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Household internal and external electricity contract switching in EU countries

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ABSTRACT

Using a representative sample of more than 13,000 households from eight countries in the European Union (EU), this article empirically studies the factors related to household electricity contract switching by distinguishing between internal switchers (households that switched contracts but stayed with the same supplier) from external switchers (households that switched to a new supplier). The econometric analysis includes individual preferences, household structural factors and socio-demographic characteristics, as well as electricity market characteristics. The study explicitly explores the role of risk and time preferences on switching behaviours, with risk and time preferences elicited through incentivized experiments as well as self-assessment scales. The main results suggest that internal and external switching are not related to the same factors, that risk and time preferences affect switching behaviours, and that renters are less likely to switch than homeowners; further, electricity market characteristics are found to affect household electricity contract switching.

KEYWORDS
Electricity supplier switching; inertia; liberalization; risk and time preferences

JEL CLASSIFICATION
D10; D90; Q40

I. Introduction

Since the 1980s, many countries have liberalized their electricity markets. In the European Union (EU), the 'Electricity Directive' 96/92/EC has defined common rules for an internal EU electricity market, with the aim of enabling all consumers to freely choose their preferred suppliers. The liberalization of the electricity markets typically meant a deregulation of the wholesale and retail markets. Since the transmission and distribution grids constitute natural monopolies, they remained regulated.[1] Greater retail competition was expected to lead to more varied supplier offers that would reflect variations in customer preferences, thus enabling welfare gains. Indeed, besides lower electricity prices, the liberalization of electricity markets in the EU has spurred new offers from both existing and new electricity providers. Often, such offers include welcome bonuses, instant discounts, limited price guarantees and prepaid offers. To compensate for these low-priced initial offers though, providers often increase prices later (ACER 2015). In addition, liberalization has been shown to lead to more offerings of green tariffs, but with substantial variation across countries (e.g. Bird, Wüstenhagen, and Aabakken 2002; Markard and Truffer 2006; Macdonald and Eyre 2018). The expected effects on supply variety therefore appear to have occurred (e.g. Concettini and Creti 2014; Littlechild 2009); however, whether welfare gains also occur depends on customers' willingness to switch contracts.

Despite the increased variety of electricity contracts, empirical studies typically find that household switching rates are low and differ across countries. Between 2013 and 2015, less than 5% of households, on average, switched their electricity contract in the roughly 20 EU countries that had liberalized their electricity markets within the previous 10 years (ACER 2016).[2] In the EU countries with a longer history of market liberalization (including the United Kingdom, Germany and

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[1]Thus, high shares of the network component and of taxes and other levies (e.g. to finance support for renewable energy sources) of the total retail price mean that retail competition only refers to a relatively small share of the total electricity bill.

[2]See also A1 in the Appendix for key characteristics of the electricity retail markets in the countries included in the empirical analysis in this article.

Supplemental data for this article can be accessed here.

Sweden), more contract variety can be observed, and the average switching rate is about 10%. Similarly, low product variety and switching rates are observed in markets (including Romania) where the incumbent electricity supplier is dominant and where competitive pressure in the retailing sector is low (ACER 2015). It has also been observed that many countries set price caps (maximum levels) for end-use electricity prices at low levels, thus discouraging supplier switching, market entry and innovation. Even after almost a decade of full opening of electricity retail markets, such regulated retail prices still exist – typically in parallel with nonregulated prices – in about half the EU countries, including France, Poland, Romania and Spain. In these countries, public regulators tend to set retail prices at low levels because they strongly weigh social considerations. In some countries, such as Romania, supplier markups are even negative. Therefore, the vast majority of households in these countries are on regulated prices. Yet, the share of household consumers in the EU supplied under regulated prices has substantially decreased from 54% in 2008 to 35% in 2015 (ACER 2016).

In this article, we econometrically analyse the factors associated with electricity contract switching, relying on a representative survey in eight EU countries (France, Germany, Italy, Poland, Romania, Spain, Sweden and the United Kingdom). These eight countries account for about 80% of the total electricity use in the EU. The study contributes to the literature through its explicit comparison of internal switching (i.e. switching to a new contract with the current provider) and external switching (i.e. switching to a new contract with a new provider). Failing to account for internal switching means neglecting significant dimensions of household switching activity and of the liberalization of the electricity market. For example, as new suppliers enter the electricity market, incumbent providers extend their portfolio to keep their customers as well as acquire new customers. Furthermore, we expect that the factors related with internal and external switching may differ, for instance because households trust their current provider more than competing providers. Finally, a sole focus on external switching means that internal and nonswitchers are considered homogenous; this may lead to erroneous conclusions. Since our survey distinguishes between internal and external switching, we employ a multinomial probit model to jointly estimate the equations governing contract choice. In addition to our focus on internal and external switchers, our rich set of covariates includes parameters of risk and time preferences, elicited via incentivized experiments and self-assessment scales. The role of risk and time preferences has been explored in explaining household adoption of energy-efficiency technology adoption (e.g. Bradford et al. 2014; Cohen, Glachant, and Söderberg 2017; Qiu, Colson, and Grebitus 2014; Schleich et al. 2018), but has been neglected when studying household electricity contract switching behaviour. For example, risk-averse individuals may be less prone to switch providers due to a lack of trust in the new provider. Risk-averse individuals may also prefer contracts with price guarantees, protecting them from tariff increases for a certain period of time. Individuals who discount the future more strongly (are less patient) may, on the one hand, be more likely to switch to a new contract that involves lower tariffs now versus higher payments in the future; however, they may be reluctant to switch contracts if switching involves cancellation fees. On the other hand, individuals who are generally more patient may be more likely to incur transaction costs associated with contract switching, in particular with external switching. Risk and time preferences therefore appear particularly relevant factors related to electricity contract switching. Finally, unlike most previous studies, we rely on large representative household samples of multiple countries, which differ by electricity retail market characteristics, not least, because they are at very different stages of the liberalization process. In summary, this article contributes to the literature through its focus on internal and external switching, the inclusion of risk and time preferences as factors explaining contract switching, and the utilization of a large multi-country representative sample, which allows controlling for differences in electricity market characteristics across countries.

The remainder of the article is organized as follows. Section 2 reviews the empirical literature on the factors associated with household electricity contract switching. Section 3 describes the methodology and data. Section 4 presents the results of the econometric analysis. Section 5 discusses the findings and concludes.

II. Literature review

The extant literature (e.g. Klemperer 1995; Salies 2007; Wilson 2012) finds that households' reluctance to switch electricity contracts even though doing so would be profitable to them can be explained by search costs and by actual or perceived switching costs. Search costs result from gathering information about new contracts and providers, whereas actual or perceived switching costs include additional effort, lower quality of service, termination fees or foregone loyalty payments. A recent EU-wide survey among energy consumption experts identifies insufficient monetary gains, lack of trust in new providers, hassle costs, perceived complexity of the switching process and satisfaction with the current provider as the main barriers to household electricity supplier switching (ACER 2015).[3] Defeuilley (2009) argues that household-level risk aversion and behavioural biases, such as status quo bias, may explain the observed sluggish switching behaviour. Similarly, households may (erroneously) believe that the frequency of power outage events, service during power outage events or other facets of customer support (e.g. reliability of metering or ease of billing) differ across providers, resulting in a preference for the current provider.[4]

The scant but growing empirical literature exploring household electricity contract switching using multivariate analysis typically finds that supplier switching is governed by expected electricity cost savings, switching costs and trust in providers. Relying on a (nonrepresentative) survey of Dutch households prior to liberalization, Wieringa and Verhoef (2007) infer that intended supplier switching is driven by perceived switching costs and the quality of the relationship between households and the provider (building on trust, or service quality). Ek and Söderholm (2008) analyse the switching behaviour of owner-occupied dwellings and conclude that internal switching and external switching are both positively related with expected financial benefits. In addition, they find that external switching is negatively related with perceived uncertainty about the financial consequences. For a representative United Kingdom (UK) household sample, Flores and Waddams Price (2013) conclude that external switching is mostly driven by expected financial savings, but not by switching costs. For a representative sample of households in Denmark, Yang (2014) finds that the main barriers to external switching include lack of financial benefits and psychological lock-in. In a recent study, Daglish (2016) employs household data provided by the main distribution grid company in New Zealand at the level of meshblocks (corresponding to about 50 households). His findings tentatively suggest that external switching (or lack thereof) is related to customers' concern for price, for taking a moral stance and by a strong preference for staying with their current provider. Similarly, employing household-level data from the residential electricity market in the state of Texas, Hortaçsu, Madanizadeh, and Puller (2017) conclude that when households search for alternative electricity providers, they attach a substantial brand advantage to their current provider. Drawing on a (convenience) sample of households in Vienna (Austria), Six, Wirl, and Wolf (2017) find that lack of information about tariffs and about providers is associated with lower external provider switching. The large sample analysis for Japan by Shin and Managi (2017) confirms that provider switching is related to expected cost savings, trust in new providers and environmental preferences. Finally, He and Reiner (2017) focus on household attitudes towards energy issues and their perceptions of the costs and benefits of switching their gas or electricity provider; relying on a representative survey for the UK, they find that external switching is positively related with stated support for simplifying energy tariffs and ease of understanding energy bills. Conversely, external switching is negatively related with the expected difficulty of changing suppliers and

[3]For the UK, Wilson and Waddams Price (2010) found that some consumers fail to select the most beneficial electricity contract. At least one out of five consumers chose a contract that made them worse off than before switching.

[4]Shin and Managi (2017) provide a comprehensive review of the literature on the significance and the determinants of electricity-provider switching.

with the stated lack of attention to energy prices. Overall, these studies bring to the fore similar barriers that keep households from switching to external providers: lack of information, behavioural loyalty to old provider and perceived risk of switching. Interestingly, excluding Ek and Söderholm's study (Ek and Söderholm 2008), the factors related to internal switching have not been studied, even though a large proportion of contract switches consist of new tariffs with the same provider (60% of all tariff switches in our sample).

III. Methodology and data

This section first describes the survey before presenting the dependent and explanatory variables and the statistical model.

Survey

Data were collected between July and August 2016 through an online survey distributed to members of the Ipsos GmbH online access panel. Roughly 15,000 respondents from France (FR), Germany (DE), Italy (IT), Poland (PL), Romania (RO), Spain (ES), Sweden (SE) and the United Kingdom (UK) participated in the survey. Quota sampling was used to obtain representative samples for each country in terms of gender, age (between 18 and 65 years) and regional population distribution. To obtain qualified responses, only respondents who reported being involved in their household's investment decisions for utilities, heating and household appliances were selected for the survey. To ensure language consistency, the original English surveys were professionally translated to each of the target languages; back translation was then used to check (and eliminate) inconsistencies.

To elicit risk and time preferences, the survey included incentivized noncontextualized multiple price list experiments (MPLEs). Besides questions on electricity contract switching behaviour, the survey also asked for dwelling characteristics and assessed environmental preferences via established scales. Socio-demographic information was gathered both at the beginning of the questionnaire (to ensure that quota requirements were met) and at the end.

External databases were used to assess retail market characteristics in each of the eight countries in the study. Table A1 in the Appendix provides an overview of key indicators of the deregulated electricity markets in the eight countries. Table A1 shows substantial differences between countries for the dates at which the retail markets were opened, for the number of retailers and market concentration, whether retail prices are regulated, and for the levels of electricity prices and decomposition into costs for energy, network and other cost components. In particular, internal and external switching rates from 2008 to 2010 vary substantially by country.

Statistical model

We model household electricity contract choice employing a standard multinomial response model with the following three outcome categories: no-switching, internal switching and external switching.[5] The multinomial response model can be motivated via the Random Utility Model (McFadden 1973). In our case, the household is assumed to choose the category that yields the highest utility. This (latent) utility V of household i may be written as

$$V_{ij} = z_{i1}\beta_{j1} + z_{i2}\beta_{j2} \ldots + z_{ik}\beta_{jk} + \varepsilon_{ij} \\ = z_i\beta_j + \varepsilon_{ij} \quad (1)$$

where j = 1, 2, 3, denotes the contract switching categories, k indexes the explanatory variables z, β denotes the (vector of) coefficients associated with the explanatory variables and ε_{ij} reflects the idiosyncratic error term for choice j. The probability of household i making choice j is then

$$P_{ij} = Prob(V_{ij} > V_{im} \forall m \neq j) \quad (2a)$$

$$P_{ij} = Prob(z_i\beta_j + \varepsilon_{ij} > z_i\beta_m + \varepsilon_{im} \forall m \neq j) \quad (2b)$$

$$P_{ij} = Prob(\varepsilon_{ij} - \varepsilon_{im} > z_i\beta_m - z_i\beta_j \forall m \neq j) \quad (2c)$$

[5]We note that using a nested model to estimate household electricity contract choice is not feasible, since information on the characteristics of the old and new contracts is not available. In such a model, the household is assumed to first decide whether to switch the electricity contract, and then whether to switch internally or externally.

Assuming the difference $\varepsilon_{ij} - \varepsilon_{im}$ to be normally distributed gives rise to the multinomial probit model.

Dependent variable

The survey included the following question to measure respondents' switching of electricity contracts and suppliers: 'In the past 10 years, did you change to a different electricity contract (for instance going to a cheaper rate or a day-night tariff) within your current residence?' The response categories were: (1) 'No'; (2) 'Yes, but stayed with the same supplier' (internal switching); and (3) 'Yes, when switching to a new supplier' (external switching). Thus, our dependent variable reflects stated switching behaviour and may take on three outcomes.[6] The survey did not include information on characteristics of the old or new contract (such as quality of electricity supply), nor on switching frequency; it also did not allow for both external and internal switching.[7]

Table 1 shows heterogeneity across countries in propensities to switch electricity contracts and suppliers for the full sample. While at the aggregate level, more than half the households reported to have switched contracts in the previous 10 years, in France, Italy, Poland, Romania and Spain, the majority of households did not switch contracts. On average, internal switching accounted for almost 60% of all contract switching, with the highest shares of internal switching observed for France, Italy and Romania. In comparison, the share of external switching was particularly high in Germany, Italy, Sweden and the UK. The findings presented in Table 1 are generally consistent with the external switching rates for 2013–2015 presented in ACER (2015), which report average rates of *ca* 10% for the nine EU countries (including Germany, Spain, Sweden and the UK) that had liberalized their electricity markets more than 10 years before, of *ca* 5% for the 17 countries with a history of market liberalization of between 5 and 10 years (including France, Italy and Poland), and 0% for the three countries where liberalization of the electricity market had taken place less than five years before (including Romania).

Explanatory variables

The set of explanatory variables includes, on the one hand, survey information on risk and time preferences, environmental preferences, household financial motives, household structural factors and standard socio-economic characteristics and, on the other hand, country-specific information on electricity retail markets. Table 2 provides more detailed information about each explanatory variable. Descriptive statistics are listed in Table A2 in Appendix A for the sample used in the empirical analysis.

Risk and time preferences

Particular attention was given to variables reflecting preferences for risk and time. We employ two types of measures. First, preferences for risk aversion and time discounting were elicited and estimated jointly via noncontextualized MPLEs Second, we use self-assessment scales. following Coller and Williams (1999) and Holt and Laury (2002).

Elicitation via experiments. To calculate parameters reflecting individual preferences for risk and time, we rely on a standard version of the

Table 1. Number of observations (and shares) by switching behaviour.

	8 countries	FR	DE	IT	PL	RO	ES	SE	UK
(1) No switching	7,315 (48.59%)	1,149 (57.45%)	812 (40.56%)	708 (35.40%)	1,291 (64.29%)	859 (56.18%)	1,064 (53.17%)	798 (52.67%)	634 (31.70%)
(2) Internal switching	4,520 (30.02%)	688 (34.40%)	420 (20.98%)	766 (38.30%)	587 (29.23%)	624 (40.81%)	577 (28.84%)	301 (19.87%)	557 (27.85%)
(3) External switching	3,220 (21.39%)	163 (8.15%)	770 (38.46%)	526 (26.30%)	130 (6.47%)	46 (3.01%)	360 (17.99%)	416 (27.46%)	809 (40.45%)

[6]Since the sampling method excluded individuals older than 65 years and households without internet access, the reported switching rates may overstate the population switching rates since the excluded groups are less likely to have switched electricity contracts.

[7]The subsequent analyses implicitly assume that (the arguably few) respondents who are both internal and external switchers nonsystematically chose response category (2) or (3).

Table 2. Description of covariates.

Variable	Description
α	Parameter reflecting risk preferences; elicited via multiple price list experiments; higher value means lower risk aversion.
WTRisk	Z-score to item: 'In general, how willing are you to take risks?' (1 = 'not at all willing' to 5 = 'very willing').
δ	Parameter reflecting time preferences; elicited via multiple price list experiments; higher value means lower time discounting.
WTWait	Z-score to item: How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future? (1 = 'not at all willing' to 5 = 'very willing').
Relevance energy costs	Z-score based on unweighted average of respondent-stated importance of energy costs in a decision (either real or hypothetical) to buy a light bulb and an appliance (1 = played no role to 5 = very important).
Size	Residence space used for living (excluding garage, cellar, attic, etc.) in 100 square metres (using midpoint of four categories, and the lower level of the highest category).
Environmental_ID	Z-score to equally weighted items: 'Please rate how much you agree with the following statements (i) To save energy is an important part of who I am. (ii) I think of myself as an energy conscious person. (iii) I think of myself as someone who is very concerned with environmental issues. (iv) Being environmentally friendly is an important part of who I am' (1 = strongly disagree to 5 = strongly agree).
Moved	Dummy = 1, if the household changed residence in the last 10 years.
Tenant	Dummy = 1, if the household is renting the current dwelling.
Urban	Dummy = 1, if respondent lives in the centre of a major town or in a suburban town.
Income	Household annual income (after taxes) in 1000 euro per year (using midpoint of 11 income categories, and the lower level of the highest category).
Education	Dummy = 1 if level is equal to or higher than country median. Considered levels: no degree or certificate/trade or vocational certificate/high school or equivalent/higher education.
Age	Respondent age in years.
Male	Dummy = 1, if respondent is male.
Supply variety	Number of suppliers per 100,000 households.
Retail concentration	Cumulative market share of the main electricity retailers in 2016 (in 100%).
Electricity price	Price for energy component of electricity price in 2016 (in €/kWh, purchasing power parity); calculated by multiplying columns G and H in Annex Table A1.

Table 3. Multiple price list for eliciting time preferences (MPLE 1).

Line	Option A	Option B
1	Receive 98€ in 6 months and one week	Receive 100€ in 12 months
2	Receive 94€ in 6 months and one week	Receive 100€ in 12 months
3	Receive 90€ in 6 months and one week	Receive 100€ in 12 months
4	Receive 86€ in 6 months and one week	Receive 100€ in 12 months
5	Receive 80€ in 6 months and one week	Receive 100€ in 12 months
6	Receive 70€ in 6 months and one week	Receive 100€ in 12 months
7	Receive 55€ in 6 months and one week	Receive 100€ in 12 months

expected utility framework, using the following utility function: $u(x) = x^{\alpha}$, where x reflects wealth and α (≥ 0) is the parameter reflecting risk preferences. To capture individual preferences for wealth at different points in time, we use the standard model of discounting

$$\boldsymbol{U_t}(x_t, \ \ldots, x_T) = E\left[\sum_{k=0}^{T-t} \delta^k u(x_{t+k})\right] \tag{3}$$

where $\boldsymbol{U_t}(x_t, \ \ldots, x_T)$ is the expected utility of a stream of wealth gains $x_t, \ \ldots, x_T$ at different points in time from t (now if $t = 0$) to T. $u(x_t)$ is the utility of the wealth x at time t, and δ is the annual time discounting factor.[8]

In all MPLEs, participants faced a list of choices between two options, A and B, and were asked for each choice to indicate their preferred option,[9,10].

Elicitation of time preferences. Option A in Table 3 specified a monetary gain to be paid in six months and one week and Option B was a monetary gain to be paid in 12 months. We used a front-end delay of 6 months to avoid any present bias in our measure of time preferences. In general, the more often Option A is chosen, the greater the respective participant discounts future gains.

Elicitation of risk preferences. In MPLE 2, participants selected among a series of 14 choices between two options A and B. In both options in Table 4, respondents faced a lottery that paid either a high or a low monetary gain with an equal probability of 0.5 (this probability was introduced as a coin flip). Note that Option A had a lower variance compared to

[8] $\delta = 1$ / $0 < \delta < 1$ means that the participant is not discounting future outcomes / discounting future outcomes.
[9] To avoid order bias, we randomized the order of the decisions presented to participants. Thus, participants had equal chances of seeing *AB* and BA.
[10] The monetary amounts displayed to participants were adjusted across countries with different currencies to keep the relative value similar in terms of purchasing power. The following rates were applied: Poland: 1€ = 3 PLN; Romania: 1€ = 3 RON; Sweden: 1€ = 10 SEK; UK: 1€ = 1£. In all Euro-zone countries, the monetary amounts shown to participants were identical. In addition, for about 10% (7%) of the total sample, all values shown in the MPLEs were multiplied by 10 (divided by 10), relative to the baseline treatment (medium stakes).

Option B, but a higher expended value in Lines 1–7; after Line 7, Option B had a higher expected value.

Incentivization. To mitigate hypothetical bias, 54% of the participants were incentivized (only for medium and low stakes). Among those incentivized, a random subset of 1% of the participants was paid based on their actual choices. These were sent a prepaid credit card (MasterCard) with the amount they had won by postal mail; they could use this card in any online or offline shop accepting MasterCard. On average, the winners received 57.86 euros.

Calculation of preference parameters. We calculated preference parameters individually for each respondent by use of their switch-points, i.e. the points at which a given respondent started to prefer Option B over Option A in each of the MPLEs. Subjects with monotonous preferences should have had at most one switch-point in each of the MPLEs. We assumed that respondents were indifferent at the mean values of the lines between which they switched: a participant who chose Option A in Line 1 of MPLE 1 and Option B in the remaining lines was assumed to be indifferent between 96€ in 6 months and 1 week and 100€ in 12 months. Participants who never (immediately) switched, i.e. always chose A (B) in one MPLE, were assumed to be indifferent at the last (first) line of this MPLE. The switch-points thus provided two equations (one for each MPLE) that could be solved for the two unknown risk and time preference parameters α and δ.

Equation (3) illustrates the need to jointly estimate the parameters reflecting preferences over risk and time to derive internally consistent parameters for given functional forms (e.g. Abdellaoui, Bleichrodt, and Paraschiv 2007; Andersen et al. 2008). For example, estimating the parameter reflecting time preferences without simultaneously accounting for risk preferences would have resulted in underestimating the value of the time preference parameter for a risk-averse individual. Participants with multiple switch-points were dropped, resulting in a loss of 10.75% of the sample. This share is lower than in most other studies and comparable to that of Harrison et al. (2005).

Elicitation via self-assessment scales. The survey also elicited risk and time preferences using the self-assessment scales employed and validated by Dohmen et al. (2011) or Falk et al. (2015) to construct *WTRisk* and *WTWait* (see Table 4). In particular, we argue that eliciting individuals' general assessment of their willingness to take risks yields a good predictor of behaviour in several domains. In comparison, the experiment-based risk measures are good predictors of behaviour in the financial domain but may be less informative for risk-taking in nonfinancial situations (Dohmen et al. 2011, 543).

Financial benefits

This set of variables included two proxies to capture the financial benefits of contract switching discussed in the literature. First, *relevance energy costs* reflects the importance a household attaches to energy costs. Second, *size of the residence* stands for the cost-savings potential when switching to a cheaper tariff.[11]

Environmental preferences

The variable *environmental_ID* (items adapted from Whitmarsh and O'Neill 2010) was used to reflect households' environmental preferences, which are expected to be related to the propensity to choose green tariffs.

Household structural factors

First, we accounted for the effects of past moving behaviour, i.e. *moved*. Past moving behaviour is expected to lead to more external switching: first, when moving to a new town, households are often forced to switch to a new provider if the old provider does not service the new town; second, households changing residency are usually automatically serviced by the local default provider and would therefore incur transaction costs if they wanted to switch back to their old provider. Second, we included the dummy variable *tenant* to allow for effects of dwelling ownership. For tenants, costs for energy and water use are often included in the rent; in such cases, the landlord rather than the household chooses the electricity contract. Thus, tenants may be less prone to switch providers than homeowners. Note that switching behaviours of tenants and homeowners have been considered by Flores and Waddams Price (2013) and by He and Reiner (2017) for external switching, but neither found tenancy to have an effect.

[11]Information on household actual electricity consumption or electricity costs was not available.

Table 4. Multiple price list for eliciting risk preferences (MPLE 2).

	Option A		Option B	
Line	Coin shows Heads	Coin shows Tails	Coin shows Heads	Coin shows Tails
1	50€	40€	54€	10€
2	50€	40€	58€	10€
3	50€	40€	62€	10€
4	50€	40€	66€	10€
5	50€	40€	70€	10€
6	50€	40€	74€	10€
7	50€	40€	78€	10€
8	50€	40€	82€	10€
9	50€	40€	87€	10€
10	50€	40€	97€	10€
11	50€	40€	112€	10€
12	50€	40€	132€	10€
13	50€	40€	167€	10€
14	50€	40€	222€	10€

Third, *urban* was included to control for potential differences in the level of competition between urban and nonurban areas, with typically more electricity suppliers (and therefore competition) available in urban areas compared to nonurban areas. Daglish (2016) and Shin and Managi (2017) find urban households more likely to have switched suppliers than nonurban households

Socio-economic characteristics

Household *income* has been found to be positively correlated with external switching in the literature (Daglish 2016; Ek and Söderholm 2008; Hortaçsu, Madanizadeh, and Puller 2017; Shin and Managi 2017). Similarly, higher *education* has mostly been found to be positively associated with external switching (He and Reiner 2017; Hortaçsu, Madanizadeh, and Puller 2017). In comparison, the results for *age* are rather ambiguous. Daglish (2016) and Hortaçsu, Madanizadeh, and Puller (2017) find a negative relation of age and external switching, Shin and Managi (2017) find a small positive relation and He and Reiner (2017) find no relation between age and external switching. In Ek and Söderholm (2008), age is positively associated with internal switching, but not related to external switching. Finally, *male* is included to control for the gender of the survey respondent.

Electricity market characteristics

The inclusion of additional variables, relying on external databases, reflects the different outcomes of the liberalization of the electricity markets across countries on the supply side. The main model specification included *supply_variety*, which stands for the number of suppliers per 100,000 households in a country. As an alternative, we also considered *retail concentration*, which reflects the cumulative market share of the main electricity retailers in a country. In addition, *electricity price* was included to capture simultaneously incentives for new market players to enter the retail market and household financial incentives to switch contracts.[12] We only consider the energy component of the end user's electricity price, since this is the portion of the electricity price that retailers essentially compete on.

To be able to capture the effects of the retail market characteristics across countries, we pooled observations from all countries. About 15% of the respondents failed to answer the survey question on household income; for item nonresponses to the income question, we set the value of income to the median level and included a dummy *income_missing*.

IV. Results

Table 5 reports the findings (average marginal effects) for the multinomial probit model (using robust SEs).[13] The marginal effects reflect the change in the probability of observing a particular response category, i.e. no-switching, internal switching or external switching, when the associated explanatory variable changes by one unit. Therefore, for each explanatory variable, the effects reported in Table 5 add up to zero.

Risk preferences

Regarding risk preferences, the findings for *WTRisk* suggest that more risk-averse individuals (lower *WTRisk*) were less likely to have switched their

[12] Country-level data was obtained from the EUROSTAT database on electricity market indicators; for the number of households, we used the variable coded *lfst_hhhnhtych*; the main electricity retailors are those with a market share of at least 5% in a given country; the figure on *retail_concentration* for Germany was taken from the Bundesnetzagentur database (Bundesnetzagentur 2017) because it was not available in the EUROSTAT database.

[13] The multinomial probit model was estimated using the *mprobit* command implemented in Stata 14, which assumes zero correlation of the stochastic components of the choice alternatives. We show the marginal effects on the probability of choosing a particular contract rather than the coefficients of the model output since the latter refer to the latent utility and are therefore hard to interpret. In addition, these coefficients depend on the type of contract chosen as the base outcome in the multinomial model. For dummy variables and z-score transformed variables (i.e. nonmarginal changes), Table 5 reports the discrete changes in probabilities.

Table 5. Multinomial probit results (average marginal and discrete effects) for contract switching behaviour (*p*-value in parentheses).

	No switching	Internal switching	External switching
α	−0.006	0.013***	−0.007
	(0.228)	(0.005)	(0.116)
WTRisk	−0.013***	0.023***	−0.010***
	(0.006)	(0.000)	(0.006)
δ	−0.005	0.021	−0.017
	(0.876)	(0.419)	(0.486)
WTWait	−0.018***	0.009**	0.009**
	(0.000)	(0.036)	(0.023)
Relevance energy costs	−0.013**	0.006	0.006
	(0.010)	(0.149)	(0.126)
Size	−0.049***	0.011	0.038***
	(0.000)	(0.242)	(0.000)
Environmental_ID	−0.013***	0.017***	−0.004
	(0.010)	(0.000)	(0.302)
Moved	−0.030***	0.005	0.026***
	(0.001)	(0.565)	(0.000)
Tenant	0.017*	−0.061***	0.044***
	(0.095)	(0.000)	(0.000)
Urban	−0.004	0.007	−0.002
	(0.624)	(0.399)	(0.734)
Income	−0.002***	−0.001***	0.003***
	(0.000)	(0.000)	(0.000)
Income_missing	0.084***	−0.037***	−0.047***
	(0.000)	(0.001)	(0.000)
Education	−0.017*	0.018**	−0.001
	(0.061)	(0.029)	(0.894)
Age	−0.002***	−0.000	0.002***
	(0.000)	(0.699)	(0.000)
Male	−0.017**	0.011	0.006
	(0.047)	(0.164)	(0.374)
Supply variety	−0.022***	−0.023***	0.045***
	(0.000)	(0.000)	(0.000)
Electricity price	−1.141***	−0.056	1.197***
	(0.000)	(0.757)	(0.000)
Log likelihood		−13,351.657	
Prob> Chi^2		0.000	
Observations		13,347	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

electricity contracts. The coefficient associated with α is negative, thus also implying a positive relation between risk aversion and contract switching; however, the associated coefficient is shy of being statistically significant, i.e. p-value > 0.1. In general, the findings for our risk measures support the view that individuals perceive that the decision to switch electricity contracts involves risk. Thus, risk aversion appears to help explain low contract switching rates. We further found that less risk-averse individuals (i.e. higher α or higher *WTRisk*) were more likely to be internal switchers but less likely to be external switchers.

Preferences

In comparison, standard time preferences elicited through experiments were not found to be related with electricity contract switching in general, nor with internal or external switching. However, the results for the scale-based measures to elicit time preference suggest that more patient individuals (i.e. higher *WTWait*) were less likely to be non-switchers, but more likely to be external and internal switchers.

Financial benefits

Relevance of energy costs was negatively related with no contract switching, i.e. positively related with contract switching in general. Relying on the point estimate, we observe that an increase in *relevance of energy costs* by 1 SD decreased the probability of observing no-switching by 1.3 percentage points. Similarly, *relevance of energy costs* was positively associated with external and internal switching, but the coefficients were just shy of statistical significance. Households with larger residences were more likely to have switched electricity contracts and to be external switchers, but the coefficient associated with *size* was not statistically significant for internal switching.

Environmental preferences

Higher environmental identity was positively associated with contract switching in general and with internal switching. In comparison, *environmental_ID* did not turn out to be statistically significantly related with external switching.

Household structural factors

The results for *moved* confirmed that households who had changed their residence during the preceding 10 years were more prone to have changed their electricity contract. Similarly, these households were also more likely to be external switchers. Households that rent rather than own their dwelling were less likely to have switched contracts and less likely to be internal switchers, but more likely to be external switchers. We also note that the effect size of *tenants* was rather large. For example, being a tenant rather than an owner increased the probability of being an internal switcher by 6.1 percentage points. In comparison, the findings for *urban* provide no evidence that location was related to contract switching.

Socio-economic characteristics

In line with the extant literature, higher *income* households were more likely to have switched contracts and to be external switchers. At the same time, higher income households seemed less prone to be internal switchers. Households who failed to answer the survey question on income were less likely to have switched contracts and to be internal and external switchers. Higher educated households were more likely to have switched contracts and to be internal switchers. In comparison, the correlation between *education* and external switching was not statistically significant. As far as *age* is concerned, we found that older individuals were more likely to have switched electricity contracts and also to be external switchers, whereas internal switching was not related to age in a statistically significant way. Households with *male* respondents were more likely to have switched contracts, but the positive correlation of male with internal and external switching failed to be statistically significant.

Electricity market characteristics

Supply_variety was found to spur contract switching in general and external switching specifically and to inhibit internal switching. Finally, a country's higher *electricity price* was found to be positively related to electricity contract switching in general and also with external switching. In comparison, the negative correlation between *electricity price* and internal switching turned out not to be statistically significant.

Robustness checks

To investigate the robustness of our findings, we conducted several tests. First, we ran a multinomial logit rather than a multinomial probit model, thus allowing for an alternative underlying distribution. The logit model $\varepsilon_{ij} - \varepsilon_{im}$ in equation (2b) is assumed to follow a logistic distribution.[14] Results of the multinomial logit model are virtually identical to those reported in Table 5 for the multinomial probit model. Next, we employed a generalized ordered logit model, thus assuming the dependent variable to follow a natural ranking, using no-switching as the lowest, internal switching as the medium and external switching as the highest category. In general, the marginal effects of the generalized ordered logit model are very similar to the findings shown in Table 5 in terms of magnitude and significance. Furthermore, rather than employing *supplier variety* to reflect the effects of the electricity market structure on contract switching, we used *retail concentration*, i.e. the cumulated market share of the largest suppliers in a country. We find that the associated coefficient is statistically significant for all three outcome categories. Higher *retail concentration* is negatively related with contract switching in general and also with external switching and positively related with internal switching. The findings for the other covariates are virtually the same as those reported in Table 5. Finally, we explored whether item nonresponse affects our findings. The results for the sample where item nonresponses on the income question were excluded are virtually identical to those reported in Table 5. In sum, our findings appear to be robust to the alternative model specifications considered.

V. Discussion and conclusion

This article empirically studies the factors related to household electricity contract switching. We distinguish between households that switched contracts but stayed with the same supplier (internal switching) and those that switched to a new supplier (external switching). The analyses rely on more than 13,000 observations drawn from eight EU countries, which differ in terms of state of liberalization. The econometric analysis includes a broad set of individual preferences, household structural factors, socio-demographic characteristics and country-level retail market characteristics. Regarding individual preferences, our article appears to be the first to explicitly explore the role of risk and time preferences on switching behaviours. In addition, we thereby explicitly distinguished between scale-based measures of risk and time preferences and risk and time

[14] All results that are not shown to save space are available from the authors.

preference parameters elicited via context-free incentivized experiments.

We find that less-risk-averse individuals were more likely to generally have switched contracts, yet they were more likely to be internal switchers and less likely to be external switchers. The latter finding is somewhat surprising, yet consistent with the observation that contracts with price guarantees, protecting customers from tariff increases for a certain amount of time, are often offered by new market entrants to attract new customers (i.e. external switching). In sum, our findings for risk preferences do not corroborate the view that internal switching was preferred over external switching because households bestowed more trust in the old provider than in other providers.[15]

Time preferences were also associated with switching behaviours in our sample. Findings based on the scale-based measure of time preferences – but not on the experiment-based measure – provide evidence that impatience also helps explain sluggish electricity contract switching behaviour. Arguably, individuals who are generally more patient are more likely to bear the search and other transaction costs of internal and external contract switching. Somewhat surprisingly, the results based on the time preference parameter elicited via experiments imply that more patient individuals were less likely to be external switchers. Thus, the findings on the role of impatience for external switching appear to depend on the method used to elicit time preferences.

In line with previous literature, our empirical results further suggest that household electricity contract switching is related with financial benefits (i.e. relevance of energy costs in energy-related decision making, and size of the residence as a proxy for the cost saving potential; as in Flores and Waddams Price 2013 and Yang 2014), environmental preferences (as in Shin and Managi 2017), income (as in Ek and Söderholm 2008 and Daglish 2016), education level (consistent with Hortaçsu, Madanizadeh, and Puller 2017 and He and Reiner 2017), age (as in Shin and Managi 2017), previous moving and tenancy (renters being less likely to switch). The impact of renting has previously been explored by Flores and Waddams Price (2013) and He and Reiner (2017), yet they did not find significant effects probably due to their small sample size. Our results therefore point to the necessity of separating renters from homeowners when studying contract switching.

The findings for retail market characteristics confirm that a low variety of electricity suppliers, high retail market concentration and low electricity prices impede electricity contract switching.

We further found that the factors correlated with internal and external switching may differ. For external switching, the probability to switch to a new electricity provider was positively associated with risk-aversion, perceived relevance of energy costs (marginally), size of the residence, energy price level, supplier variety, renting, previous moving, income and age. For internal switching, which with the exception of Ek and Söderholm (2008) has not been studied so far, we found the propensity to switch to a new electricity contract with the former provider to be positively associated with risk-loving, patience, perceived relevance of energy costs (marginally), environmental preferences and education. Furthermore, internal switching was found to be negatively associated with renting, income and supplier variety. Because previous literature has typically only focused on external switching, it has implicitly treated internal switching and no-switching to be the same. Our results however indicate that no contract switching and internal switching appear to be driven by different factors. Thus, whenever possible, external, internal and nonswitching should be distinguished.

Overall, these findings also provide guidance for policymakers and utilities. From a policy-making perspective, the findings on the impact of home and household characteristics on switching behaviours suggest that policies may need to be adapted for specific groups. Special policies could be designed to target groups that are less likely to switch, such as renters, low-income households or households with lower education levels. Furthermore, increasing retail competition, notably by phasing out regulated tariffs, is expected to increase supplier switching.

[15]This conclusion implicitly presumes that trust towards providers is related to risk perceptions (e.g. about security of supply).

For utilities, our findings on financial benefits and the role of electricity prices are consistent with new entrants' strategies focusing on price competition. In comparison, offering green tariffs will likely help utility companies keep their customers. The findings on risk preferences suggest that utilities may encourage internal contract switching (and thus prevent external switching) by offering contracts that carry some financial risk. To this end, utilities may offer tariffs, which foreshadow frequent adjustments to the electricity wholesale market price dynamics. New entrants may attract risk-averse individuals by offering price guarantees or contracts with built-in downward (but not upward) price flexibility when wholesale market prices drop sufficiently. Finally, our results on time preferences imply that utilities may foster internal and external switching by offering contracts that reward more patient customers. For example, patient customers may find well-designed loyalty payments more attractive than up-front welcome bonuses.

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Appendix

Table A1. Characteristics of electricity retail markets.

	Column	FR	DE	IT	PL	RO	ES	SE	UK
Year of household electricity retail market opening[1]	A	2007	1998	2007	2007	2007	2009	1999	1999
Number of retailers in 2015[2]	B	171	1238	579	134	95	267	118	37
Number of main retailers, i.e. with a market share of at least 5% in 2015[2]	C	2	4	2	5	5	4	2	6
Regulated retail prices (in 2015)[3]	D	YES	NO	NO	YES	YES	YES	NO	NO
Cumulative market share of main retailers in 2015[2]	E	86.7	31	41	85.1	61.2	78.5	38	77.8
Electricity prices in 2016, all taxes and levies included (in €/kWh)[4]	F	0.170	0.297	0.238	0.134	0.125	0.223	0.193	0.189
Electricity prices in 2016, all taxes and levies included (in €/kWh, purchasing power standard) [4]	G	0.158	0.288	0.243	0.248	0.257	0.251	0.153	0.168
Share of energy component (in%)[5]	H	38	29	40	46	32	41	24	59
Share of network component/in %)[5]	I	29	21	19	29	40	38	35	24
Share of other components (including taxes, VAT, support for renewables) (in %)[5]	J	33	50	41	25	28	21	41	17
Share of external switchers in 2 years prior to mid-2010 (in %)[1]	K	2.2	9.6	3.9	0.2	0	0.8	13.9	17.7
Share of internal switchers in 2 years prior to mid-2010 (in %)[1]	L	5	19	8	4	7	4	15	10

Sources: [1]European Commission (2010); [2]EUROSTAT Electricity Market Indicators (March 2017); [3]ACER (2016); [4]EUROSTAT (using variable *nrg_pc_204*); [5]ACER (2015);

Table A2. Summary statistics, mean and SD of the explanatory variables.

	8 Countries	FR	DE	IT	PL	RO	ES	SE	UK
α	0.832	0.794	0.852	0.861	0.737	0.975	0.872	0.909	0.719
	(1.092)	(0.999)	(1.107)	(1.069)	(1.085)	(1.376)	(1.123)	(1.079)	(0.927)
WTRisk[a]	3.042	2.976	2.819	2.911	3.175	3.409	3.19	3.043	2.93
	(0.959)	(0.904)	(0.907)	(0.94)	(0.957)	(0.972)	(0.904)	(0.97)	(1.01)
δ	0.847	0.868	0.856	0.828	0.839	0.817	0.835	0.86	0.866
	(0.199)	(0.171)	(0.2)	(0.201)	(0.213)	(0.247)	(0.206)	(0.173)	(0.178)
WTWait[a]	3.534	3.362	3.489	3.6	3.575	3.776	3.548	3.428	3.552
	(0.87)	(0.872)	(0.825)	(0.83)	(0.913)	(1.003)	(0.808)	(0.857)	(0.823)
Relevance energy costs[a]	4.017	4.004	4.088	4.349	4.137	4.059	4.009	3.664	3.775
	(0.797)	(0.72)	(0.762)	(0.607)	(0.766)	(0.848)	(0.784)	(0.854)	(0.856)
Size	1.052	1.08	1.082	1.154	0.915	0.898	1.077	1.035	1.122
	(0.451)	(0.436)	(0.442)	(0.431)	(0.451)	(0.417)	(0.429)	(0.447)	(0.48)
Environmental_ID[a]	14.484	14.831	14.042	15.473	14.567	14.883	15.049	13.012	13.821
	(3.303)	(3.014)	(3.231)	(2.869)	(3.2)	(3.199)	(3.085)	(3.647)	(3.574)
Moved	0.524	0.61	0.552	0.479	0.494	0.459	0.505	0.589	0.494
	(0.499)	(0.488)	(0.497)	(0.5)	(0.5)	(0.499)	(0.5)	(0.492)	(0.5)
Tenant	0.315	0.354	0.562	0.199	0.165	0.209	0.225	0.466	0.33
	(0.464)	(0.478)	(0.496)	(0.399)	(0.371)	(0.407)	(0.418)	(0.499)	(0.47)
Urban	0.588	0.485	0.486	0.632	0.609	0.682	0.629	0.57	0.642
	(0.492)	(0.5)	(0.5)	(0.482)	(0.488)	(0.466)	(0.483)	(0.495)	(0.479)
Income	30.59	29.825	35.593	29.747	17.875	12.508	28.315	40.905	46.42
	(21.402)	(18.191)	(19.776)	(15.893)	(10.974)	(11.537)	(15.253)	(24.01)	(27.963)
Income_missing	0.157	0.147	0.146	0.192	0.213	0.101	0.194	0.133	0.11
	(0.363)	(0.355)	(0.354)	(0.394)	(0.409)	(0.301)	(0.395)	(0.34)	(0.313)
Education	0.643	0.575	0.511	0.827	0.533	0.661	0.619	0.886	0.605
	(0.479)	(0.494)	(0.5)	(0.378)	(0.499)	(0.474)	(0.486)	(0.318)	(0.489)
Age	41.079	42.105	42.604	42.961	38.434	36.074	41.48	42.403	41.385
	(12.874)	(13.554)	(13.082)	(12.617)	(11.856)	(10.292)	(12.319)	(13.756)	(13.334)
Male	0.497	0.490	0.504	0.489	0.496	0.500	0.507	0.493	0.495
	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
Supply variety	1.482	0.587	3.064	2.244	0.942	1.272	1.448	2.446	0.129
	(0.956)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Retail concentration	63.479	86.7	31	41	85.1	61.2	78.5	38	77.8
	(21.643)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Electricity price	0.0857	0.0600	0.0834	0.0971	0.1140	0.0822	0.1030	0.0366	0.0989
	(0.023)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	13,347	1,885	1,797	1,721	1,752	1,263	1,745	1,345	1,839

[a]Descriptive statistics are reported for original items (rather than the z-score). Calculating means and SDs assumes that the points on the inherently ordinal scale are equidistant and the data can be interpreted as interval.