The Rebound Effect in Energy-Intensive Industries: A Factor Demand Model with Asymmetric Price Response

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In this paper the rebound effect from energy efficiency improvement in the Swedish energy intensive industry is empirically assessed. The rebound effect represents economic behavior that will offset energy savings from energy efficiency improvements.

The challenge of climate change, together with energy security concerns, has spurred an increased societal interest in energy efficiency improvements. In 2016 EU presented a package of measures, "Clean energy for all", in which one ambition is to prioritize improvements in energy efficiency. The EU Energy Efficiency Directive has been revised within this package and now includes updated and extended national energy savings requirements to 2030 (Article 7). The Commission declares that the most efficient energy is the one not being consumed, i.e., indicating an ambition of decreasing energy use. This addresses the importance of not implementing policy measures resulting in significant rebound effects.

The paper focuses on four sectors in Sweden during the period 2001-2012; pulp and paper, iron and steel, chemical, and mining. We apply a factor demand model to estimate energy own-price elasticities, which serve as approximations of the size of the direct rebound effect. The model allows for asymmetric price response, i.e., that firms may response differently to increasing versus decreasing energy prices. In that case own-price elasticities calculated on decreasing energy prices should serve as approximations of the size of the rebound effect.

The result shows considerable rebound effects in the studied industries. For electricity and non-fossil fuels, e.g., efficiency improvements could even result in 'backfire'. Regarding fossil fuels the results suggested a smaller, but still considerable, rebound.

The results have important policy implications, not the least in relation to so-called industry energy efficiency programs. In Sweden, such a policy gives industrial firms the opportunity to seek financial support if conducting investments in energy efficiency measures whilst meeting the minimum permitted energy tax rate within the EU. However, to mitigate rebound, such policies should instead be combined with a raise in energy taxes if the ambition is to reduce overall energy use.

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