INDUSTRY LEVEL PRODUCTION FUNCTIONS AND ENERGY USE

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Overview

The industrial sector uses more delivered energy than any other end-use sector, consuming about 54% of the world's total delivered energy. Additionally, industrial sector energy consumption is projected to increase by an average of 1.2%/year worldwide. Despite the importance of energy use by industry, there are few studies examining the effect of energy consumption on industrial output by sectors. The aim of this study is to analyze this effect within a growth framework in nine European countries. With this purpose, industry-level translog production functions are estimated by using panel data from 9 European countries and 1995-2011 period. Productive energy use, physical capital and total employee hours are considered as production factors.

Methods

Industry-level translog production functions are estimated for the case of 3 factors (physical capital stock, productive energy use and total employee hours) by using panel data referring to 9 European countries along the period 1995 to 2011. The translog production functions are estimated for ten industry levels: Food and beverages, textiles, wood, pulp and paper, chemicals, non-metallic, transport equipment, machine, other manufacturing, mining and construction. The parameters are estimated empirically through panel data techniques. Positive values of the coefficients of terms with cross-products of the variables indicate there is complementarity between the corresponding productive factors, while negative values of those coefficients indicate there is substitutability between them. The coefficients of the quadratic terms characterize the returns to scale. Two control variables have been used in order to control for heterogeneity. The first one refers to relative productivity of the sector of one country respect to the countries mean. The other refers to the size of the industry sector respect to their own industry size.

Results

The obtained results indicate that all elasticity values for energy in the central point of the sample are positive. Nevertheless, its value differs significantly among sectors. The lowest elasticity value is observed for wood, pulp and paper and transport equipment, being equal in both cases to 0.06. The highest value is observed for machine sector, being its value equals to 0.28 . Substitutability relationships between energy and physical capital are observed only in food and beverages while complimentarily relationships are observed in the machine and all manufactories sectors. Similarly, it may be noted that the parameters of the squared terms of energy use proves to be positive and significant in food and beverages, chemicals, mining and the whole manufacturing sectors, implying increasing returns. In addition is observed that in all sector, except for construction, the size is relevant for industry productivity. However, the ratio between country productivity respects to the mean group is not always relevant, meaning that there is not productivity convergence in all sectors.

Conclusions

This study analyses the role of energy in the industry growth for ten sectors by estimating translog production functions. Thus, the strength of the link between energy and growth in the industry is studied. The productivity elasticity with respect energy use varies throughout sectors being positive for all them. Values differ notably among sectors. These positive values represent the potential negative impact on economic growth due to energy conservation policies for cutting down emissions. In Food sector, substitutability relationships between physical capital and energy used are observed. Therefore, increases in energy efficiency are available through increased capital purchases.

References

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