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Rebound Effects in Practice: An Invitation to Consider Rebound From a Practice Theory Perspective

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ABSTRACT

Rebound effects are the unintended consequences of improvements in energy efficiency. They refer to situations in which efficiency improvements are reduced or even reversed by changes in behavior. In many cases these effects stem from small behavior changes rooted in cultural values or from the interconnectedness of everyday practices. Practice theory has established itself in many social science disciplines, including ecological economics, and its focus on routinized activities in everyday life promises to provide beneficial insights to debates on rebound. Since this has not been done to date, this article aims to fill the gap by offering suggestions as to how practice theory can complement and enhance existing explanations of rebound effects. Drawing on existing practice theory research on energy consumption, we identify and discuss a number of starting points for practice theory-inspired research on rebound effects. These include the pivotal role of distributed agency between humans and non-humans (e.g. technical devices), the co-dependence of practices, the co-evolution of practices with systems of provision, as well as a general trend towards the acceleration of everyday life.

1. Introduction

Technological progress in areas ranging from energy efficiency to alternative forms of mobility can bring about unintended side effects: improvements in efficiency brought about by such progress can, paradoxically, lead to an increase in energy consumption and thereby reduce potential energy savings. This phenomenon is generally described as a rebound effect, or Jevons' paradox. Thereby, the term “rebound effect refers to any circumstance where efficiency improves by X%, but resource consumption declines by something less than X% or increases” (York and McGee, 2016 p. 76). The Jevons' paradox is given, more specifically, when rebound effects exceed 100% so that there is an actual increase in resource use and not merely a loss of expected benefit (Sorrell, 2009; Alcott, 2005).

Given the existence of ambitious policy goals aimed at reducing overall energy consumption, rebound effects constitute a challenging issue for both policy makers and researchers as unintended side effects of the modernization of society (Beck, 1996). Up to now, rebound effects have been studied largely within economic research programs. It is only recently that other social sciences such as sociology, psychology, and cultural anthropology have started to pay attention to the issue of rebound effects.

Taking up Røpke's plea for a practice theory perspective in ecological economic studies on consumption (Røpke, 2009), we will argue in the following that practice theory could offer deeper insights into rebound mechanisms, ones that build on but also depart from explanations offered by psychological and economic theories. Since the latter two usually focus on individual intentions, choices, and isolated behaviors, they run the risk of neglecting the recursive relationship between everyday human activities and socio-technical structures. In contrast to this, “social practice theories posit that institutional, infrastructural, and cultural structures play a strong role in shaping social action, understood as a constellation of practices rather than the result of individual attitudes and values” (Huddart Kennedy et al., 2015 p. 4).

The aim of this article is to provide some conceptual food for thought with regard to how practice theory could complement and enhance psychological and economic explanations of rebound effects at the household level – and vice versa. Since – in particular form a practice theory perspective – rebound effects on a household level cannot be disconnected in a meaningful way from the societal meso or macro level, we also point beyond the household level in our argumentations. By so doing, we first give a brief overview of the current state of research on household level rebound effects. Then, we introduce practice theory by contrasting its basic assumptions with those

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of theories of human behavior. Drawing on existing practice theory research on energy consumption, in sections 4 and 5 we identify and discuss a number of starting points for rebound research inspired by practice theory. Our hope with this article is to contribute to the debate about the origins of direct and indirect rebound effects at a household level.

2. State of Research on Rebound Effects

The rebound effect can be formally described as “the gap between engineering assessments of potential energy (or emissions) savings (PES) and actual energy (or emissions) savings (AES) that are measured after the energy-efficient technology or measure is adopted” (Azevedo, 2014 p. 396). Mathematically expressed, this means: Rebound = 1 − AES/PES. In the research literature, rebound effects are usually further differentiated into the following types:

- **Direct rebound effect**: The demand for a specific good or service increases after an energy efficiency improvement of the same good or service, thereby partly offsetting potential energy savings (Sorrell and Dimitropoulos, 2008 p. 637). For example, due to increases in the fuel efficiency of cars, longer distances are travelled or additional car journeys undertaken. This is especially the case among users of electric vehicles who use their cars about twice as much every day in comparison to those who own cars with combustion engines (Schrader, 2018 p. 18). Apparently they seem to assume that they do something good for the environment by driving electric and thus produce a direct rebound.
- **Indirect rebound effect**: The demand for a specific good or service increases after an energy efficiency improvement in other goods or services (Sorrell and Dimitropoulos, 2008 p. 637). For example, cost savings due to a more efficient heating system are re-invested in additional car journeys.
- **Economy-wide rebound effect**: While direct and indirect rebound effects occur at the micro level of energy consumers or households, economy-wide rebound effects operate at the macro level of entire economies. Sorrell describes the economy-wide rebound effect as follows: “A fall in the real price of energy services may reduce the price of intermediate and final goods throughout the economy, leading to a series of price and quantity adjustments, with energy-intensive goods and sectors likely to gain at the expense of less energy-intensive ones” (Sorrell and Dimitropoulos, 2008 p. 637). In short, this means that energy efficiency improvements induce economic growth which, in turns, leads to additional energy consumption (Jevons, 1865; Saunders, 2000; Alcott, 2005; Saunders, 2013).

The basic economic mechanisms of rebound effects on the micro level are income and substitution effects (Azevedo, 2014 p. 402). However, in addition to these monetary mechanisms, some scholars argue that micro rebound effects can also be triggered by time savings (Jalas, 2009; Binswanger, 2004). This ‘time use rebound’ occurs when technological improvements bring about time savings which, in turn, are used to engage in other energy consuming activities. This occurs, for example, when faster modes of transport (e.g., faster trains) encourage people to travel longer distances and thus give rise to additional energy demand due to the further travel distance. Thus, time savings can also be a trigger for additional energy consumption bringing about rebound effects.

In addition to the types of rebound effects mentioned above, Santarius and Soland assume that there are also psychological rebound effects which are not related solely to monetary or time savings (Santarius and Soland, 2018). They argue that these psychological rebound effects are triggered by psychological processes such as moral licensing. According to Santarius and Soland, moral licensing can cause rebound effects when “the purchase or use of an efficiency-improved technology is perceived as a good deed that licenses increased preferences for purchase/use of that technology, or of other technologies” (Santarius and Soland, 2018 p. 418).

However, the debate about types of rebound effects and their definitions as well as about the mechanisms that give rise to rebound effects is far from settled. Madlener and Turner state that the definitions, terminology, and mechanisms behind rebound effects require further clarification (Madlener and Turner, 2016 p. 21).

The need for further conceptual clarification notwithstanding, the existence of rebound effects is broadly acknowledged within the scientific community and public policy domain (Font Vivanco et al., 2016 p. 115). In an article that provides an overview of direct rebound effects, Sorrell et al. have compiled the following estimates of long-term direct rebound effects in the OECD (Sorrell et al., 2009 p. 1363):

Table 1
Estimates of long-term direct rebound effects in the OECD.
Source: (Sorrell et al., 2009)

End use	Range of values	‘Best guess’	No. of studies	Degree of confidence
Personal automotive transport	3–87%	10–30%	17	High
Space heating	0.6–60%	10–30%	9	Medium
Space cooling	1–26%	1–26%	2	Low
Other consumer energy services	0–41%	< 20%	3	Low

Despite the broad variation in estimates which, according to Sorrell et al., has mainly to do with differences in definitions and methodical approaches, it can be assumed that rebound effects are likely to be substantial in different domains of consumption (see ‘Best guess’ column in Table 1).

According to Santarius, rebound research is faced with two main challenges: cause-effect relativity and micro-macro discrepancy (Santarius, 2015). Cause-effect relativity refers to the crucial point that it is extraordinarily difficult to isolate the causal effect of an energy efficiency improvement from other factors in real-world settings, since “multiple parameters usually shape an individual's decision how to spend money saved through, say, a car's increased fuel efficiency” (Santarius, 2015 p. 86). While energy efficiency improvements are identified and conceptualized in theory as the causal trigger of rebound, it is difficult to demonstrate the existence of this assumed causal relation empirically. On the one hand, then, a clear-cut definition specifying causal relations is needed to guide empirical studies and to ensure comparability between these studies. At the same time, however, it is obvious that the assumed causal relation is too simplistic, being unable to capture the complexity of causation. Furthermore, at least from a sociological perspective, clear causal relations that are sought to explain human activities and societal developments are extremely difficult to identify because of the overlap between different variables and due to ‘social systems’ (e.g. cultural, religious, political, economic, technological) mutually influencing one another (Hafferty and Castellani, 2009; Urry, 2016; Byrne, 1998).

While the challenge of cause-effect relativity refers to the causality behind the rebound phenomenon, the challenge of micro-macro discrepancy refers to the question of how changes in consumer behavior relate to structural socio-economic changes, and vice versa (Smart, 2010). This question remains unanswered in rebound research (Madlener and Turner, 2016 p. 32). However, it is unlikely that this issue will be resolved in the near future, particularly given that the micro-macro problem is one of the key issues that sociology (among many other social science disciplines) has been struggling with for a long time (see, for example, Alexander and Giesen, 1987; Knorr-Cetina and Cicourel, 2015 [1981]). In our view, a weakness in the aforementioned economic and psychological explanations for the occurrence of rebound effects lies in their focus on the individual as a consciously