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The importance of framing for consumer acceptance of the Smart Grid: A comparative study of Denmark, Norway and Switzerland

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ABSTRACT

This study examines the impact of the careful choice of the default on consumers' participation in the Smart Grid. In an online experiment in three countries, participants ($N = 3802$) were randomly assigned to three conditions, two of which (opt-in vs. opt-out) implied different defaults and the third was "neutral" in terms of defaults (i.e., participants had to make an active choice). Next, the experiment was replicated in a field setting with homeowners having a heat pump ($N = 140$). An important finding from the field experiment is that in practice it may not be possible to force people to make an active choice. As expected, both studies find that an opt-out frame leads to a significantly higher participation rate than an opt-in frame. When participants are forced to make an active choice (neutral condition), the same level of participation as in the opt-out condition is found. This suggests that the two conditions are equally effective at overcoming the temptation to procrastinate and at stimulating a reasoned and deliberate choice process. Hence, when promoting Smart Grid technology to private households an opt-out framing is superior to an opt-in framing both in terms of effectiveness and stimulating a reasoned choice process.

1. Introduction

Increasing demand [1], climate change, and nations' desire to become more sustainable and self-sufficient with respect to energy have resulted in a need to change electricity production and consumption, including a radical increase in renewable sources of electricity [2]. To allow a growth of renewable electricity sources and ensure a reliability grid, there is a debate about the development of the electricity grid in terms of expanding it or developing a more flexible system that better handles the challenges of balancing the supply and demand of electricity, often referred to as a Smart Grid.[1] With Smart Grid technology, electricity demand can be shifted toward times of the day when electricity is plentiful, e.g., from wind, solar or hydropower, and away from times when little electricity is generated from these sources (e.g., because the wind is not blowing and the sun is not shining).

For a Smart Grid to function optimally, electricity consumption must be flexible in time [3], which is why electricity consumers play a key role in the development of the Smart Grid. A sufficiently high share of the electricity consumed by homes and other electricity consumers needs to be made available to net operators as flexible capacity that can be used to meet inflexible demand for electricity when the supply from renewable sources is low. This means in practice that consumers, as a minimum, must be willing to accept that part of their electricity consumption can be remotely controlled by an electricity company or a net operator. The electricity consumption of the residential sector in Europe increased by 40% between 1990 and 2010 and now accounts for 30% of total electricity consumption [4], thereby representing a large potential for flexible capacity.

Remotely controlling electricity consumption in a Smart Grid requires the installation of a "smart meter" with a remote control. The simplest type of smart meters is a digitalized electrical meter that enables two-way communication between consumers' electricity system and a utility company, which makes on-site meter reading redundant (see [5], for further details about possible features of smart meters). More advanced smart meters include features that enable an electricity supplier or distribution system operator to remotely control in-house appliances' electricity consumption [6]. With this technology, an electricity supplier or

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[1] In Europe, a Smart Grid is commonly defined as an "electricity network that can intelligently integrate the behavior and actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies" [53].

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system operator can manage electricity demand on the grid by, for example, remotely switching off appliances when demand on the grid is high (a "peak-period"), and turn them on again when demand is low (an "off-peak" period). When talking about Smart Grid technology in the following, we refer to this latter type of advanced smart meters.

Since the Smart Grid makes it possible to change the composition of electricity sources toward renewables [7], it benefits electricity consumers and the society in the long term. Hence, if the costs are not too high, participation in the Smart Grid is in the best interest of electricity consumers and society. However, because it is a complex issue involving the physical installation of new technologies in the home, consumers face barriers for participating and may have reservations (see [8]). Notably, people may resist Smart Grid technology if they fear that there are risks [9], like for example loss of comfort or invasion of privacy. Moreover, only small financial gains are expected for private electricity consumers from participating in the Smart Grid.

However, without discarding the significance of these structural conditions, behavioral and experimental economists have in recent years successfully challenged the conventional view that individual actors make decisions purely by trading off expected costs and benefits and suggested that behavioral predictions should be based on a "bounded rationality" framework instead [10,11]. Specifically with regard to the type of decision we study here, scholars have highlighted the importance of studying how people make decisions about their involvement in energy systems and the effects of different methods and framing techniques when introducing them to new technologies [12,13].

Complexity makes people uncertain about the consequences of a choice, and when they are uncertain they try to avoid choosing, which usually implies doing nothing [14]. However, doing nothing is actually also a choice since it implies that one gets the option that happens to be the default in the situation. By definition, a default is a condition that is imposed when an individual fails to make a decision [15].

Research and practice show that it is possible to significantly impact people's behavior by carefully setting the default [16]. For example, when asking for consent to store personal data online for marketing purposes, consent rates are higher when consent is the default (i.e., a "presumed consent" model) compared to a situation where the default is no consent (i.e., an "explicit consent" model) [17]. Empirical studies in a wide range of fields show that different default positions (i.e., where people have to "opt-in" vs. "opt-out") result in dramatically different participation rates, including choices regarding medical issues [18], saving plan enrolment [19], insurance [20], research participation [21], organ donation [15,22] and "green" electricity [23]. In all of these areas, research indicates that an opt-out framing[2] creates a higher level of participation than an opt-in framing, which is consistent with the proposition that people tend to stick to the default.

Some argue that people stick to the default because they are "cognitive misers" [24], minimizing the cognitive effort when making decisions [15]. For example, when presenting people with the choice to become an organ donor [15], a range of complicated considerations might be involved [25]. Hence, when asked to sign up, staying with the default is the easy way out (implying that the person will not sign up to be an organ donor).

Choi et al. [48] argue that people tend to stay with the default due to procrastination. Even when they want to make a change, people tend to delay that change longer than they should, which may be costly for them in the long run. Others suggest that some people stay with the default because they interpret it as a recommendation or a guideline from the person or organization that established this option [21,26].

Park et al. [27] believe that the default effect can sometimes be attributed to loss aversion, arguing that people tend to use the presented default as reference point and therefore experience a loss when subtracting something from the default. Empirically, they found that consumers end up with a more expensive package when they are offered a "full package" with additional options included in addition to a basic product than when they are offered a "basic package" with the possibility of adding options. Because losses loom larger than gains [28], people feel a numerically bigger loss when deleting a feature than the gain they experience from adding the same feature to the package. Similar results are reported by Herrmann and colleagues [29], who found that people tend to stay with the default option presented to them when buying a racing bike.

Verplanken [30] argues that when a risk or problem is not imminent or salient in people's everyday life it tends to be disregarded. People are usually only highly involved in a decision when they expect immediate personal consequences [30,31]. People who fail to identify important personal consequences of the choice and who are therefore less involved in making the decision are more likely to end up with the default. Following this reasoning, since the benefits from participating in the Smart Grid are mainly societal and long term, most people should not be expected to be highly involved in this decision, and many might therefore end up with whatever is set to be the default.

The existence of a default effect is just one among a range of phenomena that question whether people's real preferences are necessarily revealed by their choices [32], as commonly assumed by mainstream economists (referring back to [33]). It also means that there is a risk that consumers are manipulated and taken advantage of by someone having the power to set the default, which is an argument for consumer protection (e.g., [21]). The banning of the opt-out or "presumed consent" model in many contexts (e.g., in French and German law regarding consumer privacy on the Internet) reflects the view that decision makers' real preferences are less likely to be revealed when an opt-out frame than when an opt-in frame is used [34]. The basic reservation against the former is that it might trick consumers to "sign up" although they would not want to, had they thought it through. Moreover, people may be less committed to their "signing up" in an opt-out frame, and subsequently, they may refuse to proceed with their "decision" afterwards [35]. However, it has also been argued that an opt-in frame often produces a result that is inconsistent with people's real preferences. Notably, in many instances people's inclination to procrastinate and decision avoidance means that they miss out on positive outcomes that "signing up" would have led to [36].

We do not question that the opt-out approach (presumed consent) is indeed sometimes used to manipulate people to passively choose a suggested option that is not in their own best interest, but primarily benefits somebody else. However, the evidence, for example, about people's inclination to procrastinate even with regard to important decisions challenges the view that the opt-out approach *always* produces a result that is less consistent with people's real preferences than an opt-in approach. We propose that there are identifiable, and quite common, circumstances under which choices are likely to be more consistent with

[2] We use the terms "frame" and "framing" in a broad sense, referring to the typically unconscious structures that we think in terms of and which are physically realized in neural circuits in the brain [54]. According to Lakoff [54], "(a)ll of our knowledge makes use of frames, and every word is defined through the frames it neurally activates. All thinking and talking involves 'framing.' And since frames come in systems, a single word typically activates not only its defining frame, but also much of the system its defining frame is in."