HOW WILL MANUFACTURING INDUSTRIES ACROSS OECD COUNTRIES RESPOND TO CHANGES IN ENERGY PRICES?

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(1) Overview

Several manufacturing industries in OECD countries face an increased competitive pressure, particularly high-energy intensity industries that compete on an international market. In the coming years these industries may face both a general increase in energy prices and changes in relative prices. Factors driving this development are increased global energy scarcity, higher taxes to limit CO2 emissions, and changes in the structure of competition in energy markets. For Europe in particular, one may expect that increased interconnectivity between gas markets and electricity markets will change the relative prices between countries and between energy carriers.

Our focus is on manufacturing industries' demand for energy. The response to future changes in absolute and relative prices of the manufacturing industry in an OECD country depend on the existing mix of manufacturing industries, particularly with respect to energy intensity in production. Furthermore, it is influenced by initial prices on energy carriers in the country, degree of competition with manufacturing in other countries, and country-specific regulations.

The objective of this paper is to provide insight into the energy demand response for the overall manufacturing sector in selected OECD countries and for particular manufacturing sub-industries. Although we include several energy carriers in our analysis, our main emphasis is on industrial demand for natural gas.

(2) Methods

Previous studies have demonstrated modest own price responsiveness in the short run, but higher long-term own-price elasticity as well as a range of substitution possibilities between fuels, labour and capital. Yi (2000) highlights the substitutability of fuels and capital and electricity and labour in Swedish manufacturing industries. Using two alternative dynamic cost frameworks on US industry data Urga and Walters (2003) find very inelastic own and cross price responsiveness, but an 'implausibly' rapid rate of adjustment of fuel use to price changes. Similarly, Roy et al (2006) find conservative own-price elasticities, but a wider range of substitution elasticities across countries and industries; ranging from –1.96 to 9.80 for energy and capital and from 2.61 to 7.11 for labour and energy.

We provide a descriptive statistical analysis and an econometric analysis of the structure of manufacturing energy demand in OECD countries. In the descriptive analysis we examine patterns of energy demand, prices and taxes between countries, and also for sub-sectors.

The econometric analysis is concerned with estimation of dynamic panel data models of energy demand on the general form

$$X_{j,i,c,t} = D_{j,i,c,t}(X_{j,i,c,t-1}, P_{j,i,c,t}, Y_{i,c,t}),$$

where the subscript *j* is the energy carrier, *i* is industry, *c* is country, and *t* is year. X is energy quantity, P_j is the price of energy carrier j (j = {Natural gas, Electricity, Coal, Petroleum}), and $Y_{i,c,t}$ is output (value added).

We obtained data from IEA, OECD and Eurostat for 14 countries (Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Spain, Switzerland, UK, USA). Depending on data availability on all required variables econometric estimates were obtained for most of these countries.

We employ a shrinkage estimator (Maddala et al., 1997), which is a weighted sum of the estimate provided by pooled random effects estimate and the estimate provided by industry-specific observed difference. This addresses the limitations of the pooled and regression estimators by combining the pooled and regression estimates and "shrinking" the group specific estimate towards the overall mean.

(3) Results

We will present energy demand elasticities from several econometric model specifications. As an example of our findings, natural gas demand is highly own price inelastic for all industries in the short run. In the long run demand is still inelastic in own price but there is also much greater variation between industries. Differences between countries also become more pronounced in the long run. As previous studies have found for individual countries, the results are somewhat sensitive to the choice of estimator. Furthermore, natural gas demand is highly inelastic in production volume in the short run, while in the long run there are both elastic and inelastic responses to production increases depending on industry and country.

(4) Conclusions

Our estimation approach sheds light on the heterogeneity in natural gas demand elasticities wrt. own price, cross prices and output across industries and countries. The estimates imply that the demand responses to moderate CO2 taxes will be small for most industries. In particular, most industries will be fairly unresponsive to higher natural gas prices, even in the long run. The estimated demand model suggests that future production growth in the industries, which usually is largely determined by domestic and international economic growth, will have greater consequences for natural gas demand.

References

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