INDICATORS OF ENERGY SECURITY IN INDUSTRIALIZED COUNTRIES

Andreas Löschel[a]

Ulf MOSLENER[a,c]

Dirk T.G. Rübbelke[b]

[a] Centre for European Economic Research (ZEW), Mannheim, Germany

[b] Faculty of Economics and Social Studies, Chemnitz University of Technology, Germany

[c] Corresponding author, ZEW, P.O. Box 10 34 43, 68 034 Mannheim, Germany; Phone: +49 621 1235 209; Fax: +49 621 1235 226; e-mail: moslener@zew.de

(1) Overview

Recent geopolitical developments revived scientists' and politicians' interest in the topic of energy security which has become an umbrella term covering a wide range of concerns. A key indicator of (in-) security is the price of energy resources (or its variation). However, a comprehensive and commonly accepted indicator measuring energy security is lacking. Moreover, studies on energy security are in general rather heterogeneous concerning their focus and methodology. After providing a brief survey of existing attempts to define or measure energy security we suggest the distinction between ex post and ex ante indicators. Correspondingly, indices are proposed which also take into consideration the primary energy mix, market concentration and political stability. Those are then illustrated for selected industrialized countries. The indicators point out differences across countries and over time.

(2) Methods

Based on a literature review we survey (i) concepts and definitions for energy security and (ii) actual attempts to quantify of measure energy security (see, e.g., Bohi and Toman (1996) or IEA (2007)). After examining the conceptual problems of this type of indicators, we then introduce the distinction between “ex-post” and “ex-ante” indicators for energy security. Basically, this distinction is motivated by the assumption that uncertainty and potential or real constraints of availability of different energy resources are reflected by prices and traded quantities at the respective point in time. Consequently, for ex-post considerations prices and quantities (together with their evolvement over time) play a major role. On the other hand, ex-ante considerations have to account for issues such as market concentration, fuel diversity and political stability. We propose ex-post and ex-ante indicators and illustrate the development of this indicator over time with data for selected industrialized countries, e.g. Germany, Spain, and the US.

(3) Results

As an example, the indicators for ex-post considerations are based on $ES_{post} = \alpha ES_P * (1-\alpha) ES_V$, where ES_p and ES_v represent sub measures for price- and volume-security, respectively, and weighted by α. One alternative is to construct the sub

measures according to $ES_P = \begin{cases} \frac{p_{tr}}{p_c} \;\; if \;\; p_{tr} < p_c \\ \\ 1 \;\;\;\; if \;\; p_{tr} \geq p_c \end{cases}$ for the price security and similarly for volume, where p_c represents the current price and p_{tr} some expected price "trend" based on the past. According to our construction the second (ex-ante) indicator primarily focuses on market concentration, fuel diversity and political stability.

Illustration of the indicators with data for industrialized countries reveals differences between individual countries but typically shows a decline in energy security over the last decade. Our indicators are then related to the existing body of literature.

(4) Conclusions

"The concept of energy security is not well known in the existing literature", as Barton et al. (2004) point out. Therefore, there is need not only to help policy mitigating energy insecurity but also of discussions about the meaning and measuring of energy security. An issue that cannot be measured will be difficult to improve. After structuring the existing literature, we develop and illustrate new indicators based on our approach of distinguishing between ex-ante and ex-post indicators. Thereby, we attempt to contribute to the ongoing debate and to help formulating long term energy policy goals.

References

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