

Operational and Investment Response to Energy Prices in the OECD Manufacturing Sector

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Jevgenijs Steinbuks and Karsten Neuhoff

This working paper builds upon an earlier EPRG working paper by Steinbuks, Meshreky, and Neuhoff (2009), which attempts to address the limitations of current econometric models of energy demand in reflecting the adaptation of the capital stock to energy price changes. Their econometric model explicitly incorporates the capital stock, and separately accounts for operational and investment choices in different sectors. Specifically, traditional estimation of energy, materials, and labour responses to input price changes is expanded by including vintages of the capital stock. Each vintage has its own energy efficiency, which is a function of input prices at the time of investment, and the exogenous technological change. In this vintage capital model, rational cost-minimizing firms choose both the optimal input quantities and the efficiency of new capital stock. The model therefore is able to separate the flexibility of substitution between input factors to production (labour, energy and materials), and the potential for more efficient use of these inputs by choosing more efficient technologies at the time of investment.

This paper attempts to evaluate the robustness of the results of Steinbuks, Meshreky, and Neuhoff (2009) by applying their model to less aggregate data, thus reducing the distortions from exogenous structural shifts and measurement errors. The model is estimated for five manufacturing industries in 19 OECD countries between 1990 and 2005. Our results confirm that including capital stock vintages significantly improves the econometric model's goodness of fit. Estimated own-price elasticities of energy demand vary between 0.26 and 1.00 and are economically sound. Estimated own-price investment elasticities of energy efficiency of capital stock vary between 0.03 and 0.9. This result indicates that the investment response to energy prices varies significantly across manufacturing industries, being significant in some and negligible in others.

An important finding of this paper is that energy and climate policies aimed at reductions in fossil fuel emissions can result in a substantial reduction of energy use in energy intensive sectors. The results of



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policy simulations for the U.K. petrochemical industry (the most energy-intensive industry in the sample) indicate that a 17 percent increase in energy prices from a 30 dollar carbon tax results in a 19 percent decline in energy use. That is total (operational and investment) own-price elasticity of energy demand is close to one.

Contact s782@cam.ac.uk
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