Energy Policy 74 (2014) 376–382

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Short Communication

From intention to action: Can nudges help consumers to choose renewable energy?

Katharina Momsen [a], Thomas Stoerk [b,*]

[a] Center for Doctoral Studies in Economics, University of Mannheim, D-68131 Mannheim, Germany
[b] Department of Economics and Business, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, 08005 Barcelona, Spain

HIGHLIGHTS

- Preferences concerning renewable energy contracts do not translate into action.
- Nudges are cheap policy tools, easily scaled up, coercion-free, and usually unavoidable.
- We design and implement a survey experiment to test various nudges.
- A default nudge proves effective in aligning intention and action.

ARTICLE INFO

Article history:
Received 3 March 2014
Received in revised form
2 July 2014
Accepted 5 July 2014
Available online 5 August 2014

Keywords:
Behavioural economics
Nudge
Pro-environmental behaviour
Renewable energy
Survey experiment

ABSTRACT

In energy consumption, individuals feature a gap between intention and action. Survey data from the US, the UK, and other European countries show that 50–90% of respondents favour energy from renewable sources, even at a small premium. Yet less than 3% actually buy renewable energy. We investigate how nudges – a slight change in the information set that an individual faces when taking a decision – can help individuals align behaviour with intention. We present evidence from an original survey experiment on which nudges affect the choice whether to contract renewable energy or conventional energy. We find that only a default nudge has a significant effect, while all other nudges prove ineffective. In our setting, a default nudge increases the share of individuals who choose renewable energy by 44.6%.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

One of the most pressing environmental problems is climate change (Nordhaus, 2013; Stern, 2006). While energy production is the biggest single contributor to greenhouse gas emissions (IPCC, 2007), consuming renewable energy instead of conventional energy reduces these emissions (Shafiei and Salim, 2014). Renewable energy policies that address climate change thus either focus on innovations in technology or changes in behaviour. While policy-making has predominantly relied on the former, we investigate the latter. The following stylized fact shows the potential of our research:

Surveys in various Western countries typically show that 50–90% of respondents favour energy from renewable sources, even at a small premium (Kaenzig et al., 2013; Pichert and Katsikopoulos, 2008). Yet, those preferences do not translate into action: actual users of renewable energy constitute but a tiny fraction of the population, 0.4% in Finland, 0.5% in the UK, 1% in Ireland and Germany, 2% in Switzerland, and 2.8% in the US (Bird et al., 2002; Heeter and Nicholas, 2013). The gap between intention and action has only recently been recognised in research on energy behaviour (Allcott and Mullainathan, 2010; Sunstein and Reisch, 2013). A nudge – a slight change in the information set that an individual faces when taking a decision – can help people align intention and action.

The use of nudges as a policy tool has become widespread following Thaler and Sunstein (2008) and Camerer et al. (2003). This literature suggests two complementary rationales for using nudges: firstly, the gap between intention and action shows that individuals are boundedly rational in the choice between conventional and renewable energy. Due to their limitations in cognitive processes and attention, individuals have difficulties understanding the situation they are in and suffer from an imperfect ability to process new information (Ariely, 2009; Spiegler, 2011; Thaler and Sunstein, 2003). Consequently, they often fail to act upon their long-term intentions (O'Donoghue and Rabin, 1999; Taubinsky, 2013). This is where nudges can help individuals. Nudges are an attractive policy tool: they are cheap and can easily be scaled up. Furthermore, nudges are coercion-free: individuals retain the freedom to pick from the

* Corresponding author. Tel.: +34 93 542 2689.
E-mail addresses: katharina.momsen@gess.uni-mannheim.de (K. Momsen), thomas.stoerk@upf.edu (T. Stoerk).

http://dx.doi.org/10.1016/j.enpol.2014.07.008
0301-4215/© 2014 Elsevier Ltd. All rights reserved.

original choice set. Lastly, they are uncontroversial: it is unavoidable to present a decision in some way or another.

Secondly, research on the effectiveness of nudges in energy consumption (Allcott, 2011; Allcott and Mullainathan, 2010; Allcott and Rogers, 2012; Costa and Kahn, 2013) has shown the great effectiveness of using nudges as energy policy instruments. Allcott and Mullainathan (2010), for instance, find that a nudge can lower energy consumption by as much as 2% and at a negative cost. Empirical evidence on the effectiveness of different nudges for the choice between conventional and renewable energy is missing, however. Our research fills this gap. We use an original survey experiment to test how several nudges affect the choice whether to contract renewable energy or conventional energy. The nudges we implement in our survey each address one or more potential biases in the behaviour of decision makers.

The remainder of this article is structured as follows: Section 2.1 presents the setting of our experiment, Section 2.2 describes each nudge and its implementation, and Section 3 presents and discusses the empirical results. Section 4 concludes and provides policy recommendations.

2. Methods: an original experiment

2.1. Setting

We provide evidence on which nudges do and which do not work at the time of choosing an energy contract. Our original experiment imitates the situation that a consumer faces when she has just clicked on the website of a utility company and can choose between two different contract offers. To emulate this setting, we implemented the experiment as an online survey (a similar methodology is used by Lillemo, 2014).

Our experiment runs as follows: we ask the subjects to imagine they have moved to a new neighbourhood and need to sign an energy contract. The control group faces two options: buy conventional energy or buy a 50%/50% mix of renewable and conventional energy at a higher cost.[1] The decision for the control group is depicted in Fig. 1.

Note that we cannot exclude that our subjects were distracted while taking part in our experiment. We consider these potential disturbances a good thing, however, because they add realism to our setting: disturbances also occur when people choose an energy contract in real life.

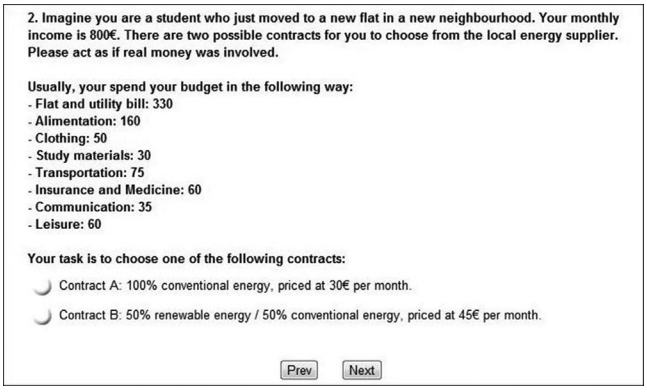

Fig. 1. Decision screen for the control group.

[1] The choice between a purely conventional energy contract and a contract that offers a 50%/50% mix is due to the offers that were available at the authors' local utility companies at the time of creation of the experiment in early summer 2011.

The survey was sent to German and international students in June 2011.[2] Since we expected a large share of Germans, the economic choice situation is built on data for income, prices and spending that reflect the typical German student.[3] Note that the default nudge was implemented using a different software. Due to a programming error, we did not obtain any data in 2011. After changing the software, we reran the original default survey without any changes in October 2013 targeting similar subjects.[4]

2.2. The nudges

We operationalise each nudge in up to three experimental treatments. The original decision screens for all nudges are shown in the Appendix Online (Supplementary material). The following section presents (i) a *review* of the theory and evidence on the working of each nudge and (ii) our *implementation* in the survey experiment.

2.2.1. Priming

Review: Mazar and Ariely (2006) find that having subjects recall the ten commandments decreases cheating. A similar effect can be found in consumption: Morwitz et al. (1993) find that when asked whether they intend to buy a car in the following six months, consumers' purchase rates increased by 35%. This effect is called "priming" and can be explained by bounded rationality. Tversky and Kahneman (1974), for instance, argue that people assess the probability that an event occurs with the ease by which they can recall examples of it. Following this line of reasoning, Gennaioli and Shleifer (2010) find that a decision maker does not use all available information but relies on what comes to mind. According to Kahneman and Frederick (2005), what comes to mind is shaped by stimulus salience and priming.

Implementation: We implement three different kinds of treatments for priming. *Priming-Intention*: Directly before presenting the actual choice problem, we ask subjects whether they intend to buy renewable energy in the future. *Priming-Memory*: We ask subjects to write down from memory everything they know about the link between climate change and energy production. They therefore have their own knowledge in mind when taking the decision. *Priming-Reassemble*: Here, we ask subjects to reassemble fragments of sentences about the relationship of energy production and climate change. This revives the subjects' knowledge and makes the negative effects of choosing conventional energy more salient.

2.2.2. Mental accounting

Review: A lab experiment performed by Mazar and Zhong (2010) shows that individuals who have spent money on green products behave in a less altruistic way in a dictator game than individuals who have spent money on conventional products. The authors cannot fully explain this licensing effect, where a previous ethically favourable action induces subsequent reductions in ethical behaviour. In our view, the above behaviour can be interpreted in the light of mental accounting, according to which individuals classify

[2] To be precise, we sent it to mailing list subscribers of Club der Ehemaligen e.V., Friedrich-Ebert-Stiftung, Max Weber-Programm Bayern, and Studienstiftung des deutschen Volkes, as well as to graduate students of the Barcelona Graduate School of Economics.

[3] Our main source is a study by the German National Association for Student Affairs (19. Sozialerhebung des Deutschen Studentenwerkes, Kurzfassung (p. 22)) that investigated the average budget of German students in 2009. The energy budget comes from a casual survey done among our colleagues at the Barcelona Graduate School of Economics. We round these data for convenience. Our sample features 77% Germans.

[4] We used Surveymonkey for the main part of the experiment, but needed to use GoogleDrive for the default nudge due to that feature not being implementable in Surveymonkey. Unbeknownst to us, GoogleDrive neither recorded the choices nor other data.

expenditures into different mental accounts which can act as self-control devices (Thaler, 2004). Consumers hesitate to use the money mentally labelled into one account for a purpose that falls into another.

As established empirically by Mazar and Zhong (2010), the consumption of green products carries ethical cachet compared to conventional consumption. Analogous to the choice between conventional and renewable energy, consumers compare two dimensions: the satisfaction of their consumption needs and the ethical benefit. When deciding how much to offer in a dictator game that follows ethical spending, an individual will give less. By the same token, consumers might attribute the cost of the green product to two different mental accounts, the consumption account and the ethical account.

Implementation: Consumers might tend to choose the ethically favourable renewable energy contract when exposed to a situation that refills their ethical account. We implement *Mental Accounting* by informing subjects that an ethical donation of 15€ has not been successful because the recipient NGO has gone out of business. Notice that 15€ is the price difference between conventional and renewable energy.

2.2.3. Framing

Review: When confronting the individual with the decision which contract to choose, the energy supplier can formulate the choice in different ways. It can inform the consumer about the carbon dioxide emissions she would mitigate with renewable energy, or it can state how much more carbon dioxide is produced when choosing conventional energy. The energy supplier can thus emphasize possible gains or losses, while the outcome is the same.

The study of framing goes back to Tversky and Kahneman (1981), who empirically verified its importance. Their findings can be interpreted from the view of Prospect Theory (Kahneman and Tversky, 1979), according to which individuals evaluate outcomes in terms of deviations from a reference point. The individuals' response when facing a loss is stronger than when experiencing an equivalent gain. In our case, this reference point is the option that is not framed in terms of losses or gains. Tversky and Kahneman (1981) conclude that adopting a frame is an ethically significant act that has an effect in the choice process.

Implementation: We provide additional information by informing the decision maker about the additional carbon dioxide emissions from Contract A as compared to Contract B. We frame this fact either as gains (*Framing-Gains*) or as losses (*Framing-Losses*).

2.2.4. Decoy

Review: Consumers often violate the independence of irrelevant alternatives axiom of von Neumann–Morgenstern expected utility theory (Ariely, 2009; Ariely and Wallsten, 1995). This phenomenon was first studied by Huber et al. (1982): Consider a consumer who has to choose between two products whose attributes differ in various dimensions, and where none of the items is dominant in all the dimensions. An energy contract can differ on essentially two dimensions: price and the percentage of energy produced from renewable sources.[5] The introduction of a third alternative – a decoy – that is clearly dominated by only one of the two alternatives can greatly influence the decision process.

Ariely and Wallsten (1995) analyse this behaviour. The consumer, initially unable to weight the different dimensions, reconstructs the choice space subjectively. By ignoring certain dimensions and giving more weight to others, the consumer ends up with a subjective dominance relationship. The decoy might thus work by helping the consumer to weight information.

Implementation: In our case, the decoy is an alternative that is weakly dominated by the environmentally friendly contract, as it is equal in the price dimension and dominated in the environmental dimension. We expect this additional information to nudge the individual towards the environmentally friendly contract.

2.2.5. Social norms

Review: Experiments show that people conform to the opinion of others (Sunstein, 2003). Furthermore, evidence from field experiments has shown that an upfront lead donation increases the contributions of potential donors by a staggering 44–300%, with neutral or positive effects on the response rates (Huck and Rasul, 2007; List and Lucking-Reiley, 2002). In the field of household energy choice, Costa and Kahn (2013) evaluate a randomised field experiment in California, in which information on neighbours' energy consumption is added to households' electricity bills. In particular, each household receives a comparison between its own energy consumption and that of its neighbours plus that of its energy-efficient neighbours. The average treatment effect of this nudge is a 2% decrease in energy consumption. These findings confirm earlier evidence in Allcott and Mullainathan (2010).

Implementation: We add the following sentence to the control group's choice: “From your local energy provider you receive the information that the majority of your neighbours uses an energy mix that features 50% renewable energy”.

2.2.6. Default

Review: The fact that people tend to stick to the default option can be explained by inertia. Since decision makers prefer not to change the status quo due to switching costs and loss aversion, they rather decide not to decide (Spiegler, 2011). Rubinstein (2012) refers to this bias of sticking to the chosen option as default tendency.

In the context of organ donations, Johnson and Goldstein (2003) show that the share of organ donors is twice as high when being a donor is the default compared to the situation when not being a donor is the default. Clearly, sticking to the default must yield positive benefits for the decision makers. In the context of energy choice, Pichert and Katsikopoulos (2008) analyse empirically if people stick to the kind of energy that is offered to them as a default contract. Using natural and laboratory experiments, they show that more people end up using renewable energy when this kind of energy is the default contract.

Implementation: We inform our subjects that the default energy contract in their region consists of 50% renewable energy and 50% conventional energy. They can actively choose between this default contract and a contract consisting entirely of conventional energy. If they do not make an active choice, however, they will keep the default contract and use renewable energy.

2.3. Recorded data and randomisation

Recorded data: The outcome of interest is each subject's choice of energy contract. After that decision, each subject rated their agreement to a number of statements to elicit the subject's preferences for money, the environment, and environmental action in their daily lives. Typical statements are “If I were a little richer, my current life would be more enjoyable”, “I am concerned about climate change” and “I am willing to pay higher taxes for improved environmental conservation”. The subjects furthermore reported their ecological footprint and their carbon footprint.[6] Additionally, we recorded study major,

[5] We assume for simplicity that we can pin down environmental impact into this single criterion. This is a simplifying assumption given that nuclear energy is being reconsidered as a low carbon energy source.

[6] We used a tool provided by the World Wide Fund for Nature (WWF), available online http://footprint.wwf.org.uk/ [last accessed 3rd June 2011 17:00 CET].

Table 1
Descriptive statistics.

	Priming [Intention]		**Priming [Memory]**		**Priming [Reassemble]**		**Mental accounting**		**Framing [Gains]**		**Framing [Losses]**		**Decoy**		**Social Norms**		**Default**		**Control**
	Mean [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]	*p*-value	**Mean** [Stand. Dev.]
Demographics																			
Age	**24,242** [3.336]	*0.7114*	**24,200** [3.144]	*0.8928*	**24,074** [3.222]	*0.8495*	**24,292** [3.895]	*0.55*	**24,586** [4.084]	*0.9608*	**23,448** [6.679]	*0.0152***	**23,176** [2.528]	*0.0914**	**23,767** [3.664]	*0.4018*	**25,636** [3.906]	*0.5484*	**24,174** [4.687]
Female	**0.563** [0.504]	*0.4263*	**0.571** [0.514]	*0.5862*	**0.538** [0.508]	*0.3451*	**0.476** [0.512]	*0.1763*	**0.586** [0.501]	*0.5678*	**0.536** [0.508]	*0.3229*	**0.576** [0.502]	*0.4928*	**0.533** [0.507]	*0.3034*	**0.545** [0.522]	*0.5135*	**0.652** [0.482]
German	**0.697** [0.467]	*0.4224*	**0.786** [0.426]	*0.9505*	**0.769** [0.430]	*0.9343*	**0.750** [0.442]	*0.796*	**0.786** [0.418]	*0.9369*	**0.724** [0.455]	*0.602*	**0.781** [0.420]	*0.9713*	**0.833** [0.379]	*0.5583*	**0.909** [0.302]	*0.3301*	**0.778** [0.420]
Economist	**0.294** [0.462]	*0.9364*	**0.182** [0.405]	*0.4907*	**0.261** [0.449]	*0.8318*	**0.273** [0.456]	*0.9133*	**0.370** [0.492]	*0.4647*	**0.250** [0.441]	*0.7438*	**0.156** [0.369]	*0.1927*	**0.273** [0.456]	*0.9133*	**0.273** [0.467]	*0.9328*	**0.286** [0.457]
Monthly budget	**1,031,212** [619.343]	*0.4771*	**823,000** [376.942]	*0.2207*	**853,077** [487.112]	*0.0643**	**1,052,083** [935.320]	*0.4177*	**1,128,200** [827.280]	*0.8623*	**1,048,427** [679.182]	*0.5504*	**897,697** [540.273]	*0.0792**	**893,970** [576.670]	0.172	**1,318,111** [555.430]	*0.0866**	**1,037,067** [497.465]
Monthly rent	**328,250** [237.925]	*0.3479*	**281,643** [115.619]	*0.2102*	**276,750** [127.571]	*0.0887**	**342,333** [289.679]	*0.3257*	**315,133** [269.504]	*0.1475*	**349,265** [269.356]	*0.5223*	**298,212** [135.198]	*0.2887*	**287,704** [217.845]	*0.1003*	**420,625** [279.878]	*0.4519*	**368,326** [190.818]
Monthly utility bill	**157,031** [179.697]	*0.5514*	**125,500** [156.536]	*0.5485*	**210,000** [167.851]	*0.2012*	**327,727** [613.659]	*0.0746**	**320,370** [535.984]	*0.5098*	**279,821** [335.710]	*0.1403*	**152,828** [141.748]	*0.8367*	**182,200** [186.224]	*0.8685*	**113,714** [144.971]	*0.4212*	**178,171** [236.238]
Preferences for																			
Environment	**5042** [0.819]	*0.4039*	**4840** [0.517]	*0.2954*	**5166** [0.659]	*0.2429*	**4848** [0.724]	*0.4647*	**5024** [0.700]	*0.7476*	**4850** [0.763]	*0.4913*	**4980** [0.757]	*0.9299*	**5074** [0.697]	*0.5326*	**5088** [0.58]	*0.5851*	**4955** [0.777]
Money	**4467** [0.846]	*0.9785*	**4479** [0.672]	*0.5743*	**4452** [0.764]	*0.6431*	**4714** [0.785]	*0.1237*	**4394** [0.574]	*0.1948*	**4574** [0.599]	*0.9627*	**4645** [0.742]	*0.4088*	**4384** [0.961]	*0.5591*	**5164** [0.476]	*0.0004****	**4,548** [0.701]
Environmental action	**4573** [0.703]	*0.137*	**4244** [0.760]	*0.5718*	**4593** [0.593]	*0.2116*	**4397** [0.748]	*0.6888*	**4477** [0.851]	*0.4494*	**4248** [0.583]	*0.3229*	**4363** [0.961]	*0.9969*	**4409** [0.786]	*0.9697*	**4411** [0.675]	*0.9506*	**4362** [0.788]
Behavior																			
Ecological footprint	**2850** [0.585]	*0.2014*	**2693** [0.596]	*0.7566*	**2467** [0.610]	*0.3146*	**2575** [0.705]	*0.656*	**2557** [0.820]	*0.3777*	**3082** [1.104]	*0.1313*	**3050** [0.986]	*0.0980**	**2459** [0.630]	*0.2903*	**2133** [0.264]	*0.0257***	**2738** [0.960]
Carbon footprint	**13,546** [5.508]	*0.3425*	**11,637** [5.503]	*0.8342*	**10,643** [4.215]	*0.2604*	**11,381** [4.881]	*0.4603*	**11,196** [5.036]	*0.3335*	**14,192** [6.464]	*0.2913*	**14,635** [7.010]	*0.1922*	**10,394** [4.639]	*0.1411*	**13,137** [1.694]	*0.3548*	**12,877** [6.679]

Interpretation: the *p-value* is obtained from a parwise Wilcoxon ranksum test of equality of means between each treatment group and the control group.
This table shows descriptive statistics on the composition of each treatment group along three dimensions of covariates (*Demographics*, *Preferences*, *Behaviour*).
The overall lack of significant differences between treatment and control groups shows that the randomisation of the treatments worked.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

gender, nationality and age as well as self-reported data on monthly income, rent payment and utility expenses. Table 1 reports descriptive statistics for the subjects. Each column belongs to a treatment group or the control group.

Randomisation: We used day of birth as randomisation device. Depending on the stated day, participants were assigned to a different treatment. Note that even if some subjects reported the wrong date of birth, we see no reason to believe that this should have occurred in a systematic way. Table 1 shows that randomisation worked: excepting the odd, small-magnitude case, the *p*-values of a pairwise mean-comparison between each treatment and the control group are insignificant.[7]

Notice that in the main, balancedness also holds for the subjects in the default treatment who were surveyed at a different point in time due to a software error. Default subjects were slightly richer (at a 10% level), favour money more and have a slightly lower ecological footprint. All other covariates are statistically indistinguishable from the control subjects.

3. Results and discussion

In this section, we first present summary statistics for the different treatment groups. Second, we test whether the probability of choosing the renewable contract is significantly different in any of the nudging groups compared to the control group.

Fig. 2 shows how the 475 subjects chose, according to each treatment group. The result from the no-nudge comparison group is the benchmark against which we compare the effectiveness of each nudge. As can be seen, renewable energy was chosen by 41 out of 85 subjects in this group, or 48.2%. Recall that for all nudges we test the following $H_0 : \mu_{control} = \mu_{nudge}$, where μ_{nudge} depicts the mean choice of contract in treatment groups.[8]

Fig. 2 suggests that several nudges seem to have a strong effect on the choice of renewable versus conventional energy. Some nudges seem to have worked as expected, such as Priming [Reassemble] (share of choices for renewable: 56.7%), Social Norms (58%) or Default

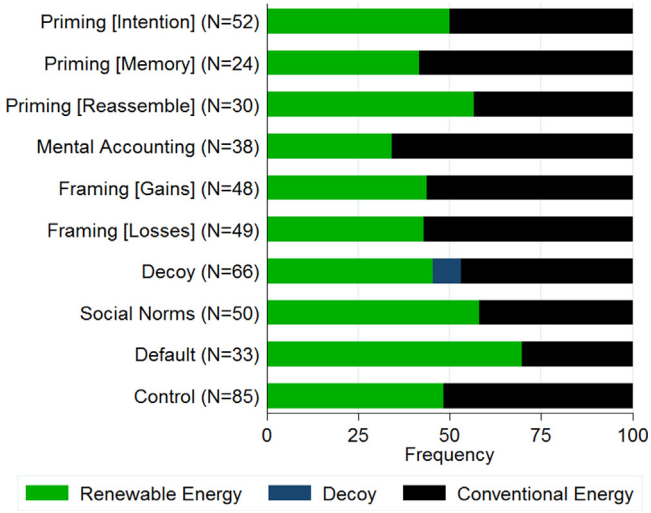

Fig. 2. Raw choice data.

Table 2
Average treatment effects.

		p-value	*t*-statistic
Linear probability model			
Priming (Intention)	0.0176	0.843	0.198
	(0.0889)		
Priming (Memory)	−0.0657	0.570	−0.569
	(0.1155)		
Priming (Reassemble)	0.0843	0.429	0.791
	(0.1066)		
Mental accounting	−0.1402	0.141	−1.474
	(0.0951)		
Framing (Gains)	−0.0449	0.621	−0.494
	(0.0908)		
Framing (Losses)	−0.0538	0.551	−0.597
	(0.0900)		
Decoy	0.0101	0.901	0.124
	(0.0811)		
Social norms	0.0976	0.275	1.093
	(0.0893)		
Default	0.2146**	0.028	2.197
	(0.0977)		
Observations	475		
R-squared	0.028		

Dependent variable equals 1 if individual has chosen contract with renewable energy, 0.5 for the decoy contract, and zero otherwise. Model includes a constant. Robust standard errors in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

(69.7%). Interestingly, other nudges appear to have a *negative* effect: they seem to increase the share of respondents that choose conventional energy. In particular Priming [Memory] (41.7%) and Mental Accounting (34.2%) appear to have worked in this way. In the next step, we determine whether these graphical differences are statistically significant.

Table 2 reports the results from a linear probability model with dummies for each treatment group (the omitted category being the control group). Because the treatments were assigned using day of birth, randomization is not conditional on the covariates. This allows us to estimate the average treatment effect for each nudge using a linear probability model without additional controls. The coefficients on the dummies show the average treatment effect of each nudge. As can be seen from Table 2, only the default nudge had a significant effect. Following our treatment, the share of subjects who selected the renewable energy contract increased by 44.6% relative to the control group (from 48.2% to 69.7%). While we are aware of the fact that the *magnitude* of the effect in our survey experiment does not directly translate into real world applications, we believe that the *direction* of the effect can be trusted: our results show that the mechanism of the default nudge works convincingly in our decision situation of whether to contract conventional or renewable energy.

We prefer the linear probability model as compared to a Probit or Logit specification due to its easier interpretability. To test the robustness of our findings, however, we estimated the average treatment effects of the same model via both Probit and Logit and find qualitatively identical effects of very similar magnitudes. As a further robustness check, we compute the same hypothesis tests via *t*-tests and non-parametric Wilcoxon rank sum tests. In both cases, only the default nudge is statistically significant up to the 10% level. These results are available upon request.

Compared to the findings from the field studies on nudges in energy consumption analysed in Allcott and Mullainathan (2010) that find a 2% effect from a nudge, a 44.6% increase in the uptake of renewable energy seems very large. Such a large effect of a default, however, is consistent with the anecdotal evidence reported in Pichert and Katsikopoulos (2008), who mention two real-world examples from Germany where the share of households using renewable energy exceeded 90% after the introduction of a default.

[7] As a robustness check, we computed the non-parametric Kruskal–Wallis test to jointly test all treatment groups. We find statistically significant differences in the ecological footprint, the carbon footprint and the preferences for money. As can be seen from Table 1, these differences are not large, however.

[8] For the decoy treatment, we coded the dominated decoy contract as "0.5", reflecting the fact that it is an intermediate option between the conventional energy contract and the renewable energy contract.

Another literature related to our paper is the research on the intention to consume sustainably produced food. Whereas we focus on the gap between intention and action, the literature on sustainable food consumption mainly deals with the difference between attitude and intention: although many people express a positive attitude towards sustainably produced food, only few people actually plan to consume it (Vermeir and Verbeke, 2006, 2008; Arvola et al., 2008). Using surveys, the mentioned authors try to explain the gap between attitude and behavioural intentions. Our research goes one step further in the process of decision making and investigates the gap between intention and action.

Our experiment was designed to establish the effectiveness of each nudge. To establish through which channels each nudge was effective or not, however, is left for future research. As Thaler and Sunstein (2008) and Sunstein and Reisch (2013) point out, defaults work through various channels such as loss aversion, endorsement and inertia, and choice complexity. Hence, it is likely through one or a combination of these channels that defaults proved effective in our survey experiment. It could well be that it is the multiplicity of channels that made the default nudge superior to the other nudges in the selection of renewable energy. Furthermore, we studied our participants' comments which they were free to give during the survey. However, the comments did not show any pattern that could hint at a reason why only the default nudge was effective.

One final caveat concerning the results is that most of the subjects were German. While our sample includes many international subjects as well, the magnitude of the effect could differ depending on the individual nationalities. We leave this question for future research as our sample is too small to study these subgroups separately.

4. Conclusions and policy implications

Climate change is a severe problem for the environment. Policies that address climate change either focus on technological innovations or behavioural changes. Whereas policy-making has mainly focused on technology, our research studies behaviour. We investigate how nudges affect an individual's decision to choose between renewable energy and conventional energy. Nudges are an attractive policy tool because they are inexpensive, free of coercion and implementable at scale. Besides, nudges are unavoidable in most situations.

Our research speaks to policy because in many Western countries a clear majority of consumers exhibit a gap between intention and action: they consume conventional energy, although they prefer renewable energy and would be willing to pay a premium (Kaenzig et al., 2013; Pichert and Katsikopoulos, 2008). Only a tiny fraction of the population, however, actually uses renewable energy (Bird et al., 2002). At the same time, the consumption of renewable energy has been linked to reductions in greenhouse gas emissions (Shafiei and Salim, 2014). A policy that can bridge this gap by helping consumers to follow through on their intention to contract renewable energy is an effective way of mitigating greenhouse gas emissions.

To inform the design of such a policy, we present evidence from an original survey experiment on which nudges have an influence on the choice whether to contract renewable energy or conventional energy. We present and review the literature on six nudges that are known to work in related decision situations and adapt them to the decision on the source of energy. Our empirical results show that only a default nudge has a significant effect, while all other nudges prove ineffective. In our setting, the introduction of a default option increases the share of individuals who choose renewable energy by 44.6%. While we believe that the precise *magnitude* of the effect is not informative outside the context of our experiment, we are convinced that the *direction* of the effect translates to the field setting that is relevant for policy.

We therefore inform policy in two dimensions: our research can inform private actors such as utility companies about the optimal design of the information that they make available to consumers, for instance through online marketing (Herbers and Ramme, 2014). Public actors, on the other hand, could use our findings to consider the implementation of default renewable energy contracts as an alternative way of promoting renewable energies. For this task, more research is needed to design the most efficient default contract in the field. While default nudges in the choice of renewable versus conventional energy have been introduced in the field by a number of private companies and shown to work in general (see Pichert and Katsikopoulos, 2008; Kaenzig et al., 2013), a systematic evaluation is still lacking.

Acknowledgments

We thank Larbi Alaoui and, in particular, Rosemarie Nagel for guidance throughout this project. Moreover, we thank Michael Anreiter, Stefan Pitschner, and Hrvoje Stojic, four anonymous referees, and seminar participants in the UPF Student Seminar, the Oxford Winter Course in Ecological Economics, and the UPF Management and Behavioural Research Breakfast for helpful comments. Financial support from the Spanish Ministry of Science and Innovation (ECO2011-25295) is gratefully acknowledged.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.enpol.2014.07.008.

References

Allcott, H., 2011. Social norms and energy conservation. J. Public Econ. 95.9, 1082–1095.
Allcott, H., Mullainathan, S., 2010. Behavioral science and energy policy. Science 327, 1204–1205.
Allcott, H., Rogers, T., 2012. The Short-run and Long-run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation. Technical Report, National Bureau of Economic Research.
Ariely, D., 2009. Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decision. Harper Collins, New York.
Ariely, D., Wallsten, T.S., 1995. Seeking subjective dominance in multidimensional space: an explanation of the asymmetric dominance effect. Organ. Behav. Hum. 63.3 (Dec.), 223–232.
Arvola, A., Vassallo, M., Dean, M., Lampila, P., Saba, A., Lähteenmäki, L., Shephard, R., 2008. Predicting intentions to purchase organic food: the role of affective and moral attitudes in the Theory of Planned Behaviour. Appetite 50, 443–454.
Bird, L., Wüstenhagen, R., Aabakken, J., 2002. A review of international green power markets: recent experience, trends, and market drivers. Renew. Sust. Energy Rev. 6.6, 513–536.
Camerer, C., Issacharoff, S., Loewenstein, G., O'Donoghue, T., Rabin, M., 2003. Regulation for conservatives: behavioural economics and the case for "asymmetric paternalism". Univ. Pa. Law Rev. 151, 1211–1254.
Costa, D.L., Kahn, M.E., 2013. Energy conservation "nudge" and environmentalist ideology: evidence from a randomized residential field experiment. J. Eur. Econ. Assoc. 11.3, 680–702.
Gennaioli, N., Shleifer, A., 2010. What comes to mind. Q. J. Econ. 125 (4), 1399–1433.
Heeter, J., Nicholas, T., 2013. Status and Trends in the U.S. Voluntary Green Power Market (2012 Data). NREL Report No. TP-6A20-60210.
Herbers, C., Ramme, I., 2014. Online marketing of green electricity in Germany – a content analysis of providers' websites. Energy Policy 66, 257–266.
Huber, J., Payne, J.W., Puto, C., 1982. Adding asymmetrically dominated alternatives: violations of regularity and the similarity hypothesis. J. Consum. Res. 9.1, 90–98.
Huck, S., Rasul, I., 2007. Comparing charitable fundraising schemes: evidence from a natural field experiment.
IPCC, 2007. Climate Change 2007 – Mitigation of Climate Change: Working Group III Contribution to the Fourth Assessment Report of the IPCC, vol. 4, Cambridge University press, Cambridge.
Johnson, E., Goldstein, D., 2003. Do defaults save lives? Science 302, 1338–1339.

Kaenzig, J., Heinzle, S.L., Wüstenhagen, R., 2013. Whatever the consumers wants, the consumer gets? Exploring the gap between consumer preferences and default electricity in Germany. Energy Policy 53, 311–322.
Kahneman, D., Frederick, S., 2005. A model of heuristic judgement. Cambridge Handbook of Thinking and Reasoning, pp. 267–293.
Kahneman, D., Tversky, A., 1979. Prospect theory: an analysis of decision under risk. Econometrica 47, 263–291.
Lillemo, S.C., 2014. Measuring the effect of procrastination and environmental awareness on households' energy-saving behaviours: an empirical model. Energy Policy 66, 249–256.
List, J.A., Lucking-Reiley, D., 2002. The effects of seed money and refunds on charitable giving: experimental evidence from a university capital campaign. J. Polit. Econ. 100.1, 215–233.
Mazar, N., Ariely, D., 2006. Dishonesty in everyday life and its policy implications. J. Public Policy Mark. 25.1, 117–126.
Mazar, N., Zhong, C.-B., 2010. Do green products make us better people? Psychol. Sci. 21.4, 494–498.
Morwitz, V.G., Johnson, E., Schmittlein, D., 1993. Does measuring intent change behavior? J. Consum. Res. 20, 46–61.
Nordhaus, W.D., 2013. The Climate Casino: Risk, Uncertainty, and Economics For A Warming World. Yale University Press.
O'Donoghue, R., Rabin, M., 1999. Doing it now or later. Am. Econ. Rev. 89.1, 103–124.
Pichert, D., Katsikopoulos, K.V., 2008. Green defaults: information presentation and pro-environmental behaviour. J. Environ. Psychol. 28.1, 63–73.
Rubinstein, A., 2012. Lecture Notes in Microeconomic Theory: The Economic Agent. Princeton University Press, Princeton, NJ.
Shafiei, S., Salim, R.A., 2014. Non-renewable and renewable energy consumption and CO_2 emissions in OECD countries: a comparative analysis. Energy Policy 66, 547–556.
Spiegler, R., 2011. Bounded Rationality and Industrial Organization. Oxford University Press, New York, NY.
Stern, N., 2006. Review on the Economics of Climate Change. London HM Treasury.
Sunstein, C., 2003. Why Societies Need Dissent. Harvard University Press, Cambridge, MA.
Sunstein, C., Reisch, L., 2013. Green by default. Kyklos 66, 398–402.
Taubinsky, D., 2013. From Intentions to Actions: A Model and Experimental Evidence of Inattentive Choice. Working Paper.
Thaler, R.H., 2004. Mental Accounting Matters. Princeton University Press, Princeton, NJ.
Thaler, R.H., Sunstein, C., 2003. Libertarian paternalism. Am. Econ. Rev. 93.2, 175–179.
Thaler, R.H., Sunstein, C., 2008. Nudge: Improving Decisions About Health, Wealth and Happiness. Yale University Press, New Haven.
Tversky, A., Kahneman, D., 1974. Judgement under uncertainty: heuristics and biases. Science 185, 1124–1131.
Tversky, A., Kahneman, D., 1981. The framing of decisions and the psychology of choice. Science 211, 453–458.
Vermeir, I., Verbeke, W., 2006. Sustainable food consumption: exploring the consumer "attitude-behavioral intention" gap. J. Agric. Environ. Ethics 19, 169–194.
Vermeir, I., Verbeke, W., 2008. Sustainable food consumption among young adults in Belgium: theory of planned behaviour and the role of confidence and values. Ecol. Econ. 64, 542–553.