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The author of this report bears the entire responsibility for the content and for the conclusions drawn therefrom.



Summary

This project investigates the effects of the possible market liberalization of the Swiss residential energy market on demand for green energy by private households. In particular, our experiments provide answers to how the new decision environment in a liberalized market will affect consumers' choices for electricity contracts. Moreover, we investigate the effectiveness of standard and behavioural policy instrument for making private users' electricity consumption more sustainable if markets are liberalized. This will provide important insights for policy makers striving to foster sustainable electricity consumption.

Zusammenfassung

Dieses Projekt untersucht die Effekte der möglichen Liberalisierung des Schweizerischen Strommarktes für private Haushalte in Bezug auf die Nachfrage nach grünem Strom durch private Konsumenten. Unsere Experimente werden Erkenntnisse liefern, wie Haushalte mit dem vergrösserten Entscheidungsspielraum nach der Öffnung des Strommarktes umgehen. Des Weiteren wird die Effizienz von standard- und verhaltensökonomischen Politikinstrumenten untersucht, die das Ziel haben, den Energiekonsum von privaten Haushalten in eine nachhaltigere Richtung zu lenken. Im Lichte der geplanten Liberalisierung des Schweizerischen Energiemarktes für Haushalte liefert diese Untersuchung wichtige Erkenntnisse wie der nachhaltige Energiekonsum durch geeignete Politikmassnahmen gefördert werden kann.



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List of abbreviations

GHG	Greenhouse gas
RES	Renewable energy sources
WTP	Willingness to pay



1 Introduction

In the present project, we investigate the effects of a possible liberalization of the Swiss residential electricity market on consumer demand from a behavioural economics perspective using experimental methods. Specifically, we investigate how the new decision environment in a liberalized market affects consumers' consumption choices and their demand for green electricity and what this means for the effectiveness of various policy instruments – both standard tools as well as behavioural "nudges" – to foster sustainable electricity consumption.

In the current report, we provide an overview of the project and its goals, of the work done so far and of the studies we plan to conduct in the coming year.

2 Context

2.1 Background

Many countries have liberalized their residential energy markets during the last decades. This means that in these countries private households have the freedom to choose their electricity provider and the type of electricity contract. For Switzerland, there exist plans for the liberalization of the residential electricity market (BfE, 2018). From a neoclassical economic perspective, liberalization should increase societal welfare as it breaks up monopolies, establishes larger and more competitive markets, and fosters free consumer choice. However, these arguments essentially hold in theory. In practice, there may be obstacles that could weaken positive welfare effects of a liberalization, especially if consumer behaviour does not correspond to the neoclassical assumptions. Thus, it is crucial to understand what the consequences of liberalization for consumer behaviour are, and what this means for electricity demand.

2.2 Motivation of the project

As mentioned above, the liberalization of the Swiss residential electricity market is currently being discussed and with the possible liberalization ahead, the question emerges how to steer private consumers towards a more sustainable energy consumption in the new environment of a liberalized market. After a possible liberalization, Swiss energy consumers would face a more complex decision environment as they would have many more energy contracts to choose from than currently. This both opens the question of how consumers react to this increased choice portfolio in terms of electricity demand, and it leaves room for policy interventions that aim at fostering the consumption of renewable energy.

2.3 Goals

The project investigates two tightly related major research questions. First, we want to understand how the more complex decision environment in a liberalized market, characterized by a much larger choice set for consumers, affects consumer demand for different types of electricity contracts. Specifically, we are interested in the liberalization's effects on consumers' demand and willingness to pay (WTP) for green electricity, as well as for domestically produced vs. foreign electricity. Second, we want to test the effectiveness of various policy instruments to steer households' electricity demand and to foster environmentally responsible consumption in a liberalized electricity market.



3 Approach and methodology

The studies we plan to conduct in the current project follow an experimental approach allowing to identify causal effects. Moreover, following the methodological paradigms of experimental economics, participants' choices will be incentivized to reduce demand and presentation effects, which are potentially problematic for studies attempting to measure the WTP for green energy sources.

Specifically, we plan to conduct two types of studies. First, we will run a series of incentivized choice experiments, in which we investigate the effects of how market liberalization, and specifically the increased choice set size in liberalized markets, compared to the current monopolistic situation, affect consumers' demand for green electricity and the WTP for domestically produced vs. foreign energy. In addition, we will investigate the effectiveness of three policy instruments: two behavioural nudges, i.e. the communication of *descriptive* and *prescriptive* norms to consumers, as well as one standard policy tool, i.e. a tax on conventionally produced electricity ("differenzierte Stromabgabe"). All these policy instruments aim at fostering the demand for green energy. Hereby, a *descriptive* norm refers to what people actually do or in other words what most people do, whereas a *prescriptive* norm describes what people should do, thus referring to moral values and societal standards (Cialdini et al., 1990, Karp, 1996). According to the literature, both kinds of norms are relevant for pro-environmental behavioural decisions (Cialdini, 2003; Nolan et al., 2008) and can have strong and lasting positive effects on behaviour (Abrahamse et al., 2005). Our third policy measure is a tax on conventionally produced electricity ("differenzierte Stromabgabe").

Second, we will run a market experiment in the laboratory, in which we investigate the behavioural effects of environmental taxes in competitive markets. Such taxes are a prominent example of policy instruments from the toolkit of standard economics that aim at curbing the externalities involved in the consumption of energy and other environmental goods. Below we explain the planned research in more detail.

3.1 Incentivized Choice Experiments

3.1.1 Motivation

The potential liberalization in the Swiss residential energy market is the main motivation of our first set of experimental studies. In particular, we want to investigate whether liberalization could affect consumers' demand for green electricity. Based on (mostly unincentivized) studies showing that consumers in electricity markets have a positive WTP for green electricity, i.e., electricity produced with renewable energy sources (RES) (see, e.g., Soon & Ahmad 2015 for a meta-analysis), one argument that has been made in favour of liberalization is that the increased consumer choice in a liberalized market will help foster the development of RES (e.g., Wüstenhagen & Bilharz, 2006).

However, the observable demand for green electricity in liberalized electricity markets is lower than the stated preferences of private households in surveys would suggest (Känzig et al. 2013). The experience from already liberalized markets such as Germany shows that consumers often stick with their legacy provider and "anchor" contract (Bundesnetzagentur, 2017; see also Defeuilley, 2009), and, if they switch, the most important criterion for switching seems to be the price (e.g., Dietz, 2017; Hänzig et al. 2013) and not attributes such as the location of energy production or the energy mix. The low switching rates and the strong focus on the price criterion mean that liberalization may actually not deliver the hoped for push in the demand for green electricity. In the experiments we describe in this section, we



plan to investigate whether the changes in the decision environments consumer face actually cause demand for green electricity to fall, and whether the more complicated choice set could be a (partial) explanation of the low switching rates we observe in liberalized markets. Our experiment will further allow us to detect possible discrepancies in the WTP between domestically and foreign produced energy.

In addition to explaining switching rates and the effect of liberalization on private residential demand for green energy we also incorporate behavioural policy instruments in the form of *descriptive* and *prescriptive* norms into our experiments with the goal to assess which form of norms is more effective in affecting household demand. Concerning energy consumption, common *descriptive* norms entail the provision of information about what most people do in terms of electricity contract choice, i.e. communicating the prevalent common behaviour in form of either feedback or descriptive statistics. The focus hereby lies on peer comparison and has been found effective for motivating people to save electricity (see, e.g., Allcott, 2011; Ayers et al., 2009; Schultz et al., 2007), and it might thus also work for increasing green energy consumption. In contrast to descriptive norms that simply describe the most prevalent behaviours or choices, *prescriptive* norms tell people how they should behave according to common moral standards. Prescriptive policy measures could include the education of electricity consumers about the impacts of energy consumption and the benefits of green energy with the goal to reduce energy consumption overall and to move demand towards more sustainable sources of energy production. Carrico & Riemer (2011) found that educating employees about energy conservation reduced energy consumption in a workplace setting. A further important dimension of prescriptive measures is related to the sensitivity of people about how appropriate their behaviour is in a societal context. Following this, Schultz et al. (2007), who provided energy consumers with feedback about their consumption, included social recognition by giving a positively or negatively valenced emoticon to energy consumers respectively.

Bearing this in mind, the question emerges which form of norms is more effective in increasing household's pro-environmental behaviour. Some researchers argue that prescriptive measures are more effective as they can steer behaviour across a range of contexts, whereas descriptive norms are always specific to a given context (see, e.g., Cialdini et al., 2006; Reno et al., 1993). Furthermore, some energy studies detected a boomerang effect for consumers who outperformed the norm after the implementation of descriptive measures leading thus to an undesired decrease in pro-environmental behaviour for these consumers (Allcott and Rogers, 2014; Schultz et al., 2007). Therefore, the literature tends to suggest an advantage of prescriptive compared to descriptive measures for motivating pro-environmental choices in the energy domain.

As a third policy instrument, we will introduce a tax on conventionally produced electricity. The tax approximates a taxation system with low (or negative) tax rates for electricity from renewable sources and high tax rates for conventionally produced electricity ("differenzierte Stromabgabe"). To make sure our tax is as realistic as possible we will choose an appropriate tax level in consultation with the BfE.

All in all, we will compare and evaluate thus three different policy measures: prescriptive and descriptive norms as well as a tax on conventionally produced electricity. By doing that, we will be able to contribute to the discussion which policy measure is the most successful in fostering green energy demand by residential electricity consumers.

3.1.2 Experimental setting

To be able to identify the impact of a liberalized residential electricity market on consumer demand for green electricity and the effects of liberalization on contract switching rates, we developed an experimental set-up that mirrors the most important differences between the two market regimes (monopoly and competition) for consumers. To make the design of the electricity contracts as realistic



as possible, we also featured an anchor contract in the experimental set-up as in reality consumers are provided with a standard contract from which they can deviate or not. The design of the first experiment is finalized and ready to be carried out. Appendix 6.1 displays the experimental materials developed for the incentivized choice experiments.

In the experimental setting, individuals are endowed with an initial amount of money. They are then presented with a choice set of different electricity contracts. We mirror the most relevant difference for consumers between a monopolistic (non-liberalized) and a competitive (liberalized) market via the size of the choice set: a small choice set mimics a monopolistic (non-liberalized) and a large choice set mimics a competitive (liberalized) market regime. The electricity contracts consumers can choose from vary according to mix of electricity sources (conventional¹, water, wind, biomass and solar), prices and location of energy production (domestic or foreign). Participants are given initial information such as that a contract corresponds to 100kWh of electricity. The design of the different electricity contracts has been made as realistic as possible, resembling electricity contracts displayed on search engines (e.g., verifox.de). Thus, we also featured an anchor contract in the experimental set-up as in reality consumers are provided with a standard contract from which they can deviate or not. The payoffs participants receive are determined by their initial endowment minus the price of their chosen contract. Further, the money paid for the electricity contracts will be used to buy certificates of origin according to the participants' choices (see also Ghesla, 2017).² At the beginning of the experiment, participants are informed about how we calculate their payoff and the money paid for the certificates of origin.

3.1.3 Hypotheses

The first set of hypotheses tested in the incentivized choice experiments refers to contract switching rates. We analyse how the switching rate varies between small and large choice sets. The switching rate describes the proportion of individuals choosing a contract other than the automatically assigned anchor contract, i.e. the proportion of individuals opting out of the anchor contract. Private households can switch away from the anchor contract both in a small choice set (e.g. non-liberalized energy market) and in a large choice set (e.g. liberalized energy market). We assume that two effects influence private households' change in the switching rate when increasing the choice set size. The first effect relates to the change in the preference match when the choice set is increased, for instance by market liberalization. The preference match describes how well private households can satisfy their preferences with a given choice set. The second effect refers to a change in the tendency to stick to the anchor contract. Below we describe in turn, how we expect an increase in choice set will affect the preference match and the anchor effect.

First, we assume that when choice set size increases, private households are more likely to find an electricity contract that better matches their preferences than the anchor contract. Therefore, ceteris paribus, people should be more inclined to switch from the anchor contract to another one if the choice set increases. Thus, by increasing the choice set size, the preference match increases, leading to a higher switching rate. Based on that, hypothesis 1 follows:

Hypothesis 1: *Private households can better match their preferences in large choice sets compared to small choice sets, which increases switching rates in large choice sets.*

¹ Conventional electricity includes all non-renewable electricity sources such as coal or nuclear power.

² If a participant selects an electricity contract with 100% conventional energy, we will not buy any certificates of origin. This is because certificates of origin from conventional energy are not traded.



Second, according to the literature, a larger choice set not only leads to better preference matches and thus more switching. An increase in choice set size may also trigger choice overload in consumers (see, e.g., Iyengar & Lepper, 2000). Choice overload means that consumers are overwhelmed by the decision they have to make, which leads them to search for strategies to simplify their decision procedures. One such strategy is to avoid making any decision at all and to stick with the anchor contract. Choice overload induced by large choice sets thus strengthens the anchor effect (e.g., Chernev et al. 2012; see also Jilke et al., 2016 for evidence from a hypothetical scenario study in an electricity context). This leads to the following hypothesis:

Hypothesis 2: Anchor effects are stronger in large choice sets compared to small choice sets, which reduces switching rates in larger choice sets.

Hypothesis 2 might explain why switching rates in liberalized markets such as Germany are not as high as expected.

Another strategy that consumers can follow to reduce choice overload when faced with large and complex choice sets, is to reduce the number of attributes they take into account when making a decision (see, e.g., Timmermans, 1993). In the electricity market context, such a strategy could mean that the relative importance of prices for consumers' choices may increase and thus outweigh the importance of other attributes, such as the environmental consequences of an electricity contract or the location of energy production, which are much harder to understand and of less direct personal relevance to most people. Therefore, hypothesis 3 follows:

Hypothesis 3: Consumers focus more on prices and less on attributes such as the location of energy production (domestic vs. foreign) or the mix of energy (environmental vs. conventional) in large choice sets.

In our experiment, electricity contracts consist of one price attribute, an environmental attribute (different sources of energy) as well as a location attribute (location of energy production). In competition, consumers are faced with a larger choice set and thus, complexity increases. To reduce this complexity, as outlined above and stated in hypothesis 3, consumers focus more on prices and less on environmental or location attributes. Given that prices for electricity contracts correlate positively with the share of green electricity in the contract, a focus on the price attribute would reduce the demand for green electricity:

Hypothesis 4: Consumers choose on average greener contracts in competition, i.e. when confronted with a larger choice set.

Lastly, we establish a hypothesis regarding the effectiveness of prescriptive and descriptive norms. As mentioned before, the literature suggests that prescriptive measures are more effective in fostering consumers' pro-environmental choices as they are applicable to a wider range of contexts and do not suffer from boomerang effects. This leads to the following hypothesis:

Hypothesis 5: Prescriptive measures are more effective than descriptive measures in increasing consumers' demand for green energy.

The incentivized choice experiments we plan to conduct are designed to test these five hypotheses.



As the literature does not provide enough evidence in the case of a tax on conventionally produced electricity, the effect of such a tax on the demand for green energy by residential consumers is unclear ex-ante. Thus, we refrain from formulating a hypothesis in this case.

All our policy instruments are implemented in a liberalized (large choice set) and a monopolistic (small choice set) market setting. Therefore, the results of our experiments will reveal how the three policy measures work under different market structures.

3.1.4 Design and experimental treatments

We implement a 2x5 between-subject design with five treatment variables and two conditions for each variable. In total we have ten experimental treatments. The first treatment variable is the size of the choice set, which can either be small (5 contracts) or large (25 contracts). The second treatment variable indicates whether the choice set contains an anchor contract or not. If participants do not select a contract, they stick to the anchor contract. However, they can opt out of the anchor contract by choosing a different contract than the anchor contract. The last three treatment variables concern the different policy measures. They each represent one specific policy measure (descriptive norm, prescriptive norm, tax on conventionally produced electricity).

3.1.5 Implementation

The incentivized choice experiments will be conducted online using the online survey tool Qualtrics. We plan to run the studies with Swiss samples, both with students as well as with a representative sample. The experiment in the student sample will feature more treatments than the experiment with the representative sample. On the one hand, the experiment with the representative sample will focus on the effect of a liberalized market (large choice set) versus a monopolistic market (small choice set) on the WTP for green energy by residential households. On the other hand, it will also focus on the differences in the WTP for domestically produced electricity vs. imported electricity. Thus, both samples will face the same experimental set-up but the amount of treatments included differs.

When the experiment starts, participants first read the instructions for the experiment and answer control questions to ensure comprehension. After that, they choose a contract from their respective choice set. The choice set a particular subject faces depends on the treatment group. Each participant is randomly assigned to one of the ten treatment groups. Having made a choice, participants will answer a questionnaire with questions on their environmental knowledge and preferences as well as on their socio-demographic characteristics.

3.2 Laboratory Market Experiment

3.2.1 Motivation

Burning fossil energy – as well as many forms of modern electricity production – leads to greenhouse gas (GHG) emissions such as CO₂. According to Pigou (1920), a negative externality can be internalized when a tax mirroring the damage of the externality is implemented. While calculating the exact amount of a Pigou-tax is almost impossible in practice, related environmental taxes are quite frequent, such as, for instance, the Swiss CO₂ tax or the plastic bag tax in Ireland or the U.K.

The effects of environmental taxes on goods that carry a negative externality are straightforward from a standard economic perspective: they reduce consumption, which reduces the extent of the externality. However, from a behavioural economics perspective two questions arise: First, what does levying an



environmental tax mean for consumers' personal motivation to reduce externalities voluntarily? Specifically, does such a tax crowd-out consumers' intrinsic motivation to avoid externalities? Second, and relatedly, does the effect on consumers' personal motivation depend on the framing of the tax, and especially on what the tax revenue is used for?

Concerning the use of tax revenue, it has been shown by Kallbekken et al., (2011) that consumers' acceptance of a tax depends crucially on how the accrued tax revenue is spent. In practice, there are different ways in which tax revenue may be spent, such as compensating third parties experiencing damage because of the negative externality, redistribution to consumers, using it to curb negative effects of the externality (e.g., CO₂ compensating projects) etc. In Switzerland, there is mainly one tax whose revenue is spent on environmental purposes: the excise tax on brownfield sites (BfS, 2003).

A phenomenon which might occur especially when tax revenue is earmarked for environmental purposes is "moral licensing". Moral licensing in our context means that paying an environmental tax that partially internalizes the negative externalities of a polluting activity, makes people feel "licensed" to now engage in this activity more often, whereas without the tax they might refrain from doing so because of intrinsic motivation. Previous literature has shown that voluntary participation in carbon offsetting programs can lead to such effects (Harding & Rapson, 2013; Jacobsen et al., 2012). It seems as if carbon offsetting can be used to assuage guilt and justify more polluting activities.

Bearing all of this in mind, our experiment aims at answering two main research questions: Can environmental taxes backfire by inducing moral licensing? And does this effect depend on how the tax revenue is used?

3.2.2 Experimental setting

Our experiment is based on the market experiment with externalities by Kirchler et al. (2015)³ who implemented a competitive double-auction set up (see also Falk & Szech, 2013). Thus, there is an experimental market with buyers and sellers who trade in a competitive market. Market participants can trade a good which has a consumption value to the buyer. However, the consumption of this traded good has a negative externality. In our case we will model this externality in form of an increase in CO₂ emissions. Specifically, the externality is implemented via a donation to CO₂ compensation projects, with each trade reducing this donation by a certain amount. To the experimental participants, we will frame the externality such that consuming the good leads to an increase in CO₂ emissions. In the market, buyers and sellers make offers. If offers match, a trade takes place (and the donation to the compensation project decreases).

3.2.3 Hypotheses

The most important hypotheses we test concern the volume of trades in markets with and without taxes. The first hypothesis deals with the phenomenon of moral licensing that may occur when implementing environmental taxes and is as followed:

Hypothesis 5: Earmarked environmental taxes trigger moral licensing and thus backfire by leading to higher trade volumes than the no tax case.

³ Note that originally we had planned to base this experiment on the set-up by Bartling et al. (2015). However, we decided to opt for the set-up by Kirchler et al. (2015) as it allows us to address the research questions we want to answer in a simpler design.



Therefore, implementing such a tax might increase the sum of negative externalities and thus, prove itself ineffective in internalizing negative externalities.

Depending on the announced use of the tax, a further hypothesis can be made.

Hypothesis 6: *When the tax takes a low value, we expect the trade volume to be larger in the earmarked tax revenue condition than in the redistributed tax revenue condition.*

The intuition behind this is that with a relatively low tax value the moral licensing effect dominates and thus, most trade occurs in the case where tax revenue is earmarked for environmental purposes. Again, taxing the traded good is therefore not effective in internalizing the negative externality and in the case of earmarked revenue more detrimental than not taxing the good at all.

When the tax is high, the situation is less clear. It may be that the moral licensing effect still dominates or it may be that the higher prices dominate the moral licensing effect and lead to less consumption. We therefore refrain from formulating a clear hypothesis for this case.

3.2.4 Design and experimental treatments

To examine how a regulatory tax influences the volume traded and the sum of externalities, we will implement a transaction tax whose revenue is spent in two different ways (depending on the experimental treatment): One case earmarks the arising tax revenue for environmental purposes, whereas in the other case the tax revenue is redistributed to the tax-payers. There are thus three different conditions in our experiment: the baseline, the redistributed revenue setting and the earmarked revenue setting. Further, we have one treatment variable, the tax, which can either be of low or high value. All in all, we then have five treatments.

3.2.5 Implementation

The laboratory market experiment will be conducted using the software z-tree (Fischbacher, 2007). We will run the experiment at the ETH Decision Science laboratory with a student subject pool. We will follow typical procedures for running laboratory experiments in accordance with best practices in experimental economics.

4 Evaluation 2018 and outlook for 2019

In 2018, most effort has been spent on designing the first experiment and reviewing the relevant literature. We are confident in the design of our experiment and are now ready to collect the first data. From the results obtained we will be able to tell how different market structures, such as monopoly or competition, affect demand for green electricity and how effective prescriptive, descriptive norms and a tax on conventionally produced electricity are in increasing private household demand for renewable energy. Finally, we have developed the basic design of a second experiment which deals with the implementation of a transaction tax in the residential energy market and the phenomenon of moral licensing.

In 2019, we will run the described experiments, analyse the results and write the corresponding research papers. We plan to start the data collection for the incentivized choice experiments in spring. Moreover, we will further concretize the design of the laboratory market experiment and plan to start the data collection in May.





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