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Combining "carrot and stick" to incentivize sustainability in households

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ABSTRACT

Electrical utilities are a main stakeholder for achieving sustainable policy goals. Effective tariff designs that incentivize electricity savings among consumers can contribute to fulfilling these goals. Prior research suggests that penalties are more effective in promoting behavior change, which can be explained by insights from behavioral economics: Loss aversion describes that people react more strongly to losses (penalties) than to rewards of the same magnitude and go greater lengths to avoid them. However, in markets where consumers freely choose their preferred tariff, it remains a major challenge to persuade consumers to voluntarily subscribe to penalizing tariffs. The present study employed a choice experiment using choice-based conjoint analysis to examine consumer preferences for electricity tariffs that apply a combination of rewards and/or penalties for electricity consumption. Results from a representative sample of Swiss electricity consumers show that consumers prefer tariffs that reward decreases in electricity consumption, rather than tariffs that penalize increases in consumption, but that tariffs combining rewards and penalties achieve substantial potential market acceptance. Direct tariff attractiveness ratings additionally support these findings showing that consumers perceive combined Bonus-Malus tariffs as sufficiently attractive. Future research avenues and implications for marketing strategies and energy policies are discussed.

1. Introduction

While government and utilities are bound to fulfill stringent sustainable development policies, the global energy demand is rising (IPCC, 2014). Energy conservation strategies, particularly strategies aiming to minimize consumption and wasteful behaviors, pose a large potential in achieving the sustainable development goals (e.g., AGECC, 2010; Swart et al., 2003). Electrical utilities can crucially contribute to achieving these goals, as many utilities are not only profit-driven, but have a clear mandate to help citizens to save energy (EED Directive, 2012; Fawcett et al., 2018; Sciortino et al., 2011).

One way of promoting energy savings is by implementing effective tariff designs that motivate households to reduce their consumption. In this context, the behavioral sciences can make important contributions by offering insights into the most efficient behavior change mechanisms. Many promising intervention strategies to reduce energy consumption have been developed based on the implementation of goal-setting techniques (Harding and Hsiaw, 2014), provision of consumption feedback (Bertoldi et al., 2016), or consumption comparisons with a social reference group (Allcott, 2011).

One of the earliest and most prominent ways to trigger behavioral change across contexts are incentive-based strategies, which reward desired behaviors and punish undesired behavior (e.g., Skinner, 1953). In the domain of electricity consumption, incentives can be applied in different manners, for example, rewarding decreases in electricity consumption and/or punishing consumption increases (or failure to decrease consumption) (e.g., Bertoldi et al., 2013; Borenstein, 2009).

In the present contribution, we first provide a brief overview of the literature describing the impact of rewards and punishments on behavior, emphasizing differences between the two approaches in the efficiency to change behavior as well as potential pitfalls that need to be considered when applying incentive-based behavior change interventions. We then discuss recent experiences with incentive-based electricity saving tariffs and outline a tariff structure that aims at maximizing behavior change as well as consumer acceptance by combining reward and punishment to encourage energy savings.

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1.1. Incentive mechanisms: reward and punishment

Incentives and their impact on human behavior have been of great interest to both economists and psychologists. Applying incentives, that is, using rewards to increase the frequency of desired and punishments to reduce the frequency of undesired behaviors, have been shown to be effective in increasing cooperation (e.g., Fehr and Gächter, 2002), dieting (e.g., Volpp et al., 2008) and exercising (e.g., Charness and Gneezy, 2009), improving work performance (e.g., Lazear, 2000), and promoting environmental conservation (e.g., recycling; Bor et al., 2004; Timlett and Williams, 2008).

Both rewards and punishments are effective in triggering behavior change, while punishments have been found to be slightly more effective (Balliet et al., 2011). Moreover, behaviors tend to change quicker in response to punishments (Azrin and Holz, 1966; Skinner, 1953) and behavioral changes sustain longer in response to punishments than to rewards (Sefton et al., 2007; Sutter et al., 2010). Hence, punishments seem to be more impactful for long-term behavioral change as compared to rewards (see, e.g., Coad et al. 2009).

Standard economic models assume that decisions and behaviors are based exclusively on considerations of the maximization of individual utility, thus expecting a monotonic relationship between incentives and performance: The higher the financial incentive, the greater the resulting effort and performance (see also Ayres, 2010; Gneezy et al., 2011), while effort and performance are expected to be minimal when there are no extrinsic incentives (Kreps, 1997). However, real-world behaviors do not follow this monotonic assumption. Instead, several additional factors influence the effect that incentives have on human decisions and behaviors, such as the type of incentive and the temporal distance to the reception of the incentive (e.g., Gneezy, 2003; Gneezy et al., 2011). Models from behavioral economics can explain real-world observations of the effect of incentives on human decisions and behaviors and account for the asymmetrical effectiveness of rewards and punishments, allowing to take into account deviations from standard rational choice models. Loss aversion, as formalized in prospect theory, postulates that rewards and punishments are perceived as deviations from a neutral reference point, with rewards being perceived as gains and punishments being perceived as losses (Tversky and Kahneman, 1986, 1991). As the value function for losses is steeper than for gains, the displeasure associated with losses is up to twice as intense as the pleasure associated with gains (Kahneman and Tversky, 1979). As a consequence, people generally show greater behavior change in order to avoid a punishment ("loss") than in order to receive a reward ("gain"; see, e.g., Fryer et al., 2012; Imas et al., 2016; Tindall and Ratliff, 1974).

In addition to this asymmetric valuation effect, insights from psychology research explain that punishments may furthermore signal a stronger social behavior norm (e.g., Coad et al., 2009; Johnson and Krüger, 2004). Under threat of punishment, the desired behaviors may be perceived as obligatory, rather than voluntary, and might therefore trigger greater compliance (Mulder, 2008; Evers et al., 2016). While findings suggest punishments produce greater behavioral change (Balliet et al., 2011), prospect theory additionally predicts that people, when offered a free choice, will vastly prefer gains to losses, and will thus more likely accept reinforcement contingencies that are based on receiving rewards than contingencies based on accepting punishments.

Empirical findings to support these theoretical predictions are, however, inconclusive: Where Luft (1994) as well as Hannan et al. (2005) showed that workers have a preference for bonus contracts that reward higher work performance, rather than penalty contracts that penalize lower work performance, other empirical findings demonstrate that, under certain circumstances, people are indeed willing to voluntarily choose loss contracts in the work context (de Quidt, 2017; Imas et al., 2016). A possible explanation for these findings is that loss contracts serve as commitment device. People may anticipate that they will work harder under threat of a potential loss (Imas et al., 2016; Kaur et al., 2015; Royer et al., 2015). de Quidt (2017) suggests that commitment alone cannot explain these findings, but that risk seeking behaviors under losses and greater salience of effort under loss contracts contribute to these voluntary subscriptions. Nonetheless, the exact psychological mechanisms and the role of loss aversion in incentive-based contract preferences are still inconclusive and more work is needed (cf. Imas et al., 2016).

1.2. Incentives and electricity tariffs

In light of the increasing prominence of using incentives in environmental policy (Shogren, 2012), their influence on environmental and sustainable actions and behaviors has been extensively studied (see Rode et al., 2015 for a review). For example, incentives have been successfully applied to promote waste management and recycling (e.g., Bor et al., 2004), energy conservation (e.g., Ito et al., 2018), and change of transportation habits (e.g., Jakobsson et al., 2002). Incentives have also proven useful for utility providers to design incentive-based conservation programs (e.g., Train, 1988).

While the above examples demonstrate the successful implementation of incentives to promote pro-environmental behaviors, other scientific insights illustrate that under specific circumstances, incentives (i.e., both rewards and punishments) can backfire and undermine the promoted behavior. This is particularly the case where behaviors have a moral component and can be driven by intrinsic motivation (e.g., blood donations, Mellström and Johannesson, 2008; acceptance of a nuclear waste repository in the neighborhood, Frey and Oberholzer-Gee, 1997). This so-called *crowding out effect* (Deci, 1971; Deci et al., 1999) illustrates that monetary incentives, both rewards and punishments, can undermine intrinsic motivation and initial civic spirit.

Despite links between incentives for energy conservation and potential crowding out effects (see Stoft and Gilbert, 1994, for a summary), a number of successful incentive-based programs exist. For example, Energy-Saving Feed-In tariffs (ESFIT) apply rewards to encourage energy-saving behaviors. ESFIT usually set a pre-defined energy-saving target for consumers and pay a financial incentive upon target fulfillment (Bertoldi et al., 2013). In contrast to this, tariffs such as the progressive tariff (PT) punish overconsumption. PT apply an inverse demand function, where the price per kilowatt per hour (kWh) increases with every additional unit of consumed energy (Borenstein, 2009). Badouard (2012) and Faruqui (2008) studied the effectiveness of PT and report that PT can mobilize significant decreases in energy consumption. A recent review by Prasanna et al. (2018) contrasted the energy-saving effectiveness of PT and ESFIT showing that, overall, penalty-based tariffs were more effective in mobilizing energy savings in residential consumers than reward-based tariffs.

Although these scientific insights suggest a greater effectiveness of punishments to promote electricity conservation, these punishment-based tariffs are implemented mainly in countries where the government regulates the electricity market and consumers do not choose their preferred tariff such as in China (Dehmel, 2011; Sun and Lin, 2013). Unlike this, in less regulated markets such as Switzerland, consumers often have the possibility to freely choose their preferred electricity tariffs from their utility provider, whereas in liberalized markets, such as within the European Union, consumers can also freely choose a utility provider. Hence, competition is strong and electricity tariffs with a rewarding incentive structure find greater implementation in these countries.

Implementing electricity tariffs that penalize consumption in countries where consumers can freely choose their tariffs is thus a challenge, as the perceived penalty that consumers face when increasing or failing to reduce their consumption can drastically decrease the attractiveness and, as a result, the acceptance of such tariffs. According to prospect theory, in comparison to a conventional flat rate tariff ("neutral reference point"), tariffs that apply a reward for electricity conservation ("gain") should be perceived as more attractive,