

Capital Adjustment and the Optimal Fuel Choice

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Executive summary

The ability of firms to switch between fuel sources has important implications for economic growth, particularly in the context of economic adjustment to oil price shocks and climate policies. While there is a large body of economic literature that looks at the issue of fuel substitution, few of these studies explicitly model the choice of fuels and corresponding fuel-using capital stocks.

Our paper proposes a novel approach to analyze interfuel substitution that explicitly incorporates heterogeneous energy-using capital stocks in the estimation of optimal fuel choice. We model the capital and energy use decisions jointly, implying that firms choose capital and energy inputs concurrently. The fundamental choice that firms make is among different competing fuel-using technologies; this contrasts with the traditional approach in which firms first choose which fuels to use and then choose the other factor inputs. We argue that this approach may capture more realistic dynamics of fuel substitution that are currently missing in both econometric analysis of fuel substitution and the energy-environment component of CGE models.

The main contribution of our paper is methodological. That is, we develop and outline an appropriate model of fuel substitution, which can be applied to the firm-level data. To illustrate how the model is estimated we use a rich firm-level panel data for the Republic of Ireland, which is, to our knowledge, the best available dataset that has been previously employed to analyze fuel choice problems. Because of the imperfect nature of our data, most importantly due to the absence of clearly delineated fuel-using capital stocks, our estimates should be interpreted with a degree of caution. This caveat notwithstanding, our empirical results suggest that the costs of adjusting capital stocks in response to changing fuel prices are large for all types of capital, and an order of magnitude higher than in studies where capital adjustment costs are implicitly estimated. Furthermore, our results suggest that investment in fuel-using capital stocks may be irreversible; this is indicative of prohibitively large adjustment costs associated with divestment of assets.

Our findings have important implications for both econometric and economic modeling studies of interfuel substitution. Failure to incorporate proper heterogeneous fuel-using capital adjustment dynamics in econometric studies will likely result in the downward biased long run elasticities of optimal fuel choice. Similarly, considering more appropriate nesting structure of capital energy interaction and revising the magnitude of fuel-using capital adjustment costs would yield an improvement in robustness of dynamic energy-environmental CGE models.

Keywords: capital adjustment, fuel choice

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