MEASURING THE EFFICIENCY OF ENERGY-INTENSIVE INDUSTRIES ACROSS 23 EUROPEAN COUNTRIES

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Overview

The global economic growth, abrupt increase in population and continuous improvement of living standards are the most significant contributors to the increasing energy use. The International Energy Outlook (2014) reports that the global energy consumption is predicted to grow by 56% between 2010 and 2040 with the industrial sector consuming more than half of global delivered energy in 2040. It also mentions that industrial activities are responsible for almost 40% of worldwide CO2 emissions and are expected to increase by 46% in 2040. Improving energy efficiency is considered, by most studies, to be the best way of meeting the increasing industrial energy consumption and minimizing environmental degradation. Energy efficiency also contributes to improving competitiveness and decoupling economic growth. Therefore, finding ways to enhance industrial energy efficiency can make a major contribution to moving the world onto a more sustainable energy future. This study evaluates the energy efficiency trends of ten energy-intensive industries in 23 European Union (EU) countries over the period 2000–2009. In particular, the analysis covers the sectors of construction, electricity, mining and quarrying, transport, and six sub-sectors of manufacturing (food and tobacco, textiles and leather, pulp and paper, coke and chemicals, non-metallic mineral and fabricated metal, as well as machinery). The selection of these sectors was based both on data availability and the significant impact of these sectors on country's economy.

Methods

At the first stage, Data Envelopment Analysis (DEA) is employed to evaluate the relative efficiency of these sectors using a comprehensive set of variables related to socioeconomic and environmental factors. At a next stage, the DEA-based Malmquist Productivity Index (MPI) approach is used to examine the efficiency trends over time and distinguish between efficiency change and technology change. Understanding the determinants that have the highest explanatory power in efficiency performance is also essential for the development of the appropriate policy-making initiatives and actions. Therefore, a cross-classified multilevel modeling is performed for the analysis of the main drivers behind the observed efficiency performance considering a number of sector and country characteristics.

Results

According to the results, construction, transport, food, textiles, and machinery are almost at the optimal size for their particular input–output mix as the scale effect is weaker in these sectors. The evaluation and decomposition of MPI reveal that the improvements due to efficiency change have been modest at best, whereas improvements due to changes in the best practices (the technology factor) have been significant in most sectors. The results from the two-level cross-classified model show that the combination of sector and country levels is the most relevant in explaining

the energy efficiency variance. However, a large proportion of energy efficiency variance is due to the sector characteristics.

Conclusions

Energy efficiency strategies applied to pulp and coke could be more effective as there is more room for considerable improvement in these sectors. The results of the econometric analysis, show that policymakers should turn their attention to strengthening the private sector's contribution to the overall economy, and at a lesser extent, promoting productivity gains. Measures such as promoting the gradual displacement of fossil fuels, should also be part of the policy-/decision-making when it comes to improving industrial energy efficiency. The results also show that opening up the electricity market by creating a more competitive environment might contribute to energy efficiency improvement.

References

International Energy Outlook 2014: World Petroleum and Other Liquid Fuels. U.S. Energy Information Administration.