and* **;**

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \acute{\eta}_t ; \qquad \acute{\eta}_t \sim NID(0, \sigma_n^2) \quad (3)$$

$$\beta_t = \beta_{t-1} + \xi_t \qquad \xi_t \sim NID(0, \sigma_\xi^2) \quad (4)$$

The hyper-parameters and other parameters of the model are estimated by combination of maximum likelihood and Kalman filter.

Hunt et al. (2003) introduced the concept of Underlying Energy Demand Trend which stands for exogenous factors such as; technical progress, change in consumer tastes, change in regulations, economic structure and rebound effect.

Stochastic Trend is used in this study in order to capture UEDT (technological progress and other exogenous factors that affect energy demand).

Data: Annual time series data from 1978-2007 for E (natural gas consumption ktoe), Y (GDP 2000 constant US dollar-PPP) and P (OECD-Europe Real natural gas price index 2000 =100) are used for the analysis.

Source: International Energy Agency (IEA) 2009.

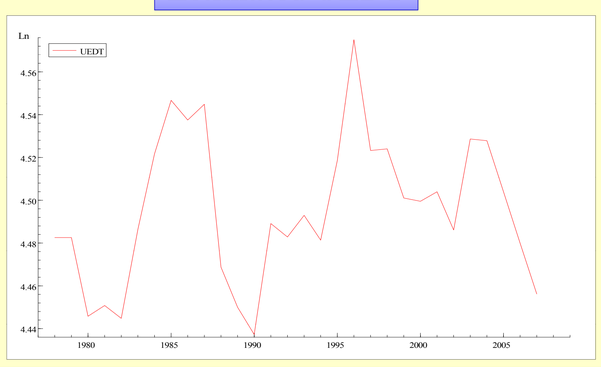
3. Estimation Results:

$$e_t = 0.94665\, y_{t-1} - 0.17585 p_{t-1} - 0.17585 Lvl1988 + \mu_{2007}$$

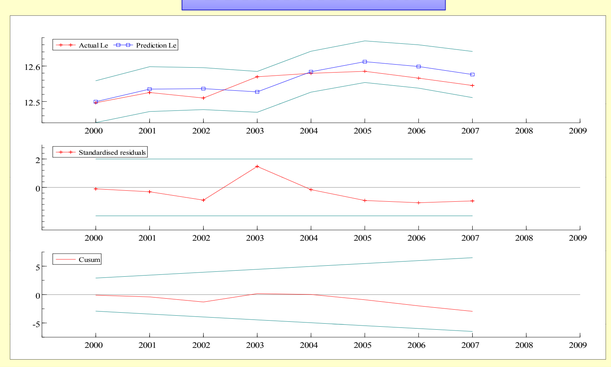
$$\mu_{2007} = 4.53230$$

Variables	*Coefficients*	*T-Values*	*Probabilities*
y_{t-1}	*0.9467*	*4.24*	*0.000*
p_{t-1}	*-0.1759*	*-2.20*	*0.034*
Lvl1988	*-0.0761*	*-2.28*	*0.031*

Estimated UEDT



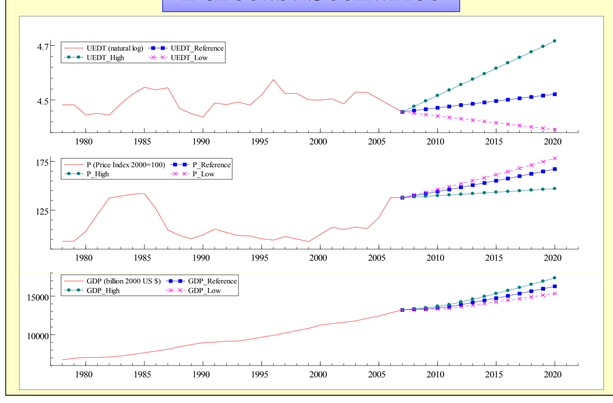
Prediction Tests



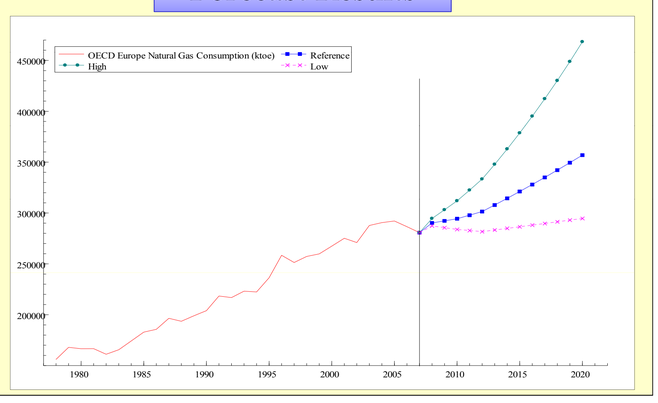
4. Forecast Scenarios And Forecast Results:

Three scenarios are implemented with different assumptions namely; high, reference and low cases. In the high and low case scenarios, combinations of economic variables that 'maximize' and 'minimize' the natural gas consumption are chosen respectively. In the reference scenario, the values of these variables that are regarded as 'most probable' are used. According to these three scenarios that are generated in this study, OECD-Europe natural gas consumption is expected to be between 295,357 and 468 mtoe.

Forecast Scenarios



Forecast Results



5. Discussions and Conclusions:

- **This study identifies the structure and composition of OECD-Europe natural gas demand and responsiveness to main determinants, and it also attempts to minimize the uncertainty about future natural gas consumption.**
- **Income, price and UEDT are the important factors that affect OECD-Europe natural gas consumption.**
- **The income and the price elasticities are 0.95 and -0.18 respectively. Income has a greater impact on European natural gas demand than price and this result is consistent with the previous studies.**
- **OECD-Europe natural gas consumption is expected to be 295, 357 and 468 mtoe by 2020 according to the generated low, reference and high case scenarios.**