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The Rebound Effect and Energy Efficiency Policy

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Abstract

Is there any validity to the claims that energy efficiency improvements can actually lead to an increase in energy use? This article tries to clarify what the rebound effect is, and provides a guide for economists and policymakers interested in its existence and magnitude. However, our understanding of the macroeconomic rebound effect remains limited, particularly as it relates to induced innovation and productivity growth [1].

1. Introduction

Buy a more fuel-efficient car, drive more. This is perhaps the simplest illustration of what has come to be known as the "rebound effect"—the phenomenon that an increase in energy efficiency may lead to less energy savings than would be expected by simply multiplying the change in energy efficiency by the energy use prior to the change [1].

The goal of this article is to more clearly define the rebound effect in the context of energy efficiency improvements, including clarifying its various channels, and to critically assess the literature that estimates its magnitude [1].

For instance, according to eceee, (the European Council for an Energy Efficiency Economy) the current 2020 target on 20% energy efficiency is accompanied by a 20% greenhouse gas (GHG) reductions target and a 20% target for renewable energy in each Member State [2].

Therefore, for the EU, energy efficiency policy means replacement of energy sources. For the US on the other hand, the benefits of energy efficiency policies are manifold—lower energy bills, improved air quality, reduced greenhouse gases, energy security, and deferred infrastructure costs [3]. And these are referring to that from nation to nation and region to region the energy efficiency policy can be different.

2. Microeconomic Channels For The Rebound Effect

In general, in production of goods when energy efficiency improves, the price of energy services changes. Substitution and income effects arise, which influence consumers' consumption of the energy services and, ultimately, energy use, this process towards to the lower effective price for the energy service. Hence the consumer's purchasing power will increase, which means consumers will further increase consumption of the more energy-efficient product. Finally, their increased purchasing power means that consumers will also increase their consumption of other normal goods [1].

The Direct Rebound Effect is normally defined as the change in energy use resulting from the combined substitution and income effects on the demand for the *energy efficient product*. However, it is important to note that this estimation of the direct rebound effect ignores any changes in the demand for *other* goods due to either the change in relative prices or purchasing power [1].

The Indirect Rebound Effect on the other hand, it is the effect of an energy efficiency increase on the demand for all *other* goods, and the subsequent change in energy use. However, the most common approach in the literature is to refer to the indirect rebound effect as including *only* the income effects on the consumption of all other goods [1].

2.1 Estimating Microeconomic Rebound Effects

When we are discussing about specific estimates, it is important to consider the following factors: 1. in order to to provide reliable guidance for analyses, it is critical that studies estimate a *causal* effect; 2. the conversion of demand elasticity into an estimate of the direct rebound effect requires an assumption about symmetry of consumer response to changes in fuel prices and energy efficiency; 3. the consumer response to any change in usage costs may vary depending on the timeframe of the response, and the last each estimate of price elasticities is for a particular time and place, and energy demand could vary with the specific setting [1].

Many studies focus on gasoline or electricity use to estimate microeconomic rebound effects, and it may not be appropriate to apply the estimates to other energy services, including those that use natural gas, heating oil, or other fuels. Unfortunately, there is limited evidence on the price elasticity of demand for other energy services [1].

3. Macroeconomic Channels For The Rebound Effect

References

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2. http://www.eceee.org/policy-areas
3. http://www.nrel.gov/docs/fy10osti/46532.pdf